Direct and reciprocal effects among social skills, vocabulary, and reading comprehension in first grade

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ABSTRACT

Social skills and vocabulary are important areas of development involved in early reading achievement, yet little attention has been given to understanding the dynamic associations among them during the elementary years. This study examined the relations among three dimensions of social skills—cooperation, assertion, and self-control—vocabulary and developing reading comprehension (RC) skills in a longitudinal sample of first graders ($n = 468$). Using Structural Equation Modeling, reciprocal effects were observed between vocabulary and RC as well as direct effects among social skills, vocabulary, and RC after controlling for the influence of problem behaviors. This study highlights the reciprocal nature of students' vocabulary and RC skills as well as provides preliminary evidence suggesting that social skills play a role in developing vocabulary and RC skills, and further, vocabulary and RC skills play a role in social development during middle childhood. Implications for policy and practice are discussed.

1. Introduction

The development of early social and language abilities is integral for successful classroom participation and early reading achievement (Cain, Oakhill, & Bryant, 2004; Catts & Weismer, 2006; Merritt, Wanless, Rimm-Kaufman, & Peugh, 2012; Rotheram-Fuller, Kasari, Chamberlain, & Locke, 2010). Studies have suggested that social skills, such as accepting others' ideas, understanding classroom expectations, and initiating interactions are important for classroom learning (Arnold, Kupersmidt, Voegler-Lee, & Marshall, 2012; Halle, Hair, Wandner, & Chien, 2012) and provide a foundation for academic success during middle childhood—a critical developmental period spanning from 6 to 11 years (Del Giudice, 2014; Speece et al., 2010). Inversely, strong language skills, including vocabulary, are essential in social competence (Mashburn, Justice, Downer, & Pianta, 2009) and widely accepted as crucial for reading achievement (National Reading Panel [NRP], 2000; Nation & Snowling, 2004).

Although links between social, language, and reading skills have been established, much of the literature has suggested unidirectional associations among the variables, with social skills and vocabulary influencing reading development (e.g., McClelland, Acock, & Morrison, 2006; Nation & Snowling, 2004). Only a few studies have suggested potential reciprocal relations among the variables (e.g., Arnold et al., 2012; Connor et al., 2016; Trzesniewski, Moffitt, Caspi, Taylor, & Maughan, 2006). Connor et al. (2016) highlighted the dynamic interplay between semantic knowledge (knowledge of words) and reading comprehension, documenting the reciprocal nature of development during middle childhood. Trzesniewski and colleagues also suggested reciprocal relations between social and reading abilities, suggesting that students who struggle to read feel a loss of self-esteem and relatedness toward their higher achieving peers—beginning a negative cycle of social and academic withdrawal (Trzesniewski et al., 2006).

Extending on this body of literature, we propose that the relations among social skills, vocabulary, and reading comprehension (RC) may support one another through the transition from early to middle childhood (Sameroff, 2009; Trzesniewski et al., 2006). Social skills and vocabulary may support higher-order thinking skills, including RC, and developing RC may facilitate more advanced social skills and vocabulary development. Investigating the nature of the relations among social skills, vocabulary, and RC may inform approaches to support

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development and learning in early elementary classrooms (Lansdown, Jimerson, & Shahroozi, 2014). Hence, the purpose of this study was to explore the relations among social skills, vocabulary, and RC during the first grade school year—a period for the consolidation and integration of developmental and academic skills (Del Giudice, 2014).

1.1. The classroom context

Dynamic systems theories (Sameroff, 2009; Yoshikawa & Hsueh, 2001) and the lattice model (Connor et al., 2014, 2016) provide a theoretical framework to conceptualize the complexity and reciprocity involved in classroom learning and development. This framework posits that learning is a dynamic and transactional process involving multiple sources of influence that work together to shape child development over time, with a core emphasis on the bidirectional interplay among influences (Sameroff, 2009). Key assumptions of the lattice model include reciprocal effects across developmental domains as well as with the instructional context. The individual skills and characteristics that students bring with them into the classroom work together to influence their learning experiences and support development over time. We consider students' vocabulary knowledge and social skills, such as their ability to work cooperatively as a member of the classroom community (Gee, 2001), contribute to classroom discussions (Kucan & Beck, 1997; Murphy, Wilkinson, Soter, Hennessey, & Alexander, 2009), and participate fully in peer learning opportunities (Palincsar, Collins, Marano, & Magnusson, 2000) as two important areas that influence RC. At the same time, we propose that learning to read and comprehend text supports students' social skills and vocabulary development (Mar, Oatley, & Peterson, 2009). We posit that vocabulary and RC will influence each other reciprocally as well as predict social skills, and further, social skills will predict developing vocabulary and RC across first grade.

1.2. Social skills

Early and middle childhood are developmental periods critical for the acquisition of social skills (Hess et al., 2013; Merritt et al., 2012; Walthall, 2005), the learned skills and behaviors that enable a student to interact effectively and avoid unacceptable responses (Gresham & Elliott, 1990). In the current study, we define social skills across three dimensions: cooperation, assertion, and self-control—constructs that are well represented by the Social Skills Rating System (SSRS; Gresham & Elliott, 1990), a scale completed by classroom teachers. Cooperation refers to a set of social behaviors related to joint engagement and collaboration such as *compromising* and *accepting others' ideas*. Assertion refers to a set of social behaviors that involve initiating actions and interactions with others such as *introducing oneself* and *asking others for information*. Self-control refers to a set of social behaviors related to classroom self-management and includes behaviors such as *using free time appropriately* and *finishing class assignments*.

Evidence has suggested that typical development of adaptive social skills during this period play a pivotal role in kindergarten transitioning, participation in classroom activities, and independence and compliance (McClelland et al., 2006; Ziv, 2013). Studies have also documented an association between social skills and early literacy achievement (Arnold et al., 2012; McClelland et al., 2006). In a recent study, Montroy, Bowles, Skibbe, and Foster (2014) documented a direct association between social skills and reading outcomes in a sample of preschool students, such that students with stronger social development made greater gains in decoding, letter word knowledge, and phonological processing over the course of the school year (Montroy et al., 2014).

There is surprisingly little research that has investigated the association between students' social skills and developing RC skills (Arnold et al., 2012). However, this is an important area of research considering current academic national standards, such as Common Core State

Standards (CCSS), which calls for increasingly complex and nuanced understanding of text at younger ages (Porter, McMaken, Hwang, & Yang, 2011). In addition, there is an increasing focus on students' attainment of higher-order social-cognitive skills, such as the abilities to infer character traits, infer and recognize conflicts, and interpret words as used in the text (NAEP, 2015) through classroom participation and discussion (Jadallah et al., 2010; Murphy et al., 2009). It is possible that students with weaker social abilities also struggle with these social-cognitive tasks, and thus, might have greater difficulty participating in important learning opportunities that support RC (Merritt et al., 2012; Metsäpelto et al., 2017; Rotheram-Fuller et al., 2010). Thus, this study extends the current literature by examining the relation among social skills, vocabulary, and RC during first grade, when students are first being exposed to formal literacy instruction for extended periods of time (Spira, Bracken, & Fischel, 2005).

1.3. Social skills, vocabulary, and reading comprehension

Reading proficiency is among the most important skills students need to master if they are to succeed in their education and in life (NRP, 2000; Rapp, Broek, McMaster, Kendeou, & Espin, 2007). Students who fail to achieve proficient levels of reading are at an increased risk for grade retention, peer rejection, conduct problems, and school dropout (Reynolds, Ou, & Topitzes, 2004; Shonkoff & Phillips, 2000). Studies have also documented an association between low reading achievement and long-term negative outcomes, such as lower educational attainment, limited community involvement, higher unemployment, and higher rates of incarceration (Ladd & Dinella, 2009; Maughan & Caroll, 2006; National Center for Education Statistics [NCES], 2015; Rapp et al., 2007). However, according to the most recent National Assessment of Educational Progress report (2015), only 36% of U.S. students are performing at or above a proficient level of reading by fourth grade, with 50% of students who attend high poverty schools failing to achieve even a "basic" level of reading. These troubling statistics highlight the need for increased understanding of the dynamic relations between developmental processes and academic skills during middle childhood. First grade is particularly important because children are beginning to master formal instruction (Chatterji, 2006; Juel, 1988)—failure to develop the social, language, and reading skills necessary to adapt to the demands of formal schooling by the end of first grade might contribute to lower achievement and/or poor overall educational outcomes (Trzesniewski et al., 2006).

1.3.1. Reading comprehension

Reading comprehension (RC) is a complex developmental process that calls on the coordination of cognitive, language, social, and text-specific processes. Learning to read begins in early childhood as children develop social communication and language skills through interactions with caregivers and their environment (Liszkowski, Carpenter, & Tomasello, 2008; Scarborough, Neuman, & Dickinson, 2009). They begin to develop early literacy skills as they recognize that print carries meaning and sounds can be manipulated to create new words as well as grasp sound-symbol correspondence and orthographic patterns (Justice et al., 2013; Lonigan, 2006). Furthermore, exposure to narrative text in early childhood, a complex form of discourse, through book sharing with caregivers early in development also supports rich word learning and social-cognitive development (Slaughter, Peterson, & Mackintosh, 2016). These early skills provide the platform needed for children to develop proficient reading abilities upon entry to formal school settings (Cain et al., 2004; Colle, Baron-Cohen, Wheelwright, & van der Lely, 2008; Dickinson, Golinkoff, & Hirsh-Pasek, 2010).

1.3.2. Vocabulary and reading comprehension

The relation between language, including vocabulary, and RC has been well documented in the research literature, with studies showing that students' syntactic, semantic, and phonological abilities support

early and later reading achievement (Colle et al., 2008; Griffin, Burns, & Snow, 1998). Vocabulary knowledge, including understanding of specialized academic vocabulary and content in language arts, science, and social studies has been considered as one of the foundational components in students' reading success (NRP, 2000; Storch & Whitehurst, 2002). Studies have illustrated that a strong vocabulary provides the critical platform needed for a student to acquire and advance in reading (Compton, Fuchs, Fuchs, Elleman, & Gilbert, 2008; Dickinson et al., 2010; Nation & Snowling, 2004).

1.3.3. Social skills, vocabulary, and reading comprehension

As students advance through middle childhood, making the shift from learning to read to reading for understanding (Chall, 1967), social aspects of language and social-cognitive skills also (i.e., metacognitive monitoring, perspective taking) become increasingly important for deriving meaning from text they have decoded (Cain et al., 2004; Colle et al., 2008). Words are put together in sentences where shades of meaning, paradox, word play, allusion, allegory, and figurative language can all in turn change the meaning(s) of a phrase. Successful interpretation of text requires students to infer meaning (Cain et al., 2004) and generate a semantic representation of the text (Nation & Snowling, 2004). Furthermore, studies have suggested that narrative text offers a life-like simulation of the social world—that the capacity to project oneself into a story to infer meaning is similar to projecting oneself into another's mind to infer their intentions (Mar et al., 2009). Successful interpretation requires individuals to feel characters' emotions and intentions (Kidd & Castano, 2013) in order to make predictions and conclusions about characters' motivations, thoughts, and beliefs. One might conjecture that students with stronger social skills, who are able to appropriately respond to teasing, compromise, and understand peer pressure—skills outlined on the SSRS—,would be able to leverage these skills to identify with characters in stories and understand their emotions, intentions, and motivations.

1.4. Reciprocal effects

There is an emerging body of literature that suggests reciprocal relations among social skills, vocabulary, and RC. In a recent study, Connor et al. (2016) documented reciprocal effects between semantic knowledge and RC, providing evidence for the synergistic effect between the constructs beginning in first grade and continuing through second grade. There is also evidence that vocabulary impacts social development—students with stronger vocabulary abilities are more able to socially interact with their peers (Mashburn et al., 2009), whereas students with weaker language and vocabulary are arguably less able to learn from peer-mediated learning activities (Connor et al., 2012). Finally, studies have proposed that RC and social competence share common social-cognitive processes that might support one another in development (Baron-Cohen, Lombardo, Tager-Flusberg, & Cohen, 2013; Capps, Losh, & Thurber, 2000; Randi, Haven, Haven, & Grigorenko, 2010). For example, students who have difficulty drawing inferences and conclusions in order to adequately comprehend a text (Cain et al., 2004; Catts & Weismer, 2006), might also struggle with understanding and predicting others' perspectives and intentions during social interactions (Kidd & Castano, 2013)—necessary skills involved in social competence (Paul, 2007; Paul & Cohen, 1985; Tager-Flusberg, Paul, & Lord, 2005; Wakusawa et al., 2007; Watson, Nixon, Wilson, & Capage, 1999). While evaluating the processes that underlie social and reading competence is outside the scope of the current study, this literature provides some evidence that social skills and RC may develop reciprocally, improvement (or lack thereof) in one domain may influence the other (Diehl, Bennetto, & Young, 2006). Investigating the dynamic relations among social skills, vocabulary, and RC may provide insight into the components that they share as well as a platform for future research. This research could inform best practices in reading instruction as well as facilitate social and vocabulary development in the classroom context.

1.5. Study purpose and research aims

This study explores the dynamic relations among social skills—cooperation, assertion, and self-control—vocabulary, and students' developing reading comprehension (RC) skills from the beginning to the end of first grade. Overall, this study seeks to capture the dynamic and reciprocal associations among social skills, vocabulary, and RC within a longitudinal sample of first grade students. Extending on the current literature, which has illustrated the importance of vocabulary in reading development, we hypothesize that students' RC will also play a significant role in vocabulary and social skills development. We hypothesize that vocabulary and RC will influence each other reciprocally as well as predict social skills, and further, social skills will predict students' developing vocabulary and RC skills.

2. Methods

2.1. Participants

This study included participants recruited for a longitudinal cluster-randomized controlled study on individualizing student instruction spanning from 2008 to 2011 (Connor et al., 2013). Students ($n = 468$) and their teachers ($n = 28$) who participated in the longitudinal study were recruited in 2008 to 2009—the beginning of their first grade school year from five schools in the Florida Panhandle. These students were then followed, along with any new classmates, through third grade ($n = 541$ students; 40 teachers). Parental consent was obtained for all participating students. Teachers were randomly assigned to either a literacy or mathematics intervention, in which they received the same amount of professional development on how to individualize either literacy or mathematics instruction. Results of the study on differentiating instruction showed a significant effect on reading comprehension for students in the reading group but no effect of treatment on mathematics for students in the mathematics group (Connor et al., 2013).

The current study included students ($n = 468$) within their first grade school year and their teachers ($n = 28$) across five school districts in Northern Florida. Participating students were 46% male and ranged between 6.0 and 8.5 years of age ($M = 6.6$, $SD = 0.44$) at the beginning of first grade. Four of the students were 8-years-old, three of whom turned eight one month into the school year. Regarding racial and ethnic background, 84% of the sample identified as Non-Hispanic White, 3% Hispanic White, 5% Black or African American, 2% Asian, and 6% Multiracial. Thirty-six percent of the students in the sample were eligible for free or reduced price lunch (FARL), a proxy for socioeconomic status. In addition, 9% of the students within the sample had an educational exceptionality, many of whom with a primary disability of speech and language impairment. Of these students, 4% qualified for Exceptional Student Education (ESE) services for reading and/or reading, writing, and math.

Participating first grade teachers were all female (100%) and reported an average of 17 ($SD = 11$) years of teaching experience. Ninety-seven percent identified themselves as White, and 3% identified as Black or African American. Twenty-eight percent of the participating teachers reported having a M.A or M.S. degree, and 7% reported having an M.Ed. Furthermore, 31% held certification in early childhood development, 86% in elementary education, 17% in ESE and 3% in reading.

2.2. Teacher report and standardized measures

As part of the longitudinal study, teachers filled out the *Social Skills Rating System* (SRSS; Gresham & Elliott, 1990) for each of their students in the winter (January/February) of the school year to assess social

behaviors. In addition, all participating students completed a battery of reading and vocabulary measures including the *Woodcock-Johnson III Tests of Achievement* (WJ-III; Mather & Woodcock, 2001) in the fall (August/September) and spring (April/May) of the school year as well as the *Gates-MacGinitie Reading Tests, 4th Edition* (GMRT-4; MacGinitie & MacGinitie, 2006) in the spring (April/May). Full descriptions of the assessments are provided below.

2.2.1. Social skills

The *Social Skills Rating System* (SSRS; Gresham & Elliott, 1990) is a comprehensive, standardized rating scale of social behaviors intended for students between 3 and 18 years of age. The SSRS provides a broad overview of social development while documenting the frequency of behaviors that influence students' development of social competence and adaptive functioning. The measure consists of separate parent and teacher rating forms. For this study, we used the SSRS, Teacher version (SSRS-Teacher) Social Skills and Problem Behaviors subscales. The Social Skills scale includes 30 questions that ask teachers to rate the frequency of their students' social skills (never, sometimes, very often) across three dimensions: cooperation (i.e., *compromises, gets along with others, accepts others' ideas*), assertion (i.e., *introduces self, joins in on activities, initiates conversations*), and self-control (i.e., *controls temper, attends to instruction, uses free time appropriately*). The SSRS also includes the Problem Behaviors scale, which measures behaviors that may interfere with classroom learning (externalizing, internalizing, and hyperactivity). Standard scores from the Social Skills and Problem Behaviors scales were used in the analyses and reported in Table 1. The SSRS is a widely used tool and has overall good reported reliability, with coefficients ranging between 0.80 and 0.90. The SSRS was normed using a large, national sample of children with varying abilities and educational classifications.

Table 1
Standardized and teacher report measures.

Standardized and Teacher-Report Measures	Descriptive Statistics		Distribution Properties	
	M	SD	Skewness	Kurtosis
WJ-III (Fall)				
LW ($n = 454$)[a]	419.78	27.34	0.84	0.57
PC ($n = 454$)[a]	442.66	22.84	−0.54	0.29
PV ($n = 454$)[a]	482.07	9.82	0.20	0.38
LW ($n = 454$)[b]	106.22	13.98	0.16	0.08
PC ($n = 454$)[b]	98.09	16.30	−0.45	0.13
PV ($n = 454$)[b]	102.32	9.60	0.22	0.21
WJ-III (Spring)				
LW ($n = 468$)[a]	462.41	21.96	−0.07	0.02
PC ($n = 468$)[a]	475.08	13.40	−0.23	−0.18
PV ($n = 468$)[a]	487.25	9.83	0.25	0.17
AK ($n = 458$)[b]	480.65	9.85	−0.36	−0.16
LW ($n = 468$)[b]	112.54	12.11	−0.55	0.23
PC ($n = 468$)[b]	105.13	11.34	−0.49	0.07
PV ($n = 468$)[b]	102.96	9.50	0.12	0.07
AK ($n = 458$)[b]	104.16	11.52	−0.15	−0.37
GMRT-4 (Spring)				
Total Composite ($n = 462$)	417.35	44.36	0.23	−0.36
SSRS (Winter)				
SS ($n = 449$)	102.02	16.96	−0.17	−0.34
PB ($n = 457$)	101.13	14.78	0.64	−0.54

Note. The sample size for each measure is listed. Rasch-based W scores ([a]) and standard scores ([b]) are reported for the Woodcock-Johnson III Tests of Achievement (WJ-III). Extended Scale Scores, similar to W scores, are listed for the Gates-MacGinitie Reading Tests-4th edition (GMRT-4). Standard Scores are reported for the Social Skills Rating System (SSRS) Social Skills (SS) and Problem Behaviors (PB) scales. Letter-Word Identification (LW); Passage Comprehension (PC); Picture Vocabulary (PV); Academic Knowledge (AK); fall season (Fall); spring season (Spring); winter season (Winter).

2.2.2. Vocabulary and RC

The *Woodcock-Johnson III Tests of Achievement* (WJ-III; Mather & Woodcock, 2001) are individually administered standardized assessments of students' achievement. The WJ-III includes varying subtests to measure students' reading, mathematics, oral language, and academic knowledge. Four WJ-III subtests were used in the current study. The Passage Comprehension (PC) subtest measures reading comprehension (RC) by asking students to use context clues to fill in blank spaces from increasingly difficult passages. The PC subtest requires students to integrate syntactic (structural) and semantic features of the text in order to construct an accurate representation of the passage (Wendling, Schrank, & Schmitt, 2007). The Letter-Word Decoding (LW) subtest measures decoding and word reading by asking students to identify letters and their corresponding sounds and read lists of increasingly difficult words. The Picture Vocabulary (PV) subtest measures students' vocabulary knowledge and taps into the cognitive processes of object recognition, lexical access, and lexical retrieval by requiring students to recognize, access, and label pictures of increasing difficulty (Wendling et al., 2007). The Academic Knowledge (AK) subtest is similar to the PV subtest, yet the content is focused on students' general encyclopedic knowledge across varying content areas and requires students to use reasoning and factual knowledge to answer open-ended questions.

We used W scores in analyses, which address the variation in age observed in the sample because they take into account a student's ability as well as the test item level of difficulty (Jaffe, 2009). W scores, which are a variation of the Rasch score (Rasch, 2001), also provide an equal-interval metric across grade and age. They are centered on a value of 500, which represents the expected score of a 10-year-old student when using age norms. Because they provide an equal-interval scale, W scores have been documented as more optimal for assessing change in reading development over time (Hughes, Im, & Wehrly, 2014). W and standard scores were reported in Table 1. The WJ-III was standardized on a national sample and has good reported reliability on each scale, with reported test-retest reliability coefficients ranging from 0.80 to 0.89 and reported alpha coefficients between 0.88 and 0.94.

The *Gates-MacGinitie Reading Tests 4th edition* (GMRT-4; MacGinitie & MacGinitie, 2006) is a group administered standardized measure designed to assess reading achievement across two tests: Word Decoding and Comprehension. Word Decoding assesses students' ability to recognize and decode words. Comprehension measures students' ability to read and understand different types of genres including fiction, narrative, and expository passages and requires students to infer and draw conclusions. Students choose pictures that illustrate the text or answers a question about the passage. The GMRT-4 derives three scores, a Word Decoding score, Comprehension score and a Total score. The Total score, which includes Word Decoding and Comprehension, was used in the current study. Extended scale scores (ESS), which are similar to W scores ($M = 500$), were used in the analyses as well as reported in Table 1. The GMRT-4 was normed on a large international sample and has good reported reliability coefficients (alpha = 0.92).

2.3. Analytic methods

2.3.1. Observed and latent variables

Latent variables represent the common or shared variance among a set of observed variables while considering the unique variance that is not shared (i.e., error; Kline, 2016), thus providing a more robust measure of the theoretical construct of interest. In the current study, confirmatory factor analysis (CFA) was used to create latent variables to represent the winter social skills and spring RC and vocabulary constructs as well as evaluate the fit of the measurement model. The models were evaluated using Mplus software (Muthén & Muthén 2012) and the Maximum Likelihood Robust (MLR) estimator to account for the nested nature of the data (students nested in classrooms) by adjusting standard errors (Kline, 2016). Specification of the latent variables is consistent with previous studies (Connor et al., 2013, 2016),

which have used the LW and PC subtests of the WJ-III to create a "reading" latent variable and the PV and AK subtests of the WJ-III to create a "semantic" latent variable.

In the current study, the fall RC and vocabulary constructs were modeled as observed variables using the fall PC and PV subtests on the WJ-III. The LW and PC subtests on the spring WJ-III as well as the Total score on the spring GMRT-4 comprised the spring RC latent variable in order to capture the increasing complexity of RC as students progressed through their first grade school year (Connor et al., 2016) and provide a more robust measure of the theoretical construct. Similarly, the PV and AK subtests on the spring WJ-III comprised the spring vocabulary latent variable because of the shared common variance between the variables—providing a robust measure of vocabulary. In addition, the social skills latent variable was modeled as a single-indicator using the SSRS Social Skills scale standard score in order to partial out measurement error. The Problem Behaviors scale on the SSRS was included in the model as a covariate to reduce the likelihood of specification error because of the covariation documented between the Social Skills and Problem Behaviors scales on the SSRS ($r = -0.79$).

2.3.2. Model specification and identification

Structural Equation Modeling (SEM) was used to evaluate the direct effects among social skills, vocabulary, and RC from the beginning to the end of first grade while controlling for the covariation among problem behaviors, vocabulary, and RC. Cross-lagged paths were included in the model to test for potential reciprocal relations between vocabulary and RC. Autoregressive paths were included in the model to evaluate the stability of RC and vocabulary from fall to spring of the school year and examine direct effects between RC and social skills as

well as vocabulary and social skills after controlling for the influence of problem behaviors. See Fig. 1.

Sample size to parameter ratio was 19:1, with 468 participants and 25 parameters. The measurement and structural models met the recommended identification assumptions. The model degrees of freedom (*df*) was greater than zero and scaling constraints were imposed on the variances of the latent variables and error terms. The social skills latent variable was identified by fixing the error term of the single indicator latent variable to equal $1 - r$ (S^2), where *r* equals reliability (Kline, 2016).

The SEM model was evaluated using Mplus software (Muthén & Muthén 2012) and the MLR estimator. Evaluation and interpretation of model fit was guided by the information obtained from the following model fit statistics. Root Mean Square Error of Approximation (RMSEA; with 90% confidence interval) and Standardized Root Mean Square Residual (SRMR), with values approaching zero indicating good fit and values approaching 1.0 indicating increasingly poor fit; Comparative Fit Index (CFI), with values greater than 0.95 indicating good fit (Hoyle, 2012; Kline, 2016). It is important to note that the chi-square ($\chi 2$) test of exact model fit is not trustworthy when using the MLR estimator because MLR uses robust standard errors and corrected model test statistics. In the current study, interpretation of model fit was based on careful evaluation of each fit index outlined above in addition to the parameter estimates.
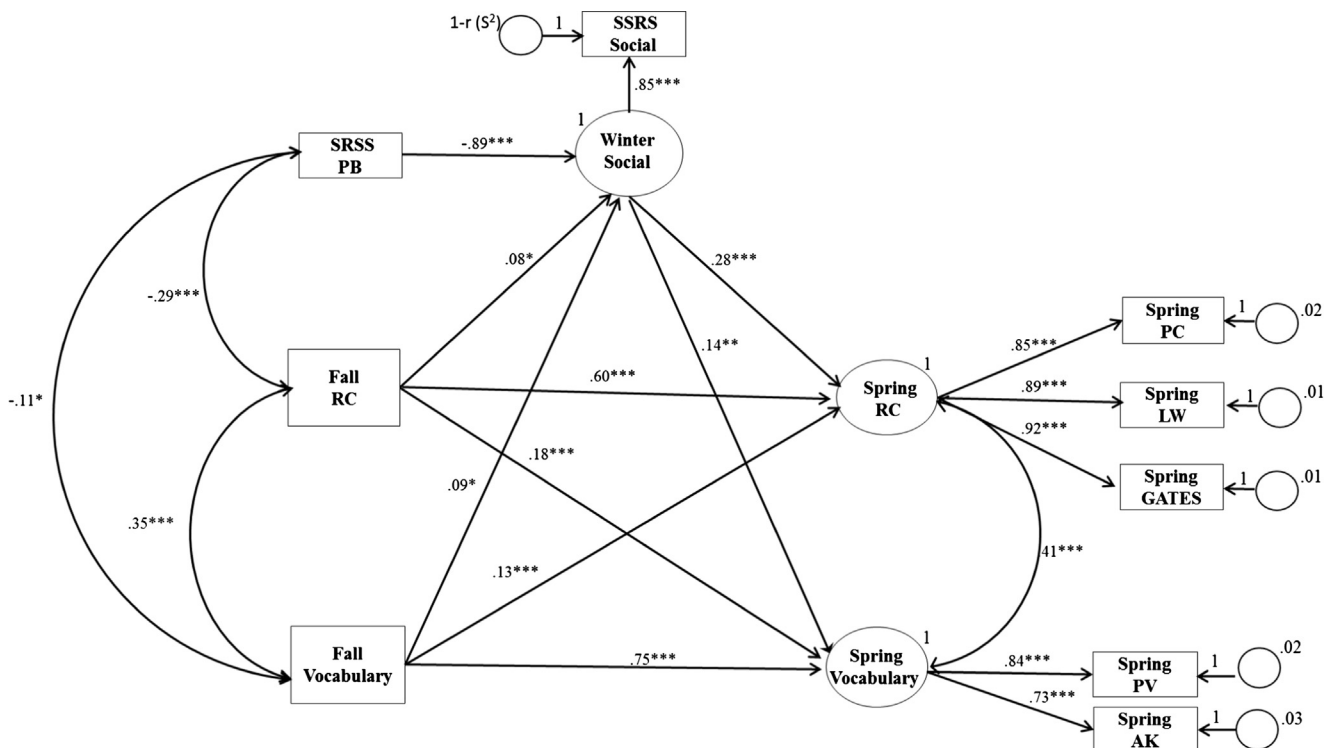

Fig. 1. Standardized parameter estimates for the structural equation model evaluating direct associations among social skills, vocabulary, and reading comprehension (RC) from the beginning to the end of first grade. The winter social skills factor (Winter Social), which was comprised using the Social Skills Rating System (SSRS) Social Skills scale, was identified by fixing the error term of the single indicator factor (Kline, 2016). RC at the beginning of the school year (Fall RC) was measured using the Passage Comprehension (PC) subtest of the fall Woodcock-Johnson III Tests of Achievement (WJ-III). The LW and PC subtests from the spring WJ-III as well as the Total composite score on the spring Gates-MacGinitie Reading Tests 4th edition (GMRT-4) comprised the spring RC latent factor (Spring RC) in order to capture the increasing complexity of reading development as students progressed through first grade. Similarly, vocabulary was measured using the Picture Vocabulary (PV) subtest on the WJ-III in the fall (Fall Vocabulary) and the PV and Academic Knowledge (AK) subtests in the spring (Spring Vocabulary). All direct effects between the variables were estimated controlling for the covariation between fall vocabulary, RC and problem behaviors (PB) measured by the SSRS. The direct association between winter social skills and spring RC was estimated controlling for the influence of PB. $^{*}p < 0.05$. $^{**}p < 0.01$. $^{***}p < 0.001$.

3. Results

3.1. Preliminary analyses

3.1.1. Data preparation

Distribution properties were examined through descriptive statistics and visual inspection of histograms and scatterplots. After bringing one outlier on the fall LW and PC subtests within the three interquartile range from the median, all variables included in the SEM model were normally distributed (skewness and kurtosis values < 2). The shape of the distribution appeared linear. See Table 1 for the distribution properties of each of the variables included in the model. Data appeared to be missing at random; observations differed from observed scores by chance. There were no significant differences observed in missing data patterns due to differences in gender, FARL status (a proxy for socio-economic status), or ethnic background ($p > 0.05$). Missing data were handled using full-information maximum likelihood (FIML) estimation, a model-based approach for handling missing data patterns while the model is being estimated.

3.1.2. Descriptive statistics

Students showed substantial variability in their social abilities in the classroom as measured via the SSRS; however overall, they demonstrated typically developing social skills ($M = 102.02$, $SD = 16.96$) and were generally well behaved ($M = 101.13$, $SD = 14.78$). Fall WJ-III scores were in the typically developing range, with an average PV standard score of 102.32 ($SD = 9.60$), PC score of 98.08 ($SD = 16.30$), and LW score of 106.22 ($SD = 13.98$). See Table 1 for descriptive information on each of the measures. It is important to note that we documented a significant mean difference in problem behavior ($F = 10.90$, $p < 0.01$) and the spring GMRT-4 Total score ($F = 14.16$, $p < 0.001$) between students who were and were not eligible for FARL. Students who were eligible for FARL exhibited more problematic behaviors ($M = 103.33$, $SD = 14.33$; $M = 98.02$, $SD = 13.29$) and weaker reading scores ($M = 410.74$, $SD = 34.12$; $M = 428.29$, $SD = 42.81$).

3.2. Correlations

Correlations among variables included in the model were examined using Pearson product-moment correlation coefficients for normally distributed data and are presented in Table 2. Overall, there were significant small to moderate, positive correlations observed between the SSRS Social Skills scale and the WJ-III subtests ($r = 0.18$–37) as well as moderate correlations between the Social Skills scale and the GMRT-4 Total score ($r = 0.45$). Small to moderate, negative correlations were observed between the SSRS Problem Behaviors scale with the WJ-III subtests ($r = -0.17$ to -0.39) and GMRT-4 Total score ($r = -0.42$).

Moderate to strong correlations were observed among the various domains of students' vocabulary and RC ($r = 0.28$–0.82). Similar patterns of association among the variables were observed between students who were and were not eligible for FARL.

3.2.1. Direct and reciprocal effects among social Skills, Vocabulary, and RC

The measurement model [RMSEA = 0.115 (0.086–0.145); SRMR = 0.029; CFI = 0.967] and structural model indicated overall good fit to the data [RMSEA = 0.087 (0.069–0.107); SRMR = 0.035; CFI = 0.973]. Each of the factor loadings, covariances, and path coefficients were significantly different from 0 ($p < 0.05$). See Fig. 1. Overall, direct effects were documented among social skills, vocabulary, and RC from the beginning to the end of first grade while controlling for the covariation ($p < 0.05$) between problem behaviors, vocabulary, and RC. Reciprocal effects were observed between vocabulary and RC whereby RC measured at the beginning of the year significantly predicted students' vocabulary in the spring ($\beta = 0.18$, $p < 0.001$), and vocabulary measured at the beginning of the year significantly predicted students' RC in the spring ($\beta = 0.13$, $p < 0.001$). RC ($\beta = 0.60$, $p < 0.001$) and vocabulary ($\beta = 0.75$, $p < 0.001$) appeared to be somewhat stable across the school year. Furthermore, direct effects were observed between RC and social skills as well as vocabulary and social skills across the year after controlling for the influence of problem behaviors. RC in the fall significantly predicted winter social skills ($\beta = 0.08$, $p < 0.05$), and further, winter social skills significantly predicted RC in the spring ($\beta = 0.28$, $p < 0.001$). Similarly, vocabulary in the fall significantly predicted winter social skills ($\beta = 0.09$, $p < 0.05$), and further, winter social skills significantly predicted vocabulary in the spring ($\beta = 0.14$, $p < 0.01$).

Due to the significant mean differences in the spring GMRT-4 Total score between students who were and were not eligible for FARL, we conducted further analyses to evaluate whether FARL status influenced the research findings. We reevaluated the structural model after excluding students who were eligible for FARL and did not observe differences in model fit [RMSEA = 0.089 (0.068–0.112); SRMR = 0.033; CFI = 0.973] or differences among the relations of the variables. Each of the factor loadings, covariances, and path coefficients were significantly different from 0 ($p < 0.05$).

4. Discussion

This study evaluated direct and reciprocal relations among students' social skills, vocabulary, and developing reading comprehension (RC) skills from the beginning to the end of first grade—a critical transition in middle childhood. The contributions that this study brings to the current literature are twofold. Firstly, much of the previous literature

Table 2
Pearson correlations among social skills, vocabulary, and reading comprehension.

Variables	1	2	3	4	5	6	7	8
1. SRSS SS								
2. SRSS PB	−0.79[***]							
3. Fall PV	0.18[***]	−0.11[*]						
4. Fall PC	0.32[***]	−0.29[***]	0.34[***]					
5. Spring AK	0.33[***]	−0.26[***]	0.58[***]	0.39[***]				
6. Spring PV	0.21[***]	−0.17[***]	0.72[***]	0.39[***]	0.61[***]			
7. Spring PC	0.36[***]	−0.33[***]	0.42[***]	0.62[***]	0.46[***]	0.51[***]		
8. Spring LW	0.37[***]	−0.39[***]	0.28[***]	0.68[***]	0.41[***]	0.37[***]	0.77[***]	
9. GMRT-4 Total	0.45[***]	−0.42[***]	0.37[***]	0.67[***]	0.50[***]	0.44[***]	0.77[***]	0.82[***]

Note. Pearson correlations for variables included in the SEM model. Social Skills Rating System Social Skills (SSRS SS) and Problem Behaviors (SSRS PB) scales; Woodcock-Johnson III Tests of Achievement (WJ-III); Picture Vocabulary (PV), Passage Comprehension (PC), Letter-Word Identification (LW); and Academic Knowledge (AK) subtests; Gates-MacGinitie Reading Tests-4th Edition total composite score (GMRT-4 Total); fall season (Fall); spring season (Spring).

[**] $p < 0.01$.

[*] $p < 0.05$.

[***] $p < 0.001$.

has focused on early childhood education, whereas this study extends findings to a sample of elementary students. Secondly, we explored a more nuanced relation among social skills, vocabulary, and RC—examining reciprocal paths between vocabulary and RC and modeling RC and vocabulary as predictors of social skills as well as modeling social skills as a predictor of vocabulary and RC.

Overall, the results of this study support our hypotheses and our theoretical framework that incorporates dynamic systems theories (Sameroff, 2009) and the lattice model (Connor et al., 2014, 2016), which emphasize the dynamic and reciprocal nature of learning and development in the context of the classroom. This framework posits that multiple developmental domains simultaneously work together to shape learning over time, such that the individual skills that students bring with them into the classroom will influence each other to impact development and learning. Findings from this study provide evidence that students' RC skills contribute to vocabulary and social development. Vocabulary and RC influenced each other reciprocally as well as predicted social skills, and further, social skills predicted students' vocabulary and RC skills. The indicated importance of each upon the other suggested in this study may have important implications for various aspects of education.

4.1. Dynamic relations among social Skills, Vocabulary, and reading comprehension

4.1.1. Reciprocal effects

Similar to Connor et al. (2016), we documented reciprocal effects between vocabulary and RC, highlighting the synergistic relation between the two constructs during first grade. The overall good fit of the measurement and structural models provide further evidence to support the reciprocal nature of the data. The impact of vocabulary on RC has been well documented in the research literature. A strong vocabulary is considered foundational to students' reading success (NRP, 2000) as it provides the platform needed to acquire and advance in reading (Dickinson et al., 2010; Lonigan, 2006; Storch & Whitehurst, 2002). This study provides further support that this association continues through first grade. Studies have also elucidated the impact of RC on vocabulary. For example, how exposure to text and print materials provide rich learning opportunities to acquire new vocabulary (Dickinson & Porche, 2011).

4.1.2. Vocabulary and reading comprehension on social skills

In addition, studies have provided support for understanding the impact of vocabulary on social skills. Students who exhibit stronger vocabulary abilities are more able and willing to interact with their peers during peer-mediated learning opportunities (Connor et al., 2012; Mashburn et al., 2009). Just as vocabulary provides a foundation for successful RC, it might also contribute in part, to successful social interaction and discussion in the classroom context.

As previous research has suggested (i.e., Mar & Oatley, 2008; Trzesniewski et al., 2006), we found a direct relation between RC and social skills in first grade while controlling for the influence of problem behaviors. The current research literature provides potential support for interpreting this finding. Studies have suggested that the social-cognitive skills that are important for RC (i.e., perspective taking, emotional knowledge) also underlie social competence (Capps et al., 2000; Mar et al., 2009; Paul, 2007; Tager-Flusberg et al., 2005). Hence, students who are able to successfully read and comprehend text are being exposed to various social situations and perspectives—which might support continued social development and RC (Kidd & Castano, 2013). For example, comprehending narrative text engages social-cognitive skills, challenging readers to empathize with story characters, consider others' perspectives and intentions, make predictions, interpret problems, and generate solutions (Mar et al., 2009; Randi et al., 2010)—opportunities

to closely read and analyze narrative text might provide a rich platform for social learning in addition to supporting RC (NAEP, 2015). However, deciphering causality is extremely difficult and warrants further research to explore these complex developmental pathways early in development and into elementary school.

4.2. Social skills on vocabulary and reading comprehension

Similar to previous studies that have documented the importance of social skills on early literacy skills, such as decoding, letter word knowledge, and phonological processing (e.g., Montroy et al., 2014), this study extends these findings by documenting that social skills also play a role in the development of vocabulary and RC over the course of first grade. Evidence has suggested that typical development of adaptive social skills in preschool settings lays an important foundation for academic success. Students' with stronger social skills are more able to take advantage of rich classroom learning opportunities, participate fully in classroom activities, and work cooperatively with their peers (Arnold et al., 2012; Ziv, 2013). We extend on this body of literature to show that social skills continue to support classroom learning in first grade.

It is possible that students who exhibit stronger social skills are able to leverage the necessary skills needed to successfully comprehend text. For example, during early schooling children are acquiring a foundation of literacy and social skills—learning how to interact with peers, generate ideas, understand others may have different ideas, and participate in activities (Hair, Halle, Terry-Humen, Lavelle, & Calkins, 2006). These early social skills are important for early literacy learning and provide a foundation for later reading development (Merritt et al., 2012; Pentimonti, Justice, & Kaderavek, 2014). As students progress through middle childhood, specific social skills, such as being able to accept or disagree with others' ideas or notice and consider details and perspectives, might become particularly important for making the most out of learning opportunities that support higher-order skills, including classroom discussion, peer learning activities, and RC (Connor et al., 2012; Efklides & Misailidi, 2010; Murphy et al., 2009; Watson et al., 1999). Future research is needed to better understand the role of specific social skills on RC as well as the dynamic relation between social development and RC using varying measures that tap into underlying social-cognitive processes that have been proposed to support RC and social competence (e.g., perspective taking).

4.3. Strengths and limitations

One of the principal limitations of the current study was reliance on the SSRS (Gresham & Elliott, 1990), a teacher report tool of student social skills, to investigate the associations among social skills, vocabulary, and RC. An updated version of the SSRS has been released since the time of this data collection. Future research should incorporate the revised scales as well as more comprehensive methods for measuring students' social skills, such as classroom observation to evaluate social skills without the possible influence of teacher bias. In addition, including a measure that more broadly conceptualizes and tracks students' language abilities would help tease apart the specific language domains, such as receptive language and syntax. Furthermore, including additional measures that characterize the sample within future studies would allow for further investigation of specific student characteristics, such as attention and self-regulation, that may be associated with social, language, and reading development. Finally, this study was conducted in the context of a longitudinal cluster-randomized controlled study where teachers received professional development on how to individualize either literacy or mathematics instruction (Connor et al., 2013). The focus of the professional development was on supporting teachers' ability to individualize instruction to meet their

students' learning needs in either reading or mathematics, depending on the group to which they were assigned. [1] Given the nature of the sample, future research is needed to examine the impact of social skills on students' response to literacy and mathematics intervention.

This study included a large longitudinal sample of first grade students. The measures used in the current study have been widely used across studies and have good reported reliability and validity. The use of latent variables provide a more robust measure of each of the constructs. It is important to note, that although the direct effects between social skills, vocabulary, and RC are small, they remain significant while controlling for the influence of students' problem behaviors. This is a strength of this study as previous studies evaluating social skills and RC have typically not included problem behaviors as a covariate in analyses. However, we felt it was important to understand the unique contribution that vocabulary and RC have on social skills as well as the unique contribution that social skills has on RC and vocabulary by accounting for the influence of problematic behavior. This research contributes to a limited body of evidence on students' social skills and extends the current literature to a sample of elementary students by providing important information on the dynamic and reciprocal relations among social skills, vocabulary, and RC. While the size and age range of the sample participants support generalizability to first grade students whose teachers receive individualized reading or mathematics instruction, future research should examine potential differences in the structure of the relations among social skills, vocabulary, and RC in students from low resource families.

4.4. Educational implications and future directions

Overall, these findings raise important considerations for educational practices and provide meaningful information regarding the association between prosocial and academic skills—an area of need (Hendrickx, Mainhard, Boor-Klip, & Brekelmans, 2017). Expanding on the current literature, which underscores the relations among social, language, and reading skills in preschool children (Arnold et al., 2012; Mashburn et al., 2009; Montroy et al., 2014), this study found similar relations within first grade students, emphasizing the developmental continuity in these interrelated skills. Evaluation of vocabulary in tandem with RC as well as RC as a predictor of social skills may be informative for both researchers and practitioners. Hence, better understanding of how students with differing social skills and language abilities manage the demands of the classroom-learning environment may provide insight into how best to facilitate higher-order skills, including RC. A growing emphasis on social-emotional learning is also relevant to considering social skills as well as academic, language, and cognitive skills (Jones, Brown, & Lawrence Aber, 2011). One might anticipate that social-emotional learning should enhance social skills, which, according to our findings, would also strengthen RC. Furthermore, as educators target improved social-cognitive skills for inferring meaning from text, they may also be facilitating social (Mar & Oatley, 2008) and vocabulary development.

The CCSS were developed to support the application of knowledge through higher-order thinking (Porter et al., 2011). This may be particularly important for students who need more practice comprehending meaning from text, students with limited cooperation, assertion, and self-control behaviors as well as students who exhibit weaker language skills, including vocabulary knowledge. As instruction is created for students struggling with social, language, and/or reading skills, educators may consider that those with weaknesses in one area may need support across

related developmental domains. For example, if a student has difficulty compromising and accepting others' idea in social contexts, he/she may also struggle with the social pragmatic aspects involved in RC. With the implementation of the CCSS and recent adoption of new nationwide curricula that encourages classroom discussion to support student learning, it is crucial that future research continue to investigate the complex nature of the relations among social skills, language, and RC in the interest of ensuring that practices reach their full potential in supporting students' development across multiple dimensions.

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[1] Connor et al., 2013 documented significantly stronger letter-word identification and passage comprehension outcomes in 1st–3rd grade classrooms in which teachers received professional development on how to individualize literacy instruction (ISI) when compared to a treated control condition, highlighting the benefits of personalized literacy instruction. Furthermore, the authors documented an accumulation effect, with students receiving ISI across 1st–3rd grade achieving the greatest gains in reading skills.

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