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Kindergarten predictors of third grade writing

Young-Suk Kim [a,*], Stephanie Al Otaiba [b], Jeanne Wanzek [a]

[a] Florida State University/Florida Center for Reading Research, United States
[b] Southern Methodist University, United States

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ABSTRACT

The primary goal of the present study was to examine the relations of kindergarten transcription, oral language, word reading, and attention skills to writing skills in third grade. Children ($N = 157$) were assessed on their letter writing automaticity, spelling, oral language, word reading, and attention in kindergarten. Then, they were assessed on writing in third grade using three writing tasks — one narrative and two expository prompts. Children's written compositions were evaluated in terms of writing quality (the extent to which ideas were developed and presented in an organized manner). Structural equation modeling showed that kindergarten oral language and lexical literacy skills (i.e., word reading and spelling) were independently predicted third grade narrative writing quality, and kindergarten literacy skill uniquely predicted third grade expository writing quality. In contrast, attention and letter writing automaticity were not independently related to writing quality in either narrative or expository genre. These results are discussed in light of theoretical and practical implications.

1. Introduction

The ability to express one's thoughts and ideas in writing is critical for success in school, in the workforce, and in participating in modern society. Despite the critical role of good written communication, recent statistics indicate that only 30% of students in grades 8 and 12 can write at or above a proficient level (National Center for Education Statistics, 2012). As such, it is not surprising that the Common Core State Standards, which were adopted by the majority of states in the United States, explicitly lay out expectations for students' writing skills even as young as kindergarten (National Governors Association Center for Best Practices, Council of Chief State School Officers, 2010). As expected, the standards become more demanding as children develop such that by grade 3, children are, for instance, expected to write not only stories (or narratives) but also opinion pieces that support a point of view with reasons, and to write informative/explanatory texts that "examine[s] a topic and convey[s] ideas and information clearly." (p. 19).

Research in the area of reading has provided strong evidence that precursor component skills of reading can be identified (e.g., phonological awareness, alphabet knowledge, oral language; see Schatschneider, Fletcher, Francis, Carlson, & Foorman, 2004 and National Early Literacy Panel, 2008). Furthermore, targeting these early reading skills through intervention is key to preventing future reading failure and promoting successful reading acquisition (National Research Council, 1998; Torgesen, 1998). A similar approach to research in writing is needed to identify the precursor component skills for writing early on so that teachers may also promote proficient writing and help children meet grade level writing expectations.

1.2. Theoretical models of writing for developing writers

Juel, Griffith, and Gough (1986) proposed the simple view of writing in which writing is a function of two necessary component skills, ideation and transcription. Ideation refers to planning, generating, and organizing texts whereas transcription refers to getting the generated texts into print. Juel and her colleagues found that oral language production which captures ideation and spelling which captures transcription were both related to writing for children in grades 1 and 2.

Another prominent theoretical model of writing is the "not-so-simple view of writing" proposed by Berninger and Winn (2006). According to this model, multiple skills involved in writing are clustered into three primary parts – transcription, text generation (i.e., "mental production of a linguistic message", McCutchen, 2006, p. 121), and executive functions and self-regulations – and working memory plays a central role in coordinating and integrating these three parts. Compared to the simple view of writing, the not-so-simple view of writing explicitly underscores the roles of self-regulatory and attentional processes and working memory. Finally, Bereiter and Scardamalia (1987) have proposed another theoretical account for developing writers, the knowledge-telling model. According to this model, children's writing, particularly for beginning writers, is dominated by knowledge-telling

* Corresponding author at: Florida State University/Florida Center for Reading Research, Florida State University, 1114 W. Call Street, Tallahassee, FL 32306, United States. Tel.: +1 850 645 8726; fax: +1 850 644 9085.
E-mail address: ykim@fcrr.org (Y.-S. Kim).

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approach, in which the child's writing is transcription of what they know about topic (content knowledge) and genre (i.e., discourse knowledge). According to these three models, the following skills appear to contribute to writing for developing writers: transcription skills, oral language, executive function (e.g., working memory) and self-regulation (e.g., attention), and content and discourse knowledge. Previous studies have shown evidence for these as component skills of writing for children from kindergarten to middle school (e.g., Abbott & Berninger, 1993; Berninger & Abbott, 2010; Berninger, Abbott, Abbott, Graham, & Richards, 2002; Berninger & Swanson, 1994; Graham, 2006; Graham, Berninger, Abbott, Abbott, & Whitaker, 1997; Hooper, Swartz, Wakely, de Kruif, & Montomery, 2002, Hooper et al., 2011; Kim et al., 2011, 2013; Kim, Al Otaiba, Sidler, Greulich, & Puranik, 2014; McCutchen, 2006; Olinghouse, 2008; Olinghouse & Graham, 2009; Shanahan, 2006). However, the majority of these studies were concurrent predictions, and longitudinal predictive studies are lacking. In the present study, we examined the relations of transcription, oral language, word reading, and attention in kindergarten to writing quality in third grade. Below is a review of literature on the relations of these skills to writing.

1.3. Transcription skills and writing

Transcription, including spelling and handwriting fluency, is a necessary component skill for writing (Berninger, 1999; Berninger & Swanson, 1994; Berninger et al., 2002; Graham et al., 1997) because writing requires written output. As children become proficient with their transcription skills, they can utilize their cognitive resources such as attention and working memory for higher order cognitive processes including idea generation and translating those ideas into oral language (Graham, 1990; Graham et al., 1997; McCutchen, 2006; Scardamalia, Bereiter, & Goleman, 1982). It should be noted that although both handwriting fluency and spelling are considered transcription skills, spelling and handwriting fluency are hypothesized to tap into different processes (Graham et al., 1997). Handwriting fluency refers to the accuracy and rate of writing letters and words, and is typically measured by asking the child to write alphabet letters accurately with speed within a specified time (letter writing automaticity; Berninger et al., 1992, 2002; Jones & Christensen, 1999; Kim et al., 2011, 2013, 2014) or asking the child to copy as many words and sentences as possible within a specified time (paragraph copying; Graham et al., 1997; Wagner et al., 2011). On the other hand, the transcription skill of spelling, is typically assessed as an accuracy measure, and is a function of multiple skills such as letter–sound correspondence knowledge, morphological awareness, phonological awareness, and orthographic awareness (e.g., Apel & Masterson, 2001; Bourassa, Treiman, & Kessler, 2006; Kim et al., 2013). Previous studies have shown somewhat different relations of handwriting fluency and spelling to writing. Handwriting fluency has been consistently related to both writing quality and productivity (Author et al., 2011; Berninger et al., 1997; Graham, 1990; Graham et al., 1997; Kim et al., 2014; Kim, Al Otaiba, et al., in press; Wagner et al., 2011). In contrast, the relation of spelling to writing appears to be somewhat inconsistent. For the writing quality outcome, spelling was independently related in a study with children in grades 2 and 3 (Kim, Al Otaiba, et al., in press) whereas it was not in other studies with children in primary and intermediate grades (Graham et al., 1997; Kim et al., 2014). Similarly, spelling was related to writing productivity in some studies (Author et al., 2011; Graham et al., 1997), but not in others for children in primary grades (Kim, Al Otaiba, et al., in press). Longitudinal relations of transcription skills to writing have been less explored, but a recent study showed that letter writing automaticity in kindergarten was not directly related to first grade writing after accounting for kindergarten writing (Kent, Wanzek, Petscher, Al Otaiba, & Kim, 2014). In contrast, lexical level literacy skill (i.e., spelling and word reading) in kindergarten was directly related to writing quality and productivity (Kent et al., 2014).

1.4. Oral language and writing

Oral language is another component skill of writing according to the simple view and not-so-simple view of writing. “Ideation” in the simple view of writing and “text generation” in the not-so-simple view of writing are primarily operationalized as oral language because generated ideas have to go through a translation process at the word, sentence, and discourse levels to put the generated ideas into oral language (Berninger et al., 2002) — the writer selects the right words, puts them in an appropriate order, and organizes them at the discourse level. Despite its importance in the translation process, however, research on the relation of oral language to writing has been limited (Shanahan, 2006). Extant studies, however, do show that oral language skills make a contribution to writing concurrently for children at various stages of development ranging from kindergarten to middle school (Author et al., 2011;Berninger & Abbott, 2010; Duin & Graves, 1986; Juel et al., 1986; Kim et al., 2014; Kim, Al Otaiba, et al., in press; Olinghouse, 2008). Further evidence of salience of oral language in writing development may be found in studies involving students who have impaired oral language. Previous findings suggest that compared to students without oral language impairment, students with oral language impairment produce written texts with poor grammar and vocabulary (Dockrell & Connelly, 2009, in press; Dockrell, Lindsay, & Connelly, 2009) and demonstrate poor organization. Even as early as first grade, students with oral language impairment also produce fewer words and ideas, even after accounting for their expressive vocabulary, reading, and transcription skills (Kim, Puranik, et al., in press). However, the importance of the role of early oral language in writing longitudinally is less clear. For example, Coker's study (2006) showed that children's receptive vocabulary in grade 1 predicted writing (description of a picture) concurrently but did not predict writing growth rates from grade 1 to grade 3.

1.5. Attention and writing

According to the not-so-simple view of writing, executive function and self-regulatory attentional processes[1] are also important to writing. As writing requires juggling of multiple processes, it necessitates focused and sustained attention, and continuous monitoring of performance. In the present study, attention was included as one aspect of the larger executive function and self-regulatory attentional construct. Cross-sectional studies have shown the relation of attention to writing for children in primary grades. For instance, Hooper et al. (2011) showed that a latent variable composed of attention and executive function measures was concurrently related to writing in grades 1 and 2, but attention in grade 1 was not related to writing in grade 2 after accounting for children's fine motor and oral language-based[2] skills (Hooper et al., 2011). However, it should be noted that the writing outcome in Hooper's study was not written composition, but was composed of letter writing automaticity, writing fluency (i.e., writing words related to a topic), and sentence combining tasks. In our previous study, we found that children attention using a teacher-rated SWAN measure was concurrently related to writing for children in grade 1 (Kim et al., 2013). Furthermore, children's attention in kindergarten has been shown to be predictive of their writing in grade 1 (Kent et al., 2014). Another source of evidence for the role of attention in writing comes from studies with children with attention deficit or hyperactivity disorder (ADHD). These studies have shown that children with ADHD

[1] Note that although Berninger and Winn (2006) used the term, executive function, to refer to a broad cognitive system that involves inhibitory control, goal setting, planning, regulating attention, and self-monitoring (Berninger & Winn, 2006), we use the term, executive function and self-regulatory attentional processes, given varied definitions of executive function (see Miyake et al., 2000; Welsh, Pennington, & Groisser, 1991; Zelazo, Carter, Reznick, & Frye, 1997).

[2] The oral language latent variable in Hooper et al.'s (2011) study included alphabet letter knowledge, phonological awareness, and vocabulary.

made more spelling and grammatical errors (Casas, Ferrer, & Fortea, 2013; Gregg, Coleman, Stennett, & Davis, 2002; Re, Pedron, & Cornoldi, 2007), and more content errors or digressions, and poor text structure features (Casas et al., 2013).

1.6. Reading and writing

Although not included in the developmental models of writing, reading skills have been suggested to be an important contributor to writing development (Shanahan, 2006; Shanahan & Lomax, 1986) and in fact, a bidirectional relation has been hypothesized (Berninger et al., 2002; Shanahan & Lomax, 1986). In particular, accumulating evidence suggests that reading comprehension is related to written composition (Ahmed, Wagner, & Lopez, 2014; Berninger & Abbott, 2010; Berninger et al., 2002; Kim et al., 2013). In contrast, the lexical level reading skill, word reading, has been shown to be strongly related to the lexical level writing skill, spelling (see Ehri, 2000 for a review) and has been shown to have a bidirectional relation for children in grades 1 to 6 (Berninger et al., 2002; but see Ahmed et al., 2014).

1.7. Present study

In the present study, we extend our previous study of kindergarten predictors to first grade writing in two ways. First, we examined children's writing performances in grade 3. Kindergarten is a critical period to build foundations in basic literacy skills such as oral language, word reading, letter writing, and spelling. Thus, kindergarten presents a window of opportunity for preventing future reading and writing difficulties through early intervention. Third grade is also an important period when children are expected to have developed foundational literacy skills, including writing foundations. They are expected to read and write to learn rather than just continue to learn to read and write. Kindergarten predictors were based on the simple view and not-so-simple view of writing, and included the following skills: transcription skills such as letter writing automaticity and spelling; oral language skills such as vocabulary, grammatical knowledge, and sentence memory; reading skills through word reading; and attention. At the kindergarten level, it is difficult to assess reading comprehension due to floor effects so we constrained our examination of reading to word reading to match the developmental level of the students. As reviewed above, these predictors have been shown to be related to writing concurrently (e.g., Author et al., 2011;Berninger et al., 2002; Graham et al., 1997; Kim et al., 2013, 2014; Kim, Al Otaiba, et al., in press; Olinghouse, 2008), but longitudinal predictive relations are lacking. The second way extend our previous study is that we examined children's writing skills in both narrative and expository genres. This was important given greater demands and expectations in writing in expository genres (e.g., Common Core State Standards). In summary, the primary question in the present study was how transcription, oral language, word reading, and attention in kindergarten predict later writing skill in third grade.

2. Method

2.1. Participants and study context

The present study included a sample of 157 children in a medium-sized city (53% boys; mean age at the end of third grade = 8.38, $SD = .46$) who had participated in an earlier study in kindergarten (see below) and whose parents consented that their writing skills be assessed again in third grade. For the larger study, schools had been recruited that served students with higher risk for reading difficulties. Thus, demographics for the present study reflect this earlier study's recruitment and the kindergarten measures were administered in that context. In the present study, approximately 57% of the children were African Americans, 29% Whites, 7% multiracial, and 6% belonged to other ethnicities. Approximately half of the children (49%) were in the treatment condition. These children attended 27 classrooms in 9 schools in kindergarten and 45 classrooms in 15 schools in third grade. Approximately 50% of these children were eligible for the free or reduced lunch programs.

The present study is situated in a larger study ($N = 556$) that had provided kindergarten teachers training to use data to guide their literacy instruction. Furthermore, all kindergarten measures were selected for this larger study, with the intention to track students longitudinally to learn about their reading and writing development. In this larger study, schools were recruited with guidance from the district reading specialist to reflect schools that served students with higher risk for reading difficulties. Kindergarten programming was provided for the full-day, with a strong focus on reading and language arts instruction (mandated for a minimum of 90 min). The schools had reading coaches and all schools who participated in the longitudinal follow up used the explicit and systematic *Open Court* as the core reading program (Bereiter et al., 2002). Puranik, Al Otaiba, Folsom, and Gruelich (2014) reported that the mean amount of writing-related instruction during the 90 min language arts block in kindergarten was only 6.1 min in the fall and 10.5 min in the winter. The majority of the time, students were observed to be practicing writing independently. Less than one minute of teacher instruction was observed in fall and winter on the following teacher level observation variables: watching teacher write, teacher editing, brainstorming, process instruction, and teacher-directed group instruction both in the fall and winter semester. However, information on writing instruction in grades 1, 2, and 3 are not available.

In the larger cluster randomized trial, teachers were assigned to two types of training conditions to learn to individualize or differentiate reading instruction. Teachers in both conditions received a researcher-delivered summer day-long workshop on individualized instruction and each month, they were provided class sets of materials from for small group instruction that had been designed by the Florida Center for Reading Research. Also, teachers in both conditions received progress monitoring data four times per year through the Florida Progress Monitoring and Reporting Network. This data included Dynamic Indicators of Basic Early Literacy Skills (Good & Kaminski, 2002) such as letter naming fluency, phoneme segmentation fluency, and nonsense word fluency. Beyond this, teachers in the Individualized Student Instruction for Kindergarten (ISI-K) condition were trained to use assessment data to inform the amounts of instruction that would be optimal for students, along with suggested groupings. ISI was designed by Connor, Morrison, and Katch (2004) and Connor et al. (2009), who used child assessment data and data from classroom observations to develop algorithms that used a predetermined end-of-year target outcome. The students' assessed language and reading scores were entered into the Assessment to Instruction (A2i) software that calculated recommended amounts of instruction in a multidimensional framework of teacher- or child-managed instruction that is either code- or meaning-focused. Further, teachers in ISI-K received monthly ongoing teacher professional development, and were provided bi-weekly in-class support for individualizing reading instruction during the language arts block.

The study (see Author et al., 2011) found that teachers in both conditions provided small group instruction and the observed quality of instruction was similar, but that teachers in the ISI-K treatment condition provided significantly more individualized instruction. Students in the ISI-K classrooms scored significantly higher on a composite of reading performance with an effect sizes of $d = .52$. In the present study, children's treatment status in kindergarten was included as a control variable.

As noted above, the present study utilizes a subsample of children who participated in a larger study in kindergarten, and were followed until grade 3. Note that the focus of the larger study was the effect of an intervention in kindergarten with a focus on reading ($N = 556$; see

Author et al., 2011), and therefore, does not overlap with the focus of the present study, which focuses only on writing, and on how writing developed longitudinally.

3. Measures

3.1. Kindergarten predictors

Children's transcription skills (letter writing automaticity and spelling), oral language, word reading, and attention in kindergarten were primary predictors. Children's free and reduced lunch status and treatment status at kindergarten were included as control variables in the structural equation analysis.

3.1.1. Letter writing automaticity

Children were asked to write as many lower case alphabet letters as possible in one minute with accuracy, which is widely used as a measure of children's letter writing automaticity (Author et al., 2011; Berninger et al., 1992; Jones & Christensen, 1999; Wagner et al., 2011). 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. 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 kindergarten, 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 .99.

3.1.2. Spelling

Children's spelling skill was also measured by diction tasks including the WJ-III Spelling subtest (Woodcock, McGrew, & Mather, 2001) and by another spelling task developed by Byrne and Fielding-Barnsley (1993). The WJ-III Spelling task was a dictation task of increasingly difficult words. In the Byrne & Fielding–Barnsley's task, the 5 real decodable words were 'dog,' 'man,' 'plug,' 'limp,' and 'tree,' and 5 sight words included 'one,' 'said,' 'blue,' 'come,' 'went'. 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*). The spelling rubric on a scale from 0 to 6, adapted from Tangel and Blachman (1992) (also see Ouellette & Sénéchal, 2008), was used. That is, each word was given a score ranging from 0 to 6. A 0 indicated a random string of letters or no response; 1 was a single phonetically related letter (e.g., for *dog* student wrote an *o* or a *g*); 2 was a correct first letter followed by other unrelated letters (e.g., *dib* or *d* followed by random letters and *g*); 3 was more than one phoneme that was phonetically correct (e.g., *do* for *dog*); 4 was all letters represented and phonetically correct (e.g., *dawg*); 5 was all letters represented and phonetically correct *and* the student made an attempt to mark a long vowel (e.g., for the word *blue* if the student wrote *blew* or *bloo*); 6 was the word was spelled correctly (e.g., *dog*). Thirty-six samples were randomly selected for independent scoring by two raters. Inter-rater agreement was 94.75% and Cohen's kappa was .92. Cronbach's alpha estimates were .90 for the WJ-III spelling, .79 for the decodable words, and .83 for the sight words.

3.1.3. Oral language

Children's oral language skill was measured by vocabulary, grammatical knowledge, and sentence memory because vocabulary and grammatical knowledge are foundational oral language skills (Kim, in press; Lepola, Lynch, Laakkonen, Silvén, & Niemi, 2012). Sentence memory has been shown to be related to grammatical comprehension, auditory short-term memory, and phonological working memory (e.g., Eadie, Fey, Douglas, & Parsons, 2002; Gillam, Cowan, & Day, 1995; Rescorla, 2002).

Children's expressive and receptive vocabulary knowledge was assessed by WJ-III Picture Vocabulary (Woodcock et al., 2001) and the Vocabulary subtest of the *Kaufman Brief IQ test* (KBIT; Kaufman & Kaufman, 2004). In the Picture Vocabulary task, children were asked to name pictured objects. Median reliability was estimated to be .77 (Woodcock et al., 2001). In the KBIT Vocabulary subtest, children were asked to point to a picture among several that represented the best answer to the examiner's prompt. The internal consistency was reported to be .89 and test–retest reliability to be .85 (Kaufman & Kaufman, 2004). Children's grammatical knowledge was assessed by the Grammatic Completion subtest of the Test of Language Development — Primary, third edition (TOLD-P: 3; Hamill & Newcomer, 1997). The child listens to a sentence read aloud with a word missing and is asked to provide grammatically correct responses for the missing part. The 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*). Reliability was reported to be .90 for 5-year-old children (Hamill & Newcomer, 1997). Finally, in the Sentence Imitation subtest of TOLD, the child is asked to repeat sentences that increase in length and complexity. Reliability was reported to be .91 for 5-year-old children (Hamill & Newcomer, 1997).

3.1.4. Word reading

Children's word reading skill at the end of kindergarten was measured by three standardized measures: Woodcock Johnson-III (WJ-III) Letter Word Identification (Woodcock et al., 2001), WJ-III Word Attack (Woodcock et al., 2001), and the Sight Word Efficiency subtest of the Test of Word Reading Efficiency (Torgesen, Wagner, & Rashotte, 1999). In the Letter Word Identification task, the child is asked to read aloud letters and words of increasing difficulty. In the Word Attack, the child is asked to read aloud nonwords. In the Sight Word Efficiency task, the child is asked to read words of increasing difficulty with accuracy and speed. Reliabilities (Cronbach's alpha) were reported to be .99 for the Letter Word Identification, .94 for the Word Attack for 5 year olds. Test retest reliability for the Sight Word Efficiency was reported to be .93 for 6 year olds.

3.1.5. Attention

The first nine items of the Strengths and Weaknesses of ADHD-symptoms and Normal behavior scale (e.g., SWAN; Swanson et al., 2006) was used to measure children's attentiveness. SWAN is a behavioral checklist 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). SWAN was completed by the students' classroom kindergarten teachers. The first 9 items are related to sustaining attention on tasks or play activities (e.g., "Engage in tasks that require sustained mental effort") while the other items assess hyperactivity (9 items) and aggression (12 items). A recent study showed that the first nine items indeed captures one's ability to regulate attention (Saez, Folsom, Al Otaiba, & Schatschneider, 2012). Higher scores represent greater attentiveness. Cronbach's alpha across the 9 items was .91.

3.2. Third grade writing outcome measures

Children were assessed on their writing in the spring of third grade using three prompts: one narrative experimental prompt, and two expository prompts. The narrative prompt was "One day when I got home from school…." Children were asked to write a story about what happened when they got home after school. This prompt was developed by McMaster, Xiaoqing, and Pestursdottir (2009) and has been used in previous studies (e.g., Kim et al., 2013, 2014). The two expository prompts included one standardized and normed writing task

and one experimental task. The former was taken from the Wechsler Individual Achievement Test — Third Edition (WIAT-III), in which children were asked to write about a favorite game and include at least two reasons as support. The second expository prompt was adapted from a previous study (Wagner et al., 2011). In this task, children were asked to write about a classroom pet they would like and explain why. Children were given 10 min to write per prompt and each prompt was administered on a different day.

Children's writing composition was evaluated on writing quality. Writing quality has been widely examined in previous studies (Abbott & Berninger, 1993; Graham, Berninger, & Fan, 2007; Graham, Harris, & Chorzempa, 2002; Graham, Harris, & Mason, 2005; Olinghouse, 2008). Writing quality was evaluated on the extent to which their ideas were developed and the extent to which the ideas are presented in an organized manner, using a rating scale similar to the 6 + 1 Trait rubric (Northwest Regional Educational Laboratory, 2011). Idea development (clarity and richness of ideas) was on a scale of 1 (low) to 7 (high), and organization (how ideas were expressed in an organized manner) was on a scale of 1 to 6. Raters were told and trained not to take into consideration children's spelling and/or handwriting. Quality of idea development and organization have been used as indicators of writing quality in previous studies (Graham et al., 2005; Graham et al., 2007; Olinghouse, 2008), and a recent study demonstrated that they are best described to capture a single dimension and showed that high reliability is achievable with rigorous training of raters (Kim, Al Otaiba, et al., in press). Forty-five writing samples per prompt were randomly selected and double coded by two independent raters. Reliabilities (Cohen's kappa) ranged from .82 to .88 for ideas and organization for the three tasks.

3.3. Procedures

Word reading, spelling, letter writing automaticity assessments, and SWAN for the current study were collected during spring of kindergarten. The oral language measures such as WJ-III Picture Vocabulary, K-BIT vocabulary and the TOLD Grammatic Completion and Sentence Imitation were assessed in the fall of kindergarten. Trained research assistants assessed children individually for the letter writing automaticity, word reading, and oral language assessments. Two research assistants administered spelling and letter writing automaticity to all consented students as a class-wide group in kindergarten. Writing assessments in third grade were administered in small groups (typically 3–8 children).

3.4. Data analysis strategy

Confirmatory factory analysis (CFA) and structural equation modeling using MPLUS 7.1 (Muthén & Muthén, 2013) were primary data analytic strategies. Latent variables were created for the following constructs which had multiple measures: Writing, word reading, spelling, and oral language. Latent variable approach is advantageous to approaches using a single measure per construct because latent variables capture common variables among observed variables (also called indicators), and minimize the influence of measurement error (Bollen, 1989; Kline, 2005). Structural equation models were fitted to address the primary research question. Model fits were evaluated by using the following multiple indices: Chi-square statistics, comparative fit index (CFI), the Tucker–Lewis index (TLI), root mean square error of approximation (RMSEA), and standardized root mean square residuals (SRMR). Typically, RMSEA values below .08, CFI and TLI values equal to or greater than .95, and SRMR equal to or less than .05 indicate an excellent model fit (Hu & Bentler, 1999), and TLI and CFI values greater than .90 are considered to be acceptable (Kline, 2005). Univariate and bivariate distributions were checked and multinomial normality for the confirmatory factor analysis and structural equation modeling was examined and confirmed. Measurement models were examined prior to structural equation analysis.

4. Results

4.1. Descriptive statistics and preliminary analyses

Descriptive statistics are presented in Table 1. Children's word reading skills in kindergarten were in the average range with mean standard scores of 106.87 for the WJ-III Letter Word Identification, and 110.61 for the WJ-III Word Attack, but certainly there were large variations around the means. Children were able to read approximately 15 words per minute, on average, on the TOWRE Sight Word Efficiency but standard scores are not available due to lack of normative information in kindergarten (i.e., norms begin at age 6). Children's mean score in the WJ-III spelling task was also in the average range compared to the norm sample. Children's mean performances on vocabulary knowledge measured by the WJ-III Picture Vocabulary and KBIT Vocabulary were in the average range, but were somewhat low in the KBIT vocabulary (mean standard score = 92.92). Children's sentence imitation and grammatical knowledge was in low average range with mean standard scores of 8.14 and 7.37, respectively. Mean scores in the writing quality indicators in grade 3 ranged from 2.93 to 4.52 with sufficient variation around the means (i.e., standard deviations are not restricted). Children wrote 82.74 to 90.59 words, on average.

Table 2 shows correlations among variables in the study. All the kindergarten variables were weakly to strongly related to each other except that letter writing automaticity was not significantly related to the oral language measures (i.e., WJ-III Picture vocabulary, KBIT vocabulary, and TOLD sentence imitation). Grade 3 writing scores were weakly to fairly strongly related with each other. The majority of kindergarten variables were weakly to moderately related to writing scores in grade 3 although letter writing automaticity and WJ-III Picture

Table 1
Descriptive statistics (N = 157*).

Variable	Mean (*SD*)	Min–Max
Kindergarten predictors		
Word reading		
WJ-III Letter Word Identification — raw	22.95 (6.54)	13–44
WJ-III Letter Word Identification — SS	106.87 (12.95)	80–142
WJ-III Word Attack — raw	6.67 (3.82)	2–21
WJ-III Word Attack — SS	110.61 (12.05)	78–149
TOWRE Sight Word Efficiency**	15.43 (12.87)	0–62
Spelling		
WJ-III Spelling — raw	15.97 (3.24)	10–26
WJ-III Spelling — SS	103.84 (12.64)	72–134
Sight words — raw	16.96 (5.92)	0–30
Decodable real words — raw	18.28 (5.88)	0–30
Oral language		
WJ-III Picture Vocabulary — raw	16.18 (2.91)	1–25
WJ-III Picture Vocabulary — SS	99.64 (10.64)	30–128
KBIT Vocabulary — raw	25.85 (6.19)	8–46
KBIT Vocabulary — SS	92.92 (12.26)	59–125
TOLD Sentence Imitation — raw	8.03 (5.43)	1–26
TOLD Sentence Imitation — SS	8.14 (2.83)	2–18
TOLD Grammatic Completion — raw	6.16 (5.02)	0–19
TOLD Grammatic Completion — SS	7.37 (2.78)	1–14
Letter writing automaticity	9.90 (4.93)	1–24
SWAN attention	40.32 (12.90)	9–63
Writing in third grade (*raw scores*)		
Writing quality		
Narrative prompt: Idea development	4.52 (.99)	1–7
Narrative prompt: Organization	3.52 (.86)	1–6
WIAT-III prompt: Idea development	3.94 (.88)	2–6
WIAT-III prompt: Organization	3.32 (.95)	2–6
Pet prompt*: Idea development	3.79 (.74)	2–6
Pet prompt: Organization	2.93 (.70)	2–5

Note: SS = Standard score.
WJ-III = Woodcock Johnson-III; TOWRE = Test of Word Reading Efficiency; TOLD = Test of Language Development; WIAT-III = Wechsler Individual Achievement Test — Third Edition.
* Sample size for the Pet prompt was 138.
** Standard Scores are not available for the TOWRE Sight Word Efficiency.

Table 2
Correlations among measures.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1. WJ-III Letter Word Identification	1																
2. WJ-III Word Attack	.73	1															
3. TOWRE Sight Word Efficiency	.92	.73	1														
4. WJ-III Spelling	.78	.65	.77	1													
5. Spell sight words	.65	.52	.61	.64	1												
6. Spell real words	.64	.50	.61	.64	.78	1											
7. WJ-III Picture Vocabulary	.29	.37	.31	.25	.28	.25	1										
8. KBIT Verbal	.21	.33	.20	.21	.33	.28	.48	1									
9. TOLD Sentence Imitation	.20	.32	.25	.18	.26	.24	.34	.48	1								
10. TOLD Grammatic Completion	.27	.42	.26	.23	.32	.30	.48	.53	.54	1							
11. Letter writing automaticity	.32	.30	.31	.41	.33	.39	.13+	.02+	.01+	.24	1						
12. SWAN Attention	.43	.39	.41	.38	.42	.46	.20	.22	.19	.35	.34	1					
13. Narrative: Idea development	.26	.25	.28	.23	.24	.14+	.14+	.21	.22	.14+	.10+	.27	1				
14. Narrative: Organization	.37	.35	.37	.26	.32	.23	.24	.29	.38	.38	.10+	.27	.61	1			
15. WIAT-III: Idea development	.28	.23	.30	.22	.17	.12+	.10+	.10+	.26	.11+	.23	.24	.42	.33	1		
16. WIAT-III: Organization	.46	.42	.45	.37	.30	.27	.15+	.23	.24	.20	.15+	.27	.33	.30	.34	1	
17. Pet: Idea development	.20	.17+	.20	.17+	.22	.20	.02+	.06	.09+	.12	.05+	.14+	.30	.28	.41	.29	1
18. Pet: Organization	.34	.31	.37	.32	.32	.24	.04+	.11+	.15+	.20	.14+	.21	.33	.38	.34	.27	.46

Note: All coefficients are statistically significant at .05 level except those with + symbols.
WJ-III = Woodcock Johnson-III; TOWRE = Test of Word Reading Efficiency; TOLD = Test of Language Development; WIAT-III = Wechsler Individual Achievement Test – Third Edition.

Vocabulary were not statistically significantly related to the majority of writing scores in grade 3.

Because children were nested within classes, in order to examine amount of variance due to classroom differences, intraclass correlations (ICC) were calculated using SAS 9.4, and they ranged from 0 to .45 in the measures included in the present study. The majority of variables (12 out of 16 variables) including kindergarten word reading measures, letter writing automaticity, attention, and third grade writing scores had an ICC value of less than .10 and many had zero variance due to classroom differences (e.g. Word Attack, letter writing automatic, and idea development and organization quality in writing). However, the experimental spelling tasks had high values of .33 and 45, respectively. However, it should be noted that when a very limited number of children are in each class (e.g., 1 or 2) which was observed in kindergarten, but particularly in grade 3, cautions need to be taken as ICC estimates are not stable. Therefore, we did not use multilevel modeling in the structural equation models below.

The following latent variables were constructed using confirmatory factor analysis: writing, word reading, spelling, and oral language skills. For the third grade writing variables, measurement models indicated that a two factor model of narrative writing quality and expository writing quality was superior to a single factor model of overall writing quality (ΔX^2 [$\Delta df = 1$] = 18.99, $p < .001$). Narrative writing quality and expository writing quality were fairly strongly related ($r = .70$), and in subsequent structural equation model analysis, narrative writing quality and expository writing quality were used as outcomes. Standardized loadings are found in Figs. 1 and 2. Measurement models were also examined for the word reading and spelling variables. Results showed that a two factor model of word reading and spelling was superior to a single factor model (ΔX^2 [$\Delta df = 1$] = 9.45, $p < .001$). However,

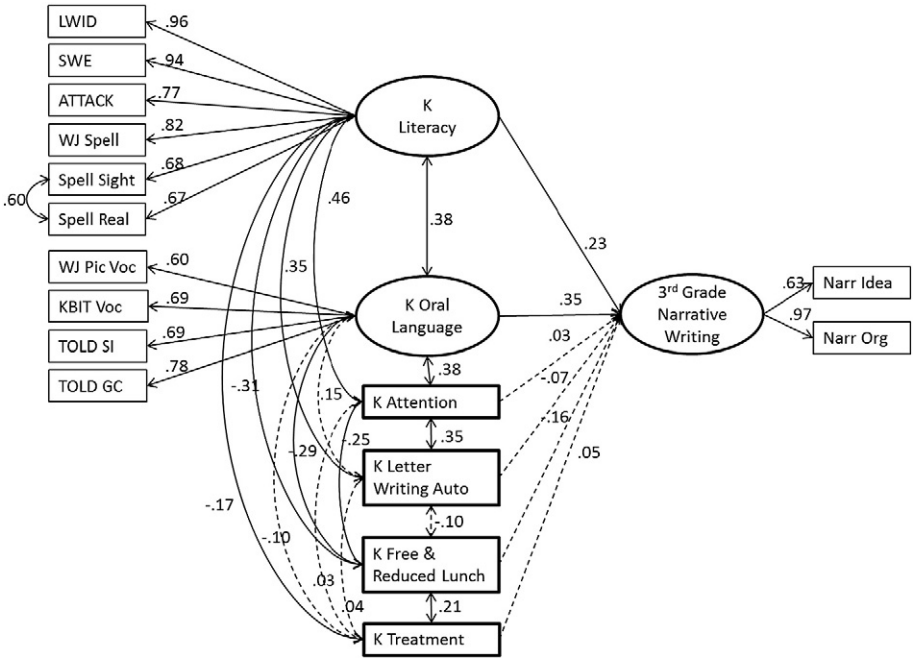

Fig. 1. Standardized regression coefficients for the narrative writing quality outcome. All the loadings are statistically significant at .001 level. Solid lines represent statistically significant paths at .05 level. Dashed lines represent statistically non-significant paths. K = Kindergarten; LWID = WJ-III Letter–Word Identification; Attack = WJ-III Word Attack; SWE; Sight Word Efficiency; GC = Grammatic Completion; SI = Sentence Imitation; Letter writing auto = Letter writing automaticity; Treat = Treatment status.

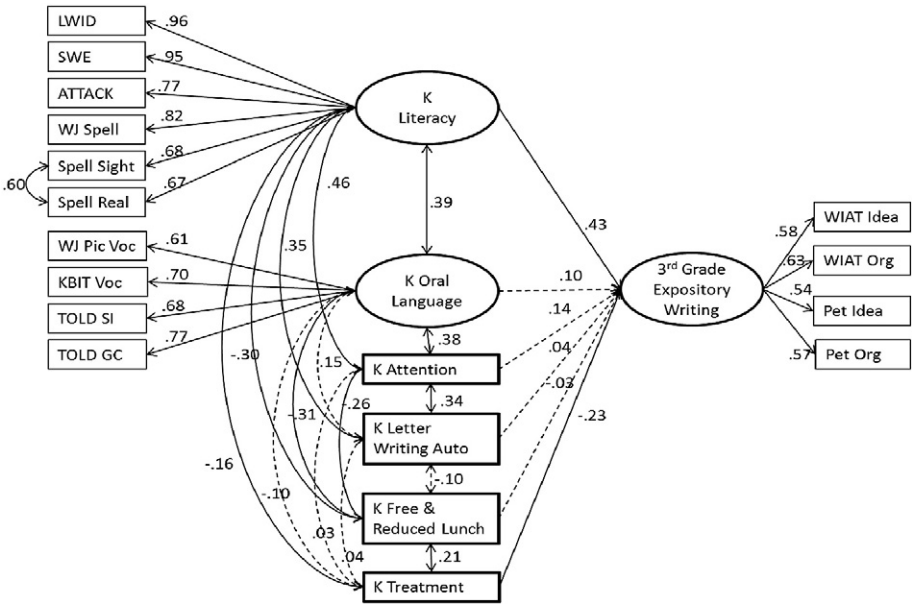

Fig. 2. Standardized regression coefficients for the expository writing productivity outcome. All the loadings are statistically significant at .001 level. Solid lines represent statistically significant paths at .05 level. Dashed lines represent statistically non-significant paths. K = Kindergarten; LWID = WJ-III Letter–Word Identification; Attack = WJ-III Word Attack; SWE; Sight Word Efficiency; GC = Grammatic Completion; SI = Sentence Imitation; Letter writing auto = Letter writing automaticity; Treat = Treatment status.

in subsequent structural equation models, a single latent variable of lexical level literacy skill (lexical skill hereafter) was used because (1) the word reading and spelling latent variables were highly correlated at .92; (2) this high correlation would entail multi-collinearity such that both word reading and spelling latent variables are likely to be nonsignificant when they are in models simultaneously, and (3) model fit for the one factor was excellent (χ^2 [8] = 12.65, p = .12; CFI = .99; TLI = .99; RMSEA = .062 (90% CI = .00–.12); SRMR = .027). Standardized loadings of the variables are found Figs. 1 and 2. Note that residuals of sight word spelling and real word spelling were allowed to covary because the scoring approach on a scale of 0–6 was different from the other variables which were scored dichotomously. Finally, the oral language latent variable had good fit and standardized loadings are presented in Figs. 1 and 2.

4.2. Kindergarten predictors of writing quality in third grade

In order to examine the relations of kindergarten oral language, attention, and literacy skills to third grade writing, structural equation models were fitted for narrative writing quality and expository writing quality outcomes. Children's free and reduced lunch status and treatment status (1 = treatment; 0 = control) at kindergarten were included as control variables. Note that when children's gender and age were included, they were not statistically significant in both outcomes. Therefore, those are not included in the model presented in the article for parsimony.

The model fit for the narrative writing quality was good: χ^2 (86) = 127.43, p = .003; CFI = .96; TLI = .95; RMSEA = .055 (90% CI = .033–.075); SRMR = .058. Standardized regression weights are presented in Fig. 1. Kindergarten literacy (β = .23, p = .01) and oral language (β = .35, p < .001) were both related to narrative writing quality in third grade. In contrast, kindergarten attentiveness (β = .03, p = .77) and letter writing automaticity (β = −.07, p = .43) were not independently related to narrative writing quality after accounting for kindergarten literacy, oral language skills, free and reduced lunch status, and treatment status. Finally, children's free and reduced lunch status, and treatment status did not make unique contributions to third grade writing. A total of 30% of variance in narrative writing quality was explained by the included predictors.

When the outcome was expository writing quality in third grade, the model fit was also good: χ^2 (117) = 172.04, p < .001; CFI = .95; TLI = .94; RMSEA = .055 (90% CI = .036–.072); SRMR = .061. As shown in Fig. 2, only kindergarten literacy skill was related (β = .43, p < .001) whereas the other predictors were not ($ps \geq .18$). An exception was treatment status such that it was negatively related to expository writing quality after accounting for the other predictors in the models (β = −.23, p = .009). The included kindergarten predictors explained a total of 43% of variance in expository writing quality in third grade.

5. Discussion

The primary goal of the present study was to examine transcription, oral language, attention, and reading predictors at kindergarten for children's writing performance in grade 3. Kindergarten (lexical level) literacy skill was composed of six indicators of word reading and spelling whereas oral language skill consisted of vocabulary, grammatical knowledge, and sentence memory. Writing quality outcomes were examined for narrative and expository genres separately based on confirmatory factor analysis results. Finding revealed that kindergarten literacy skill and their oral language were positively and independently related to their narrative writing quality in grade 3. For the expository writing quality in grade 3, only literacy skill was uniquely related. In contrast, kindergarten attention and letter writing automaticity were not related to either writing quality outcome, after accounting for oral language, literacy skills, free and reduced lunch status, and treatment status.

The independent relation of oral language to narrative writing quality is convergent with previous studies with primary grade children (Berninger & Abbott, 2010; Juel et al., 1986; Kim et al., 2014; Olinghouse, 2008). However, the findings of the present study provide a nuanced picture about the role of oral language in writing as its independent contribution to writing quality differed in narrative vs. expository genres. These results indicate that variation in children's oral language sophistication in kindergarten mattered three years later in how children express, communicate, and elaborate, and organize their ideas in written texts, but only in the narrative task. Children's writing in the expository tasks was not uniquely predicted by oral language over and above transcription skills, attention, free and reduced lunch status, and treatment status. Note that majority of previous studies which examined the relation of oral language to

writing used narrative writing tasks with an exception of Berninger and Abbott (2010) which used the WIAT-II expository prompt and WIAT-II scoring procedures.

Why would oral language be uniquely predictive for narrative but not expository writing quality? One potential explanation is that narrative and expository tasks differ in terms of elicited syntactic structures. Expressing complicated ideas may be more facilitated by the use of complex syntactic structures in narrative tasks. For instance, expressing sequence of events in narratives by using complex sentences using subordinate clauses such as "*After* A, B" is more sophisticated and precise than commonly found, repetitive and imprecise use of a coordinating conjunction, and (e.g., "A *and then* B *and then* C…"). On the other hand, expository tasks often require use of certain subordinate clauses, and evidence showed that children in grades 3, 5, and 7 consistently used greater number of clauses T unit due to use of subordinate clauses in argument writing tasks than in other tasks (e.g., narrative, description, and compare-contrast; Beers & Nagy, 2011[3]). The expository prompts in the present study (identifying a favorite game and providing reasons; identifying a favorite class pet and providing reasons) certainly require the use of subordinate clauses such as "I think (believe) that …," and "because A, B." Therefore, conveying the author's ideas in this type of expository tasks may not require employing as much differentiation and variation in syntactic structures. Then, children's syntactic ability may not be as strongly related to writing quality in expository compared to writing quality in narrative tasks, at least at this point of development. This speculation and our results are somewhat in line with Beers and Nagy's (2009) work on syntactic complexity in narrative and expository writing by middle school students. They found that syntactic complexity (clauses per T units) in written composition was differentially related to narrative writing quality vs. expository writing quality such that syntactic complexity in written composition was positively related to writing quality in narratives, but negatively related to writing quality in expository essays. However, to our knowledge, no previous study has investigated whether children's oral language skills including syntactic knowledge is differentially related to different types of writing tasks. Our present findings suggest that the relation of oral language to writing may be nuanced and thus, indicates a need for future studies to learn about how oral language is related to writing. Note that the goal was to examine the relation of oral language skills to later writing such that oral language skill was examined as a latent variable, and therefore, it was beyond the scope of the present study to examine specific detailed mechanism of the relation of oral language to writing. For instance, oral language representation has been hypothesized to be important at multiple levels such as word, sentence, and discourse (Berninger et al., 2002). Therefore, an important direction of future studies would include expanding our understanding of the nature of oral language skills at various levels to different types of writing.

The present findings also underscore the importance of lexical level literacy skill (i.e., word reading and spelling) at kindergarten to writing three years later. We found that word reading and spelling were both highly related in kindergarten, which is convergent with previous studies with beginning readers and spellers (Ahmed et al., 2014; Byrne & Fielding-Barnsley, 1993; Ehri, 2000; Juel et al., 1986; Kim et al., 2014). As transcription skills are necessary and release cognitive resources for high-order processes, its impact on both writing quality has been hypothesized in developmental models of writing (e.g., Berninger & Winn, 2006; Juel et al., 1986). The present study suggests that lexical level literacy skill composed of spelling and word reading in kindergarten is a foundational skill for later writing achievement both in narrative and expository genres.

[3] Note that studies have shown syntactic features in students' writing differ not only between narrative and expository genres, but also within expository genres (e.g., description, summary, argument, compare-contrast) (see e.g., Beers & Nagy, 2009, 2011; Berman & Nir-Sagiv, 2007; Schleppegrell, 2004; Scott & Windsor, 2000).

In contrast to the result for the literacy latent variable, letter writing automaticity, which is theorized as part of transcription skill, was not uniquely predictive of third grade writing. The present findings are divergent from previous studies which have shown that letter writing automaticity is related to writing quality for children in elementary grades (Berninger et al., 2002; Graham et al., 1997; Jones & Christensen, 1999; Kim, Al Otaiba, et al., in press). However, note that these previous studies were concurrent investigations with an exception of Kent et al. (2014). One potential explanation is that letter writing automaticity in kindergarten might be no longer sensitive to capture variation among children in handwriting fluency that is needed for third grade writing. In previous studies, letter writing automaticity, sentence copying, and paragraph copying tasks have been used to capture handwriting fluency. Although they are all purported to capture the accuracy and rate in handwriting, they differ in the linguistic levels — letter writing automaticity is at the letter level, sentence copying at the sentence level, and paragraph copying at the passage level. Therefore, cognitive processes required to successfully complete these tasks might differ as sentence and passage level tasks might require greater linguistic and cognitive (e.g., working memory) processing for fast and accurate copying of letters and words. Some supportive evidence for this speculation comes from previous studies which showed that letter writing automaticity, sentence copying, and paragraph copying were only moderate correlated ($.32 \leq rs \leq .50$) (Graham et al., 1997; Kim, Al Otaiba, et al., in press; Wagner et al., 2011) with an exception for primary grade sample in Graham et al.'s (1997) study ($r = .77$). Furthermore, a recent study showed that letter writing automaticity and paragraph copying were both uniquely predictive of writing for primary grade children (Kim, Al Otaiba, et al., in press).

Another potential explanation is that letter writing automaticity primarily captures children's alphabet knowledge that has been shown to be important to lexical level literacy skills such as word reading and spelling (Schatschneider et al., 2004; Treiman & Kessler, 2003; see National Early Literacy Panel, 2008). A recent study has shown that letter writing automaticity is related to letter naming and letter sound fluency at .36 and .50, respectively (Kim, Al Otaiba, Puranik, Folsom, & Greulich, 2014). If letter writing automaticity primarily captures alphabet letter knowledge, the influence of letter writing automaticity on writing is likely to be indirect via lexical level literacy skill. In the present study, correlations between letter writing automaticity, and word reading and spelling ranged from relatively weak ($r = .30$) to moderate ($r = .41$). However, this speculation is discrepant from previous findings which showed that handwriting fluency predicted writing quality over and above a lexical level literacy skill, spelling, for children in primary and intermediate grades (Graham et al., 1997) as well as reading and oral language for children in grades 2 and 3 (Kim, Al Otaiba, et al., in press). Future replication and investigations about the role of handwriting fluency in writing, longitudinal relations in particular, are necessary.

Although previous studies have shown that attention is related to children's writing skills, even for young children in grade 1 (Kent et al., 2014; Kim et al., 2013), in the present study, attention in kindergarten was not uniquely related to third grade writing outcomes, after accounting for the other skills in kindergarten. These results are discrepant from a longitudinal prediction of kindergarten attention to first grade writing (Kent et al., 2014), but convergent with a finding that grade 1 attention was not predictive of grade 2 writing in Hooper et al. (2011). However, direct comparison of these results requires caution as studies differ in how attention and writing skills were measured in these studies. For example, Hooper et al. (2011) used direct, multiple measures of attention/executive function composed of short term, long term, working memory, and planning and retrieval fluency measures, and their writing skill outcome was not compositional quality (see above). Interestingly, our previous study of kindergarten prediction of first grade writing involved similar approaches including how writing was scored (Kim et al., 2014), but results about attention are discrepant.

Therefore, one way to interpret the present findings is that although attention at kindergarten is predictive of children's writing in grade 1, attention loses a unique and independent predictive power to writing skills three years later. Based on previous studies, it is possible that the predictive power of attention is indirect via other skills included in the study. As shown in Figs. 1 and 2, attention was moderately related to oral language, lexical level literacy skills, and letter writing automaticity in the present study, and a previous study showed that attentiveness was related to writing indirectly via an orthographic factor (e.g., identifying letter groups, and letter writing automaticity; Thomson et al., 2005). Thus, the impact of attention at kindergarten on writing three years later might have been mediated by these language and literacy skills at kindergarten. Future studies are needed to expand our understanding about the nature of role of attention in writing skills.

Although not the primary focus of the present study, the finding that participation in treatment negatively related to expository writing quality, even after accounting for the other predictors was surprising. However, note that these results should be limited to the present sample as the present study did not include all the participating children in the original intervention study due to the longitudinal nature of the current study. Furthermore, given that the focus of the intervention was reading, word reading in particular, and that very little writing instruction was observed in kindergarten (Puranik et al., 2014), future research is needed to examine the impact of more focused writing instruction within kindergarten and to explore its impact longitudinally. There are always time trade-offs; thus had there been algorithms for writing outcomes that suggested nuanced or individualized transcription or ideation instruction, findings may have differed.

5.1. Limitations, directions for future research, and implications

The following limitations are worth noting. Our findings should be limited to students with similar demographics and thus, predictions might differ in schools serving students from higher socioeconomic backgrounds or different performance levels. It should be noted that although children with reading difficulties in the context of a larger study were included, their lexical level literacy skills are in the average range compared to the norm sample (see Table 1). In addition, our kindergarten variables, although extensive, predicted a relatively modest amount of third grade reading quality. Although this is consistent with previous studies (Author et al., 2011; Kim et al., 2014), future work is needed to investigate other early sources of writing. Potential sources include self-efficacy and motivation, and content and discourse knowledge (see Graham et al., 2005; Limpo & Alves, 2013; Olinghouse & Graham, 2009), and the types of writing instruction students received (Author et al., 2013; Moat, Foorman, & Taylor, 2006). Future research is needed that directly observes writing instruction, and does so longitudinally to track potential accumulating effects. It would also be interesting to examine both early predictors and concurrent predictors. An additional limitation includes use of a single measure for attention in the present study, and it would be ideal to include several measures of attention including direct observation. In addition, in the not-so-simple view of writing, executive function includes various constructs such as planning, goal setting, and self-monitoring in addition to supervisory attention. It will be informative to examine these various aspects of executive function and their relations to writing skills (e.g., Limpo & Alves, 2013; see Graham, 2006). Finally, oral language measures were assessed in the fall of kindergarten whereas transcription, word reading, and attention were assessed in the spring of kindergarten. It would have been ideal if these oral language measures were assessed concurrently with the other measures in kindergarten.

Despite these limitations, the findings of the present study underscore the importance of oral language and literacy foundational skills for students' writing development. While recognizing that the present study was correlational in nature, we believe that, in conjunction with other studies, the findings in the present study offer some suggestions about potential areas for instructional attention. Given that writing cannot be effectively assessed for many children in kindergarten, kindergarten assessment in the lexical level literacy skills and oral language skills might be a consideration in order to identify children who are potentially at risk for writing difficulties in the future. In addition, results suggest that for the child to develop as a competent writer, she needs to develop not only fundamental literacy skills but also oral language skills to translate and articulate thoughts into written production. The importance of developing these skills has already been substantiated for future reading ability (Hoover & Gough, 1990; Joshi, Tao, Aaron, & Quiroz, 2012; Weiser & Mathes, 2011); this study further substantiates the importance of these skills for writing development. Finally, our findings combined with a recent meta-analysis conducted by Graham, Harris, and Santangelo (in press) support the critical need for future writing intervention research, particularly in the early grades and with students demonstrating risk factors for future reading and writing difficulties. This will become even more salient as the Common Core State Standards articulate what students should master, but the field needs a stronger set of converging findings to inform practice.

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