International Journal of Language & Communication Disorders

INT J LANG COMMUN DISORD, MARCH–APRIL 2016,
VOL. 51, NO. 2, 148–161

Research Report

School readiness of children with language impairment: predicting literacy skills from pre-literacy and social–behavioural dimensions

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(*Received September 2014; accepted June 2015*)

Abstract

Background: School readiness generally captures the notion that children do best when they arrive at formal schooling with a certain threshold of skill that will help them thrive in the classroom's academic and social milieu.
Aims: To examine the dimensionality of the construct of school readiness among children with language impairment (LI), as well as the extent to which these dimensions relate to children's end-of-kindergarten literacy skills.
Methods & Procedures: Participants were 136 preschool-aged children with LI. Children were assessed on measures of pre-literacy, social, and behavioural skills in preschool and reading and spelling in kindergarten.
Outcomes & Results: Confirmatory factor analyses indicated that school readiness for this sample of children with LI is best characterized as two dimensions: pre-literacy and socio-emotional. Of the two dimensions, pre-literacy readiness was predictive of children's future performance in reading and spelling.
Conclusions & Implications: The results further our theoretical understanding of the dimensions of school readiness, as well as our knowledge of how these skills are related among children with LI. Identifying domain-specific readiness skills that are predictive of kindergarten success can help to identify means of early assessment and targets for speech–language intervention.

Keywords: school readiness, language impairment, literacy skills.

What this paper adds?
To advance understanding of school readiness among children with LI, this study empirically examines the dimensionality of school readiness in this population. Although it is commonly accepted that school readiness is multidimensional, this is largely based on theoretical conceptions of the various aspects of readiness, such as the academic/non-academic dichotomy. An empirical assessment of the dimensionality of this construct is important for accurate conceptualization of the readiness construct. The results of the present study further our theoretical understanding of the dimensions of school readiness, as well as our knowledge of how these skills are related among children with LI. Identifying domain-specific readiness skills that are predictive of kindergarten success can help to identify means of early assessment and targets for speech–language intervention.

Introduction

School readiness generally captures the notion that children do best when they arrive at formal schooling with a certain threshold of skill that will help them to thrive in the classroom's academic and social milieu (Snow 2006). While the construct of school readiness is a fairly amorphous one, numerous studies have documented the significant and positive relations between children's pre-literacy and social skills at kindergarten entry and their future achievement across a broad range of literacy outcomes (National Early Literacy Panel (NELP) 2008, NICHD Early Child Care Research Network (ECCRN) 2005). In the present study, we contribute to research on school readiness by examining the construct of school readiness among a group of children considered to be at elevated risk for difficulties with school readiness and future academic achievement, namely children with

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International Journal of Language & Communication Disorders
ISSN 1368-2822 print/ISSN 1460-6984 online
DOI: 10.1111/1460-6984.12193

language impairment (LI) (Justice *et al.* 2009). Relative to children with typical language skills, children with LI are rated by their kindergarten teachers as being significantly less prepared for kindergarten in such areas as literacy, math, pro-social communication and behavioural competence (Justice *et al.* 2009). Such circumstances may contribute to the elevated rates of poor school achievement among these youngsters, most well-documented in the area of literacy. Kindergarten readiness skills such as alphabet knowledge and phonological awareness are typically depressed among children with LI, and this appears directly to impede achievement of skilled reading among these youngsters (Catts *et al.* 2002).

The present study was designed to address two aims, the first of which was to examine the construct of school readiness as it represents the skills of children with LI. For our purposes, we define school readiness as the 'the state of child competencies at the time of school entry that are important for later success' (Snow, 2006). Important to note is that the first part of this definition is descriptive in nature, such that it references the skills and abilities that children possess at or near entry to kindergarten. School readiness is a complex developmental, theoretical and political construct that has been defined and conceptualized in a variety of ways (e.g., Blair *et al.* 2007, Duncan *et al.* 2007, Snow 2006). Indeed, there are any number of skills and abilities that children exhibit at this time, from being able to tell a story to being able to tie their shoe laces. An important aspect of school-readiness research is to identify those competencies that are most important for representation within this construct and how these competencies may interact.

To date, research has generally conceptualized readiness to reflect two broad dimensions: academic and non-academic skills (see, for example, the meta-analysis by La Paro and Pianta 2000). The academic dimension typically encompasses oral language, literacy and mathematical skills, whereas the non-academic dimension includes socio-emotional competencies, encompassing children's social, emotional and behavioural skills, as well as attention (Duncan *et al.* 2007). Social skills are those that children utilize to interact socially with others and to form friendships. Emotional and behavioural skills reflect children's ability to manage their own emotions and behaviours, both internally and externally (referred to as internalizing and externalizing behaviours). Studies have shown that children's skills in both academic and socio-emotional dimensions are related to future academic outcomes, although it is generally accepted that academic readiness is most strongly related to future literacy skill (Duncan *et al.* 2007). It is important to note that children with LI are at risk with respect to both academic and non-academic readiness (e.g., Brinton and Fujiki 1999, Catts *et al.* 2002), although we might theorize that limitations in academic readiness are most problematic to future academic success, particularly in literacy. Longitudinal studies have explicitly examined the predictive relationship between kindergarten-entry skills and future literacy outcomes for children with LI. For example, Catts *et al.* (2002) found that the best kindergarten predictor of reading outcome at second and fourth grade for children with LI was letter identification, followed by a grammar composite, nonverbal IQ, rapid naming and phonological awareness. However, that study did not include non-academic indicators of readiness, and thus may be incomplete with respect to examining the role of school readiness, broadly defined, to future literacy skills among children with LI.

To advance understanding of school readiness among children with LI, this study empirically examined the dimensionality of school readiness in this population. Although it is commonly accepted that school readiness is multidimensional within the larger body of research on typically developing children (Hair *et al.* 2006, Konold and Pianta 2005), this is largely based on theoretical conceptions of the various aspects of readiness, such as the academic/non-academic dichotomy (La Paro and Pianta 2000). An empirical assessment of the dimensionality of this construct is important for accurate conceptualization of the readiness construct. Thus, we compared three potential models of school readiness among children with LI: a unidimensional model, a two-dimensional model and a three-dimensional model. For the first, the parsimonious unidimensional model considers all indices of school readiness to represent a single dimension, whereas the two-dimensional framework considers academic and non-academic competence as distinct dimensions. Note that in the present study we utilized measures of oral language and early literacy to operationalize the academic dimension and thus refer to this dimension as 'pre-literacy' subsequently. The three-dimensional model considers readiness to consist of three distinct dimensions: pre-literacy, social and behavioural skills. Although much of the existing literature combines social and behavioural skills into the broad socio-emotional domain, these may be separate dimensions of school readiness, at least for children with LI. Research on the relationships between these skills and their trajectories over time has shown the skills to be distinct. For example, children with LI are known to have difficulty with social skills but results are mixed on whether they are more likely to exhibit externalizing and/or internalizing behaviour problems (e.g., Stanton-Chapman *et al.* 2007, Tomblin *et al.* 2000). Also, social and behavioural skills in children with LI behave differently over time, with some difficulties in some domains increasing and others decreasing (e.g., Lindsay and Dockrell 2012). Thus, it is plausible that these are in fact distinct entities and their contribution to school readiness and academic achievement would be

more precisely investigated and understood by examining them separately in a three-dimensional model.

The second aim of this study, which addresses the second part of the school readiness definition used (i.e., the predictive aspect, that readiness is 'the state of child competencies at the time of school entry that are important for later success'; Snow, 2006), was to identify which dimension(s) of school readiness (presuming it is a multidimensional construct) served to predict literacy skills after one year of formal schooling for children with LI. Much of the interest in school readiness stems from the presumed relations between children's readiness at school entry and the likelihood they will profit from schooling over time. A lack of readiness may have far-reaching impacts for children with LI specifically, as children with poor language and literacy skills often exhibit a reading disability not only in the later primary grades (Catts *et al.* 2002) but into adolescence as well (Stothard *et al.* 1998).

For present purposes, our primary interest was to identify those aspects of school readiness that relate most prominently with future skills in literacy, as literacy difficulties affect a majority of children with LI (Catts *et al.* 2002) and represents a major cause of educational under-achievement among this population. Indeed, a large body of work has focused on the demonstrated susceptibility of children with LI for problems with literacy outcomes, such as reading and spelling (Catts, *et al.* 2002, Justice *et al.* 2009), with studies consistently showing that these difficulties tend to persist over time (Conti-Ramsden *et al.* 2012, Skibbe *et al.* 2008).

While it is well established that early literacy and language skills are important predictors of later literacy performance among children without LI (e.g., Duncan *et al.* 2007, Hair *et al.* 2006, NELP 2008), research investigating the predictive nature of socio-emotional skills has yielded equivocal results and warrants further examination. Some studies have found little to no relationship between socio-emotional skills and literacy achievement (e.g., Ortiz *et al.* 2012), whereas other studies have provided evidence supporting the relationship (e.g., Konold and Pianta 2005). Given that children with LI tend to show poorer readiness in socio-emotional and behavioural competencies relative to other children, the extent to which these non-academic readiness skills may relate to future literacy skills warrants direct examination.

To summarize, this study was designed to advance understanding of the construct of school readiness among children with LI by describing component skills and assessing dimensionality of this construct, and by examining the relations of the readiness dimensions to children's literacy skills after one year of formal instruction. The questions were twofold. First, how is school readiness of children with LI characterized, both descriptively and in terms of dimensionality? Specifically, in terms of dimensionality, is school readiness best represented as a unidimensional, two-dimensional or three-dimensional construct? This first question was addressed using a large ($N = 136$) clinically identified sample of children with LI who were administered 12 measures of school readiness in the spring prior to kindergarten entry. Second, what dimension(s) of school readiness best predict children's literacy skills after one year of formal schooling? This second question was addressed using two literacy outcomes, decoding and spelling, collected one year following collection of the school readiness measures.

Methods

Participants

Participants were 136 preschool-aged children with LI drawn from 83 early childhood special education (ECSE) classrooms in two different regions of a Midwestern state. For the purposes of the present study, we define LI as performance in language skills that falls below population norms (specifically, using a cut-point of 1 SD (standard deviation) below the mean), where the cause of the LI may be either explained or unexplained. We recognize the importance of providing an explicit definition of LI as applied to the participants in the present study, especially given the current debate regarding diagnostic criteria and labelling (Bishop 2014, Reilly *et al.* 2014). Although this debate is multifaceted and has not yet reached a conclusion, we have chosen to use the term 'LI' as an overarching, inclusive label that applies to all children with language difficulties. We do not attempt to differentiate between children whose language difficulties are explained (by co-existing disabilities that may cause LI) or unexplained (which may include unknown aetiology or co-existing diagnoses that are not considered to cause LI). Such a distinction depends on the ability to determine which co-morbidities may cause LI and those that do not, and this is not always a simple distinction to make. Instead, our definition of LI is inclusive of all children in the ECSE classroom with language difficulties, regardless of aetiology. Therefore, our research reflects the true heterogeneity of LI in ECSE classrooms and the results have ecological validity for this setting. Additionally, as Lauchlan and Boyle (2014) point out, there is a lack of empirical evidence to suggest that children with explained versus unexplained LI require different treatments, and thus an attempt to differentiate these subgroups is not useful for such purposes. We extend this argument to suggest that differentiating LI based on aetiology is also not useful for the purpose of the present study, given the absence of empirical evidence that the relations between language and literacy skills would differ between children with explained versus unexplained LI.

The children with LI in the present study had served as participants in a large multi-year study titled Sit Together and Read—2 (STAR-2), which involved a randomized controlled trial of a classroom book-reading intervention designed to improve the early literacy skills of children participating in ECSE classrooms, to include children with disabilities as well as typically developing peers. STAR-2 featured an experimental design, with random assignment occurring at the classroom level at the start of children's preschool year. The children participated in testing at three time points: T1 (fall of preschool), T2 (spring of preschool) and T3 (one year after T2, which for some children was during a second year of preschool or the spring of kindergarten). The T2 and T3 assessments were completed in a 4-week window at the end of the academic year.

The STAR-2 study contains data on more than 700 children, a subset of whom had LI with and without significant co-morbidities (e.g., autism, hearing loss). To identify children with LI, for present purposes inclusionary procedures were applied to the STAR-2 database to identify children with LI. First, children were required to receive a standard score of ≤ 85 (≤ –1 SD of the mean) on the expressive *or* receptive composite of the Clinical Evaluation of Language Fundamentals: Preschool—2 (CELF-P:2; Wiig *et al.* 2004). Overall, children's mean receptive language standard score was 71 (SD = 14.5, range = 45–100), and their mean expressive language standard score was 70 (SD = 14.4, range = 45–102). Second, children were included if they were in kindergarten during the T3 assessment time point. Note that treatment condition was not included as an exclusionary/inclusionary criterion; children were eligible for inclusion in the present study regardless of condition, as data used in this study were collected post-intervention at the end of preschool and again in kindergarten. Although the intervention may have inflated children's skills in some areas, it should not have affected the *dimensionality* of school readiness (our first aim) or the *relations* between post-intervention measures of school readiness and future literacy skills (our second aim).

The 136 children in this study were, on average, 56 months (SD = 4.5, range = 48–69 months) at the fall of the preschool year (T1 time point in STAR-2). As is typical of special education programmes (Hibel *et al.* 2010), males were over-represented (78%, n = 106). Nearly all (96%; n = 131) of the children had Individualized Education Plan (IEPs) specifying receipt of speech–language services. Twenty-two per cent (n = 29) of the children were reported to have co-existing disabilities, such as autism or autism spectrum disorders (ASDs) (n = 12), attention deficit hyperactivity disorder (ADHD) (n = 2), Down syndrome (n = 2), developmental delay (n = 2), hearing loss (n = 1), and fetal alcohol syndrome (FAS) (n = 1). Six per cent (n = 8) of the children were reported to have severe or profound cognitive impairment. T1 assessments showed that children's nonverbal intelligence scores, as measured by the Matrices subtest of the Kaufman-Brief Intelligence Test (K-BIT; Kaufman and Kaufman 1990), ranged from 53 to 116 with a mean = 76.5 and SD = 15.86.)

The majority of children were Caucasian (74%), with 17% African-American, 6% Latino and 3% reported as 'other'. English was reported as the first language for 99% (n = 132) of the children, with English spoken in the home for 98% of the children. Spanish was spoken at home for 2% of the children. The median annual income reported by the families was in the range of US$35 001–40 000. Forty-three per cent reported annual income up to US$25 000; 16% reported annual income from US$25 001 to US$50 000; 25% reported annual income from US$50 001 to US$85 000; 17% reported annual income over US$85 001; one family reported 'other'; and information was missing for 21 children. Reports of highest level of education completed by the children's mother or female caregiver indicated that 7% had some high school experience, 21% had a high school diploma, 42% had some college experience, 15% had a bachelor's degree, 10% had a master's degree, and 4% had a doctorate. One per cent reported 'other'.

Data collection and procedures

Data utilized in the present study involved: direct child assessments and indirect assessments (questionnaires completed by teachers and caregivers) collected at T2 (spring of the preschool year) and T3 (spring of kindergarten) as part of the larger STAR-2 study. For the direct assessments, children were individually assessed in a quiet location at their school. Trained professional field assessors had completed a thorough training process for each measure that entailed viewing an online training module, scoring at least 85% on a written quiz about each measure, and observing skilled assessors in the field. Indirect assessments were collected via caregiver and teacher completion of questionnaires, typically via mail. Caregivers and teachers completed the questionnaires on their own and returned them to the researchers.

School readiness measures: spring of the preschool year (T2)

Three categories of measures were utilized to represent children's school readiness in the spring of their preschool year to examine: (1) pre-literacy skills (oral language and early literacy), (2) social skills and (3) behavioural skills. Mean raw scores and sample-specific reliabilities for each measure are presented in table 1.

Table 1. School readiness indices for children with LI (*N* = 136)

	Range	Mean	SD	Alpha
Pre-literacy				
Oral language (CELF-P:2 composite)	0–69	36.95	17.26	0.86
Print concepts (PWPA)	0–17	7.05	4.11	0.72
Alphabet knowledge (PALS)	0–52	25.85	18.78	0.98
Phonological awareness (TOPEL)	0–26	10.53	5.60	0.65
Social				
Pragmatics (DPP)	26–104	78.38	17.06	0.97
Cooperation (SSRS)	5–20	13.31	3.78	0.86
Assertion (SSRS)	0–20	10.60	4.88	0.89
Self-control (SSRS)	2–20	13.38	4.32	0.89
Behavioural				
Internalizing (Teacher SSRS)	0–6	0.95	1.30	0.63
Externalizing (Teacher SSRS)	0–12	3.32	3.08	0.87
Internalizing (Caregiver SSRS)	0–5	0.83	1.20	0.55
Externalizing (Caregiver SSRS)	0–12	4.44	2.92	0.81

Notes: Raw scores are reported; standard scores are reported in the text for applicable measures.
CELF-P:2 = Clinical Evaluation of Language Fundamental Preschool: 2nd Edition; PWPA = Preschool Word and Print Awareness; PALS = Phonological Awareness Literacy Screening; TOPEL = Test of Preschool Early Literacy; DPP = Descriptive Pragmatics Profile; SSRS = Social Skills Rating System.

Pre-literacy skills

Children's pre-literacy skills prior to kindergarten (collected at T2) included oral language and early literacy skills. In total, four measures were used: (1) the CELF-P2 (Wiig *et al.* 2004), (2) the Preschool Word and Print Awareness test (PWPA; Justice *et al.* 2006), (3) the Alphabet Knowledge subtest from the Phonological Awareness Literacy Screening (PALS; Invernizzi *et al.* 2004), and (4) the Phonological Awareness subtest from the Test of Preschool Early Literacy (TOPEL; Lonigan *et al.* 2007).

The Core Language Index of CELF-P:2 was used to evaluate children's oral language skills. This index is a composite of three subtests—Sentence Structure, Word Structure and Expressive Vocabulary—measuring receptive and expressive language with respect to grammar, morphology and vocabulary. The Sentence Structure subtest requires the child to interpret spoken sentences of increasing length and complexity, and select pictures that most closely match a verbal stimulus from a choice of four (maximum raw score = 22). The Word Structure subtest requires the child use correct grammatical elements such as pronouns, derivations and inflections. The child is provided with a verbal model and must finish the sentence with one word (maximum raw score = 24). The Expressive Vocabulary subtest requires the child label people, objects and actions in pictures they are shown. Most items are scored as 2 points for correct answers and 1 point for partially correct answers, with a maximum possible raw score of 20. Satisfactory reliability and validity are reported by the authors (Wiig *et al.* 2004), with test–retest reliability ranging from .77 to .91, internal consistency (Cronbach's alpha) of .77–.95, and moderate to high correlations with other tests of language disorders. For the purposes of this study, the raw composite score of the Core Language Index was used for analyses. Children's standard scores for the Core Language Index ranged from 45 to 116, with mean = 76.53 and SD = 15.86.

The PWPA assesses children's concepts about print using the fictional storybook *Nine Ducks Nine* (Hayes 1990). Children are asked to explain or identify 12 print concepts (e.g., upper- versus lower-case letters, print directionality). Specific examples of items include 'Show me the front of the book,' 'Where do I begin to read?' and 'Show me just one letter on this page.' The maximum raw score is 17. Test developers report an inter-rater reliability coefficient of .94 (Justice *et al.* 2006). Children's raw scores were used in analyses. Standard scores for the PWPA ranged from 46 to 161, with mean = 95.27 and SD = 19.34.

The Alphabet Knowledge subtest of the PALS was used to measure children's upper- and lower-case letter knowledge (Invernizzi *et al.* 2004). The child is shown an 8.5 by 11-inch page with all the upper-case letters on it in random order, followed by a similar page with all lower-case letters, and asked to name the letters one by one. Internal consistency ranges for the full test from .77 to .93 and inter-rater reliability is reported with a Pearson product-moment correlation coefficient of .99 (Invernizzi *et al.* 2004). Validity for this task showed correlations of .61 and .71 with similar assessments. Internal consistency specifically for the alphabet knowledge subtest has been reported at .97 (Cabell *et al.* 2011). We used a raw score of upper- and lower-case letters identified correctly (out of 52) in analyses.

Phonological awareness was assessed using the TOPEL (Lonigan *et al.* 2007). Two sets of tasks measure elision (requiring a child to say a word, then to say what is left after dropping out specific sounds) and blending (requiring a child to listen to separate sounds and combine them to form a word). Internal consistency for this subtest is reported as .86 for 3–4-year-olds, and .88 for 5-year-olds. The subtest has strong criterion-prediction validity with the Comprehensive Test of Phonological Processing (CTOPP; Wagner *et al.* 1999) subtests of Elision (.59) and Blending (.65). The raw score on the Phonological Awareness subtest was used in analyses. Maximum score is 27. Standard scores for the

Phonological Awareness subtest ranged from 54 to 118, with mean = 76.71 and SD = 14.30.

Social skills

Children's social skills were assessed across four specific constructs. The Descriptive Pragmatics Profile (DPP; Wiig *et al.* 2004) was used to measure pragmatics, and the Social Skills Rating System (SSRS; Gresham and Elliott 1990) was used to measure cooperation, assertion and self-control. The DPP consists of 26 items for which a teacher rates how often the child demonstrates a skill, on a scale of 1 (never) to 4 (always), or N/A (not applicable or culturally appropriate). There are three categories of skills on the DPP: nonverbal communication skills, conversational routines and skills, and asking for, giving and responding to information. Ratings are totalled for an overall score that can range from 26 to 104. Test authors report high internal consistency (Cronbach's alpha = .95) and test–retest reliability (.87). The overall raw score for the DPP was used as a measure of pragmatics.

The Social Skills scale of the SSRS (Gresham and Elliott 1990) consists of a 30-item checklist that requires the informant (in this case, the teacher) to rate the frequency of children's cooperation, assertion and self-control on a 3-point scale from never to very often. Reliability of the SSRS is shown with adequate internal consistency, .94, for the teacher-rated Social Skills scale. Four-week test–retest reliability ranges from .85 to .88. Criterion related validity testing between the SSRS and Social Behavior Assessment (SBA; Stephens 1978), a comprehensive 136-item teacher rating of children's social skills behaviours, revealed a Total Scale correlation of –.68 for Social Skills. We used raw scores from the cooperation, assertion and self-control scales for analyses.

Behavioural skills

The Problem Behaviors Scale of the SSRS was utilized to measure children's behaviour. Both caregivers and teachers completed this 10-item questionnaire, rating the frequency of children's internalizing and externalizing behaviours on a 3-point scale from never to very often. Internal consistency for the Problem Behaviors scale is reported at .82 for teachers and .73 for caregivers. Four-week test–retest reliability ranges from .85 to .88 for teachers and .58 to .87 for caregivers. Criterion related validity testing between the Problem Behaviors scale of the SSRS and SBA (Stephens 1978) revealed a Total Scale correlation of .55 for Problem Behaviors. Raw scores for externalizing and internalizing subscales (obtained from both teachers and caregivers) were used in our analyses in order to capture children's range of behaviours both in the home and school context.

Kindergarten literacy skills: Spring of Kindergarten year (T3)

Children's literacy skills (decoding, spelling) were measured in the spring of kindergarten, approximately one year following the collection of the school-readiness measures. For decoding, the Word Attack subtest of the Woodcock–Johnson Tests of Achievement—3rd Edition (WJ-III; Woodcock *et al.* 2001) was administered to measure children's skill in applying phonic and structural analysis skills to the pronunciation of unfamiliar (nonsense) words. Test developers report internal consistency greater than .90 and .83, respectively, and test–retest reliability of .92 and .89, respectively. The WJ-III is highly correlated with other tests measuring similar constructs, and therefore demonstrates concurrent validity (Schrank *et al.* 2001). Raw scores were used in analyses for those children who continued on to kindergarten and therefore had available decoding scores ($n = 99$). For spelling, the Spelling subtest of the PALS-Kindergarten (Invernizzi *et al.* 2004) was administered. For this test, children are given five consonant–vowel–consonant words to spell. Each word is then scored on a scale of 0–4 points, with credit given for phonetically similar spellings. Test–retest reliability is reported at .89 and inter-rater reliability at .99. Again, raw scores were used in analyses for those children who continued on to kindergarten and therefore had available spelling scores ($n = 99$).

Analytical strategy

The data were initially examined descriptively (e.g., means, SDs, ranges). Confirmatory factor analyses (CFA) then were conducted using MPlus (Muthén and Muthén 1998–2010) to address our first study aim regarding examination of three possible theoretical models of school readiness. Our goals in using CFA analyses were twofold. First, CFAs allowed us to determine which of our three hypothesized models demonstrated a comparative best fit for the data. Second, CFAs allowed us to examine the relationship of our specified models to observed data. Thus, a unidimensional model of school readiness was tested, along with a two-factor model of school readiness (pre-literacy and socio-emotional factors), as well as a final three-factor model (pre-literacy, social and behavioural factors). Based upon recommendations from Schumacker and Lomax (2004), we utilized the following fit indices to compare the *relative fit* of competing models to each other: (1) Akaike's information criterion (AIC; Akaike 1987), which is a log-likelihood measure of fit comparing competing models, in which smaller AICs indicate better fit (Kline 2013); and (2) the Bayesian information criterion (BIC; Schwarz 1978), which is a closely related measure of

comparative model fit that imposes a stronger penalty for model complexity than the AIC (Kline, 2013). We used additional model fit indices to assess the *overall fit* between the hypothesized model and sample data. Two model fit indices (one absolute and one incremental) were utilized in this assessment of the models: (1) the standardized root mean square residual (SRMR) and (2) the comparative fit index (CFI).

To address our second study aim, we conducted two multiple regression analyses to determine the predictive nature of school readiness in children with LI to their end-of-kindergarten literacy abilities (i.e., decoding and spelling). Specifically, we harvested the factor scores from the best-fitting model of school readiness and used those factors as independent variables, with T3 literacy abilities as the dependent variable (decoding skills as the dependent variable in the first model and spelling skills in the second model).

Results

Description of school readiness in children with LI

Descriptive data representing the children's performance on measures of pre-literacy, social and behavioural skills are presented in table 1. Of note, children's language skills were low, as was to be expected given that the children exhibited LI. On average, the children had scores more than 1 SD below the mean on our measure of oral language. Moreover, the large SD for the language measure shows that there is a high level of variability in children's scores, suggesting there are individual differences in oral language skills. On the two measures representing children's knowledge about print, namely the PWPA (mean = 95.27) and PALS Alphabet Knowledge (mean = 25.8 letters correctly identified), children's scores were relatively high, albeit with appreciable range. However, the PWPA scores are similar to those reported previously for 4-year-old children with specific LI (Justice *et al.* 2006). The children's phonological awareness scores (mean = 76.71) are more aligned with prior published reports of phonological awareness among children with LI (e.g., Catts *et al.* 2005), with children's mean performance substantially lower than average.

For the teacher-rated SSRS Social Skills Scale (a composite of Cooperation, Assertion and Self-control scales), the descriptive data showed that children scored in the average range on this scale (mean = 96.32, SD = 16.26, range = 46–130). The same was also true for the Problem Behaviors scale (a composite of Externalizing and Internalizing) from both teacher and caregiver report; children scored in the average range on these scales (mean = 98.39, SD = 12.28, range = 85–134 and mean = 96.70, SD = 12.86, range = 85–137 respectively).

As an additional descriptive step, in order to understand the bivariate relationships in the data, we examined correlations among school readiness measures to be used in our models. These correlations are presented in table 2. As expected, many significant relationships were observed among these variables. Interestingly, teacher report of externalizing problem behaviours was negatively correlated with every academic factor, whereas caregiver report of externalizing problem behaviours was not significantly correlated with any of the pre-literacy factors. Further, caregiver reports of internalizing and externalizing behaviours were not significantly correlated with any other social or behavioural measures based on teacher report (with the exception of the significant yet small relationship between teacher and caregiver report of externalizing behaviours), which converges with the findings of Dinnebeil *et al.* (2013) which documented low levels of congruence between caregivers and teachers on measures of problem behaviours with the same sample of children. Given the small and non-significant correlations, we chose to eliminate the caregiver report of internalizing and externalizing behaviour measures from the CFA analyses to be described subsequently.

Dimensionality of school readiness

The first research aim involved investigating theoretical models of school readiness among children with LI, for which we utilized CFA to assess the fit of three models. Results from CFA analyses demonstrated that the two-factor model (including separate pre-literacy and socio-emotional factors) is the best fit for the data (AIC = 7710.95, BIC = 7800.32, SRMR = 0.05, CFI = 0.92, $\chi^2(34) = 93.88$, $p < .01$) as compared with the three-factor (AIC = 7714.16, BIC = 7809.29, SRMR = 0.05, CFI = 0.91, $\chi^2(32) = 93.09$, $p < .01$) and unidimensional model (AIC = 7845.84, BIC = 7932.33, SRMR = 0.11, CFI = 0.72, $\chi^2(35) = 230.77$, $p < .01$). Note that although an insignificant χ^2 is desirable when assessing model fit, the chi-square statistic is highly sensitive to sample size, departures from multivariate normality and model complexity and, therefore, are likely to imply erroneously a poor data-to-model fit (Schumacker and Lomax 2004). Given the issues with the reliability of the chi-square statistic, results from the SRMR and CFI fit statistics were weighted more highly in our final decisions regarding overall model fit. However, as the chi-square statistic is useful as a more descriptive index of fit, we did use the χ^2 difference test to determine which model was the best fit for the data, with lower χ^2 values indicating a better fitting model. Results showed that the unidimensional model was the poorest fit for the data, and that the two- and three-factor models were statistically equivalent $\chi^2(2) = 0.79$, $p > .05$. Therefore, the most parsimonious (i.e. two-factor)

Table 2. Inter-correlations: school readiness and kindergarten literacy variables

Variable	1	2	3	4	5	6	7	8	9	10	11	12
Inter-correlations among school readiness measures (N = 136)												
1. Oral language	–	.74[a]	.41**	.61**	.50**	.43**	.45**	.48**	–.08	–.32**	–.08	–.09
2. Print concepts			.29**	.58**	.36**	.26**	.29**	.30**	–.22[a]	–.18[a]	–.05	–.02
3. Alphabet knowledge				.40**	.15	.24**	.05	.27**	–.11	–.21[a]	.02	–.06
4. Phonological awareness					.42**	.38**	.29**	.30**	–.07	–.28**	–.14	–.08
5. Pragmatics						.71**	.78**	.69**	–.31**	–.53**	.03	–.14
6. Cooperation							.70**	.72**	–.27**	–.58**	–.10	–.09
7. Assertion								.72**	–.27**	–.41**	.03	–.09
8. Self-control									–.31**	–.67**	–.08	–.17
9. Internalizing (teacher)										.24**	.12	.15
10. Externalizing (teacher)											.12	.21[a]
11. Internalizing (caregiver)												.43[a]
12. Externalizing (caregiver)												–
Inter-correlations among school readiness and kindergarten literacy measures (N = 99)												
13. Decoding	.28**	.22**	.55**	.28**	.01	.07	.00	.06	–.02	.04	.08	.06
14. Spelling		.19	.35**	.26**	.11	.10	.06	.14	.04	–.15	–.04	–.05

Notes: Decoding and spelling are correlated at .66**.
[a]$p < .05$, **$p < .01$.

model was chosen as the best fit. Further confirmation that the three-factor model should *not* be considered the best fitting model was provided by the fact that the correlation between the social and behavioural factors in this model was very high at .96. Brown (2006) recommends factor correlations lower than .80 or .85 for good discrimination of latent constructs. Thus, discrimination among the two factors (social and behavioural) can be characterized as poor, and it is not clear that a three-dimensional representation of school readiness provided a *substantive* improvement over that of the two-dimensional model.

In contrast, results for the two-dimensional model (figure 1) showed that the pre-literacy and socio-emotional dimensions are only modestly correlated (.55), indicating that each provides independent and unique information about children's readiness for schooling. Standardized factor loadings for each item in the two-factor model are reported in figure 1. All items yielded statistically significant factor loadings ranging between .34 and .93, indicating moderate to strong correlations between items and constructs. Note that negative loadings are expected for problem behaviours, as increased problem behaviours are associated with poorer academic outcomes.

Predictive nature of school readiness to literacy achievement

The second research aim was to examine the predictive nature of the two identified school readiness indices with respect to future literacy skills of children with LI. Our interest in literacy as our focal outcome stems from considerable research showing that underperformance in literacy skill characterizes a majority of children with LI (Catts *et al.* 2002). We sought to determine which aspect of school readiness best informs us about children's future literacy skills. To conduct this analysis, the two factor scores were harvested from the two-factor CFA model and used as predictors in regression analyses.

Table 3. Summary of regression analysis for the prediction of literacy skills

	b (SE(*b*))	*F*(1,98) (significance)
Decoding (N = 99)		
Constant	3.31 (.25)	186.85 (< .001)
Pre-literacy	0.07 (.02)	11.24 (< .001)
Socio-emotional	0.17 (.15)	1.26 (.27)
Spelling (N = 99)		
Constant	10.43 (.59)	311.32 (< .001)
Pre-literacy	0.14 (.05)	7.96 (.01)
Socio-emotional	0.09 (.37)	0.06 (.81)

First, kindergarten decoding skill was predicted from the two readiness factors representing pre-literacy and socio-emotional skills. A statistically significant proportion of the variance in decoding skills was explained by this set of independent variables, $R^2 = .11$, R^2 adjusted $= .09$, $F(2,95) = 5.75$, $p < .01$. The total proportion of variance explained by this model is $R^2 = .09$, indicating that about 9% of the variability in children's decoding skill is accounted for by the model. One-degree-of-freedom *F*-tests, parameter estimates and standard errors are presented in table 3. The factor score for pre-literacy skills was found to be a significant predictor, $F(1,98) = 11.24$, $p = .001$, of decoding skills; in contrast,

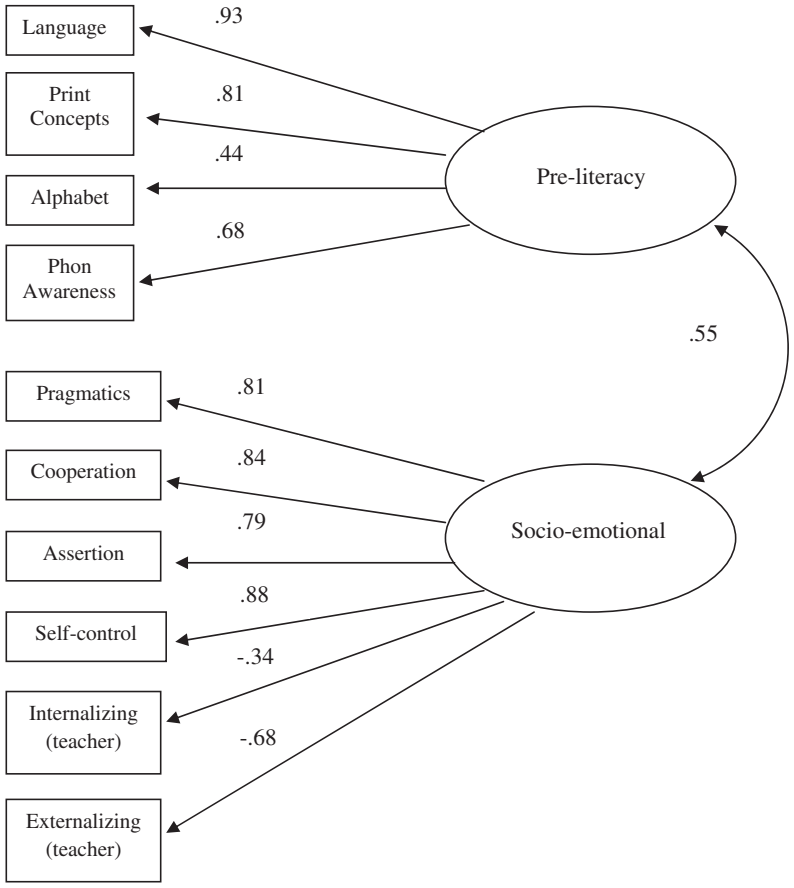

Figure 1. Two-factor model of school readiness.

the factor score for socio-emotional skills was not a significant predictor.

Next, we conducted the same analyses predicting kindergarten spelling ability. In total, the pre-literacy and socio-emotional factors provided a statistically significant explanation of spelling, $R^2 = .10$, R^2 adjusted $= .08$, $F(2,95) = 4.95$, indicating that 8% of the variability in children's spelling ability is accounted for by the model. One-degree-of-freedom *F*-tests, parameter estimates and standard errors for each independent variable are presented in table 3. Similar to findings in the model predicting spelling skills: only the factor score for pre-literacy skills was found to be a significant predictor, $F(1,98) = 7.96$, $p < .01$, of spelling skills.

Given that results suggested that the pre-literacy factor was predictive of both decoding and spelling skills, we conducted follow-up analyses to understand the predictive relationship between the component skills of the pre-literacy factor (i.e., oral language, print concepts, alphabet knowledge and phonological awareness skills) and future decoding and spelling skills. Therefore, two additional regression analyses were conducted. In the first model, kindergarten decoding skill was predicted from the four component skills which comprise the pre-literacy factor. A statistically significant proportion of the variance in decoding skills was explained by this set of independent variables, $R^2 = .32$, R^2 adjusted $= .29$, $F(4,93) = 11.11$, $p < .01$. The total proportion of variance explained by this model is $R^2 = .29$, indicating that about 29% of the variability in children's decoding skill is accounted for by the model. One-degree-of-freedom *F*-tests, parameter estimates and standard errors are presented in table 4. The score for alphabet knowledge skills was found to be a significant predictor, $F(1,98) = 30.1$, $p < .001$, of decoding skills. However, the scores for the remaining component pre-literacy skills were not significant predictors.

The final analysis we conducted predicted kindergarten spelling ability from the pre-literacy component skills. In total, this collection of predictors provided a statistically significant explanation of spelling, $R^2 = .18$, R^2 adjusted $= .14$, $F(4,92) = 5.03$, indicating that 14% of the variability in children's spelling ability is accounted for by the model. One degree-of-freedom *F*-tests, parameter estimates, and standard errors for each independent variable are presented in table 4. As seen in

Table 4. Summary of regression analysis for the prediction of literacy skills from the component skills of the pre-literacy factor

	b (SE(*b*))	*F*(1,98) (significance)
Decoding (N = 99)		
Constant	0.42 (.65)	.43 (.52)
Oral language	0.02 (.02)	.74 (.40)
Print concepts	0.03 (.08)	.12 (.73)
Alphabet knowledge	0.07 (.01)	30.1 (< .001)
Phonological awareness	0.02 (.05)	.13 (.72)
Spelling (N = 99)		
Constant	4.05 (1.7)	5.64 (.02)
Oral language	0.09 (.05)	2.76 (.10)
Print concepts	–0.07 (.20)	.11 (.74)
Alphabet knowledge	0.09 (.03)	7.68 (.007)
Phonological awareness	0.10 (.13)	.56 (.46)

the model predicting decoding skills, only the score for alphabet knowledge skills was found to be a significant predictor, $F(1,98) = 0.14$, $p < .01$, of spelling skills.

Discussion

Policy-makers, practitioners and researchers of late have been invested in improving understanding of the construct of school readiness, both from a theoretical perspective and for more practical purposes (e.g., developing kindergarten-readiness assessments). Results of the present work advances conceptualization of school readiness by assessing the dimensionality of this construct with respect to pre-literacy, social and behavioural dimensions, as well as the extent to which these dimensions may predict children's literacy skills after one year of formal instruction. The present work focuses specifically on children with LI, a population of children known to be highly susceptible to reading difficulties (Catts *et al.* 2002). Within this discussion, we provide an overview of our major findings as well as a discussion of the implications from these findings.

Description of school readiness in children with LI

Our first major finding provides several insights into the school readiness of children with LI, which has seldom been studied. First, as expected, children in our sample exhibited depressed scores in key language and literacy skills (particularly phonological awareness) in the spring of their preschool year prior to entering kindergarten. Such findings were anticipated based on the extant literature. Of note, however, is that these children received average scores on caregiver and teacher report of social skills (measures of pragmatics, cooperation, assertion and self-control), which is divergent from previous work suggesting that children with LI often encounter social difficulties (Brinton and Fujiki 1999). Similarly, the children with LI in our sample had behavioural skills within the average range, as both caregivers and teachers reported relatively low levels of problem behaviours (both externalizing and internalizing). Such work conflicts with that of Stanton-Chapman *et al.* (2007), who found that preschool children with LI were more likely to exhibit internalizing behaviour problems compared with children with typical language skills, although other studies suggest that children with LI are more likely to exhibit externalizing and/or internalizing behaviour problems (e.g., Tomblin *et al.* 2000). We hypothesize that our sample may be different than previous studies in that the students in our study were drawn from ECSE classrooms as contrasted with other commonly used approaches, including convenience sampling and sampling from general early childhood classrooms. The ECSE teachers in our sample, all highly experienced working with children with disabilities, may have been less likely to see the children's behaviours as problematic or out of the ordinary as compared with general education preschool teachers. Regardless, we suggest that further research is needed to examine the social and behavioural skills of children with LI, particularly given that these non-academic skills are identified by practitioners as key indicators of children's readiness for kindergarten (Rimm-Kauffman *et al.* 2000) and by researchers to be equally as important as academic skills when conceptualizing children's school readiness (Shonkoff and Phillips 2000).

We do also want to point out an interesting finding that surfaced in this work, namely that teacher report of children's externalizing behaviours was negatively associated with pre-literacy factors, whereas caregiver report was not. Considering children's school readiness holistically, such correlations suggest that children with higher levels of behaviour problems may simultaneously exhibit lags in their development of key language and literacy skills, presumably in a bidirectional fashion (i.e., children with behavioural concerns may have difficulty benefiting from instruction, and vice versa). Nonetheless, when examining children's externalizing behaviours based on caregiver report, such correlations were non-existent. Such findings suggest limited congruence between teacher and caregiver report of children's behaviours (Dinnebeil *et al.* 2013), which leads to several possible speculations. First, it may be that caregivers and teachers would rate the same child differently due to their own skills and experience; second, it may be that children's behaviour varies substantially as a function of context (Wakschlag *et al.* 2010). That is, children may be exhibiting different externalizing behaviours at home compared with school. Given that behaviour is an important aspect of school readiness, improved understanding of children's behaviours within

the classroom context (and the accuracy of teacher report for such calibrations) is an important future research avenue.

Dimensionality of school readiness

Our second major finding contributes to the body of research which posits that school readiness is a multidimensional construct. Through analysis of three separate models of school readiness, we aimed to gain a clearer understanding of pre-literacy, social and behavioural indices that may contribute to the school readiness of young children with LI. Results of this study show that school readiness among children with LI cannot be conceptualized as a unidimensional concept or as a three-dimensional concept, but instead is best characterized as two separate dimensions: pre-literacy readiness and socio-emotional readiness.

These results are noteworthy in that they suggest that the measures of school readiness utilized in this study capture a distinguishable set of two key school readiness skills in children with LI, which converges with much of the existing literature that conceptualizes school readiness as two broad dimensions (with academic and socio-emotional factors; Hair *et al.* 2006, Konold and Pianta 2005). From a theoretical perspective, our finding that substantiates the two-dimensional model as superior is divergent from the conclusions of Lindsay and Dockrell (2012), based on their longitudinal research on trajectories of children with LI, that social and behavioural skill are distinct and behave differently over time. Rather, our finding offers continued support for the argument that social and behavioural dimensions should be studied together as a single socio-emotional dimension, at least when conceptualizing or examining school readiness.

Many researchers have hypothesized that school readiness is a multidimensional construct (e.g., Snow 2006); to this end, our empirical investigation of school readiness dimensionality in children with LI is an important step towards integrating theoretical and empirical understanding of how best to define the construct of school readiness. The present findings suggesting that pre-literacy and socio-emotional readiness dimensions should be considered separately can help the field to identify and refine appropriate assessment measures for children as they enter formal schooling, a matter which has been of particular interest of late with the current emphasis on standards-based education, including adherence to the Common Core. Further, identification of the key dimensions of school readiness may aid in distinguishing which dimensions to utilize as predictors of school-aged academic achievement, an endeavour that is particularly important when considering children with LI who are highly susceptible to reading difficulties (Catts *et al.* 2002).

Predictive nature of school readiness

Our third major finding relates to the predictive nature of our identified school readiness dimensions (pre-literacy and socio-emotional) for children with LI. Of these two school readiness components, pre-literacy readiness was found to relate most prominently with children's later performance on measures of literacy (i.e., decoding and spelling). This relationship converges with previous research that has found academic factors to be associated with later learning outcomes in both typically developing children (e.g., Duncan *et al.* 2007) and those with LI (Bishop and Adams 1990, Boudreau and Hedberg 1999, Catts *et al.* 2002). Further, the specific measures used in the pre-literacy dimension in our models are measures that have been found in a growing body of research to be moderate to strong predictors of future reading achievement, specifically alphabet knowledge, phonological awareness, print concept knowledge, and oral language (e.g., NELP 2008). As the majority of prior research in this area has involved typically developing children, our findings are particularly relevant in that they confirm that these relationships are similar for children with LI. Moreover, our follow-up analyses which explored the relationship between the specific component skills that comprised the pre-literacy factor and Kindergarten decoding and spelling skills suggested that alphabet knowledge was a particularly important skill in predicting future reading skills. This finding is convergent with the wealth of research with typically developing children which suggests that children's knowledge of letter names and sounds is the best predictor of their later reading and spelling abilities (Hammill 2004, Scarborough 1998, Schatschneider *et al.* 2004).

Interestingly, we did not observe a predictive relationship between phonological awareness and later literacy skills, which differs from previous research supporting the role of phonological awareness in reading development (e.g., Melby-Lervåg *et al.* 2012, Muter *et al.* 2004, NELP 2008), yet converges with the work suggesting that phonological skills may not be the best predictors of later reading outcomes (Scarborough 1998). We hypothesize that our findings regarding the lack of relationship between phonological awareness and later literacy skills may be due to our investigation of this relationship in the presence of oral language skills. Specifically, it is likely that an overlap in skills between the phonological awareness and oral language domains may be present in children at the onset of learning to read. Our hypothesis is supported by research that shows that the development of phonological awareness

is influenced by vocabulary (Hogan 2010, Walley *et al.* 2003) and narrative skills (Hipfner-Boucher *et al.* 2014). Thus, it is possible that for preschool-aged children, phonological awareness may not add to the prediction of reading and decoding skills beyond the contribution of language because of the commonalities between the two skills.

The importance of gaining a clear understanding of the academic readiness of children with LI, and its relationship to future reading ability, is highlighted by persuasive evidence proposing that improvements in the literacy skills of children with LI just prior to formal schooling can ameliorate children's risks for future reading problems. This 'critical age hypothesis' (Bishop and Edmundson 1987, Justice *et al.* 2009) posits that young children whose language problems are addressed and mitigated during this 'critical age' will find more success in formal schooling than those children whose issues are not addressed. This hypothesis argues that, in effect, support during this critical age would allow children with LI to 'close the gap' in reading achievement that often exists between children with LI and their typical peers (Skibbe *et al.* 2008).

While it might not seem particularly surprising that pre-literacy readiness best predicts future academic (literacy) outcomes, previous research has indicated that young children's socio-emotional skills are also associated with later academic achievement (NICHD ECCRN 2005). Nonetheless, there is in general a lack of consensus in the existing literature regarding the contribution of socio-emotional skills to academic achievement (e.g., Duncan *et al.* 2007). For instance, Duncan *et al.* (2007) found that kindergartners' reading and math skills were the best predictors of reading and not other non-cognitive skills, although this work also identified attention skills as an additional predictor of reading outcomes. Nonetheless, it is possible that social and behavioural factors may be predictive of other schooling outcomes not identified in the present study. For instance, such factors may have important relationships with children's engagement, motivation, relationships with peers and teachers, and overall self-concept (Greenberg *et al.* 2003). Further, it may be that our measures of socio-emotional skills, which relied upon teacher and caregiver report, introduced bias, whereas evaluating children's socio-emotional skills with more direct measures may yield more nuanced results. In their meta-analysis, La Paro and Pianta (2000) found that children's social emotional skills lacked stability across preschool and early school years, which they suggested may be partly due to inadequate measurement of such skills. The validity of existing measures of socio-emotional skills should be further investigated, particularly as used with special populations such as children in ECSE. Without valid measures, it is difficult to understand the relationship between socio-emotional skills and later achievement. Moreover, with respect to behavioural measures, we utilized measures of problem behaviours but may have gained more nuanced information on this key construct if measures of prosocial behaviours were included in our analyses as well.

Limitations and conclusions

This study has several limitations that warrant mention. First, estimates of children's socio-emotional skills were based on caregiver and teacher report. Some of the shared variance among these variables may be due to the shared method in which they were collected. The lack of congruence between caregiver and teacher report with respect to children's behaviours also raises questions about which index provides the 'best' estimate of children's skills. Importantly, the psychometric adequacy of these measures as used with children in ECSE is unknown. Future research examining the validity of these measures in ECSE settings would be useful. Furthermore, with regard to the parent version of the SSRS specifically, the alpha for the internalizing behaviours scale was low. Despite this being a limitation of the measure, this score was used only in our description of the children and not in any analyses. Future studies may also consider additional, direct sources of measuring children's socio-emotional skills. A second limitation of the present study is that the R^2's for each of the predictor models were small. Thus, the relationships represented here do not account for large portions of the variation in children's literacy skills (i.e., decoding and spelling). We acknowledge that one possible reason for this is that many other potentially relevant variables are not represented in this study. This includes ecological factors (e.g., home literacy environment) as well as cognitive factors (e.g., attention, memory, rapid naming) that have been shown in other research to be predictive of children's literacy outcomes.

The results of the present study help to further our theoretical understanding of the dimensionality of school readiness and make a unique contribution to the school readiness literature base by empirically testing the nature of school readiness models for children with LI. Moreover, this work extends our understanding of school readiness among children with LI, who experience a developmental disability that presents elevated risks for children's school readiness (Justice *et al.* 2009) and academic under-achievement due to literacy difficulties. In essence, the present findings help to clarify the domain-specific readiness skills that are essential for preparing children with LI for success in later reading achievement. Strengthening the understanding of readiness skills has implications for future research, as this knowledge can help to inform the choice of

skills targeted in intervention studies conducted with children with LI. Future research might also investigate how to best assess key readiness skills and use such assessments as a means of early identification of future reading difficulties in children with LI. Additionally, given that the present findings provide us with an understanding of the dimensionality of school readiness in a broader group of children with LI, future research might examine whether these relationships are similar for different subgroups of children with LI (e.g., explained versus unexplained). Finally, this work has practical significance, as distinguishing readiness skills that are most predictive of kindergarten success can aid both educators and speech–language pathologists in identifying key components of instructional programming.

Acknowledgements

The authors gratefully acknowledge the support provided by the National Center for Special Education Research, Institute of Education Sciences (Grant Number R324A080037). They also thank all the teachers, families and children who participated in this study; as well as Rashaun Geter, Aileen Hunt, Kim Thompson, Charla Forsty, Jason Flowers and many additional members of our research team for their assistance with this project.

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