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**Author(s):** Silinskas, Gintautas; Pakarinen, Eija; Lerkkanen, Marja-Kristiina; Poikkeus, Anna-Maija; Nurmi, Jari-Erik

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## Accepted Manuscript

Classroom Interaction and Literacy Activities in Kindergarten: Longitudinal Links to Grade 1 Readers at Risk and not at Risk of Reading Difficulties

Gintautas Silinskas, Eija Pakarinen, Marja-Kristiina Lerkkanen, Anna-Maija Poikkeus, Jari-Erik Nurmi

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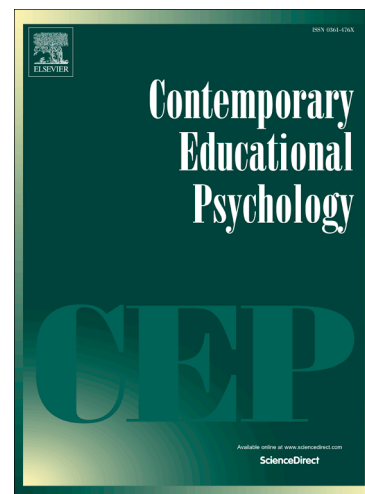
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Running Headline: KINDERGARTEN QUALITY AND GRADE 1 READING

Classroom Interaction and Literacy Activities in Kindergarten:

Longitudinal Links to Grade 1 Readers at Risk and not at Risk of Reading Difficulties

Gintautas Silinskas<sup>a</sup>, Eija Pakarinen<sup>b</sup>, Marja-Kristiina Lerkkanen<sup>b</sup>, Anna-Maija Poikkeus<sup>b</sup>,  
and Jari-Erik Nurmi<sup>a</sup>

<sup>a</sup> Department of Psychology, University of Jyväskylä

<sup>b</sup> Department of Teacher Education, University of Jyväskylä

Gintautas Silinskas and Jari-Erik Nurmi, Department of Psychology, University of Jyväskylä, Finland; Eija Pakarinen, Marja-Kristiina Lerkkanen, and Anna-Maija Poikkeus, Department of Teacher Education, University of Jyväskylä, Finland.

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For any correspondence, contact: Gintautas Silinskas, Department of Psychology, University of Jyväskylä, P.O. Box 35, 40014 Jyväskylä, Finland. E-mail:

[gintautas.silinskas@jyu.fi](mailto:gintautas.silinskas@jyu.fi); phone: +358-408-054-215.

Classroom Interaction and Literacy Activities in Kindergarten:

Longitudinal Links to Grade 1 Readers at Risk and not at Risk of Reading Difficulties

ACCEPTED MANUSCRIPT

## Abstract

The purpose of the present study is to establish how the quality of kindergarten classroom interactions and the frequency of literacy activities affect reading development among Grade 1 children—both those who are at risk and not at risk of developing reading difficulties. Interaction was assessed in terms of classroom organization, and the level of emotional and instructional support offered in 49 kindergarten classrooms in Finland using the CLASS (Classroom Assessment Scoring System). Kindergarten teachers also recorded the frequency of literacy activities in their classrooms. The phonological awareness and letter knowledge of 515 children (i.e., their pre-reading skills) were assessed at the end of kindergarten, as were their reading skills at the start and at the end of Grade 1. Eighty-seven of these children were identified in kindergarten as being likely to develop reading difficulties. The results showed that emotional support and classroom organization in kindergarten were positively associated with the development of children's reading skills across Grade 1, especially for those prone to reading difficulties. They also showed that frequent literacy activities in kindergarten were positively related to children's reading skills shortly after entering Grade 1. All the positive longitudinal associations were stronger for those children seen to be at risk of developing reading difficulties than for those not at risk.

*Keywords:* emotional support, classroom organization, instructional support, literacy activities, risk status, children at risk of reading difficulties, reading

## Classroom Interaction and Literacy Activities in Kindergarten:

### Longitudinal Links to Grade 1 Readers at Risk and not at Risk of Reading Difficulties

#### 1. Introduction

Teachers in early education clearly differ in the quality of their interactions with children (Howes et al., 2008; Pianta, La Paro, Payne, Cox, & Bradley, 2002), as well as in the frequency with which they expose them to literacy activities (Connor, Morrison, & Slominski, 2006; Stipek & Byler, 2004). The quality of teacher–child interactions in classrooms, in terms of emotional, organizational, and instructional support, for instance, has been found to affect children’s learning outcomes both in early childhood education (Mashburn et al., 2008; Palermo, Hanish, Martin, Fabes, & Reiser, 2007) and at school (Birch & Ladd, 1997; Cadima, Leal, Burchinal, 2010; Hamre & Pianta, 2005; Pakarinen et al., 2014). However, there is little longitudinal evidence on the role of quality in these interactions after children’s entrance to Grade 1 (see Curby, Rimm-Kaufman, & Ponitz, 2009; and Lee & Bierman, 2015 for exceptions). Another factor that seems to affect the development of children’s reading skills is their level of exposure to literacy activities (Connor et al., 2006; Stipek & Byler, 2004). Nevertheless, this has not been looked at together with the quality of classroom activities in the same study. Expert teacher–child interactions in kindergarten seem particularly important for children at risk of failing in school (Hamre & Pianta, 2005). So it seems reasonable to ask to what extent the links between such interactions and Grade 1 reading is different for children prone to reading difficulties (RD) than for those without. The purpose of the present longitudinal study of children’s transition from kindergarten to primary school has thus been to investigate the longitudinal associations between reading outcomes among children in Grade 1 and the quality of interaction and frequency of literacy activities in kindergarten; with a key interest

being to investigate how these associations differ for children at risk of RD from those not at risk.

### 1.1. Reading Skills Development and Risk of Reading Difficulty

Phonological awareness and letter knowledge are among the most consistent and reliable predictors of future reading skills (Leppänen, Niemi, Aunola, & Nurmi, 2004; Lerkkanen, Rasku-Puttonen, Aunola, & Nurmi, 2004; Lonigan, Burgess, & Anthony, 2000; Pennington & Lefly, 2001; Torppa et al., 2016; Wagner, Torgesen, & Rashotte, 1994). Phonological awareness is typically seen as an individual's ability to detect and process sounds at the level of syllable, onset, rhyme, and phoneme (e.g., identify, separate, combine, and compare them). Letter knowledge, in turn, refers to recognizing and distinguishing letters by knowing their different names and sounds. This ability to identify and know letters, and to play with sounds allows for sequences of grapheme–phoneme connections to be made and basic decoding to take place (Torppa et al., 2016). Once decoding is mastered, then higher level skills such as reading fluency and comprehension have the means to develop.

Reading skills develop especially rapidly in kindergarten and at the start of primary school (Catts, Fey, Tomblin, & Zhang, 2002; Skibbe et al., 2008). It has also been suggested that some children (e.g., those at risk of RD) develop slower in their reading skills than other children, and the gap between children's reading achievement widens with time. This widening of individual differences in reading has been called the *Matthew Effect* (Stanovich, 1986), or *cumulative reading trajectory* (Leppänen et al., 2004). However, others have suggested that the differences between 'good' and 'poor' readers gradually decrease during the early years of elementary school. One possible reason for this decrease is that teachers adapt their instruction; that is they adjust the time spent and type of instruction used with a particular child (Nurmi et al., 2013). This phenomenon has been called the *compensatory reading trajectory* (Leppänen et al., 2004; Morgan, Farkas, & Wu, 2011; Skibbe et al., 2008);

and most recent studies provide evidence of its existence (Aunola, Leskinen, Onatsu-Arviolommi, & Nurmi, 2002; Leppänen et al., 2004; Parrila, Aunola, Leskinen, Nurmi, & Kirby, 2005; Skibbe et al., 2008), rather than evidence of the cumulative trajectory (Stanovich, 1986).

The risk of RD has been found to have a strong negative effect on subsequent reading skills, even in studies that have controlled for child gender, nonverbal ability, and parental education (Kiuru et al., 2013). Some studies have found that students who struggle with reading are also likely to continue to do so throughout their later school years (Juel, 1998; Stanovich, 1986); while others suggest that a risk of RD—determined by a family background of reading difficulties, or by deficits in early language and literacy development—will result in poor reading skills (Lyytinen et al., 2004; Pennington & Lefly, 2001; Snowling, Gallagher, & Frith, 2003).

In the present study, we therefore examined the development of reading fluency among both children at risk and those identified as not being at risk of developing RD. Whether they were deemed at risk was based on tests of initial phoneme identification, letter knowledge and processing speed (e.g., rapid automatized naming). These criteria have consistently been selected as robust predictors in identifying a child's risk of RD at an early age (e.g., de Jong & van der Leij, 1999; Lerkkanen et al., 2004; Lerkkanen, Ahonen, Poikkeus, 2011; Saine, Lerkkanen, Ahonen, Tolvanen, & Lyytinen, 2011). In addition, we took into consideration those children who came from families in which at least one member had already been found to have RD (Gilger, Pennington, & DeFries, 1991; Lyytinen et al., 2004, 2006; Pennington & Lefly, 2001; Snowling, Gallagher, & Frith, 2003). Although this was one of the main criteria for identifying the risk, not all children with such a family background end up with deficient reading skills. Therefore, we used a combination of low pre-reading skills and familial RD as a basis for identifying children at risk.



## 1.2. The Quality of Classroom Interactions in Kindergarten and Children's Reading

### Skills

According to the TTI framework (Teaching Through Interactions), the quality of teacher–child interaction is a vital component in children's learning (Hamre, Hatfield, Pianta, & Jamil, 2014; Hamre et al., 2013). It suggests teacher–child interactions stimulate children's academic development in terms of three domains of interaction: *emotional support*, *classroom organization*, and *instructional support* (Pianta, La Paro, & Hamre, 2008; Pianta & Hamre, 2009).

*Emotional support* refers to the ways in which teachers foster a positive classroom climate for learning, minimize the negative, and attend to children's needs and interests in a responsive and sensitive manner (Curby et al., 2009; Hamre et al., 2013; Pianta et al., 2008). Previous research has shown that emotional support relates not only to a broad range of children's emotional and social outcomes (Howes et al., 2008; La Paro, Pianta, & Stuhlman, 2004; Mashburn et al., 2008; Pianta et al., 2008), but also to overall academic achievement (Hamre & Pianta, 2005; Perry, Donohue, & Weinstein, 2007; Pianta et al., 2002; Rudasill, Gallagher, & White, 2010). In reading, for instance, emotional support is linked to a growth in phonological awareness across kindergarten and Grade 1 (Curby et al., 2009). A close teacher–student relationship in kindergarten, and teachers that show warmth and sensitivity have been shown to have a positive impact on children's vocabulary and decoding at the end of Grade 1 (Connor, Son, Hindman, & Morrison, 2005), as well as their overall literacy skills (Lee & Bierman, 2015).

*Classroom organization* includes teacher activities such as managing children's behavior in class, and fostering their interest in learning (Cameron, Connor, & Morrison, 2005; Cameron, Connor, Morrison, & Jewkes, 2008; Emmer & Stough, 2001; Pianta et al., 2008). Some research has found that well-managed classrooms are ones in which teachers set

clear expectations for student behavior, provide well-established routines, help children regulate their own behavior, and sustain their interest in learning activities (Emmer & Stough, 2001; Pianta et al., 2008). Others have shown that classroom organization is specifically related to children's self-regulatory skills (Hamre et al., 2013; Paris & Paris, 2001; Raver, 2004), as well as behavioral and attentional skills (Downer, Sabol, & Hamre, 2010; Hamre et al., 2013). But this is not all; by managing children's behavior and enhancing self-regulatory skills, it has also been found that classroom organization has a positive effect on academic achievements (Cameron et al., 2005, 2008; Wharton-McDonald, Pressley, & Hampston, 1998) including reading-related outcomes such as, for example, letter-word identification and phonological awareness in kindergarten (Ponitz et al., 2009), or print concepts and vocabulary in Grade 1 (Cadima et al., 2010).

*Instructional support* refers to how teachers effectively support children's cognitive and language development by scaffolding, extending knowledge, and encouraging children's efforts (La Paro et al., 2004; Pianta et al., 2008). Previous research has shown that instructional support is primarily related to children's cognitive/academic development (Curby et al., 2009; Hamre & Pianta, 2005; Howes et al., 2008; Mashburn et al., 2008; Pianta et al., 2002), including language and reading-related skills (Keys et al., 2013; Mashburn et al., 2008). For instance, in kindergarten it is linked to better pre-reading skills, such as phonological awareness, vocabulary, speaking and listening, and letter knowledge (Burchinal et al., 2008; Mashburn et al., 2008). Meanwhile, in primary school it has also been found to correlate with increased phonological awareness and a larger vocabulary, but also with improved print concepts and decoding skills (Cadima et al., 2010; Hamre & Pianta, 2001; Pianta et al., 2002).

Although some studies have shown that these three domains of classroom interaction are important for the development of children's reading skills, several important issues still

require further investigation. For instance, very few longitudinal studies have tried to predict school outcomes for children from the quality of kindergarten classroom interaction (for exceptions that prove this rule, see Curby et al., 2009; and Lee & Bierman, 2015). Studying the quality of class interaction during the transition from kindergarten to primary school is important when it comes to children's reading skills, as previous language and literacy skills have proved strongly predictive of reading development in the first years of school (e.g., Lonigan, Burgess, & Anthony, 2000; National Early Literacy Panel, 2008; Shanahan & Lonigan, 2010; Torppa et al., 2016; Wagner, Torgesen, & Rashotte, 1994). Moreover, little is known about whether reading difficulties are a moderating variable in the correspondence between high quality kindergarten interaction and the development of children's reading skills in Grade 1. There is some evidence to suggest that emotional support acts as a protective factor among children at risk of RD (Buyse, Verschueren, Doumen, Van Damme, & Maes, 2008; Hamre & Pianta, 2001, 2005). For instance, Hamre and Pianta (2005) found that those Grade 1 pupils most at risk (i.e., those with attention deficits, externalizing behavior, poor social skills, and low academic competence) matched their non-risk peers in achievement measures at the end of Grade 1 when placed in classrooms with a high level of emotional support. Specifically, instructional support in Grade 1 has been found to be associated with an increase in word reading in children with low initial word-reading skills in kindergarten, while those with higher word-reading skills did better when placed in classrooms with a lower quality of instructional support (Curby et al., 2009). The present study therefore examines the associations between kindergarten classroom interaction and reading skills in Grade 1 taking into account children at risk of reading difficulties. It was assumed that all three domains of classroom interaction (emotional support, classroom organization, and instructional support) are important in developing reading skills among children at risk of RD.

### 1.3. Kindergarten Literacy Activities and Reading Skills

It has been suggested that it is not only the general quality of instruction during teacher–child interaction which affects a child’s reading outcomes, but also the frequency of literacy activities (Connor et al., 2006; Goldenberg et al., 2014; Lipsey, Farran, & Hofer, 2015; Morrison & Connor, 2005; National Early Literacy Panel, 2008; Shanahan & Lonigan, 2010; Stipek & Byler, 2004). For instance, Connor et al. (2006) showed that frequent code-focused activities in preschool increased alphabet knowledge and letter-word recognition skills one year later in kindergarten. Ball and Blachman (1991) reported that kindergarten children who were exposed to activities related to phonemic segmentation and letter-sound correspondence developed better word-recognition skills than others. Xue and Meisels (2004), for instance, have shown from teachers’ self-reports that an approach based on phonics (e.g., learning to recognize and sound out letters) enhances children’s decoding skills. Meanwhile, Guarino, Hamilton, Lockwood, and Rathbun (2006) cite teachers reporting how kindergarten literacy practices (e.g., phonics, reading and writing activities) enhance children’s reading skills in kindergarten (i.e., letter recognition, vocabulary, and comprehension).

Previous studies have also documented that literacy-related activities are among the most frequent activities in kindergarten classrooms (Ball & Blachman, 1991; Stipek & Byler, 2004; Sverdlov, Aram, & Levin, 2014). For instance, Sverdlov et al. (2014) have noted that alphabetic skill activities were significantly more frequent than activities promoting other goals—such as writing or communication. Furthermore, Stipek and Byler (2004) have found that teacher-reported literacy activities correlate to observers’ reports of them in kindergarten and Grade 1 classrooms.

Literacy activities may vary in importance to children, depending on their existing reading abilities (Connor et al., 2006; Morrison & Connor, 2002). Indeed, to become a good

reader, it would seem that pre-reading skills—such as phonological awareness and letter knowledge—need to be mastered first. Only after this can more advanced comprehension skills be learnt. This raises the issue of appropriate instructional needs at each stage of reading development. Some research, for example, has shown that practicing letter–sound correspondence enhances the pre-reading skills of children at risk of developing RD (Ehri et al., 2001; Hatcher, Hulme, & Ellis, 1994). Meanwhile, Morrison and Connor (2002) found that children identified (at the start of Grade 1) as being at risk of developing RD had higher decoding skills after explicit teacher-managed instruction. Because the impact of instructional variables depends critically on children’s existing level of ability (Lerkkanen et al., 2016; Morrison & Connor, 2002; Rutter & Maughan, 2002), it seems that those children most at risk would especially benefit from frequent literacy activities such as phonemic awareness and letter recognition in kindergarten (Hatcher et al., 1994). Consequently, the present study investigated the extent to which the frequency of such literacy activities in kindergarten corresponds to reading skills in Grade 1, and how a risk of RD may be a moderating variable in this correspondence.

#### **1.4. Control Variables: Child Age and Gender, Parental Education, and Class Size**

In addition to being at risk of developing reading difficulties, many other factors have been shown to affect the relationship between children’s reading skills, the quality of their classroom interactions, and the frequency of their literacy activities. Such factors include their age and gender, their parents’ education, and the size of the class (Hamre & Pianta, 2005; NICHD, 2004; Rutter & Maughan, 2002). For instance, children born earlier in a particular year group have been found to have better reading (and pre-reading) skills than their younger peers (McClelland, Morrison, & Holmes, 2000; Ojala, 2005). In their first years of school, girls show a higher interest in reading activities and more frequently read on their own (Logan & Johnson, 2009) whereas boys are typically overrepresented at the lower end of

the distribution for dyslexia and reading difficulties (Halpern, 1997; Halpern & LaMay, 2000; Rutter et al., 2004). Parental level of education has also been shown to be related to children's reading (e.g., Christian, Morrison, & Bryant, 1998; Ferguson, Jimerson, & Dalton, 2001; Hamre & Pianta, 2005; Leppanen et al., 2004; Lewis, 2000; McClelland & Morrison, 2003). This might be due to parents with a higher level of education providing more cognitive stimulation at home (Guo & Harris, 2000) that, in turn, enhances language and literacy development (Scarborough & Dobrich, 1994; Torppa et al., 2007).

Finally, class size has been suggested as one of the factors affecting how children's reading skills, kindergarten classroom interactions and frequency of literacy activities interrelate (Blatchford, Bassett, & Brown, 2011; NICHD, 2004; Rutter & Maughan, 2002). Teachers not only tend to have more time for individualized teaching in small classes (Blatchford, Bassett, Goldstain, & Martin, 2003), but they also have more of a chance to implement high quality classroom practices (Graue, Rauscher, & Sherfinski, 2009); with the result that children's reading skills develop more rapidly than they would in bigger classes.

In the present study, we therefore made sure to control for the effect of the above variables on the longitudinal relationship between children's reading skills, the quality of classroom interaction, and the frequency of literacy activities.

### **1.5. Learning to Read Finnish in the Transition from Kindergarten to Grade 1**

Finnish children usually start primary school (Grade 1) in the year their 7<sup>th</sup> birthday falls, which is later than in many other countries, such as the US. At the time this study was conducted, every child was eligible but not obliged to attend kindergarten one year before Grade 1. Unlike in many other countries, Finnish kindergarten education is a public service and free of charge. Although kindergarten attendance is voluntary, when the data was gathered for this study, 98% of all children attended (Statistics Finland, 2004). Finnish kindergartens differ from primary schools in their educational traditions and procedures.

Kindergarten education in Finland has a uniform curriculum across the country, in which instruction is not divided into subject area lessons, but activities are integrated into thematic play and learning situations throughout the day. The emphasis is on play-related activities developing social skills is the major objective, rather than the systematic instruction of academic skills (National Board of Education, 2010). This is unlike in many other countries, where kindergarten education is content-focused and divided into lessons. Finnish kindergarten programs may therefore show a greater similarity to preschool (rather than ‘kindergarten’) programs in the US; and this is also in spite of the fact that Finnish children enter kindergarten one year later than children in the United States. Because it is only in Grade 1 that Finnish children are exposed to systematic instruction (Soodla et al., 2015), starting formal schooling in Grade 1 is one of the major transitions in children’s and their families’ lives (Ahtola et al., 2011).

The Finnish language has a shallow orthography, with a more or less consistent grapheme–phoneme correspondence, enabling rapid reading acquisition (Aro & Wimmer, 2003; Seymour, Aro, & Erskine, 2003). Although Finnish children are not exposed to systematic reading instruction in kindergarten, by the end of it up to 30% of them are relatively accurate decoders (Lerikkanen, Rasku-Puttonen, Aunola, & Nurmi, 2004, Soodla et al., 2015). By Grade 1, the curriculum focuses on decoding syllables and words, and practicing reading fluency and comprehension with ABC books. As with other shallow orthographies, almost all children become good decoders and accurate readers during Grade 1 (Landerl & Wimmer, 2008; Lerikkanen et al., 2004), in which they receive whole-class reading instruction alongside individual instruction and support from their teachers (Nurmi et al., 2013). For children at risk of RD, more intensive, special support is provided by teaching assistants in the classroom and special education teachers (Saine, Lerikkanen, Ahonen, Tolvanen, & Lyytinen, 2011; Soodla et al., 2015).

## 1.6. The Present Study

Previous research on the relationship between the quality of classroom interactions and the development of reading skills has some limitations. Firstly, kindergarten interactions and the frequency of literacy activities have not been investigated alongside each other in the same study. Secondly, previous research on the quality of classroom interactions has been mainly cross-sectional and restricted to the same year groups—rarely investigating longitudinal links over several grades (for exceptions, again, see Curby, Rimm-Kaufman, & Ponitz, 2009; Lee & Bierman, 2015). Thirdly, although it is evident that reading acquisition is slower for some children than for others, little systematic comparison has previously been made between children at risk of RD and those not at risk. Fourthly, most research on the relationship between the quality of classroom interactions and development of reading skills has been conducted in the United States and among English-speaking children. Extending research to countries like Finland where the transition to elementary school happens two years later than in the US, and where the curriculum does not include systematic training of literacy skills in kindergarten should provide a different perspective to understanding the classroom processes that are important in developing children's reading skills.

In view of these lacuna, the present study investigates longitudinal associations between the quality of classroom interactions in kindergarten, the frequency of literacy activities in kindergarten, and the development of children's reading skills in Grade 1 (see Figure 1); paying special attention to how a risk of RD may be a moderating variable in these associations. Following suggestions made by Hamre and Pianta (2005), we made sure to (a) investigate the natural variation in everyday classroom activities and interactions; (b) test the children over a one-year period; and (c) control for existing levels of skill in each child. The following research questions were then examined:



- (1) To what extent is the quality of emotional support, classroom organization, and instructional support (i.e., classroom interaction) longitudinally linked to children's reading skills at the start of Grade 1 and their development of these skills throughout the year? To what extent is a risk of RD a moderating variable in these associations?

We expected that children would have better reading skills in Grade 1 if they came from high quality kindergartens (i.e., offering a well-organized classroom with effective emotional and instructional support). We also predicted that associations between the quality of classrooms and reading skills are stronger for children at risk of RD than for those who are not.

- (2) To what extent is the frequency of literacy activities longitudinally associated with children's reading skills at the start and end of Grade 1? To what extent is the risk of RD a moderating variable in these associations?

We expected that more frequent literacy activities in kindergarten would lead to better reading skills in Grade 1. We also hypothesized that the impact of these activities would be greater for children at risk of RD (than for those who were not), and less for those not at risk of RD (than for those who were).

We also controlled for the age and gender of the children, their mothers' level of education, and the size of their class; as these variables have previously been shown to affect how children's reading skills, the quality of classroom interactions, and the frequency of literacy activities interrelate (Hamre & Pianta, 2005; NICHD, 2004; Rutter & Maughan, 2002).

## **2. Method**

### **2.1. Participants and Procedure**

This study used data gathered from 49 classrooms, and a total of 515 children (244 of whom were girls). The participants came from an ongoing large-scale longitudinal study, in which the development of approximately 2,000 children is being followed all the way

through from kindergarten to Grade 9 (*authors removed for reviewing purposes*). Written consent to participate was sought and received from all the kindergarten teachers, principals, and parents/guardians of the children involved in the study. As part of the study, all the kindergarten teachers were observed ( $n = 49$ ), and all the children tested ( $n = 515$ ).

**Teachers and classrooms.** A total of 49 teachers volunteered to be observed in their classrooms. Of the 49 kindergarten classes, 10 were from semi-rural schools, and 39 from urban ones. Thirty-six of them (73.5%) were from daycare centers, and the remaining 13 (26.5%) from primary schools. Most of the groups had only 6-year-old children in them, though some of the daycare classes also included those that were aged 5, and some of the primary classes also had 1<sup>st</sup> and 2<sup>nd</sup> graders. All the classes were Finnish-speaking, which is usual in Central and Eastern Finland, where the data of this particular sample was from. Kindergarten class size ranged from 3 to 24 children ( $Mode = 22$ ;  $M = 13.85$ ,  $SD = 5.92$ ).

The 49 kindergarten teachers (47 of whom were women) were asked to complete questionnaires (sent out and returned by mail) concerning the frequency of literacy activities, and some background characteristics. Their work experience in kindergartens ranged from less than a year to 15 years or more ( $Mode = '15 \text{ years or more}'$ ), and all of them had at least a Bachelor's degree.

**Children.** In the present study, we used the data of 515 children from the observed classes (see descriptives of the sample under "control variables" in Table 1). Data from three measurement points were used: (1) the end of kindergarten, (2) beginning of Grade 1, and (3) end of Grade 1. In kindergarten, trained research assistants administered pre-reading tests individually; in Grade 1, group tests of reading were administered in the classroom.

## 2.2. Identifying the Risk of RD

The risk of individual children developing reading difficulties (RD risk) was determined by researchers at the end of kindergarten on the basis of 4 criteria: (i) children's

ability to identify initial phonemes (indicating phonological awareness); (ii) their letter knowledge; (iii) their scores for rapid automatized naming; and (iv) their parents' reports of any learning disabilities of their own. Risk of RD was defined by either of two instances: if at the end of kindergarten they scored at or below the 15<sup>th</sup> percentile of the total sample in at least two of the above measured pre-reading skills, i.e., (i), (ii), and (iii); or if at least one parent of the child reported in (iv) that they have experienced some "mild" or "severe" reading difficulties (scores 2 or 3) in their lives (Lerkkanen et al., 2011). In the latter case, the child's risk of RD was determined on the basis of only one of the three measurable criteria being at or below the 15<sup>th</sup> percentile. The 15th percentile was chosen because it is close to 1 standard deviation below the mean in a normal distribution. It is also commonly accepted that about 10 to 15% of school entrants to Finnish primary schools will be late readers. In fact, out of our sample of 515 children, 87 (16.89%) were found to be at risk of RD.

### 2.3. Measures

The psychometric properties of all study and control variables for the whole sample (i.e., the valid number of cases, means, standard deviations, reliabilities [Cronbach's  $\alpha$ ], potential and actual ranges of the values, and skewness) are presented in Table 1.

#### 2.3.1. Classroom Observations and Teachers' Questionnaire in Kindergarten (T1)

**Quality of classroom interactions (T1).** The Pre-K CLASS instrument (La Paro et al., 2004; Pianta et al., 2008) was used to assess classroom quality in kindergarten, as Finnish kindergarten curriculum is more similar to that of pre-kindergarten in US. It consists of 10 dimensions that between them measure the three domains of classroom quality. Four of these cover the domain of *emotional support*: positive climate, negative climate, teacher sensitivity, and regard for student perspectives. Three cover *classroom organization*: behavior management, productivity, and instructional learning formats. Meanwhile three dimensions cover *instructional support*: concept development, quality of feedback, and language

modeling. Each dimension was rated on a 7-point scale: low (1–2), moderate (3–5), and high (6–7); and the score for each of the three domains was calculated by taking the average score of the dimensions in each domain. However, the dimension of negative climate (in the domain of classroom organization) was excluded from further analyses because previous research in the Finnish context had shown that this particular dimension had poor psychometric properties (Pakarinen et al., 2010).

Observations were made in cycles of 30 minutes. During the first 20-minute period, observers made notes about CLASS indicators on an ordinary sheet of paper. Then, during the next 10 minutes (before the next observation cycle), they coded their observations onto the scoring sheet itself. The number of CLASS observation cycles ranged from two to five on Day 1 ( $M = 4.80$ ,  $SD = 0.61$ ), and from four to five on Day 2 ( $M = 4.82$ ,  $SD = 0.31$ ). For each item the ratings were averaged across all cycles for both Day 1 and Day 2.

Seventeen people (all of them native-speaking Finnish women) were trained to conduct the kindergarten classroom observations. To be trained as an observer, these people needed at least 2 years of studies in education or psychology, an interest in educational research, and a willingness to learn a new observational tool. The training took the form of information sessions and live and video observations (see Pakarinen et al., 2010, for a detailed description of the training process). The observations themselves, which took place in the spring of 2007, were arranged so that there were always two observers making independent ratings in each classroom. The inter-rater reliabilities between the pairs of observers in terms of intra-class correlations varied between .80 and .94. On average, one to three days (but always less than a week) typically elapsed between the two observation days. The observations typically began at the start of the school day (about 9 a.m.) and lasted approximately 3 hours—up to nap-time in full-day programs, or home-time in half-day programs. On each day, an audio recording was made of one classroom activity (typically a teacher-led instructional session) using an

MP3 recorder and a separate microphone attached to the kindergarten teacher who led the activity. This was done to assure the quality and precision of ratings in cases where the discrepancy between observers' coding points was greater than 1 scale point (Pianta et al., 2008).

**The frequency of literacy activities (T1).** To evaluate the frequency with which kindergarten teachers engage their pupils in literacy activities, we asked the teachers to rate 6 items on a 5-point scale (1 = not at all, 2 = seldom, 3 = weekly, 4 = daily, 5 = several times a day). This was phrased like this: *How often do you practice the following skills or use these practices in your kindergarten classrooms? (1) rhymes, (2) initial phoneme identification, (3) games with syllables, (4) identifying and naming letters, (5) identifying letter-sound correspondences, (6) word recognition.* These activities were mainly related to decoding rather than comprehension. The questions used were based on a study by Stipek and Byler (2004), and the descriptions were based on the National Curriculum of Pre-Primary Education in Finland (National Board of Education, 2010). Previously, it has been shown that kindergarten and Grade 1 teachers' self-reported literacy activities correlate significantly with similar activities from observational data (Stipek & Byler, 2004). Explorative factor analysis confirmed that the 6 items (each representing an individual literacy activity) loaded on one factor, that is they formed an internally consistent construct (Cronbach's alpha reliability .78). Their mean score was then used in all the analyses.

### **2.3.2. Children's Tests in Kindergarten (T1) and Grade 1 (T2 and T3)**

**Pre-reading skills in kindergarten (T1).** To determine pre-reading skills in kindergarten, children were tested in phonological awareness and letter knowledge (ARMI; Lerkkanen, Poikkeus, & Ketonen, 2006). The scores for these two tests were then standardized (Z-scores), and their mean score was calculated to give a total score for pre-reading skills.

*Phonological awareness* was measured using initial phoneme identification from the ARMI test (Lerkkanen et al., 2006). Children were shown 10 sets of four pictures each, one of which was the target picture, and the other three were for comparison purposes. The children first had to name the object in all four pictures and then, after hearing the test administrator pronounce a sound, match the sound heard to that of the first letter in the target picture.

*Letter knowledge.* The children were shown the 29 uppercase letters from the ARMI test (Lerkkanen et al., 2006), divided into three rows. The children had to then name the letters one row at a time while the other two were hidden. To get a maximum score of 29, children had to give the letter name or sound the corresponding phoneme for each letter correctly (1 point each). The test would stop, however, if a child was not able to name six letters in a row. This was to avoid potential anxiety and frustration over long testing sessions.

**Reading skills in Grade 1 (T2 and T3).** Word-level reading fluency was assessed using a group-administered subtest of the nationally standardized reading test battery (ALLU; Lindeman, 1998). This measure is mainly calibrated and used to assess the accuracy and speed of reading, that is, reading fluency, although it contains also other aspects of reading skill, such as vocabulary and reading comprehension. In this speed test, 80 possible items could be answered in the allotted two-minute time slot (at both T2 and T3). For each item, the child was asked to read four phonologically similar words and draw a line between a picture and the word that matched it semantically. The form B version of the subtest (uppercase letters) was used in the fall semester of Grade 1 (T2), because children start learning to read by using uppercase letters at the start of Grade 1. However, form A (lowercase letters) was used in the spring semester of Grade 1 (T3). Lowercase letters were used because soon after learning to read using uppercase letters children are taught reading in lowercase letters. Scores corresponded to the number of correct responses made within the allotted time.

According to the test manual (Lindeman, 1998), the reliability between forms A and B has been shown to be .84. Validity information of this test is presented in test manual (Lindeman, 1998).

### **2.3.3. Parental Reading Difficulties**

Parents were asked about any reading difficulties they may have experienced in their lives using a 3-point scale (1 = no problems, 2 = mild problems, 3 = clear problems). The criterion for parental RD was if either of a child's parents marked 2 or above (Lerkkanen, Ahonen, & Poikkeus, 2011).

### **2.3.4. Background Characteristics (Control Variables)**

We also collected information on individual children's age in months at the start of kindergarten, as well as their gender, their mothers' education, and the size of their class in Grade 1 (see Table 1 for detailed information).

## **2.4. Analysis Strategy**

Based on our theoretical model (Figure 1), we constructed several path models for the whole sample. As all three domains of classroom interaction correlated highly with each other (.92–.97; see Pakarinen et al., 2010), and we were interested in investigating their independent effects, analyses were conducted separately for each of them. In these analyses, reading skills measured both at the start and end of Grade 1 were regressed on each of the three classroom interaction domains, as well as on the frequency of literacy activities, and the control variables. Reading skill measurements at the end of Grade 1 were also regressed on those taken at the start of the year; and these in turn were regressed on the pre-reading skills as measured in kindergarten. All kindergarten measures and control measures were allowed to correlate with each other. The indirect paths were also estimated from the three classroom interaction domains and frequency of literacy activities to reading skills at the end of Grade 1 via reading skills at the start of the year. In order to test whether the above model

should fit both, children at risk of developing RD ( $n = 87$ ) and for those not at risk ( $n = 428$ ), we applied multi-group procedure. This procedure tested whether the risk status serves as a moderator of the associations indicated in the previous model. For the presentation of the multi-group models, the non-significant associations (paths and correlations) were fixed to zero.

The data was analyzed within the SEM framework, using the Mplus statistical package (Version 7.3; Muthén & Muthén, 2010); and the Mplus TYPE = COMPLEX option was used to control for the hierarchical structure of the data (i.e., to account for the nesting of multiple children in each class). If the shared variance between children from the same class had not been accounted for, standard errors for the predictors would have been too small and there might have been an inflated Type I error rate, where we might have detected an effect that was not present (Raudenbush & Bryk, 2002). Mplus TYPE = COMPLEX is a standard procedure when analyses include data of a complex sample (i.e., stratification, sampling weights, and clustering), where individual cases are not selected individually, but are sampled within groups (or, in our case, classes).

The missing data method, that is, the standard MAR approach (missing-at-random to missingness) was applied. The MAR approach was chosen because the proportion of missing data for the main study variables ranged from 0–20 % ( $M = 4.65\%$ ,  $SD = 5.96\%$ ), and the significance of the Little's (1988) MCAR test ( $\chi^2 [162] = 222.388$ ,  $p = .001$ ) indicated that the data was *not* missing-completely-at-random (MCAR). Thus, the missingness-at-random (MAR) was assumed instead, and all available data were used to estimate the model without imputing any data. The distributions of the variables were skewed; thus, the model parameters were estimated using the MLR estimator (maximum likelihood with robust standard errors) which is implemented in Mplus. The MLR estimator produces standard



errors and chi-square test statistics for missing data with non-normal outcomes and non-independent observations by means of a sandwich estimator.

As we had hypotheses for our results, a one-way test of statistical significance was employed for all the SEM models. All the presented models were trimmed (i.e., all non-significant paths and correlations were fixed to zero). In all models, children's age, gender, maternal education, and Grade 1 class size were controlled for. Model fit was assessed by five model-fit statistics: the chi-square ( $\chi^2$ ), comparative fit index (*CFI*), Tucker-Lewis index (*TLI*), root mean square error of approximation (*RMSEA*), and standardized root mean square residual (*SRMR*). Non-significant  $\chi^2$ , *CFI* and *TLI* values above .95, a *RMSEA* value below .06 and a *SRMR* value below .08 indicate a good model fit (Hu & Bentler, 1999); while *CFI* and *TLI* values above .90, and *RMSEA* and *SRMR* values below .10 indicate an adequate model fit (Kline, 2011).

### 3. Results

#### 3.1. Descriptives

Table 1 shows that the quality of classroom interactions in kindergarten was moderate to high: The mean was 3.98 for instructional support (on a scale of 1–7), while the mean score was above 5 for emotional support and classroom organization. Meanwhile, Finnish teachers reported engaging their classes in literacy activities on average once a week ( $M = 3.14$  on a scale of 1–5).

Descriptives for both risk status groups and a comparison of their means are presented in Table 2. The information given in this table shows that both groups came from similar classrooms, as there were no differences in classroom quality measures between them. The results also validate our method for identifying children at risk, by showing that they indeed scored lower on all literacy measures in comparison to those not at risk. On average, the latter had better educated mothers ( $p < .05$ ) and had been placed in somewhat larger classes in

Grade 1 ( $p < .10$ ) than those at risk of RD. The chi-square test showed that risk status was marginally related to child gender ( $\chi^2 = 2.89$ ,  $df = 1$ ,  $p = .089$ ): There were more boys than girls among those at risk.

Correlations between all the study variables are presented separately for each group in Table 3. The results showed a stronger relation between the quality of classroom interactions and frequency of literacy activities for children at risk ( $r$  range .23–.37,  $p < .05$ ); while for those not at risk, the only significant relation was between emotional support and the frequency of literacy activities (.23,  $p < .01$ ). Also, for those not at risk, the links between kindergarten classroom quality and children's pre-reading and reading skills ranged from only  $-.06$  to  $.01$  ( $ps > .05$ ), with the exception of a significant relation between literacy activities and reading skills only at the start of Grade 1 (.11,  $p < .05$ ). For children at risk, the links between reading skills and quality of classroom interaction in kindergarten were higher than for children not at risk. From Table 3 we can also see that the stability of reading skills across time was higher for children not at risk.

This group's control variables also showed that older children, girls, children with better educated mothers, and children placed in larger Grade 1 classes were more likely to have better pre-reading and reading skills than the other children. For this group, higher quality classroom interaction in kindergarten was associated with having less well-educated mothers and being placed in a larger Grade 1 class. As for group at risk of RD, greater emotional support and better organized classrooms were more likely to be found in classes with a higher proportion of girls. Indeed, better pre-reading skills and the likelihood of being placed in a larger Grade 1 class were also related to being a girl. For children with this risk status, pre-reading skills in kindergarten were also cross-sectionally related to emotional support.

### 3.2. Path Analyses

**Emotional support.** The results for the whole sample showed that the model fitted the data well,  $\chi^2(19) = 23.08, p = .23; TLI = .98; CFI = .98; RMSEA = .02; SRMR = .04$ .

Emotional support positively predicted reading skills at the end of Grade 1 ( $\beta = .08, p < .05$ ), but not at the start of the year. Also, literacy activities in kindergarten positively predicted reading skills at the start of Grade 1 ( $\beta = .10, p < .05$ ), but negatively predicted it at the end of the year ( $\beta = -.10, p < .05$ ). We also found an indirect effect from kindergarten literacy activities on reading skills at the end of Grade 1 via reading skills at the start of the year (*standardized indirect estimate* = .07,  $p < .05$ ).

Next, we used a multi-group procedure to test whether risk status would serve as a moderator in the previous model (Figure 2). The trimmed model had an excellent model fit,  $\chi^2(49) = 50.73, p = .41; TLI = .99; CFI = .99; RMSEA = .01; SRMR = .05$ ; showing that emotional support positively predicted reading skills at the end of Grade 1—but this was only for children at risk of RD. The frequency of literacy activities in kindergarten, however, positively predicted reading skills for *both* groups; in other words, the more literacy activities were provided in kindergarten, the better the reading skills were by the start of school. A negative association between the frequency of literacy activities in kindergarten and reading skills at the end of Grade 1 was only found for children at no risk of developing RD. Finally, we found that the indirect path from kindergarten literacy activities to reading skills at the end of Grade 1 via reading skills at the start of school was only significant for children not at risk (*standardized indirect estimate* = .06,  $p < .05$ ).

**Classroom organization.** Results for the whole sample showed that the model fitted the data well,  $\chi^2(24) = 22.01, p = .58; TLI = 1.00; CFI = 1.00; RMSEA = .00; SRMR = .04$ ; and that classroom organization negatively predicted reading skills at the start of school ( $\beta = -.08, p < .05$ ), while literacy activities in kindergarten positively predicted them ( $\beta = .11, p < .05$ ). We also found two indirect effects: the first was from kindergarten literacy activities to

reading skills at the end of Grade 1 via reading skills at the start of that year (*standardized indirect estimate* = .07,  $p < .05$ ); and the second was from kindergarten classroom organization to reading skills at the end of Grade 1 via the same variable at the start of school (*standardized indirect estimate* =  $-.07$ ,  $p < .05$ ).

Next, to address our second research question, we again applied a multi-group procedure to test if the associations of the previous model are moderated by children's risk status (Figure 3). When trimmed it had an excellent model fit,  $\chi^2(49) = 31.23$ ,  $p = .98$ ;  $TLI = 1.00$ ;  $CFI = 1.03$ ;  $RMSEA = .00$ ;  $SRMR = .04$ ; and showed that classroom organization negatively predicted reading at the start of Grade 1 only for those children not at risk of RD. However, classroom organization positively predicted reading skills at the end of Grade 1 for both groups. As in the model for emotional support, the frequency of literacy activities positively predicted reading skills at the start of Grade 1 for both groups, and negatively predicted reading skills at the end of the year only for the group of children not at risk. Finally, we found two indirect effects for children not at risk: the first was from kindergarten literacy activities to reading skills at the end of Grade 1 via the same variable at the start of that year (*standardized indirect estimate* = .07,  $p < .05$ ); and the second was from kindergarten classroom organization to reading skills at the end of Grade 1 via reading skills at the start of the year (*standardized indirect estimate* =  $-.07$ ,  $p < .05$ ).

**Instructional support.** The whole sample model fitted the data well,  $\chi^2(25) = 23.44$ ,  $p = .55$ ;  $TLI = 1.00$ ;  $CFI = 1.00$ ;  $RMSEA = .00$ ;  $SRMR = .04$ ; and showed that instructional support was not significantly related to children's reading outcomes. Next, to test whether risk status would serve as a moderator in this model we applied a multi-group procedure and obtained a good model fit,  $\chi^2(52) = 39.78$ ,  $p = .89$ ;  $TLI = 1.02$ ;  $CFI = 1.00$ ;  $RMSEA = .00$ ;  $SRMR = .04$ ; which showed that instructional support was not related to reading outcomes in either risk status groups. Like in the models for emotional support and classroom

organization, literacy activities in kindergarten predicted reading skills at the start of school for the whole sample ( $\beta = .10, p < .05$ ), as well as separately for both children at risk of RD ( $\beta = .19, p < .05$ ) and those not at risk ( $\beta = .08, p < .05$ ); and they also negatively predicted reading skills at the end of Grade 1 for those children not at risk ( $\beta = -.10, p < .05$ ). Finally, we found an indirect effect from kindergarten literacy activities to reading skills at the end of Grade 1 via reading skills at the start of the year for all three risk status permutations: the whole sample (*standardized indirect estimate* = .07,  $p < .05$ ), children at risk (*standardized indirect estimate* = .07,  $p < .05$ ), and children not at risk (*standardized indirect estimate* = .07,  $p < .05$ ).

#### 4. Discussion

This study was set up to investigate the longitudinal associations between the quality of classroom interactions, the frequency of literacy activities in kindergarten, and Grade 1 reading outcomes in samples of children with and without risk of reading difficulties. The results showed, first, that kindergarten interactions in terms of emotional support were important for the development of reading skills across Grade 1, particularly for children at risk of RD. Second, classroom organization in kindergarten was found to be an important predictor of developing reading skills across Grade 1, especially for children at risk. Third, the frequency of literacy activities in kindergarten was positively linked to the development of children's reading skills from late kindergarten to the start of Grade 1, again for those at risk. Overall, these findings highlight the importance of good quality classroom interaction in kindergarten and frequent literacy activities to ensure a positive development of children's reading skills. More frequent literacy activities seem to provide a head start for reading development at the very beginning of Grade 1, while strong emotional support and good classroom organization have longer-term effects for the development of reading skills. The positive links between emotional support, classroom organization, and the development of

reading skills were true, however, only for those first-graders who were identified as being at risk of RD before school entry.

The present study expands our understanding of the field by (1) investigating the quality of classroom interactions and frequency of literacy activities in kindergarten as antecedents for reading development in the transition to Grade 1; (2) testing whether the pattern of longitudinal associations differs according to children's risk status; (3) examining the quality of classroom interaction and frequency of literacy activities in the same study; and (4) testing these associations across a sample from an educational system that is not based on the English language, and thus has different particular characteristics, such as a shallow orthography.

#### **4.1. Classroom Interaction Quality in Kindergarten and Reading Skills in Grade 1**

The results of the present study emphasize the importance of high-quality interactions in kindergarten for the healthy development of children's reading skills across Grade 1. Strong emotional support from the teacher was also found to be particularly important for developing the reading skills of children identified as being at risk of RD. This tallies with previous research on the importance of emotional support for the development of reading-related skills in Grade 1 (see Curby et al., 2009, for phonological awareness; Cadima et al., 2010, for vocabulary; and Connor et al., 2005, for decoding). Indeed, the results of Hamre and Pianta (2005) showed that children displaying functional risk (i.e., a combination of early behavioral, attentional, social and/or academic problems) scored as highly as their classmates on achievement tests if the classroom was characterized by high levels of emotional support. We also found a similar longitudinal effect for emotional support. In other words, a high level of emotional support in kindergarten was positively linked to the reading skills of children at risk (at the end of Grade 1). In classrooms with high levels of emotional support, teachers create a positive climate for learning in which everyone involved wants to be there, and

where teachers are aware of children's needs and respond to them. Our results contribute to previous findings by showing that high emotional support from the teacher is a significant factor in helping children at risk of RD develop their reading skills; and by using data which comes from an educational system where children enter elementary school later than in the US; and where they are learning to read a language with very different characteristics to English.

The effects of emotional support on children's reading skills can be explained by how it affects children's engagement, their connectedness to school and teachers, and enhances their motivation to learn (Hamre et al., 2013). Positive classroom interactions clearly increase children's motivation and willingness to pursue those goals valued by teachers (Wentzel, 1998, 2002), which may further contribute to skill development, whereas negative interactions lead to lower class participation and achievement. Theoretically, a close teacher-pupil relationship satisfies the child's need for emotional security, comfort, and confidence that seems so vital in a positive school environment (Bowlby, 1989). The present study adds to these findings by showing that strong emotional support experienced in kindergarten extends its positive effect to reading outcomes at the end of Grade 1, and that this effect is especially important for children at risk of RD. Interestingly, the effect of emotional support in kindergarten became evident at the end of Grade 1 rather than at the start. One possible explanation for this is that the study was conducted in Finland, where children face systematic reading instruction only after entering Grade 1. This means that reading skills would start to develop rapidly after children enter first grade. Learning to decode is relatively easy for Finnish children, because of the shallowness of orthography. Therefore, only after a certain level of a particular reading skill is mastered (i.e., accuracy) would the emotional support provided by kindergarten teachers come into play; hence it would not become evident until

the end of Grade 1. Nevertheless, future studies are needed to replicate and clarify this pattern of associations.

Similarly, managing children's behavior in kindergarten and stimulating their interest in learning (in terms of classroom organization) were found to be important antecedents for developing reading skills across Grade 1, especially for children at risk of RD. Previous research has also shown the importance of these two antecedents for reading skills in Grade 1 (see Cadima et al., 2010; Cameron et al., 2008; and Wharton-McDonald et al., 1998, for vocabulary and print concepts). Thus, it is not surprising that we found positive associations between kindergarten classroom organization and the development of children's reading skills across Grade 1. One explanation for this is that good classroom organization provides children with self-regulatory skills that later help them to focus better on learning tasks in the classroom.

Contrary to our expectations, classroom organization was negatively related to reading skills at the very start of Grade 1 for the subsample of children who were not at risk of RD. One possible reason for this is that this group may be better at self-regulation and self-direction than those at risk, so they do not need the teacher's encouragement to manage their behavior or show an interest in learning. It can also be assumed, from self-determination theory (Ryan & Deci, 2000), that excessive classroom organization by kindergarten teachers may actually inhibit intrinsic motivation of those children who are already behaving well, and are interested in early literacy tasks; i.e., those not at risk of RD, who are ready for reading instruction at the start of Grade 1. In contrast, the present study revealed that the benefits of a well-organized kindergarten were clearer for children at risk of RD. These findings are not surprising given that competencies obtained in kindergarten (such as self-regulatory behavioral and attentional skills, Hamre et al., 2013) can be applied in subsequent years, and



thus aid the development of reading skills by the end of Grade 1, especially among those children who are at risk of RD.

Instructional support in kindergarten, however, was not found to affect children's pre-reading skills in either kindergarten or Grade 1, contrary to much previous research (e.g., Burchinal et al., 2008; Cadima et al., 2010; Hamre & Pianta, 2005; Keys et al., 2013; Mashburn et al., 2008). However, our results do tally with the results of some previous research (Pakarinen et al., 2011) which shows that, although instructional support in kindergarten is related to children's behavior in achievement situations (e.g., task-persistent learning behavior), it does not affect reading-related outcomes *per se*. One reason for this might be that, as some students were already reading and understanding what they were reading, instructional support in kindergarten may have had an effect on the development of more advanced skills, such as reading comprehension. Unfortunately, such advanced skills were not the focus of this manuscript, and remains to be studied in the future.

We also found that, on average, teachers offered little instructional support in their classrooms, and this might be one reason why there were no significant associations between instructional support and pre-reading and reading skills. One further explanation is that the instructional support measured by the CLASS instrument used is calibrated to measure overall language support responsiveness and interaction, not support for skills specifically needed in early reading. Also, it is important to note that capturing specific literacy-related activities was not within the scope of our study. Therefore, classroom observations, including evaluations of instructional support, occurred also when activities other than literacy took place. One target of future research might therefore be to determine times during the day when reading activities would occur to ensure their observation.

#### **4.2. Kindergarten Literacy Activities and Reading Skills in Grade 1**

Because the quality of observed teacher–child interactions is not so much about the frequency and specific ways in which kindergarten teachers engage in children’s literacy activities, we also asked kindergarten teachers to record how often children in their classes were exposed to literacy activities in an ordinary week. Although teachers may change the frequency and type of literacy activities over the course of the kindergarten year, on average, at the end of kindergarten, teachers reported engaging their classes in literacy activities once a week, but there was great variation, ranging from seldom to several times a day. As mentioned earlier, the results showed that frequent literacy activities in kindergarten provide a good head start for developing reading skills. This effect was especially apparent at the start of Grade 1, when children were starting their formal schooling and beginning to receive systematic instruction in reading.

Another important finding was that the frequency of literacy activities in kindergarten did relate to children’s reading skills at the end of Grade 1 but indirectly, through enhancing reading skills at the start of Grade 1. These findings are understandable given the Finnish context: The Finnish kindergarten curriculum’s main aim is not to focus on the systematic teaching of reading skills but rather to provide a foundation for literacy skills by creating an environment that promotes language development (e.g., speaking, discussing, shared reading), and encourages an interest in letters and sounds through play (National Board of Education, 2010). This environment is expected to develop children’s pre-reading skills, such as letter knowledge and phonological awareness. The present study adds to our knowledge by providing empirical evidence that the more frequently children are exposed to literacy activities in kindergarten (i.e., practicing phonemic awareness and letters) the more likely they will have better reading skills in Grade 1 (Ehri et al., 2001). Taken together, these findings confirm the results of previous studies showing that children need to be exposed to a certain amount of literacy activities already before Grade 1 to be able to keep up with their

peers in reading at the start of their school career (Connor et al., 2006; Morrison & Connor, 2005). Similar findings have been obtained in research on parenting that demonstrated that a kindergarten child's frequent exposure to print *per se* in the home environment was related to enhanced reading skills at the start of Grade 1 (Sénéchal & Le Fevre, 2014; for the Finnish context, see Silinskas et al., 2012).

In particular, our results showed that literacy activities in kindergarten are especially important for those at risk of RD, which corresponds with the findings in other previous research (Hamre & Pianta, 2005; Morrison & Connor, 2002). However, our conclusion is based on a somewhat stronger premise in the present study, because we specifically looked at the associations between kindergarten literacy activities and Grade 1 reading skills for both children *at risk of RD*, as well as those *not at risk*. In this way, the pattern of the associations in both groups could be compared. The resulting difference in findings regarding children's risk status supports the notion that it is a key factor in determining what type of teacher instruction will be beneficial for advancing reading-related skills (Connor et al., 2006; Morrison & Connor, 2002). These results would correspond with previous research which shows that a high level of teacher-managed explicit instruction is optimal for children at risk of RD to be able to decode, whereas this made no difference for children with good pre-reading skills (Morrison & Connor, 2002).

The present study also showed some unexpected results regarding the long-term effects of kindergarten literacy activities and children's reading skills at the end of Grade 1. For children at risk of RD, the literacy activities in kindergarten and reading skills at the end of Grade 1 were not longitudinally associated, whereas among those not at risk, literacy activities in kindergarten were linked, albeit to a slower development of reading skills at the end of Grade 1. This resembles previous findings in the US where pre-kindergarten instruction was found to lose its significance for children's achievement in later primary

school grades (Lipsey et al., 2015; Puma et al., 2012). It would also suggest that a lack of instructional support in Finnish kindergartens relates to achievement in somewhat similar ways to that in US pre-kindergartens. For instance, one recent American study (Lipsey et al., 2015) of a state's pre-kindergarten program—with a curriculum similar to that of Finnish kindergartens—found that children participating in the program (vs. those who were not) scored higher on achievement measures such as literacy, language, and math at the end of pre-kindergarten and start of kindergarten (corresponding to the start of Grade 1 in Finland). However, the effect of participating in the program disappeared at the end of that year. Moreover, by the end of the following year (Grade 2), children who participated in the program scored lower than those who had not participated on most of the achievement measures (Lipsey et al., 2015). In another study, it has been shown that 'instruction in phonological awareness' (which resembles the frequency of literacy activities in our study) is not as important in the context of transparent (shallow) languages as it is in the more opaque languages, like English (Goldenberg et al., 2014). This might explain why a high frequency of literacy activities in Finland (which include training in phonological awareness) lays a good foundation for reading skills at Grade 1 entry, but may have a negative impact on them for children not at risk of RD, as in the long run the latter may need more advanced training than phoneme instruction to develop their reading skills.

As already mentioned above, when interpreting the effects of high-quality kindergarten classroom interactions on the development of children's reading skills across Grade 1, one must take into account the characteristics which distinguish the language and educational system in Finland. The educational system differs from many others in so far as formal school entry is unusually late (7 years of age when starting Grade 1), which means higher cognitive maturation and greater readiness for systematic learning at school entrance. Also, children are not expected to learn to read before entrance to primary school, so no systematic

teaching of reading is given before school entry (Soodla et al., 2015; Torppa et al., 2016).

The other difference is that the comparative transparency of Finnish orthography leads to a relatively rapid acquisition of decoding skills during the first months of Grade 1 (Lerikkanen et al., 2004). Indeed, almost all children become accurate and relatively fluent readers by the end of Grade 1 (Soodla et al., 2015; Torppa et al., 2016). Children with risk of reading difficulties may develop their reading skills at a faster rate than their typically developing peers due to the individualized reading instruction. Thus, the difference between good and poor readers become less evident with time, suggesting a compensatory reading trajectory among both typically developing and at-risk children (Leppanen et al., 2004; Morgan et al., 2008; Skibbe et al., 2011; Parrila et al., 2005). These factors concerning the process of learning to read have certainly shaped the results of our study.

#### **4.3. Control Variables: Child Age, Child Gender, Maternal Education, and Class Size**

The results have shown that child age, child gender, maternal education, and class size significantly relate to the quality of classroom interactions, frequency of literacy activities and pre-reading and reading skills. For children not at risk of RD, older children were more likely to have better pre-reading skills in kindergarten. Also, for those children, age was negatively related to classroom organization, indicating that older children have probably already internalized classroom routines and the behavior that is expected of them. It was thus teachers of younger children that needed to ensure careful classroom organization.

In both groups (at risk and not), girls were more likely to have better pre-reading skills than boys; and among those at risk, girls were more likely to get emotional support and greater classroom organization, suggesting that boys who are already at risk of developing RD are also less likely to get high quality classroom interactions.

For those children not at risk, lower maternal education was linked to higher emotional support and greater classroom organization. However, maternal education predicted reading

skills at the start of Grade 1 (in the model of emotional support, Figure 2), suggesting that children with better educated mothers have better reading skills even if they are placed in classes with somewhat lower levels of emotional support and classroom organization.

Concerning class size in Grade 1, for both risk status groups, children with better pre-reading skills were more likely to be placed in the larger Grade 1 classes. Among those not at risk, children from classes with more frequent literacy activities in kindergarten were more likely to be placed to the larger Grade 1 classes (in the model of classroom organization, Figure 3). Moreover, based on Table 3, higher levels of instructional support in kindergarten meant children were more likely to be placed in a larger Grade 1 classes, irrespective of their risk status. One possible explanation for these results may be that, when forming new Grade 1 classes, school administration takes into account previous characteristics of the children and the effectiveness of their kindergarten classrooms. Thus, they may try to combine children who can be expected to do well at school into larger classes, while children who are assumed to be at risk of problems end up in the smaller classes.

Finally, for children at risk of RD, pre-reading skills in kindergarten were cross-sectionally related to emotional support in kindergarten. This is a very interesting and important result, which confirms our previous longitudinal finding on the positive relation between emotional support in kindergarten and reading skills at the end of Grade 1. This finding also highlights the message that emotional support in kindergarten translates into higher pre-reading skills in kindergarten, once a number of other variables in a complex model are controlled for.

### **4.3. Limitations**

This study is not without its limitations. First, although it examined longitudinal relations, it was not experimental, and so the results cannot be interpreted as an examination of causality. Particular caution should be taken when interpreting relations between the

classroom interaction domains, literacy activities in kindergarten, and reading skills in Grade 1. This is because other factors, that were not included or assessed in this study, may have had an effect on the development of children's reading skills. For instance parental literacy teaching in kindergarten or over the summer before Grade 1 could have enhanced children's reading skills at the start of Grade 1 (Sénéchal & LeFevre, 2014; Silinskas et al., 2012). Even more importantly, teachers' instruction or individual support in Grade 1 could have confounded the association between kindergarten instruction and reading at the end of Grade 1 (Nurmi et al., 2013; Silinskas et al., 2016; Soodla et al., 2015). Although we found that two of the interaction domains (emotional support and classroom organization) were associated with reading skills by the end of Grade 1, further research is needed to uncover the mechanisms by which these domains for determining kindergarten classroom quality relate to reading outcomes at the end of Grade 1. Also, future research needs to address the ways in which the quality of classroom interactions in Grade 1 shape the development of children's reading skills. It is possible that a high quality kindergarten classroom will act as a buffer against poor classroom quality in Grade 1, or conversely that low classroom quality in kindergarten could be compensated for by high classroom quality in Grade 1.

A second limitation was the small sample size of the observed classes, which reduced the power of statistical testing, and the fact that we used a one-tailed test of statistical significance to test our hypotheses. However, our study design, based on the ideas of Hamre and Pianta (2005), nevertheless (a) captured the natural variation of everyday interactions, (b) followed children's reading development over a period of one year, and (c) accounted for the previous level of children's skills, which typically showed high-to-moderate stability.

Thirdly, literacy activities were measured by teachers' self-reports. Thus, we measured the perceived rather than the observed frequency of literacy activities in our study. This leaves us open to the valid criticism that teachers might fall prey to the social desirability

effect, thus compromising the accuracy of their evaluations. However, many previous studies have used teachers' self-ratings for gathering data to assess the frequency of certain classroom activities in previous research (Stipek & Byler, 2004; Xue & Meisels, 2004). When Stipek and Byler (2004) compared observational data from the literacy instruction practices of kindergarten and Grade 1 teachers to self-reports on items similar to the observed data, they found significant correlations.

A fourth limitation was that we had a limited definition of "literacy activities" as a limited set of activities, mainly focusing on increasing phonological awareness and letter knowledge were used. These activities were decoding related rather than comprehension related activities. If more types of literacy activity had been included (e.g., the frequency of more advanced reading skill practices, such as listening or reading comprehension), there may have emerged different kinds of associations with pre-reading and reading skills. Also, teachers' reports on the frequency of their literacy activities (also, classroom observations) were measured only once, at the end of kindergarten, that did not allow us to identify the change in those activities over a course of a year. Considering a greater number of literacy activities and assessing them more than once a year thus remains a target for the future research.

Finally, our study was particularly focused on the relations between specific types of literacy activities in kindergarten and specific child outcomes in Grade 1 (i.e., reading fluency), and how these relate to the overall quality of kindergarten (i.e., emotional support, classroom organization, and instructional support). Thus, a broader conceptualization of literacy activities (e.g., adding shared reading activities), child outcomes (e.g., vocabulary, written language) and their relation to kindergarten quality would have, in turn, enriched our understanding of our research questions even further (National Early Literacy Panel, 2008; Shanahan & Lonigan, 2010). This remains a target for the future studies.



#### 4.4. Conclusions

The present study investigated longitudinal associations between the quality of kindergarten classroom interactions, the frequency of literacy activities in Finnish kindergarten classrooms, and Grade 1 reading outcomes in samples of children both at risk and not at risk of developing RD. Overall, the findings point to the fact that frequent literacy activities provide a good basis for reading development at the very beginning of Grade 1, whereas the quality of classroom interactions in terms of emotional support and classroom organization has longer-term effects across Grade 1. These associations were especially noticeable regarding the development of reading skills in children at risk of RD.

The study adds to the literature by bringing together research on teacher-child interactions that can be directly observed in the classroom (i.e., emotional support, classroom organization, and instructional support) with research on the frequency of a number of specific literacy activities employed in the kindergarten classroom. The study was also able to disentangle the effects of kindergarten quality on reading skills at the start of Grade 1 (when systematic instruction in reading begins) from their effect on those skills at the end of Grade 1 (thus tracking the development of reading skills across Grade 1 more effectively). The study also managed to disentangle the effects of high-quality kindergarten classroom interaction for children at risk of developing RD from those who are not at risk, and by doing so, to confirm the expectation that high-quality kindergarten classroom interaction is especially important for the development of reading in those children most at risk of developing reading difficulties. Finally, the methodological strengths of this study should be recognized as our results were obtained only after we had first controlled for the previous levels of skills, as well as a number of background characteristics.

Our results have clear implications for early years practitioners and teacher educators. Frequent engagement in literacy activities such as rhyming, playing games with syllables,

phonemes, and letters should be encouraged in kindergarten, especially for children who have difficulties in naming letters and identifying sounds. This is important, because frequent literacy activities improve reading acquisition at the start of school, as well as across Grade 1. Kindergarten teachers should also be encouraged to form warm, sensitive, and respectful relations with children, to manage their behavior, and to encourage learning, especially among those children who have difficulties in pre-reading skills like naming letters or identifying sounds.

## References

- Ahtola, A., Silinskas, G., Poikonen, P.-L., Kontoniemi, M., Niemi, P., & Nurmi, J.-E. (2011). Transition to formal schooling: Do transition practices matter for academic performance? *Early Childhood Research Quarterly, 26*, 295-302.
- Aro, M., & Wimmer, H. (2003). Learning to read: English in comparison to six more regular orthographies. *Applied Psycholinguistics, 24*, 621-635.
- Aunola, K., Leskinen, E., Onatsu-Arviolommi, T., & Nurmi, J.-E. (2002). Three methods for studying developmental change: A case of reading skills and self-concept. *British Journal of Educational Psychology, 72*, 343-364.
- Ball, E. W., & Blachman, B. A. (1991). Does phoneme awareness training in kindergarten make a difference in early word recognition and developmental spelling? *Reading Research Quarterly, 26*, 49-66.
- Birch, S. H., & Ladd, G. W. (1997). The teacher-child relationship and children's early school adjustment. *Journal of School Psychology, 35*, 61-79.
- Blatchford, P., Bassett, P., & Brown, P. (2011). Examining the effect of class size on classroom engagement and teacher-pupil interaction: Differences in relation to pupil prior attainment and primary vs. secondary schools. *Learning and Instruction, 21*, 715-730.
- Blatchford, P., Bassett, P., Goldstein, H., & Martin, C. (2003). Are class size differences related to pupils' educational progress and classroom processes? Findings from the institute of education class size study of children aged 5-7 years. *British Educational Research Journal, 29*, 709-730.
- Bowlby, J. (1989). *The role of attachment in personality development and psychopathology*.
- Burchinal, M., Howes, C., Pianta, R., Bryant, D., Early, D., Clifford, R., & Barbarin, O. (2008). Predicting child outcomes at the end of kindergarten from the quality of pre-

- kindergarten teacher-child interactions and instruction. *Applied Development Science*, 12, 140-153.
- Buyse, E., Verschueren, K., Doumen, S., Van Damme, J., & Maes, F. (2008). Classroom problem behavior and teacher-child relationships in kindergarten: The moderating role of classroom climate. *Journal of School Psychology*, 46, 367-391.
- Cadima, J., Leal, T., & Burchinal, M. (2010). The quality of teacher-student interactions: Associations with first graders' academic and behavioral outcomes. *Journal of School Psychology*, 48, 457-482.
- Cameron, C. E., Connor, C. M., & Morrison, F. J. (2005). Effects of variation in teacher organization on classroom functioning. *Journal of School Psychology*, 43, 61-85.
- Cameron, C. E., Connor, C. M., Morrison, F. J., & Jewkes, A. M. (2008). Effects of classroom organization on letter-word reading in first grade. *Journal of School Psychology*, 46, 173-192.
- Catts, H. W., Fey, M. E., Tomblin, J. B., & Zhang, X. (2002). A longitudinal investigation of reading outcomes in children with language impairments. *Journal of speech, Language, and hearing Research*, 45, 1142-1157.
- Christian, K., Morrison, F. J., & Bryant, F. B. (1998). Predicting kindergarten academic skills: Interactions among child care, maternal education, and family literacy environments. *Early Childhood Research Quarterly*, 13, 501-521.
- Connor, C. M., Morrison, F. J., & Slominski, L. (2006). Preschool instruction and children's emergent literacy growth. *Journal of Educational Psychology*, 98, 665-689.
- Connor, C. M., Son, S. H., Hindman, A. H., & Morrison, F. J. (2005). Teacher qualifications, classroom practices, family characteristics, and preschool experience: Complex effects on first graders' vocabulary and early reading outcomes. *Journal of School Psychology*, 43, 343-375.

- Curby, T. W., Rimm-Kaufman, S. E., & Ponitz, C. C. (2009). Teacher-child interactions and children's achievement trajectories across kindergarten and first grade. *Journal of Educational Psychology, 101*, 912-925.
- de Jong, P. F., & van der Leij, A. (1999). Specific contributions of phonological abilities to early reading acquisition: Results from a Dutch latent variable longitudinal study. *Journal of Educational Psychology, 91*, 450-476.
- Downer, J., Sabol, T. J., & Hamre, B. (2010). Teacher-child interactions in the classroom: Toward a theory of within-and cross-domain links to children's developmental outcomes. *Early Education and Development, 21*, 699-723.
- Ehri, L., Nunes, S., Willows, D., Schuster, B., Yaghoub-Zadeh, Z., & Shanahan, T. (2001). Phonemic awareness instruction helps children learn to read: Evidence from the National Reading Panel's meta-analysis. *Reading Research Quarterly, 36*, 250-287.
- Emmer, E. T., & Stough, L. M. (2001). Classroom management: A critical part of educational psychology, with implications for teacher education. *Educational Psychologist, 36*, 103-112.
- Ferguson, P., Jimerson, S. R., & Dalton, M. J. (2001). Sorting out successful failures: Exploratory analyses of factors associated with academic and behavioral outcomes of retained students. *Psychology in the Schools, 38*, 327-341.
- Halpern, D. F. (1997). Sex differences in intelligence: Implications for education. *American Psychologist, 52*, 1091-1102.
- Hamre, B., Hatfield, B., Pianta, R., & Jamil, F. (2014). Evidence for general and domain-specific elements of teacher-child interactions: Associations with preschool children's development. *Child Development, 85*, 1257-1274.
- Hamre, B. K., & Pianta, R. C. (2001). Early teacher-child relationships and the trajectory of children's school outcomes through eighth grade. *Child Development, 72*, 625-638.

- Hamre, B. K., & Pianta, R. C. (2005). Can instructional support in the first-grade classroom make a difference for children at risk of school failure? *Child Development, 76*, 949-967.
- Hamre, B. K., Pianta, R. C., Downer, J. T., Decoster, J., Mashburn, A. J., Jones, S. M., Brown, J. L., Cappella, E., Atkins, M., Rivers, S. E., Brackett, S. E., & Hamagami, A. (2013). Teaching through interactions: Testing a developmental framework of effective teaching in over 4,000 classrooms. *Elementary School Journal, 113*, 461-487.
- Hatcher, P., Hulme, C., & Ellis, A. (1994). Ameliorating early reading failure by integrating the teaching of reading and phonological skills: The phonological linkage hypothesis. *Child Development, 65*, 41-57.
- Howes, C., Burchinal, M., Pianta, R., Bryant, D., Early, D., Clifford, R., & Barbarin, O. (2008). Ready to learn? Children's pre-academic achievement in pre-kindergarten programs. *Early Childhood Research Quarterly, 23*, 27-50.
- Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal, 6*, 1-55.
- Gilger, J. W., Pennington, B. F., & Defries, J. C. (1991). Risk for reading disability as a function of parental history in three family studies. *Reading and Writing, 3*, 205-217.
- Goldenberg, C., Tolar, T.D., Reese, L., Francis, D.J., Bazán, A.R., & Mejía-Arauz, R. (2014). How important is teaching phonemic awareness to children learning to read in Spanish? *American Educational Research Journal, 51*, 604-633.
- Graue, E., Rauscher, E., & Sherfinski, M. (2009). The synergy of class size reduction and classroom quality. *The Elementary School Journal, 110*, 178-201.
- Guarino, C. M., Hamilton, L. S., Lockwood, J. R., & Rathbun, A. H. (2006). Teacher Qualifications, Instructional Practices, and Reading and Mathematics Gains of

- Kindergartners. Research and Development Report. NCES 2006-031. *National Center for Education Statistics*.
- Guo, G., & Harris, K. M. (2000). The mechanisms mediating the effects of poverty on children's intellectual development. *Demography*, *37*, 431-447.
- Juel, C. (1988). Learning to read and write: A longitudinal study of 54 children from first through fourth grades. *Journal of Educational Psychology*, *80*, 437-447.
- Keys, T. D., Farkas, G., Burchinal, M. R., Duncan, G. J., Vandell, D. L., Li, W., ... & Howes, C. (2013). Preschool center quality and school readiness: Quality effects and variation by demographic and child characteristics. *Child Development*, *84*, 1171-1190.
- Kiuru, N., Lerkkanen, M.-K., Niemi, P., Poskiparta, E., Ahonen, T., Poikkeus, A.-M., & Nurmi, J.-E. (2013). The role of reading disability risk and environmental protective factors in children's reading fluency in grade 4. *Reading Research Quarterly*, *48*, 349-368.
- Kline, R. B. (2011). *Principles and practice of structural equation modeling* (3<sup>rd</sup> ed.). New York: Guilford Press.
- Landerl, K., & Wimmer, H. (2008). Development of word reading fluency and spelling in a consistent orthography: an 8-year follow-up. *Journal of Educational Psychology*, *100*, 150-161.
- La Paro, K. M., Pianta, R. C., & Stuhlman, M. (2004). The classroom assessment scoring system: Findings from the prekindergarten year. *The Elementary School Journal*, *104*, 409-426.
- Lee, P., & Bierman, K. L. (2015). Classroom and teacher support in kindergarten: Associations with the behavioral and academic adjustment of low-income students. *Merrill-Palmer Quarterly*, *61*, 383-411.

- Leppänen, U., Niemi, P., Aunola, K., & Nurmi, J. E. (2004). Development of reading skills among preschool and primary school pupils. *Reading Research Quarterly, 39*, 72-93.
- Lerikkanen, M.-K., Ahonen, T., & Poikkeus, A.-M. (2011). The development of reading skills and motivation and identification of risk at school entry. In M. Veisson, E. Hujala, P.K. Smith, M. Waniganayake, & E. Kikas, (Eds.). *Global perspectives in early childhood education: Diversity, challenges and possibilities. Baltische Studien zur Erziehungs- und Sozialwissenschaft.* (pp. 237-258). Frankfurt am Main: Peter Lang.
- Lerikkanen, M. K., Kiuru, N., Pakarinen, E., Poikkeus, A. M., Rasku-Puttonen, H., Siekkinen, M., & Nurmi, J. E. (2016). Child-centered versus teacher-directed teaching practices: Associations with the development of academic skills in the first grade at school. *Early Childhood Research Quarterly, 36*, 145-156.
- Lerikkanen, M.-K., Kiuru, N., Pakarinen, E., Viljaranta, J., Poikkeus, A.-M., Rasku-Puttonen, H., et al. (2012). The role of teaching practices in the development of children's interest in reading and mathematics in kindergarten. *Contemporary Educational Psychology, 37*, 266-279.
- Lerikkanen, M.-K., Poikkeus, A.-M., & Ketonen, R. (2006). *ARMI—Luku- ja kirjoitustaidon arviointimateriaali 1. luokalle [ARMI—A tool for assessing reading and writing skills in grade 1]*. Helsinki: WSOY.
- Lerikkanen, M.-K., Rasku-Puttonen, H., Aunola, K., & Nurmi, J.-E. (2004). Predicting reading performance during the first and the second year of primary school. *British Educational Research Journal, 30*, 67-92.
- Lindeman, J. (1998). *ALLU—Ala-asteen lukutesti [ALLU—Reading test for primary school]*.  
Turku: University of Turku, Centre for Learning Research.



- Lipsey, M., Farran, D., & Hofer, K. (2015). *A randomized control trial of a statewide voluntary prekindergarten program on children's skills and behaviors through third grade* (Research Report). Peabody College, Vanderbilt University.
- Little, R. J. (1988). A test of missing completely at random for multivariate data with missing values. *Journal of the American Statistical Association*, 83, 1198-1202.
- Logan, S., & Johnston, R. (2009). Gender differences in reading ability and attitudes: Examining where these differences lie. *Journal of Research in Reading*, 32, 199-214.
- Lonigan, C. J., Burgess, S. R., & Anthony, J. L. (2000). Development of emergent literacy and early reading skills in preschool children: Evidence from a latent-variable longitudinal study. *Developmental Psychology*, 36, 596-613.
- Lyytinen, H., Aro, M., Eklund, K., Erskine, J., Guttorm, T., Laakso, M. L., ... & Torppa, M. (2004). The development of children at familial risk for dyslexia: birth to early school age. *Annals of dyslexia*, 54, 184-220.
- Lyytinen, H., Erskine, J., Tolvanen, A., Torppa, M., Poikkeus, A. M., & Lyytinen, P. (2006). Trajectories of reading development: A follow-up from birth to school age of children with and without risk for dyslexia. *Merrill-Palmer Quarterly*, 52, 514-546.
- Mashburn, A., Pianta, R. C., Hamre, B. K., Downer, J. T., Barbarin, O. A., Bryant, D., ... & Howes, C. (2008). Measures of classroom quality in prekindergarten and children's development of academic, language, and social skills. *Child Development*, 79, 732-749.
- McClelland, M. M., Morrison, F. J., & Holmes, D. L. (2000). Children at risk for early academic problems: The role of learning-related social skills. *Early Childhood Research Quarterly*, 15, 307-329.
- Morgan, P. L., Farkas, G., & Wu, Q. (2011). Kindergarten children's growth trajectories in reading and mathematics: Who falls increasingly behind? *Journal of Learning Disabilities*, 44, 472-488.

- Morrison, F. J., & Connor, C. M. (2002). Understanding schooling effects on early literacy: A working research strategy. *Journal of School Psychology, 40*, 493-500.
- Muthén, L. K., & Muthén, B. O. (2010). *Mplus user's guide* (6<sup>th</sup> ed.). Los Angeles: Muthén & Muthén.
- National Board of Education (2010). *Esiopetuksen oppilaat 2007-2009 [Students in preschool education 2007-2009]*. Available online at: <https://www.data.oph.fi/wera>
- National Early Literacy Panel. (2008). *Developing early literacy: Report of the National Early Literacy Panel*. Washington, DC: National Institute for Literacy. Available at <http://www.nifl.gov/earlychildhood/NELP/NELPreport.html>
- NICHD Early Child Care Research Network (2004). Does class size in first grade relate to children's academic and social performance or observed classroom processes? *Developmental Psychology, 40*, 651-664.
- Nurmi, J. E., Kiuru, N., Lerkkanen, M. K., Niemi, P., Poikkeus, A. M., Ahonen, T., ... & Lyyra, A. L. (2013). Teachers adapt their instruction in reading according to individual children's literacy skills. *Learning and Individual Differences, 23*, 72-79.
- Ojala, M. (2005). Mitä lapset ovat oppineet esiopetuksessa? Hytönen, J. (toim.) *Esiopetuksen prosessi ja vaikutukset: esiopetuksen toimivuus ja vaikuttavuus Helsingin kaupungissa vuosina 2001-2003*. Tutkimusraportti 3. Helsingin yliopiston soveltavan kasvatustieteen laitos, tutkimuksia 259, 1-18.
- Paris, S. G., & Paris, A. H. (2001). Classroom applications of research on self-regulated learning. *Educational Psychologist, 36*, 89-101.
- Pakarinen, E., Aunola, K., Kiuru, N., Lerkkanen, M.-K., Poikkeus, A.-M., Siekkinen, M., & Nurmi, J.-E. (2014). The cross-lagged associations between classroom interactions and children's achievement behaviors. *Contemporary Educational Psychology, 39*, 284-261.

- Pakarinen, E., Lerkkanen, M. K., Poikkeus, A. M., Kiuru, N., Siekkinen, M., Rasku-  
Puttonen, H., & Nurmi, J.-E. (2010). A validation of the Classroom Assessment  
Scoring System in Finnish kindergartens. *Early Education and Development, 21*, 95-  
124.
- Pakarinen, E., Kiuru, N., Lerkkanen, M. K., Poikkeus, A. M., Ahonen, T., & Nurmi, J.-E.  
(2011). Instructional support predicts children's task avoidance in kindergarten. *Early  
Childhood Research Quarterly, 26*, 376-386.
- Palermo, F., Hanish, L. D., Martin, C. L., Fabes, R. A., & Reiser, M. (2007). Preschoolers'  
academic readiness: What role does the teacher-child relationship play? *Early  
Childhood Research Quarterly, 22*, 407-422.
- Parrila, R., Aunola, K., Leskinen, E., Nurmi, J.-E., & Kirby, J. R. (2005). Development of  
individual differences in reading: Results from two longitudinal studies. *Journal of  
Educational Psychology, 97*, 299-319.
- Pennington, B. F., & Lefly, D. L. (2001). Early reading development in children at family  
risk for dyslexia. *Child development, 72*, 816-833.
- Perry, K. E., Donohue, K. M., & Weinstein, R. S. (2007). Teaching practices and the  
promotion of achievement and adjustment in first grade. *Journal of School Psychology,  
45*, 269-292.
- Phillips, L. M., Norris, S. P., Osmond, W. C., & Maynard, A. M. (2002). Relative reading  
achievement: A longitudinal study of 187 children from first through sixth grades.  
*Journal of Educational Psychology, 94*, 3-13.
- Pianta, R. C., & Hamre, B. K. (2009). Conceptualization, measurement, and improvement of  
classroom processes: Standardized observation can leverage capacity. *Educational  
Researcher, 38*, 109-119.

- Pianta, R. C., La Paro, K. M., & Hamre, B. K. (2008). *The Classroom Assessment Scoring System. Manual, pre-K*. Baltimore: Brookes.
- Pianta, R. C., La Paro, K. M., Payne, C., Cox, M. J., & Bradley, R. (2002). The relation of kindergarten classroom environment to teacher, family and school characteristics and child outcomes. *The Elementary School Journal, 102*, 225-238.
- Ponitz, C. C., Rimm-Kaufman, S. E., Brock, L. L., & Nathanson, L. (2009). Early adjustment, gender differences, and classroom organizational climate in first grade. *The Elementary School Journal, 110*, 142-162.
- Ponitz, C. C., Rimm-Kaufman, S. E., Grimm, K. J., & Curby, T. W. (2009). Kindergarten classroom quality, behavioral engagement, and reading achievement. *School Psychology Review, 38*, 102-120.
- Puma, M., Bell, S., Cook, R., Heid, C., Broene, P., Jenkins, D., Mashburn, A. & Downer, J. (2012). *Third grade follow-up to the Head Start Impact Study final report*, OPRE Report # 2012-45, Washington, DC: Office of Planning, Research and Evaluation, Administration for Children and Families, U.S. Department of Health and Human Services.
- Raudenbush, S. W., & Bryk, A. S. (2002). *Hierarchical linear models: Applications and data analysis methods* (2<sup>nd</sup> ed.). Newbury Park, CA: Sage.
- Raver, C. C. (2004). Placing emotional self-regulation in sociocultural and socioeconomic contexts. *Child Development, 75*, 346-353.
- Rudasill, K. M., Gallagher, K. C., & White, J. M. (2010). Temperamental attention and activity, classroom emotional support, and academic achievement in third grade. *Journal of School Psychology, 48*, 113-134.
- Rutter, M., Caspi, A., Fergusson, D., Horwood, L. J., Goodman, R., Maughan, B., ... & Carroll, J. (2004). Gender differences in developmental reading disability: New

- findings from four epidemiological studies. *Journal of the American Medical Association*, 291, 2007-2012.
- Rutter, M., & Maughan, B. (2002). School effectiveness findings 1979-2002. *Journal of School Psychology*, 40, 451-475.
- Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American psychologist*, 55, 68-78.
- Saine, N. L., Lerkkanen, M. K., Ahonen, T., Tolvanen, A., & Lyytinen, H. (2011). Computer-assisted remedial reading intervention for school beginners at risk for reading disability. *Child Development*, 82, 1013-1028.
- Sénéchal, M., & LeFevre, J. A. (2014). Continuity and change in the home literacy environment as predictors of growth in vocabulary and reading. *Child Development*, 85, 1552-1568.
- Seymour, P. H. K., Aro, M., & Erskine, J. M. (2003). Foundation literacy acquisition in European orthographies. *British Journal of Psychology*, 94, 143-174.
- Scarborough, H. S., & Dobrich, W. (1994). On the efficacy of reading to preschoolers. *Developmental review*, 14, 245-302.
- Shanahan, T., & Lonigan, C. J. (2010). The National Early Literacy Panel: A summary of the process and the report. *Educational Researcher*, 39, 279-285.
- Silinskas, G., Lerkkanen, M. K., Tolvanen, A., Niemi, P., Poikkeus, A. M., & Nurmi, J. E. (2012). The frequency of parents' reading-related activities at home and children's reading skills during kindergarten and Grade 1. *Journal of Applied Developmental Psychology*, 33, 302-310.
- Silinskas, G., Pakarinen, E., Niemi, P., Lerkkanen, M.-K., Poikkeus, A.-M., & Nurmi, J.-E. (2016). The effectiveness of increased support in reading and its relationship to

- teachers' affect and children's motivation. *Learning and Individual Differences*, 45, 53-64.
- Skibbe, L. E., Grimm, K. J., Stanton-Chapman, T. L., Justice, L. M., Pence, K. L., & Bowles, R. P. (2008). Reading trajectories of children with language difficulties from preschool through fifth grade. *Language, Speech, and Hearing Services in Schools*, 39, 475-486.
- Snowling, M. J., Gallagher, A., & Frith, U. (2003). Family risk of dyslexia is continuous: Individual differences in the precursors of reading skill. *Child development*, 74, 358-373.
- Soodla, P., Lerkkanen, M.-K., Niemi, P., Kikas, E., Silinskas, G., & Nurmi, J.-E. (2015). Does early reading instruction promote the rate of acquisition? A comparison of two transparent orthographies. *Learning and Instruction*, 38, 14-23.
- Stanovich, K. E. (1986). Matthew effects in reading: Some consequences of individual differences in the acquisition of literacy. *Reading Research Quarterly*, 360-407.
- Stipek, D., & Byler, P. (2004). The early childhood classroom observation measure. *Early Childhood Research Quarterly*, 19, 375-397.
- Sverdlov, A., Aram, D., & Levin, I. (2014). Kindergarten teachers' literacy beliefs and self-reported practices: on the heels of a new national literacy curriculum. *Teaching and Teacher Education*, 39, 44-55.
- Torppa, M., Georgiou, G. K., Lerkkanen, M. K., Niemi, P., Poikkeus, A. M., & Nurmi, J. E. (2016). Examining the simple view of reading in a transparent orthography: A longitudinal study from kindergarten to grade 3. *Merrill-Palmer Quarterly*, 62, 179-206.
- Torppa, M., Tolvanen, A., Poikkeus, A. M., Eklund, K., Lerkkanen, M. K., Leskinen, E., & Lyytinen, H. (2007). Reading development subtypes and their early characteristics. *Annals of dyslexia*, 57, 3-32.

- Wagner, R. K., Torgesen, J. K. & Rashotte, C. A. (1994) Development of reading-related phonological processing abilities: New evidence of bi-directional causality from a latent variable longitudinal study, *Developmental Psychology*, 30, 73-87.
- Wentzel, K. R. (1998). Social relationships and motivation in middle school: The role of parents, teachers, and peers. *Journal of Educational Psychology*, 90, 202-209.
- Wentzel, K. R. (2002). Are effective teachers like good parents? Teaching styles and student adjustment in early adolescence. *Child Development*, 73, 287-301.
- Wharton-McDonald, R., Pressley, M., & Hampston, J. M. (1998). Literacy instruction in nine first-grade classrooms: Teacher characteristics and student achievement. *The Elementary School Journal*, 99, 101-128.
- Xue, Y., and Meisels, S.J. (2004). Early Literacy Instruction and Learning in Kindergarten: Evidence From the Early Childhood Longitudinal Study—Kindergarten Class of 1998-1999. *American Educational Research Journal*, 41, 191-229.

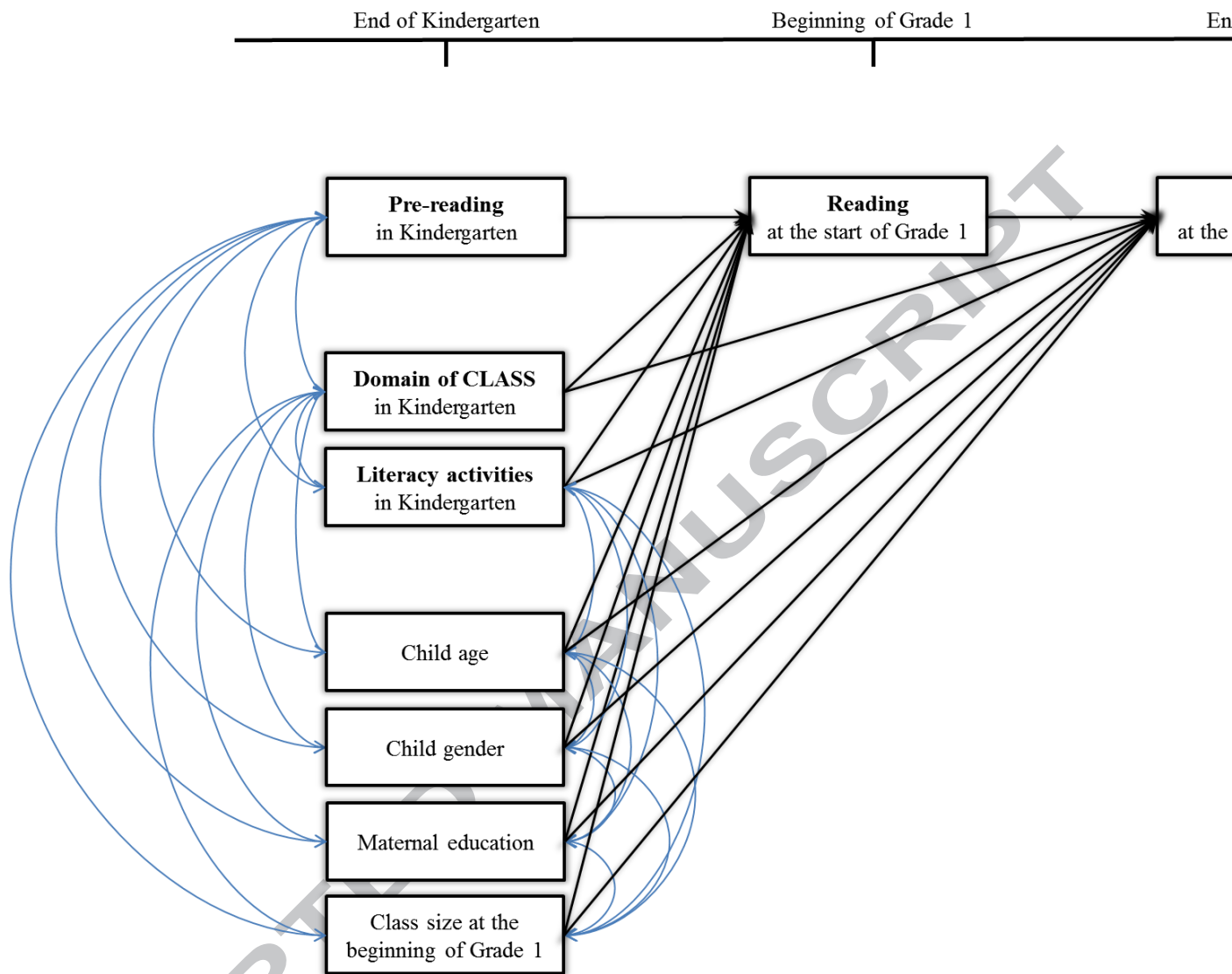


Figure 1. Theoretical model of the longitudinal associations between classroom quality (i.e., domain of CLASS) and the frequency of literacy activities in kindergarten and children's reading skills in Grade 1.



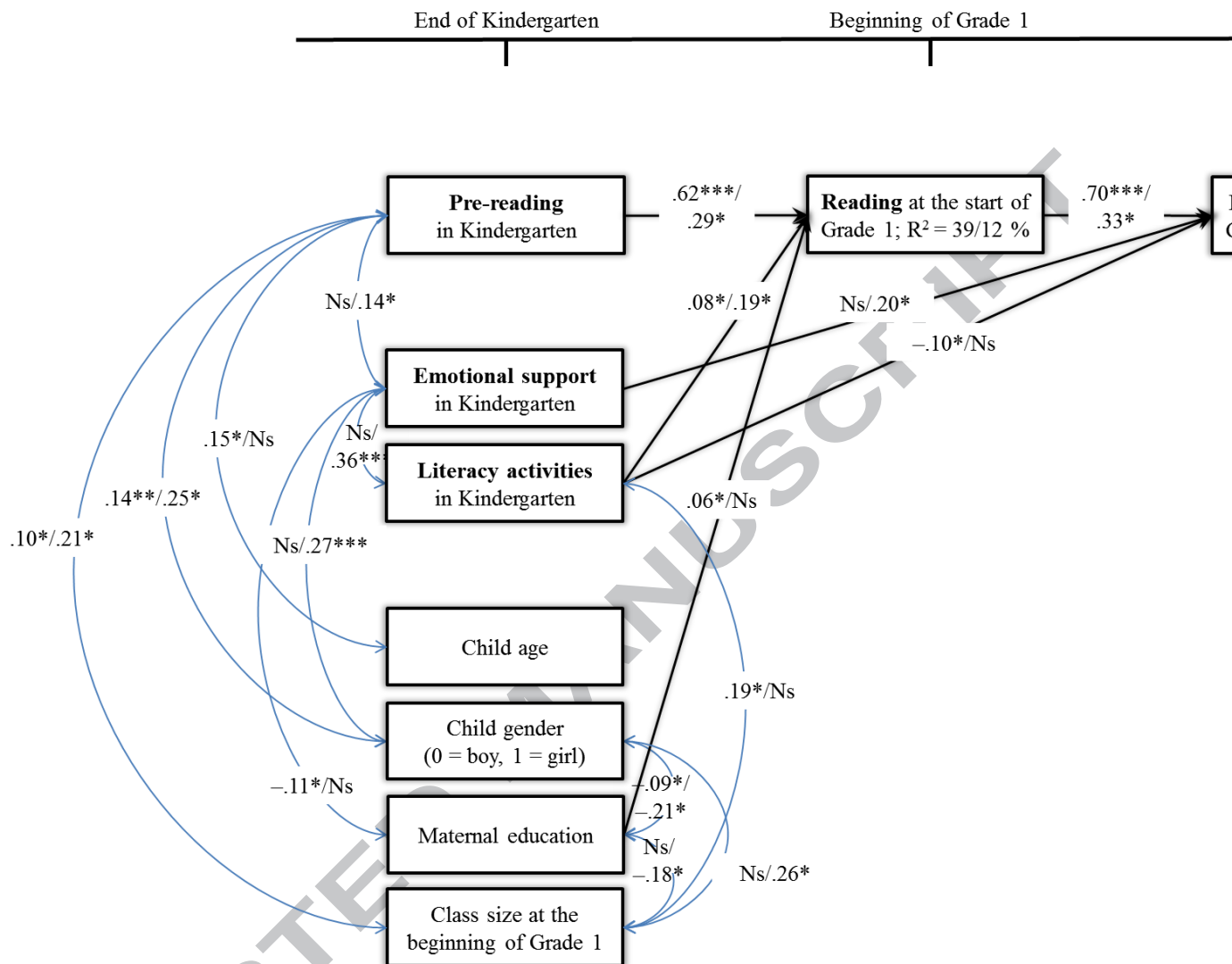


Figure 2. Emotional support and literacy activities in kindergarten and children's reading in Grade 1 for children not at risk (the first coefficient) and at risk for reading difficulties (the second coefficient). Standardized solution of the trimmed model of the multi-group path analysis (NOT AT RISK / AT RISK).  $Ns p > .05$ ;  $* p < .05$ ;  $** p < .01$ ;  $*** p < .001$ .

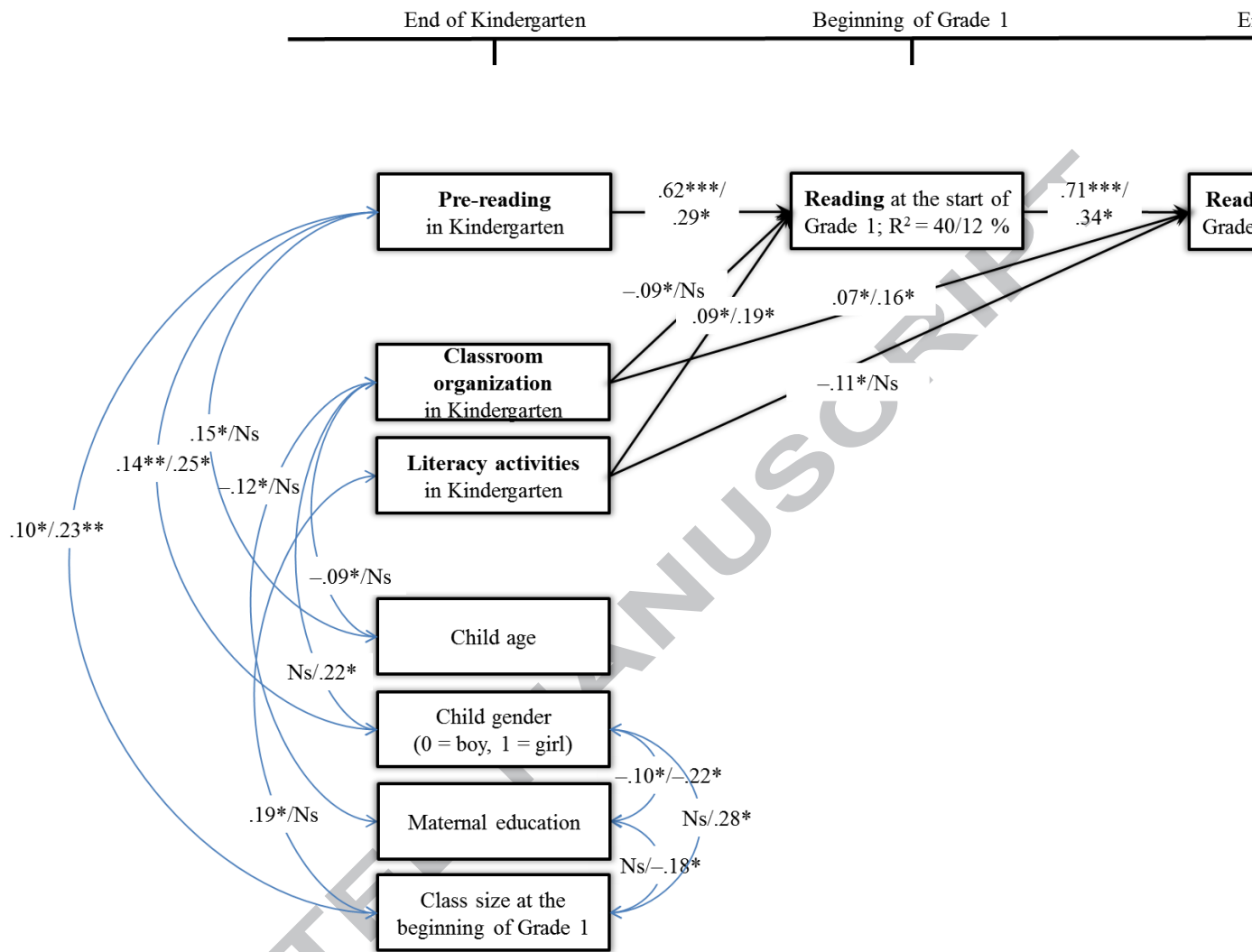


Figure 3. Classroom organization and literacy activities in kindergarten and children's reading in Grade 1 for not-at-risk (the first coefficient) and at-risk children for reading difficulties (the second coefficient). Standardized solution of the trimmed model of the multi-group path analysis (NOT AT RISK / AT RISK). Ns  $p > .05$ ; \*  $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$ .

Table 1

*Psychometric Properties of the Major Study Variables (n = 515)*

Variable	n	M	SD	Reliability (Cronbach's $\alpha$ )	Range		Skewness
					Potential	Actual	
<i>Classroom quality in kindergarten (T1)</i>							
Emotional support	515	5.07	.78	.93	1–7	2.9– 6.23	–1.15
Classroom organization	515	5.33	.64	.88	1–7	3.19– 6.27	–1.56
Instructional support	515	3.98	.91	.90	1–7	1.64– 5.54	–.61
Frequency of literacy activities	511	3.14	.53	.78	1–5	2–4.67	.52
<i>Children's skills</i>							
Phonological awareness (kindergarten; T1)	505	8.85	1.72	.78 <sup>a</sup>	0–10	0–10	–1.73
Letter knowledge (kindergarten; T1)	506	22.77	6.59	.95 <sup>a</sup>	0–29	1–29	–1.21
Pre-reading skills (kindergarten; T1)	506	.01	.87	.95		–3.45– .78	–1.36
Reading (beginning of Grade 1; T2)	470	8.79	6.79	.97 <sup>a</sup>	0–80	0–40	1.27
Reading (end of Grade 1; T3)	474	19.20	9.26	.97 <sup>a</sup>	0–80	0–50	.68
<i>Control variables</i>							
Child age (in months, beginning of kindergarten)	511	73.59	3.37			68–80	–.01
Child gender:	515	.47	.49		0–1	0–1	.11
- 0 = boy	271						
- 1 = girl	244						
Maternal education <sup>b</sup>	413	4.10	1.45		1–7	1–7	.02
Class size (beginning of Grade 1; T2)	466	19.61	5.82			3–27	–1.12

*Note.* <sup>a</sup> The Kuder-Richardson reliability, a measure of internal consistency for dichotomous variables. <sup>b</sup> Maternal education was assessed on a 7-point scale: no vocational education; short vocational courses; a vocational school qualification; a college qualification; a bachelor's degree from university; a master's degree; and a licentiate or doctoral degree. T = Time

Table 2

*Descriptive Information and Contrasts between the Not-at-risk (n = 428) and At-risk (n = 87) Children for Reading Difficulties*

Variable	Not-at-risk			At-risk			t(df)
	n	M	SD	n	M	SD	
<i>Classroom quality in kindergarten (T1)</i>							
Emotional support	428	5.08	.79	87	5.03	.73	.54(513)
Classroom organization	428	5.33	.65	87	5.32	.60	.05(513)
Instructional support	428	4.00	.92	87	3.91	.90	.87(513)
Frequency of literacy activities	427	3.15	.53	84	3.10	.49	.73(509)
<i>Children's skills</i>							
Phonological awareness (kindergarten; T1)	419	9.21	1.38	86	7.08	2.09	11.83(503)
Letter knowledge (kindergarten; T1)	420	24.37	5.21	86	15.00	7.17	14.17(504)
Pre-reading skills (kindergarten; T1)	420	.22	.67	86	-1.07	.95	15.07(504)
Reading (beginning of Grade 1; T2)	388	9.74	6.90	82	4.34	3.88	6.85(468)
Reading (end of Grade 1; T3)	392	20.55	9.21	82	12.76	6.32	7.31(472)
<i>Control variables</i>							
Child age (in months, beginning of kindergarten)	425	73.64	3.38	86	73.30	3.32	.86(509)
Child gender (0 = boy, 1 = girl)	428	.49	.50	87	.39	.49	1.70(513)
- 0 = boy	218			53			
- 1 = girl	210			34			
Maternal education <sup>a</sup>	338	4.19	1.47	75	3.71	1.31	2.64(411)
Class size (beginning of Grade 1; T2)	386	19.83	5.70	80	18.54	6.30	1.81(464)

*Note.* CI = confidence interval; LL = lower limit; UL = upper limit.

<sup>a</sup> Maternal education was assessed on a 7-point scale: no vocational education; short vocational courses; a vocational school qualification; a college qualification; a bachelor's degree from university; a master's degree; and a licentiate or doctoral degree. T = Time.

Table 3

*Correlations between All Study Variables, Separately for Children Not At Risk (below Diagonal, n = 428) and At Risk (above Diagonal, n = 87) for Reading Difficulties*

		<i>Classroom quality in kindergarten (T1)</i>				<i>Children's skills</i>					<i>Control variables</i>			
		1	2	3	4	5	6	7	8	9	10	11	12	13
<i>Classroom quality in kindergarten (T1)</i>														
1	Emotional support	—	.86**	.81**	.37**	.15	.08	.13	.18	.24*	.08	.31*	.15	.16
2	Classroom organization	.87**	—	.76**	.25*	.09	.05	.08	.09	.20+	.04	.23*	.15	.06
3	Instructional support	.83**	.82**	—	.23*	.15	.03	.11	.11	.16	.13	.16	.15	.21+
4	Frequency of literacy activities	.23**	.08	.02	—	—	—	—	.11	.11	.11	.07	.11	.11
<i>Children's skills</i>														
5	Phonological awareness (kindergarten; T1)	.01	.01	.01	—	.44*	.87*	.24*	.24*	.24*	.06	.21	.07	.24*
6	Letter knowledge (kindergarten; T1)	—	—	.01	.01	.48*	—	.82*	.23*	.34*	.19+	.22*	.08	.11
7	Pre-reading skills (kindergarten; T1)	—	—	.01	—	.87*	.87*	—	.23*	.34*	.15	.22*	.09	.22*
8	Reading (beginning of Grade 1; T2)	—	—	—	.11	.41*	.50*	.50*	—	.33*	.11	.11	.11	—
9	Reading (end of Grade 1; T3)	.02	.01	—	—	.24*	.36*	.36*	.60*	—	.11	.11	—	—
<i>Control variables</i>														
0	Child age (beginning of kindergarten)	—	—	—	—	.17*	.09+	.15*	.08	.11*	—	.11	—	.11
1	Child gender (0 = boy, 1 = girl)	.04	.04	.07	.01	.12*	.12*	.12*	.12*	.0	.0	—	—	.30*
1	Maternal education	—	—	—	.05	.02	.09+	.06	.33*	.05	.0	—	—	—
1	Class size (beginning of	.14	.08	.13	.19	.11	.0	.11	.0	—	.0	.0	.0	—

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3	Grade 1; T2)	**	*	**	3*	5	2*	4	.0	4	6	5
					*				5			

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*Note.* +  $p < .10$ ; \*  $p < .05$ ; \*\*  $p < .01$ . T = Time

**Highlights:**

- ✓ Emotional support in kindergarten related to children's reading skills in Grade 1.
- ✓ Classroom organization related to children's reading skills across Grade 1.
- ✓ Frequent literacy activities in kindergarten promoted reading at entering Grade 1.
- ✓ Kindergarten classroom quality was especially important for children at risk for RD.