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Investigating Bidirectional Links Between the Quality of Teacher–Child Relationships and Children’s Interest and Pre-Academic Skills in Literacy and Math

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This study investigated bidirectional links between the quality of teacher–child relationships and children’s interest and pre-academic skills in literacy and math. Furthermore, differences in the patterns of bidirectionality between boys and girls were explored. Participants were 461 Finnish kindergarteners (6-year-olds) and their teachers ($n = 48$). Teachers reported their closeness and conflict with each child twice throughout the kindergarten year. Children rated their interest in literacy and math, and were tested on their pre-academic skills. Cross-lagged path models indicated that teacher-perceived conflict predicted lower interest and pre-academic skills in both literacy and math. Results were similar for boys and girls. Implications for reducing conflictual patterns of relationships, together with promoting other factors, are discussed.

Kindergarten represents a crucial context in which children develop school-related skills and patterns of engagement that form the basis for the development of later competencies important for academic success (Boivin & Bierman, 2013). This is reflected in research documenting that kindergarten achievement is highly predictive of later academic skills (Duncan et al., 2007). In many countries, kindergarten introduces children to a more structured learning environment (compared to preschool) but differs from elementary school in instruction and expectations. Yet, much of the previous work in the field has focused on samples of children of preschool age or in later grades in elementary school, whereas fewer studies have been conducted in kindergarten specifically. Given the long-lasting effects that kindergarten experiences have on later schooling, it is important to understand the factors associated with children’s learning and motivation

during this time. Above and beyond children’s skills, previous literature has highlighted the benefits of positive teacher–child relationships for both academic and socio-emotional outcomes (Hamre & Pianta, 2001; Hughes, Luo, Kwok, & Loyd, 2008; O’Connor & McCartney, 2007). Positive relationships with teachers are also important to support higher academic self-efficacy and a more positive academic self-concept (Leflot, Onghena, & Colpin, 2010) as well as school engagement (Portilla, Ballard, Adler, Boyce, & Obradovic, 2014; Roorda, Koomen, Spilt, & Oort, 2011).

Although there is a large amount of research on the links between teacher–child relationships and child outcomes, conclusions about the direction of the effects remain limited for at least two reasons. First, studies have predominately been conducted in the United States (e.g., Mejia & Høglund, 2016). Only a few studies have investigated associations

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between teacher–child relationship quality and child outcomes outside U.S. classrooms (e.g., Doumen et al., 2008; Solheim, Berg-Nielsen, & Wichstrøm, 2012). Several studies suggest cross-cultural differences in relationship quality (Chen, Zee, Koomen, & Roorda, 2019; Gregoriadis & Tsigilis, 2008; Milatz, Glüer, Harwardt-Heinecke, Kappler, & Ahnert, 2014; Webb & Neuharth-Pritchett, 2011). The development of teacher–child relationships is embedded in the structures, values, and norms inherent in a nation’s educational system that, however, may differ across countries, limiting the generalizability of research from the United States to other countries (Chen et al., 2019). Thus, there is a need to investigate teacher–child relationships and child outcomes in other cultural and educational contexts outside the United States. Finland, for example, despite being a Western country, has a very different educational system compared to many other countries, particularly concerning the aims of education prior to school entry. Second, many studies are limited in their conclusions regarding the direction of effect which may be due to study design and analytical approach. While there is theoretical and empirical support for teacher–child relationships driving children’s outcomes (Hamre & Pianta, 2001), there is also evidence of effects occurring in the opposite direction, that is, children’s skills driving their relationships with teachers (Murray & Murray, 2004), and for bidirectional, reciprocal associations between teacher–child relationships and children’s outcomes (Hughes et al., 2008). The present study is one of the few to test alternative theoretical models of the directional associations between children’s outcomes and their relationship quality with teachers. Consequently, the present study can contribute to the existing literature by investigating teacher–child relationship quality in relation to children’s interest as well as pre-academic skills in literacy and math across the kindergarten year in a non-U.S. sample.

Teacher–Child Relationships

Researchers have typically conceptualized teacher–child relationship quality according to the levels of closeness and conflict (Pianta, 1999; Roorda et al., 2011). Supportive relationships with teachers are defined by a combination of high levels of closeness and low levels of conflict. Close relationships with teachers are characterized by warmth, approachability, and open communication (Birch & Ladd, 1997; Pianta, 1999). It has been suggested that in such relationships, children can use

their teacher as a secure base from which to take advantage of the learning opportunities provided (Verschuere & Koomen, 2012). Close teacher–child relationships have been positively linked to children’s school engagement (Birch & Ladd, 1997; see Roorda et al., 2011 for a review) and academic performance (e.g., Birch & Ladd, 1997; Hamre & Pianta, 2001) in kindergarten, and these associations are shown to persist throughout the elementary school grades (Baker, 2006; Hamre & Pianta, 2001). Studies have also shown that close teacher–child interactions are related to a more positive academic self-concept (e.g., Leflot et al., 2010) and higher engagement in learning (Roorda et al., 2011). Relatedly, Patrick, Mantzicopoulos, Samarapungavan, and French (2008) indicated that kindergarteners with high motivation and positive academic self-concepts reported the most support for learning and the least conflict and negativity from their teachers.

In contrast, some children develop coercive relationships with their teachers that can undermine their experiences in school (Pianta, 1999; Roorda et al., 2011). These can be characterized as conflictive relationships where tension and anger exist within the teacher–child relationship (Birch & Ladd, 1997). Teacher-perceived conflict with children has been linked to less favorable outcomes, such as lower achievement (Hughes, 2011; Mason, Hajovsky, McCune, & Turek, 2017) and higher levels of problem behaviors (Doumen et al., 2008). For example, Mason et al. (2017) revealed that teacher-perceived conflict was a small but significant predictor of subsequent math achievement across Grades 1–5. Teacher–child conflict has been shown to be a significant negative long-term contributor to children’s achievement, even when previous relationship quality and academic ability are controlled for (Hamre & Pianta, 2001). Particularly for young children, when teachers characterize their relationship with a child as tense, negative, and conflictual, this is predictive of lower academic achievement and less school engagement (Portilla et al., 2014; see Roorda et al., 2011 for a review).

Teacher–child relationship quality is particularly important in kindergarten when children start to receive an increasing amount of feedback on their emerging academic abilities and achievement. The balance between education, teaching, and care changes depending on the age of the children, indicating the need for basic care and playful activities as more essential for young children, which, nevertheless, does not exclude the presence of the elements of early learning. Preschool education is not

compulsory, whereas kindergarten education is compulsory in many countries. Compared to preschool, kindergarten is a more structured learning environment, which promotes emerging academic skills through playful activities. Children are expected to reach goals related to school readiness. However, kindergarten differs from early elementary school in the level of instruction and expectations for academic skills and self-regulation. Compared to elementary school, most kindergarten teachers teach things in a playful manner with a little formal class atmosphere. Previous studies have also shown that the core curriculum in kindergarten and elementary grades can make a difference (e.g., de Botton, 2010). Yet, much of the research on teacher–child relationship quality to date has been conducted among preschool-aged children or children in early elementary grades, whereas few studies have been conducted specifically in kindergarten classrooms. The limited research that does exist on teacher–child relationship quality in the kindergarten context found significant associations with child outcomes, both concurrently and longitudinally. Collins and O'Connor (2016), for example, showed that conflictual teacher–child relationships impaired children's academic performance in kindergarten, whereas close teacher–child relationships promoted their performance. Furthermore, Cadima, Doumen, Verschueren, and Buyse (2015) reported that close teacher–child relationships contributed to higher levels of behavioral engagement in kindergarten. Doumen, Koomen, Buyse, Wouters, and Verschueren (2012) investigated teacher and observer ratings of teacher–child relationship quality in a sample of 148 kindergarteners. The researchers found that higher levels of teacher–child closeness predicted higher levels of behavioral engagement, whereas higher levels of conflict predicted lower levels of behavioral engagement and less cooperative classroom participation and task involvement.

The quality and related outcomes of kindergarten children's teacher–child relationships also have long-term consequences in subsequent grades (Hamre & Pianta, 2001; O'Connor & McCartney, 2006; Portilla et al., 2014). Kindergarten children with low-quality teacher–child relationships, for example, not only tend to have future low-quality relationships, but they are also more likely to develop school avoidance later on and to have lower academic achievement and long-term school maladjustment (Birch & Ladd, 1997; Hamre & Pianta, 2001; Mantzicopoulos, 2005). Maldonado-Carreño and Votruba-Drzal (2011) examined

associations between teacher–child relationships and achievement across kindergarten and fifth grade and compared effects from teacher-reported and standardized achievement tests. They found no significant associations between teacher–child relationship quality measured in kindergarten and achievement measured by standardized tests later in elementary school (e.g., Grades 1–5). However, they found significant positive links between teacher–child relationships and teacher reports of students' academic achievement. McCormick, O'Connor, Cappella, and McClowry (2013) found significant effects of high-quality teacher–child relationships on math achievement but not on reading achievement assessed in first grade.

However, none of the previous studies conducted specifically in kindergarten has, to our knowledge, investigated bidirectional links between teacher–child relationship quality, motivation, and academic skills. In addition to the predictive effect of teacher–child relationship quality on child outcomes, children's academic skills and motivation also influence the quality of teacher–child relationships (Nurmi, 2012). As individual differences in motivation already manifest themselves during the early school years (Viljaranta, Aunola, & Hirvonen, 2016) and tend to be increasingly stable across the first school years (Nurmi & Aunola, 2005; Viljaranta et al., 2017), it is important to investigate the factors related to motivation in the very early stages of a child's school career. For children whose self-concept and sense of self-efficacy are developing, the quality of teachers' support may be especially influential on their engagement and interest in learning.

Theoretical Perspectives on Teacher–Child Relationships and Child Outcomes

Different theoretical approaches have been suggested to explain the links between teacher–child relationship quality and child outcomes (Mejia & Hoglund, 2016). The most prominent approaches include relationship-driven (Hamre & Pianta, 2001), child-driven (Murray & Murray, 2004), or bidirectional models (Hughes et al., 2008). Relationship-driven models are based on attachment theory, arguing that warm and supportive relationships between children and caregivers are crucial for favorable developmental outcomes (Bergin & Bergin, 2009; Pianta, 1999; Sabol & Pianta, 2012; Verschueren & Koomen, 2012). In the case of teachers, although their major responsibility is instruction and guidance, to be effective, they also need to be warm, caring, respectful, and supportive (Bergin & Bergin,

2009; Hamre & Pianta, 2001; Verschueren & Koomen, 2012). In a similar vein, self-determination theory (SDT; Ryan & Deci, 2002) posits that individuals' propensity to seek challenges and enjoy mastering new learning (i.e., intrinsic motivation) unfolds when their basic psychological needs for competence, autonomy, and relatedness are met in the classroom. In line with the attachment and SDT perspectives, scholars have proposed that high-quality teacher-child relationships may contribute to children's favorable outcomes (e.g., Hamre & Pianta, 2001; for a review, see Roorda et al., 2011) by creating a supportive environment in which children are motivated to actively and appropriately engage in classroom activities and, thus, gain more in terms of academic skills (Williford, Maier, Downer, Pianta, & Howes, 2013). In the present study, the relationship-driven model tested the hypothesis that teacher-child relationship quality predicts prospective levels of interest and pre-academic skills.

Child-driven models propose the opposite direction of influence, that is, children's academic skills and interest in learning affect the quality of their relationships with their teachers (e.g., Henricsson & Rydell, 2004; Silver, Measelle, Armstrong, & Essex, 2005). This is based on developmental theories, which argue that children take agency of their own development and, consequently, their interpersonal relationships (Nurmi, 2012; Scarr & McCartney, 1983). Children's characteristics may evoke different responses from significant adults in their lives, such as teachers and parents, and, for example, influence the formation of teacher-child relationships (Pianta, 1999; Saft & Pianta, 2001). For instance, a student's behavioral problems in the classroom may contribute to the teacher's negative emotions, which, in turn, may lead to a more conflictive relationship and increased disciplinary actions (Hargreaves, 2000; Nurmi, 2012). Interestingly, the findings of a meta-analysis testing the assumptions of the child-driven model indicated that it is not only students' behavioral characteristics that impact their relationships with teachers but also their level of motivation, engagement, and academic performance (Nurmi, 2012). Teacher-student relationships were characterized by more closeness and less conflict when students showed high levels of motivation and engagement and good academic performance. In the present study, the child-driven model tested the hypothesis that children's interest and pre-academic skills in math and literacy contribute to prospective relationship quality.

Bidirectional models are based on transactional theory (Cameron, 2012; Cappella, Aber, & Kim,

2016; Sameroff & MacKenzie, 2003), assuming that developmental outcomes are the product of a combination of an individual child's characteristics and the experiences and aspects of his or her environment (including teacher-child relationships). A central argument of the transactional theory is that "equal emphasis [is] placed on the bidirectional effects of the child and of the environment" (Sameroff & MacKenzie, 2003, p. 614). As such, interactions between teachers and children (i.e., the quality of teacher-child relationships) are reciprocal, and the experiences provided by the environment are not independent of the child nor vice versa (Cameron, 2012; Sameroff & MacKenzie, 2003). Children's characteristics and their experiences influence their interactions with their teachers and, simultaneously, the way in which teachers perceive their relationships with the children. How a teacher responds to a child, in turn, is likely to influence his or her subsequent behavior. For example, studies found that a child's behavioral problems and teacher-child relationships form reciprocal transactional cycles (Doumen et al., 2008; Hughes, Cavell & Jackson, 1999).

While both the relationship-driven and child-driven models study the associations between teacher-child relationship quality and child outcomes as if they were separate or merely linearly related, bidirectional models offer an alternative approach by describing the interactive and dynamic nature of the associations. Consistent with other developmental system frameworks (Bronfenbrenner & Morris, 2006), the transactional theory focuses attention on teachers and children and their relationships as complex, dynamic systems that unfold over time (Cameron, 2012; Cappella et al., 2016). The dynamic nature gives rise to patterns of variability in the associations between teacher-child relationships and child outcomes across time. Considering children's characteristics and aspects of their environments in conjunction rather than as isolated entities also have important implications for policy and practice, as it can help to identify where programs and interventions should best direct their efforts aimed at enhancing children's development (Cappella et al., 2016; Sameroff & MacKenzie, 2003).

In the present study, the bidirectional model tested the hypothesis that interest in literacy and math, pre-academic skills, and relationship quality are reciprocally related over time. Other studies have used a similar set of analyses. Hughes et al. (2012), for example, used cross-lagged panel models to investigate indirect effects of student-perceived conflict and warmth on achievement via motivation

across 3 years of early elementary school. In addition, Hughes (2011) examined the shared and unique effects of teacher and student ratings of relationship quality in second and third grade on academic self-concepts, behavioral engagement, and achievement when accounting for prior levels of investigated outcomes. Extending prior work that investigated bidirectional associations between child outcomes and teacher–child relationship quality (Doumen et al., 2008; Hughes et al., 2012; Leflot et al., 2010; Rudasill & Rimm-Kaufman, 2009), the present study used a non-U.S. sample of kindergarteners, standardized test scores as measures of children’s academic skills, investigated interest as an outcome, and investigated gender as a potential moderator. Moreover, the current study investigated which of the proposed models best described the data.

Child’s Gender as a Possible Moderator in the Association Between Teacher–Child Relationship Quality and Child Outcomes

Several theoretical approaches, most prominently the academic risk perspective (Hamre & Pianta, 2001) and gender role socialization theory (Ewing & Taylor, 2009), may explain gender-related differences in the association between teacher–child relationship quality and child outcomes. The academic risk perspective proposes that children who are at risk of low achievement and school failure might have more to lose or benefit from through their ability to adapt to the classroom environment (Hamre & Pianta, 2001). Previous research has indicated that gender is this kind of risk factor, whereby boys have a higher risk of poorer school adjustment and achievement (e.g., Hamre & Pianta, 2001). Based on this perspective, the quality of the relationship with one’s teacher seems to be particularly important for boys’ achievement and school adjustment (Roorda et al., 2011; Silver et al., 2005). However, as there might be different expectations for boys and girls regarding their achievement in different subjects, the academic risk perspective (e.g., Hamre & Pianta, 2001; Silver et al., 2005) argues that it is important to examine the benefits of high-quality teacher–child relationships differently for boys and girls in math and reading achievement separately.

Gender role socialization theory proposes that teachers’ differential treatment of boys and girls may reinforce behaviors in children that reflect traditional relational styles (Ewing & Taylor, 2009; Koch, 2003). In other words, girls are socialized to comply and behave responsibly and are expected to

focus on schoolwork and follow teacher directions more readily than boys (Koch, 2003). Based on gender role socialization theory, a teacher–child relationship that is consistent with gender-based relational styles and traditional gender role expectations should have a stronger impact on the school adjustment of girls compared to boys (Ewing & Taylor, 2009). Aligned with this theoretical perspective, Baker (2006) and Ewing and Taylor (2009) found that close relationships with teachers were more strongly related to girls’ academic outcomes. In contrast, McCormick and O’Connor (2015) and Ly, Zhou, Chu, and Chen (2012) indicated that teacher-perceived conflict was negatively related to girls’ math achievement.

Empirical research has shown that teachers perceive relationships with boys and girls differently. For example, teachers typically report closer and less conflictual relationships with girls than with boys (Baker, 2006; Jerome, Hamre & Pianta, 2008; Saft & Pianta, 2001; Silver et al., 2005). Given the association between positive teacher–child relationships and improved academic achievement (Hamre & Pianta, 2001), language development (Spilt, Koomen, & Harrison, 2015), and social adjustment (Doumen et al., 2008; Roorda et al., 2011), it could be suggested that girls gain more in terms of their achievement and adjustment from a positive teacher–child relationship. In addition, girls typically report higher interest in literacy than boys (Jacobs, Lanza, Osgood, Eccles, & Wigfield, 2002) and tend to score higher than boys on teacher assessments of academic competence and on standardized measures of reading achievement (Robinson & Lubienski, 2011). Yet, boys continue to outperform girls on standardized math assessments across elementary school (Robinson & Lubienski, 2011). Furthermore, researchers have found that links between teacher–child relationship quality and achievement were moderated by gender, with girls displaying stronger associations between teacher-perceived conflict and math achievement (Ly et al., 2012; McCormick & O’Connor, 2015), while boys demonstrated a stronger link between the overall quality of the teacher–child relationship and reading achievement (Ly et al., 2012). However, in a sample of kindergarteners from low-income urban schools, gender was not a significant moderator in the association between teacher–child relationship quality and early school adjustment (Murray, Waas, & Murray, 2008).

In sum, the theoretical and empirical evidence for child gender being a potential moderator of the association between teacher–child relationship

quality and children’s outcomes is far from conclusive. In line with the academic risk perspective (Hamre & Pianta, 2001; Silver et al., 2005), it could be expected that links between teacher–child relationship quality and child outcomes would be stronger among boys. In contrast, on the basis of gender role socialization theory (Ewing & Taylor, 2009), it could be assumed that girls would benefit more from a close and non-conflicted relationship with teachers in terms of their interest and pre-academic skills in math and boys would benefit more from a close and non-conflicted relationship with teachers in terms of their interest and pre-academic skills in literacy. We, therefore, did not formulate specific hypotheses but viewed this part of the analysis as exploratory.

The Present Study

Most prior research on the associations between teacher–child relationship quality and child

outcomes has called upon linear models, either taking a relationship-driven or child-driven approach. However, such models often fail to capture the dynamic nature of the association. To overcome this limitation, the overarching goal of the present study was to examine possible bidirectionality between teacher–child relationship quality, measured as teacher-perceived closeness and conflict with individual children, and child outcomes, measured as the child’s interest and pre-academic skills in literacy and math. More specifically, it was first investigated (see Figure 1 for tested models) whether closeness/conflict predicted child outcomes (relationship-driven model), child outcomes predicted closeness/conflict (child-driven model), or closeness/conflict and child outcomes were reciprocally related (bidirectional model). Finding only unidirectional associations in either direction would provide evidence to support the relationship-driven or child-driven model. Finding reciprocal relationships across time, in contrast, would support the

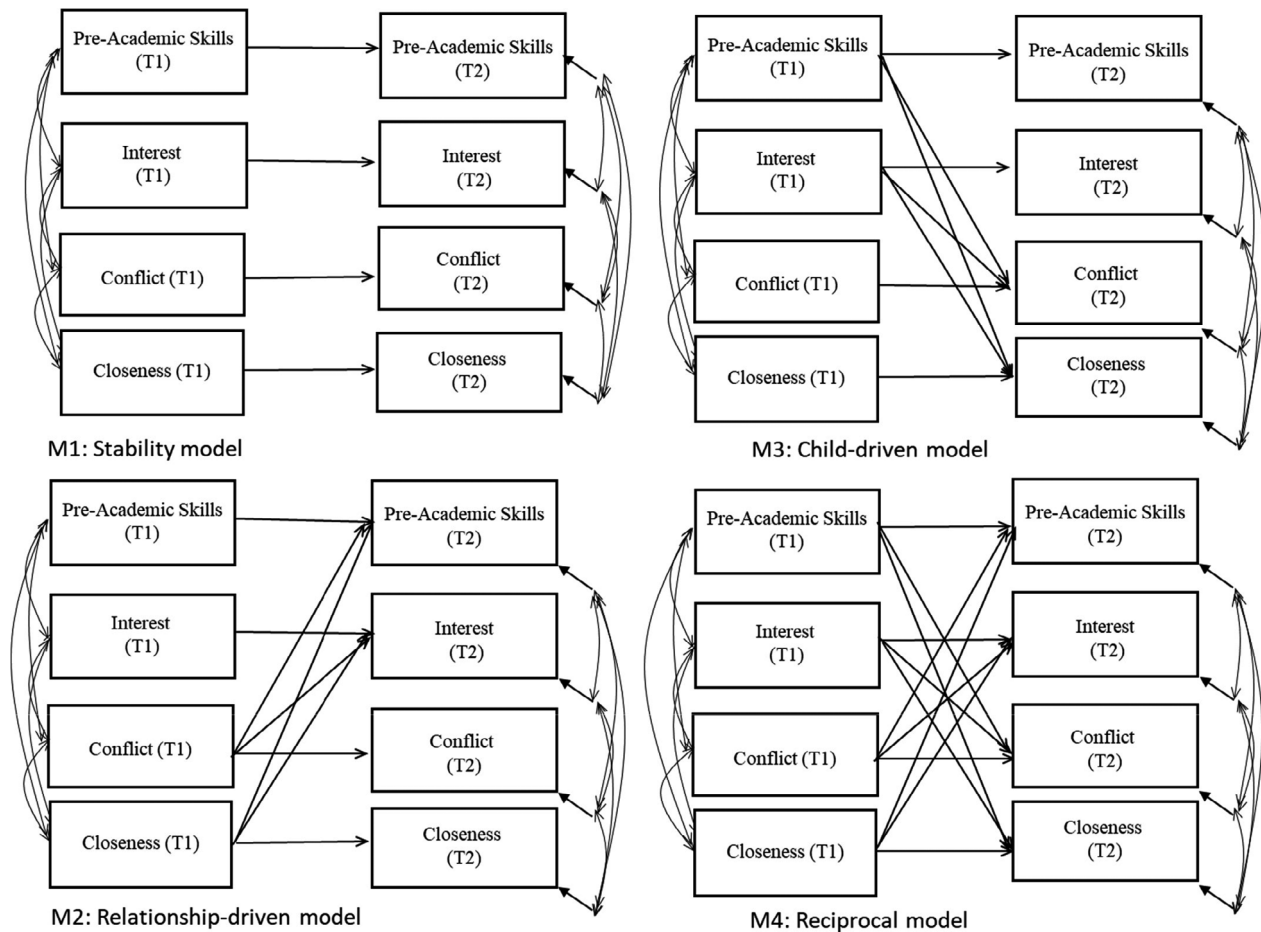


Figure 1. Tested models.

bidirectional model; that is, a child's characteristics and aspects of the child's environment influence each other as coactive processes. In addition, the present study used standardized test scores as indicators of academic skills compared to previous studies using teacher ratings (e.g., O'Connor & McCartney, 2007; Rudasill, Reio, Stipanovic, & Taylor, 2010). Second, this study investigated whether gender would moderate the associations between teacher–child relationship quality and child outcomes.

Some of the variation in teacher–child relationship quality may be explained by characteristics that children have when they enter kindergarten. There is evidence that in addition to gender, characteristics such as maternal attachment styles (O'Connor, 2010; O'Connor & McCartney, 2006), socioeconomic status (Birch & Ladd, 1997; Ladd, Birch, & Buhs, 1999), temperament (Hughes et al., 2008; Rudasill, 2011; Rudasill & Rimm-Kaufman, 2009), and behavioral problems (Doumen et al., 2008; Hargreaves, 2000; Jerome, Hamre, & Pianta, 2009) relate to differences in relationship quality with teachers. Therefore, maternal affection, parental education, child temperament, and behavioral problems were controlled for in the current study.

Method

Participants

The participants were 461 children (222 boys; $M_{\text{age}} = 73.41$ months, $SD = 3.54$ months) enrolled in 48 kindergarten classrooms from 32 centers. The centers were located in five municipalities in Central Finland, including both urban and rural areas. The reported study is part of a larger project focusing on the role of teacher–child interactions in children's learning (Lerkkanen & Pakarinen, 2016–2017). In fall 2016, kindergarten teachers were invited by phone call or email to participate in the larger study. Letters describing the study and inviting the child and the parents to participate were sent home to all parents of 6-year-old children from each classroom in which the teacher participated in the larger study. The response rate of children was 91.18%. Children whose parents provided written consent prior to data collection were included in the present analyses. Kindergarten classrooms in this study typically included 12.26 children ($SD = 3.62$; range = 3–20 children). All classrooms were Finnish speaking. Kindergarten teachers provided written consent for their own participation in the larger study. Of the participating students, 83%

came from nuclear families, 8.2% from single parent families, 6.9% from blended families, and 1.9% from other family types. Children's main language spoken at home was Finnish (95.3%). Other languages spoken were Russian, Arabic, English, Chinese, Kurdish, and Thai.

Kindergarten teachers were asked to rate the quality of teacher–student relationships with individual children twice during the kindergarten year (fall 2016 [T1] and spring 2017 [T2]). The time between the two waves of data collection was, on average, 4.40 months ($SD = 0.72$), ranging between 3 and 6 months. At both measurement points (T1 and T2), children were interviewed about their interest in literacy and math and assessed on their letter knowledge and number sequence skills by trained investigators in individual test situations. The assessments took place on daycare center/school premises during normal kindergarten hours. Each child received a sticker as an incentive for his or her participation. The teachers received gift cards of 10 or 20 euros, depending on the number of participating children in their classroom that they had to evaluate. In addition, teachers rated children's behavior problems (T1) and children's temperament (T2). Furthermore, mothers were asked to fill in questionnaires on family background and their affection (T2).

Measures

Teacher–Child Relationships

The conflict and closeness subscales of the short version of the Student–Teacher Relationship Scale (Pianta, 2001) were used to measure the quality of teacher–child relationships in kindergarten on a 5-point Likert-type scale, ranging from 1 (*definitely does not apply*) to 5 (*definitely applies*). The scale has been validated in Greece (Gregoriadis & Tsigilis, 2008), in the Netherlands (Koomen, Verschueren, van Schooten, Jak, & Pianta, 2012), in Germany (Milatz et al., 2014), and in Italy (Sette et al., 2018). The conflict subscale (eight items; e.g., *There always seems to be difficulties between this child and me*) assessed the teacher's perceived negativity of the relationship with the child, while the closeness subscale (seven items; e.g., *I have a close, warm relationship with this child*) assessed whether the teacher perceived the relationship to be warm and affectionate, including open communication (Jerome et al., 2008). In the present study, Cronbach alpha reliabilities were .88 (T1) and .89 (T2) for conflict, and .85 (T1) and .87 (T2) for closeness, respectively.

Interest in Literacy and Math

The children's interest in literacy and math was assessed through interviews using the Task Value Scale for Children (Aunola & Nurmi, 1999; see also Nurmi & Aunola, 2005). This scale was based on the study by Eccles et al. (1983) on the task value or interest that children show in relation to particular school subjects. The task motivation scale consisted of three items measuring children's interest in or enjoyment of letter tasks (*How much do you like letter tasks?; How much do you like doing letter tasks in kindergarten?; How much do you like doing letter tasks at home?*) and three items measuring children's interest in or enjoyment of math-related tasks (*How much do you like number and arithmetic tasks?; How much do you like doing number tasks in kindergarten?; How much do you like doing number tasks at home?*).

The questions were read aloud to each child individually. The child was asked to answer by pointing to one of five faces, ranging from a big frown to a big smile, which best described his or her liking for a particular subject (1 = *I do not like it at all/I dislike doing those tasks*; 5 = *I like it very much/I really enjoy doing those tasks*). The children were trained in the task motivation measure (using the practice items ice cream, snakes, and an onion) prior to administering the test items so that they would know how to make proper use of the faces. Mean scores for interest in literacy and interest in math were calculated separately as the mean of the respective three items. The Cronbach alpha for interest in literacy was .72 (T1) and .73 (T2), and for interest in math, .72 (T1) and .76 (T2).

Pre-Literacy and Pre-Math Skills

The children's pre-academic skills were assessed regarding pre-literacy skills (letter knowledge and reading fluency) and pre-math skills (number sequence). Letter knowledge and reading fluency were first standardized and a mean score was used as an indicator of pre-literacy skills in the subsequent analyses.

Letter knowledge. The children were asked to name all 29 letters in the Finnish alphabet. The letters were presented in random order on three rows (subtest of the ARMI; Lerkkanen, Poikkeus, & Ketonen, 2006). The experimenter showed one row at a time. Uppercase letters were used because in Finnish kindergartens, children are only exposed to capital letters. The child received one point for each correct response (min/max = 0/29). The Kuder–

Richardson reliability coefficient for letter knowledge was .96 (T1) and .93 (T2).

Reading fluency. The word reading fluency test (Lukilasse test; Häyrynen, Serenius-Sirve, & Korkman, 1999) was used at both measurement points. The test consisted of 90 individual words. Scoring of reading fluency was based on the total number of words read aloud correctly within 45 s (maximum score = 90). Cronbach's alphas were .94 (T1) and .96 (T2).

Number sequences. The children's pre-math skills were assessed using a number sequence test. At both time points, the children's knowledge of number sequences was assessed by having them count forward from 1 to 31, backward from 12 to 7, backward from 23 to 1, and forward from 6 to 13. To account for normal development in the children's knowledge of number sequences over time, at T2, three additional tasks were added: counting forward from number 18 to 25, counting backward from 33 to 17, and counting five items backward from 23. In each of these subtasks, the children received two points when they counted aloud with no errors, one point when they made only a small error (such as skipping one number), and zero points when they made more than one error (min/max = 0/8 points at T1 and 0/14 points at T2). The Kuder–Richardson reliability for number sequences was .76 (T1) and .83 (T2). As the children were provided with a different number of tasks at the two time points, standardized scores were used in subsequent analyses.

Control Variables

The child's age at kindergarten entry, teacher experience, elapsed time between the measurement points, parental education, child's temperament and behavior problems, and maternal affection were controlled for. As the educational level of the teachers in the current sample did not differ, their work experience was used as a control variable.

Parental education. In the present study, parents were asked to indicate their own and their spouse's level of post-secondary education. The highest education in the family was used as an indicator of parental education. A total of 27.2% of parents had a university degree, 16.6% a polytechnic degree, 4.6% a vocational college degree, 15.5% a vocational school degree, and 0.4% had no education beyond a comprehensive school degree. The information was missing for 35.7% of the children. Sensitivity analysis indicated that children whose parents reported their vocational education had

better letter knowledge ($M = 20.45$, $SD = 8.20$) than children whose parents did not report their vocational education ($M = 17.78$, $SD = 8.90$, $t(452) = -3.234$, $p < .01$). However, there were no significant differences in number sequences, interest in literacy and math, and quality of teacher–student relationships between children whose parents reported their vocational education and those whose parents did not report their vocational education.

Behavior problems were assessed as teacher reported using the Multisource Assessment of Social Competence Scale (Junttila, Voeten, Kaukianen, & Vauras, 2006) in the fall of the kindergarten year. Items were rated on a 4-point scale (1 = *never*, 4 = *very frequently*). The following two subscales were used: Disruptiveness (four items, e.g., “argues and quarrels with peers”; $\alpha = .88$ [T1]) and Impulsivity (three items, e.g., “has a short fuse”; $\alpha = .88$ [T1]). A standardized mean score of these two subscales was used as an indicator of behavior problems.

Child temperament was measured using teacher ratings of the Early Childhood Version of the Survey of Children’s Individual Differences (Martin, 2014) in the spring of the kindergarten year. The scale includes 59 items that are rated on a 7-point scale (1 = *much less than average*; 4 = *average*; 7 = *much more than average*). The present study included two subscales: Negative Emotionality (five items; e.g., “The child is emotionally upset”; $\alpha = .81$ [T2]) and Inhibition (five items; e.g., “The child is slow to warm up to new people or situations”; $\alpha = .83$ [T2]). The scales represent different temperamental dispositions than, for example, distractibility and activity level, which are similar to disruptiveness and impulsivity that were used as indicators of behavioral problems in the classroom.

Maternal affection was measured with the Block’s Child-Rearing Practices Report (Roberts, Block, & Block, 1984; revised Finnish version, Aunola & Nurmi, 2004) in the spring of the kindergarten year. In the present study, the Affection Scale ($\alpha = .81$), consisting of 10 items (e.g., “I often tell my child that I appreciate what he/she tries out or achieves” and “I often show my child that I love him/her”), was used to measure maternal warmth and responsiveness. Mothers responded to the items using a 5-point scale (1 = *does not fit me at all* to 5 = *fits me very well*).

Analysis Strategy

First, intercorrelations between the study variables were calculated. In the interest of

interpretability and comparability with previous studies, standard Pearson correlations are reported, though it is important to note that they do not account for the nesting of children within classrooms. To test the robustness of the bivariate correlations, we also used the complex option that takes the nested structure of the data into account. Although not presented in the table, coefficients tended to be slightly stronger but not substantially different. Next, gender differences in the study variables were investigated using independent samples *t*-tests.

Because the data were hierarchical in nature (i.e., each teacher assessed more than one child in a classroom: range = 1–19; $M = 10$ children), intraclass correlations (ICCs) for the key study variables were calculated. The ICCs ranged from .001 to .586 ($ns < p < .001$). Because part of the variance in the observed variables was due to differences between teachers, we used the “complex” approach in all subsequent analyses (Muthén & Muthén, 1998–2018; Williams, 2000). This approach adjusts the standard error estimates for biases resulting from the clustered design of the sample but investigates associations between teacher–child relationships and child outcomes at the level of individual children.

To test the research questions, longitudinal path analyses were conducted using the Mplus statistical package (Version 8; Muthén & Muthén, 1998–2018). We used the robust maximum likelihood estimator (MLR) and full information maximum likelihood (default estimation procedure in Mplus) to handle missing data (Muthén & Muthén, 1998–2018). The proportion of missing data in the study variables ranged from 0% to 0.061% (only parental education and maternal affection had missing data of a greater amount, 35.7% and 42.9%, respectively). We tested the independence of the missing data. The results showed that missing data were independent, both at the teacher level ($\chi^2[47] = 57.788$, $p = .135$) and at the center level ($\chi^2[31] = 38.445$, $p = .168$).

Separate models were tested for interest and pre-academic skills in literacy and math. For both dimensions, four nested models (see Figure 1) were tested and compared in order to identify the most parsimonious model. The first model (M1; stability model) contained only the autoregressive paths and cross-sectional associations. The second model (M2; relationship-driven model) contained the autoregressive paths and cross-sectional associations, as well as cross-lagged paths from conflict and closeness to interest and skills. The third model (M3; child-driven model) contained the autoregressive paths and cross-sectional associations, as well as

cross-lagged paths from interest and skills to conflict and closeness. The last model (M4; bidirectional) contained all the cross-lagged paths. To test the differences between the nested models, the Satorra–Bentler scaled chi-square difference test for maximum likelihood estimation with robust standard errors (Satorra & Bentler, 2001) was used (see Table 4). The second research question explored the extent to which the final models differed for boys and girls. Again, the Satorra–Bentler scaled chi-square difference test for MLR was used to test the differences between the models. The models were tested by controlling for the child’s age, teacher’s work experience, group size, elapsed time between the measurement points, parental level of education, child’s temperament, behavior problems, and maternal affection.

For all the models, goodness of fit was evaluated using five indicators: chi-square, Bentler’s comparative fit index (CFI), the Tucker–Lewis index (TLI), the root mean square error of approximation (RMSEA), and the standardized root mean square residual (SRMR). According to Kline (2011), TLI and CFI values above .95, RMSEA values below .06, and SRMR values close to .08 can be considered indicators of a good model fit to the data.

Results

Descriptive statistics and psychometric properties of all study variables are presented in Table 1. Zero-order correlations among major study variables and control variables are presented in Table 2. The results show that there were statistically significant correlations between teacher–child relationship quality variables and child outcomes, the associations being larger for teacher-perceived conflict. Descriptive statistics between boys and girls are presented in Table 3.

Teacher–Child Relationships and Interest and Pre-Academic Skills in Literacy

The model comparison (Table 4) indicates that the partial model (M2; relationship-driven model), which included stability paths and a predictive path from closeness and conflict to interest and pre-academic skills, best described the data. No modifications were suggested. The results (Figure 2) demonstrate that the quality of teacher–child relationships, pre-literacy skills, and interest in literacy were stable across time. In addition, teacher-perceived conflict at kindergarten entry predicted lower interest in literacy ($\beta = -.09, p < .01$) and pre-literacy skills ($\beta = -.19, p < .01$) at the end of kindergarten.

Table 1
Descriptive Statistics and Intraclass Correlations (ICCs) of the Study Variables

Variable	N	Missing%	M (SD)	Min.	Max.	ICC	Between variance (SE)	Within variance (SE)
Interest in literacy T1	458	0.007	3.96 (0.99)	1	5	.116	0.113 (.040)**	0.863 (.076)
Interest in math T1	458	0.007	4.05 (0.96)	1	5	.067	0.065 (.032)*	0.910 (.071)
Preliteracy skills T1	461	0	0.024 (0.84)	–2.052	2.583	.068	0.048 (.023)*	0.661 (.047)
Number sequences T1	459	0.004	4.63 (2.79)	0	8	.036	0.028 (.187)	7.482 (.377)
Closeness T1	461	0	4.08 (0.63)	2.13	5	.252	0.244 (.058)***	0.726 (.075)
Conflict T1	461	0	1.51 (0.72)	1	4.43	.157	0.157 (.050)**	0.842 (.113)
Interest in literacy T2	459	0.004	3.74 (1.04)	1	5	.005	0.005 (.025)	0.988 (.07)
Interest in math T2	459	0.004	3.85 (1.05)	1	5	.023	0.023 (.026)	0.968 (.062)
Preliteracy skills T2	461	0	0.018 (0.83)	–2.647	1.934	.012	0.009 (.022)	0.680 (.057)
Number sequences T2	457	0.009	8.01 (3.99)	0	14	.017	0.267 (.331)	15.617 (.937)
Closeness T2	461	0	4.12 (0.62)	1.63	5	.258	0.246 (.057)***	0.706 (.079)
Conflict T2	461	0	1.58 (0.80)	1	4.71	.240	0.238 (.079)***	0.753 (.099)
Gender ^a	459	0.004	1.49 (0.50)	1	2	.001	0.000 (.010)	0.250 (.003)
Child’s Age T1 ^b	454	0.011	73.41 (3.54)	68	80	.009	0.008 (.019)	0.933 (.039)
Time elapse T2 ^b	457	0.009	4.40 (0.72)	3	6	—		
Parental education T2 ^c	297	35.73	3.85 (1.23)	1	5	.006	0.006 (.044)	0.984 (.075)
Teacher experience T2	433	0.061	3.99 (1.19)	2	5	—		
Behavior problems T1	439	0.048	0.001 (0.93)	–0.907	3.163	.198	0.172 (.080)*	0.699 (.067)
Inhibition T2	459	0.004	3.49 (1.07)	1	6.80	.229	0.235 (.084)**	0.791 (.088)
Negative emotionality T2	460	0.002	3.20 (1.20)	1	7	.401	0.586 (.119)***	0.875 (.105)
Maternal affection T2	262	42.92	4.31 (0.39)	2.91	5	.005	0.005 (.035)	0.973 (.089)

Note. T1 = kindergarten fall; T2 = kindergarten spring. * $p < .05$. ** $p < .01$. *** $p < .001$.
^aGirl = 1; boy = 2. ^bIn months. ^c1 = no vocational education; 5 = university degree.

Table 2
Correlations Between the Study Variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	
1. Interest in literacy T1	1																					
2. Interest in math T1	.62***	1																				
3. Priliteracy T1	.13**	.12*	1																			
4. Number sequences T1	.03	.17***	.50***	1																		
5. Closeness T1	.09†	.05	.11*	.03	1																	
6. Conflict T1	-.19***	-.17***	-.17***	-.09*	-.24***	1																
7. Interest in literacy T2	.40***	.35***	.08†	.03	.11*	-.28***	1															
8. Interest in math T2	.36***	.38***	.06	.13**	.07	-.24***	.54***	1														
9. Priliteracy T2	.16**	.17***	.82***	.51***	.10*	-.21***	.13**	.15**	1													
10. Number sequences T2	.02	.13**	.48***	.71***	.04	-.13**	-.01	.09†	.50***	1												
11. Closeness T2	.09†	.06	.06	.04	.75***	-.19***	.12*	.06	.06	.07	1											
12. Conflict T2	-.20***	-.20***	-.14**	-.06	-.22***	.78***	-.23***	-.21***	-.17***	-.08†	-.29***	1										
13. Gender ^a	-.20***	-.12*	-.07	.13**	-.13**	.25***	-.24***	-.18***	-.11*	.13**	-.12*	.27***	1									
14. Child's age T1 ^b	.02	.04	.15**	.18***	.02	-.05	-.04	.00	.16**	.12*	-.02	-.03	-.03	1								
15. Time elapse T2 ^b	.03	.02	-.04	-.05	.18***	-.11*	.05	.01	.01	.00	.17***	-.07	-.06	.02	1							
16. Parental education ^c	-.05	-.01	.20***	.12*	.00	-.14*	-.04	.00	.16**	.09	-.05	-.15*	.00	-.04	-.01	1						
17. Teacher experience	.08†	-.01	-.00	.03	.06	-.03	.01	-.06	-.01	-.01	.01	-.02	-.03	-.08	-.02	.14*	1					
18. Behavior problems T1	-.19***	-.18***	-.12*	-.07	-.04	.75***	-.21***	-.19***	-.18***	-.07	-.06	.71***	.32***	-.08	-.15**	-.20**	.01	1				
19. Negative emotionality T2	-.10*	-.11*	-.06	-.00	-.06	-.46***	-.11*	-.13**	-.09*	-.01	-.09	.58***	.11*	-.12*	.04	-.19**	-.15**	.53***	1			
20. Inhibition T2	-.04	-.05	-.13**	-.10*	-.35***	.07	-.05	-.08	-.13**	-.12**	-.35***	.17***	.04	-.06	.01	.03	-.11*	.02	.47***	1		
21. Maternal affection T2	.08	.02	.15*	.05	.11†	-.11†	.03	.08	.18**	.06	.09	-.14*	-.09	-.07	.08	.13*	.10	-.16*	-.16**	-.14*	1	

Note. T1 = kindergarten fall; T2 = kindergarten spring. Two-tailed testing of significance. † $p < .10$. * $p < .05$. ** $p < .01$. *** $p < .001$. ^aGirl = 1; boy = 2. ^bIn months. ^c1 = no vocational education; 5 = university degree.

Table 3
Differences between Genders in the Study Variables

Variable	Girls M (SD)	Boys M (SD)	t(df), p	Cohen's d
Interest in literacy T1	4.14 (0.90)	3.76 (1.04)	t(432) = 4.22, p < .001	.39
Interest in math T1	4.17 (0.92)	3.94 (0.96)	t(450) = 2.55, p < .05	.24
Letter knowledge T1	20.12 (8.05)	18.68 (9.07)	t(449) = 1.80, p > .05	.17
Reading fluency T1	4.85 (9.59)	4.39 (9.85)	t(458) = 0.51, p > .05	.05
Number sequences T1	4.27 (2.76)	5.02 (2.76)	t(451) = -2.87, p < .01	.27
Closeness T1	4.13 (0.66)	3.97 (0.62)	t(455) = 2.69, p < .01	.25
Conflict T1	1.38 (0.53)	1.71 (0.76)	t(389) = -5.43, p < .001	.50
Interest in literacy T2	3.99 (0.90)	3.48 (1.11)	t(426) = 5.34, p < .001	.49
Interest in math T2	4.03 (0.94)	3.64 (1.13)	t(432) = 3.95, p < .001	.37
Letter knowledge T2	24.17 (6.12)	22.82 (7.18)	t(435) = 2.14, p < .05	.20
Reading fluency T2	9.32 (8.66)	8.04 (8.68)	t(435) = 2.14, p < .05	.15
Number sequences T2	7.52 (4.07)	8.57 (3.88)	t(452) = -2.79, p < .001	.26
Closeness T2	4.18 (0.63)	4.03 (0.62)	t(455) = 2.56, p < .05	.24
Conflict T2	1.43 (0.57)	1.83 (0.85)	t(383) = -5.91, p < .001	.54
Behavior problems T1	-0.29 (0.74)	0.30 (1.02)	t(436) = -7.01, p < .001	.66
Inhibition T2	3.45 (1.04)	3.53 (1.10)	t(456) = -.813, p > .05	.07
Negative emotionality T2	3.08 (1.17)	3.33 (1.21)	t(457) = -2.30, p < .05	.21
Maternal affection T2	4.35 (0.40)	4.28 (0.38)	t(260) = 1.38, p > .05	.18

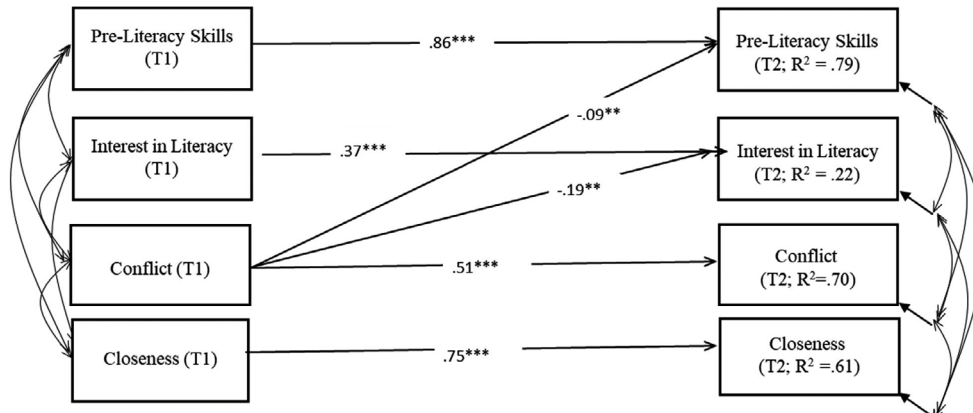


Figure 2. Path model for the full sample in interest and pre-skills in literacy. The estimates are standardized. Child's age, teacher's work experience, elapsed time between the measurement points, parental level of education, child's temperament, behavior problems, and maternal affection were controlled for in the both time points. **p < .01. ***p < .001.

The results concerning control variables showed that maternal affection was positively related to pre-literacy skills ($\beta = .06, p < .05$) at the end of kindergarten year (T2). In addition, behavior problems ($\beta = .19, p < .05$) and negative emotionality ($\beta = .23, p < .001$) were positively related to conflict (T2), whereas inhibition ($\beta = -.10, p < .05$) was negatively associated with teacher-perceived closeness (T2). Furthermore, the child's age ($\beta = -.07, p < .05$) was negatively related to closeness (T2), and group size ($\beta = -.09, p < .01$) was negatively related to conflict (T2). Elapsed time between the two measurement points ($\beta = .05,$

$p < .05$) was positively associated with pre-literacy skills (T2).

A multiple-group model compared the pattern of associations between boys and girls. The model comparison indicated that a restricted model, in which all paths and coefficients were estimated as equal between boys and girls, provided a better fit to the data than the non-restricted, freely estimated model: $\Delta\chi^2(123) = 143.126, p = .104$. A closer inspection of modification indices showed that the model fit would increase after letting the correlation between behavior problems and conflict (MI = 20.073) and between negative emotionality

Table 4
Model Fit Indices of the Tested Models

	χ^2	df	p-Value	CFI	RMSEA	SRMR	Comparison	$\Delta S-B \chi^2$	Δdf	p-Value	ΔCFI
Literacy											
M1: Stability model	27.02	12	.008	.987	.052	.048	—	—	—	—	—
M2: Partial reciprocal	4.62	8	.798	1.00	.000	.013	M1 versus M2	22.18	4	.000	.013
M3: Partial reciprocal	23.81	8	.003	.986	.065	.045	M1 versus M3	2.86	4	.582	.014
M4: Fully reciprocal	1.77	4	.776	1.00	.000	.008	M2 versus M4	2.88	4	.578	.000
	—	—	—	—	—	—	M3 versus M4	22.27	4	.000	.014
	—	—	—	—	—	—	M1 versus M4	25.58	8	.001	.013
Math											
M1: Stability model	26.13	12	.010	.986	.051	.042	—	—	—	—	—
M2: Partial reciprocal	8.16	8	.418	1.00	.007	.017	M1 versus M2	19.85	4	.001	.014
M3: Partial reciprocal	19.47	8	.013	.989	.056	.039	M1 versus M3	6.31	4	.177	.003
M4: Fully reciprocal	2.46	4	.653	1.00	.000	.011	M2 versus M4	6.31	4	.177	.000
	—	—	—	—	—	—	M3 versus M4	19.91	4	.001	.011
	—	—	—	—	—	—	M1 versus M4	26.05	8	.011	.015

Note. CFI = comparative fit index; RMSEA = root mean square error of approximation; SRMR = standardized root mean square residual.

and conflict (MI = 5.680), and the path from behavior problems to conflict (T2; MI = 10.079) and from inhibition to conflict (T2; MI = 6.138) be freely estimated between boys and girls. The fit of the final multiple-group model for interest and skills in literacy was excellent: $\chi^2(132) = 106.011$, $p = .953$; CFI = 1.000; TLI = 1.005; RMSEA = .000; SRMR = .041. While the main results were similar between genders, the modifications indicated some gender-related patterns between control variables and relationship quality: behavioral problems were related to teacher-perceived conflict (T2) only among boys, and a higher level of inhibition was related to a lower level of conflict (T2) in girls.

In sum, the relationship-driven model best described the data. Teacher-perceived conflict was predictive of both pre-academic skills and interest in literacy. The strength of the associations was small to moderate. Results were similar for boys and girls, although there were some gender differences in the associations between control variables and teacher-child relationship quality.

Teacher-Child Relationships and Interest and Pre-Academic Skills in Math

Similar to the literacy model, the model comparison for the math model (Table 4) also indicated that the partial model (M2; relationship-driven model), which included stability paths and a predictive path from closeness and conflict to interest and skills in math (Figure 3), best described the

data. A closer inspection of modification indices indicated that the model fit would increase when a predictive path was included from interest in math (T1) to conflict (T2; MI = 4.50), and from previous closeness to conflict (MI = 10.288). The results demonstrated that teacher-student relationships, interest in math, and pre-math skills were stable across time. Moreover, teacher-perceived conflict at kindergarten entry predicted children's lower interest in math ($\beta = -.15$, $p < .05$) and pre-math skills ($\beta = -.13$, $p < .01$) at the end of kindergarten.

The results concerning control variables showed that behavior problems ($\beta = .19$, $p < .05$) and negative emotionality ($\beta = .23$, $p < .001$) were positively related to conflict, whereas inhibition ($\beta = -.10$, $p < .05$) was negatively associated with teacher-perceived closeness. Furthermore, child's age ($\beta = -.07$, $p < .05$) was negatively related to closeness, and group size was negatively ($\beta = -.08$, $p < .01$) related to conflict.

A multiple-group model compared the pattern of associations between boys and girls. The model comparison indicated that a restricted model, in which all paths and coefficients were estimated as equal between boys and girls, provided a better fit to the data than the non-restricted, freely estimated model: $\Delta\chi^2(136) = 139.472$, $p = .112$. A closer inspection of modification indices indicated that model fit would increase when allowing the path from behavior problems to conflict (MI = 10.111) and the path from inhibition to conflict (MI = 5.660) to be freely estimated between boys and girls,

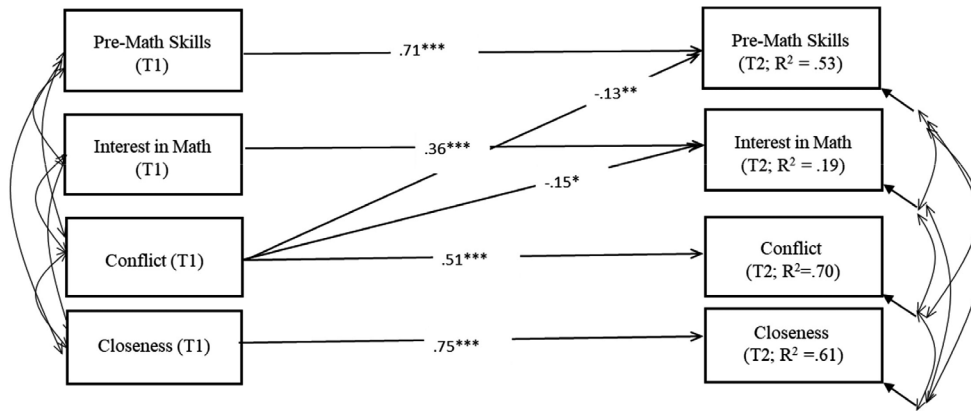


Figure 3. Path model for the full sample in interest and pre-skills in math. The estimates are standardized. Child's age, teacher's work experience, elapsed time between the measurement points, parental level of education, child's temperament, behavior problems, and maternal affection were controlled for in the both time points. * $p < .05$. ** $p < .01$. *** $p < .001$.

allowing a residual correlation between behavior problems and conflict at T1 ($MI = 19.374$), and by including a residual correlation between negative emotionality and conflict T1 ($MI = 6.244$). In addition, the modification indices suggested to add a path from pre-math skills to interest in math among boys ($MI = 5.489$). The fit of the final multiple-group model for interest and skills in math was excellent: $\chi^2(131) = 107.398$, $p = .935$; $CFI = 1.000$; $TLI = 1.019$; $RMSEA = .000$; $SRMR = .041$. The results were mainly similar for boys and girls. The results further indicated that pre-math skills promoted subsequent interest in math and behavior problems increased conflict only among boys. Higher levels of inhibition were related to lower levels of conflict in girls, albeit marginally.

In sum, the relationship-driven model best described the data. Teacher-perceived conflict was predictive of both pre-academic skills and interest in math. Again, associations were small to moderate. The results were similar in boys and girls, although some gender-related patterns between control variables and teacher-child relationship quality existed.

Discussion

Despite a recent increase in research highlighting the potential of teacher-child relationships to promote children's academic skills and school adjustment, few studies have focused on children's interest in or enjoyment of a particular subject in kindergarten. Previous studies have also shown contradictory findings regarding the direction of effect which may be due to different study design

and analytical approach used. Therefore, the present study aimed to test three alternative theoretical models, that is, child-driven, relationship-driven, and reciprocal patterns of associations between the quality of teacher-child relationships and children's interest and pre-academic skills across one kindergarten year. To our knowledge, the current paper is among the first attempts to systematically test these models beyond adjustment problems (e.g., Mejia & Hoglund, 2016). The results indicated that the relationship-driven model best described the data for interest and pre-academic skills in literacy and math: teacher-perceived conflict predicted lower interest and skills in both literacy and math. The results were largely similar for boys and girls. The results are of particular importance as the present study is among the few attempts using a non-U.S. sample to investigate the associations between teacher-child relationship quality and children's interest in academic subjects in the kindergarten context. Using a non-U.S. sample may provide important information on the possible culture/context-specific patterns of associations that should be better understood or universality of processes between teacher-child relationship quality and child outcomes. In addition, the study contributes to the literature by examining the moderating role of gender and investigating academic achievement by using standardized test scores in a sample of general population of kindergarteners. Importantly, the results were found after controlling for a wide range of control variables (child age, temperament and behavior problems, maternal affection, parental education, and teacher experience). Yet, it should be noted that the findings were small to moderate. Although this is in line with previous research in

the field (Portilla et al., 2014; for a review, Roorda et al., 2011), it indicates that there are other factors that are key to children’s development, such as their skills at kindergarten entry and the home learning environment.

Associations Between Teacher–Child Relationships and Child Outcomes

The present paper contributes to the existing literature by investigating alternative theoretical models beyond adjustment problems (e.g., Mejia & Hoglund, 2016). The results indicated that teacher–child relationship quality contributed to prospective levels of interest and pre-academic skills in both literacy and math, thus providing support for the relationship-driven model (Mejia & Hoglund, 2016). Teacher-perceived conflict was found to be negatively related to kindergarteners’ subsequent interest and pre-academic skills both in literacy and math when considering previous levels of relationship quality, children’s initial skills at kindergarten entry, and controlling for child behavior problems, temperament, and maternal affection. It is possible that when children experience conflict with teachers, they are missing out on time on learning literacy and math, either because they are disengaged from instructional activities or because teachers have to spend more instructional time on behavioral management.

The results align with previous research showing that conflictual teacher–student relationships were related to students’ lower academic skills (Hamre & Pianta, 2001; Mason et al., 2017) and less engagement (Portilla et al., 2014; Roorda et al., 2011). In a similar vein, Patrick et al. (2008) indicated that children with high motivational patterns reported the most support for learning and the least conflict and negativity from their teachers. In line with SDT (Ryan & Deci, 2002), it can be suggested that a relationship with one’s teacher without conflict and coercive interactions meets children’s needs for relatedness and belonging at school and, therefore, supports the development of their intrinsic motivation and achievement. It can also be suggested that teacher-perceived coercive interactions and negative emotions are harmful for children’s engagement in learning and diminishes their interest in academic tasks. Although we did not investigate teaching practices, it may also be possible that teachers’ conflictual and negative relationships with children are reflected in their interactions and classroom practices in a way that hampers the children’s interest and development of academic skills.

In contrast to our expectations and some previous studies (e.g., Hamre & Pianta, 2001; Maldonado-Carreño & Votruba-Drzal, 2011; Patrick et al., 2008), the expected benefits of teacher-perceived closeness did not spill over into other domains of child outcomes beyond the concurrent benefits at each time point. Previous evidence on the link between closeness and child outcomes is not conclusive, with some studies finding a significant association (e.g., Maldonado-Carreño & Votruba-Drzal, 2011), while others did not (e.g., Portilla et al., 2014; Varghese, Vernon-Feagans, & Bratsch-Hines, 2019). The findings of the present study add to this evidence. It is possible that conflict is a more powerful predictor of child outcomes, indicating that conflict is harmful from a child’s point of view or that it reflects the way a teacher who reports conflict typically behaves in classroom situations. An alternative explanation for the lack of findings regarding teacher–child closeness could be the fact that there generally tends to be limited variation in the measure of closeness for young children, indicating that most teachers of young children report close relationships with their students, whereas there is more variation in conflict. Together with our result showing the negative influence of teacher-perceived conflict on both children’s enjoyment of and pre-academic skills in literacy and math, reducing negative patterns of relationships between teachers and children in the very early stages of the children’s school careers might be particularly critical for achievement outcomes and interest.

The Role of Gender in the Associations

In addition, the study contributed to the existing literature by investigating the possible moderating role of gender in the proposed associations. In contrast to the academic risk perspective (Hamre & Pianta, 2001; Silver et al., 2005) and gender role socialization theory (Ewing & Taylor, 2009), the results were mainly similar for both genders. The lack of gender differences in the pattern of associations is surprising, in particular because all other gender differences were significant and in the expected direction (more closeness with girls than boys, more conflict with boys than girls). There might be different mechanisms at play, with one set of mechanisms explaining gender differences in relationship quality/skills and one set of mechanisms explaining gender differences in associations between quality and outcomes.

It is well known that the gender norms and expectations may differ between cultures and educational

systems, which might explain why associations between teacher–child relationships and child outcomes did not differ in the current sample compared to previous studies conducted in the United States. In Finland, the main goal of education is to offer equal educational opportunities for all irrespective of domicile, gender, financial situation, or linguistic and cultural background. Along with that, National Core Curriculum for ECEC (Finnish National Agency for Education, 2018) emphasizes the sensitivity on child’s gender in daily practices which means that teachers should encourage children to make choices without gender stereotypes. Gender sensitivity is also essential in teachers’ and parents’ meetings when making an individually tailored kindergarten plan for each child in the beginning of the kindergarten year. While a child-centered approach is also valued in the education system in the United States along with an increased awareness of gender equity and equality, teachers struggle with establishing an environment that deconstructs traditional gender roles (Ewing & Taylor, 2009; McCormick & O’Connor, 2015). Although gender stereotyping in the classroom has decreased over the past years, studies from the United States continue to show that teachers have gender-typed expectations for children’s behavior in the classroom that are, for example, reflected in their relationships with children (Ewing & Taylor, 2009; McCormick & O’Connor, 2015). It is possible that such gender-typed expectations play a role in explaining differences in the associations between teacher–child relationship quality and academic outcomes and interest for boys and girls that are found in U.S. samples (e.g., Ewing & Taylor, 2009; McCormick & O’Connor, 2015).

Teacher-perceived conflict negatively predicted interest and pre-skills in literacy and math in both genders. In contrast to our results, Ly et al. (2012) indicated that conflict was negatively related to math achievement in girls and to reading achievement in boys. Furthermore, McCormick and O’Connor (2015) demonstrated that girls with more conflictual relationships showed lower overall levels of math achievement and less growth in math than boys with similar levels of conflict. The gender-related findings may be a function of the differences in developmental stages that the current paper considers versus previous studies. It is possible that the patterns of associations may change as children proceed in their school careers, and gender-related differences may occur. For example, McCormick and O’Connor (2015) looked at the full period of middle childhood as children transitioned into early adolescence. Girls’ development of math skills

during this time may vary greatly from the trajectories of early numeracy skills that the authors presented in this paper. Thus, more research is needed to identify the onset and trajectories of gender differences using longitudinal studies. Together, the results might inform teachers to be aware of adapting activities that more closely match what they perceive to be the children’s interests. During the kindergarten year, it is important to stimulate both girls’ and boys’ interest in letters, phonemes, and numeracy, which will result in emergent academic skill development and a positive attitude toward reading and math activities.

Limitations and Future Directions

The present study is not without limitations. First, although the study employed independent measures across multiple informants and examined bidirectional pathways after accounting for the stability of each construct and within-time covariation between constructs, it had only two time points. More stringent testing of associations would require at least three time points. Consequently, caution is warranted in making causal inferences. Second, a rather large amount of data on parental level of education and maternal affection was missing. Although they were only control variables, it should be noted that we were not able to control for parental educational level and maternal affection for all children. Third, conflict and closeness in teacher–child relationships were measured by teachers’ ratings. Future studies might consider including children’s perspectives on teacher–child relationship quality (e.g., Hughes, 2011; Ly et al., 2012) and observed quality of interactions in the classrooms (e.g., Downer et al., 2010). In addition, the study was not able to rule out the possibility of a “third factor” to explain the links between teacher–child relationship quality and academic skills and interest in literacy and math. One factor that has been suggested to influence the association between teacher–child relationship quality and achievement is children’s engagement with learning activities (Sabol, Bohlmann, & Downer, 2018; Williford et al., 2013). Future studies might include a wider range of variables. Furthermore, it should be noted that the present study was conducted in Finland, a Nordic country, where the educational system is different from that of many other countries. Thus, caution is warranted when trying to generalize the findings. Relatedly, although the present sample is a non-U.S. sample, it should be noted that Finland is a Westernized country. Further investigation on

cultural variation in relationship quality is needed using an Asian or African sample, for example.

Practical Implications

The current study also provides some practical implications. The finding that teacher-perceived conflict predicted children's academic interest and achievement in both literacy and math offers strong support for the importance of developing preservice and in-service programs and interventions to assist teachers in building supportive, low conflict relationships with children. Because teachers may be more able to provide support, praise, and constructive feedback than to decrease the conflict, interventions and teacher preparation programs should focus on building and fostering the positive aspects of a relationship with each individual child. Kindergarten teachers should be provided with information about how their relationships with children can influence children's later school success.

Teacher education programs may benefit from educating teachers not only about academic content and pedagogical practices but also in strategies that build supportive relationships with children. It may be important to embed relationships into instructional practice to successfully promote academic competencies and motivation in reading and math. The current study provides some evidence that kindergarten teachers who create less conflictual relationships with the children may also be successful at developing academic competencies. Because conflict is often related to child behavior problems (as our results confirm), teachers might need to be supported in proactive behavior management in an attempt to reduce problematic behavior, and, in turn, conflict in relationships with children to support the engagement in learning of children already in kindergarten.

Conclusion

The present study is one of the first attempts to empirically investigate bidirectional effects across multiple aspects of both teacher–child relationships and child outcomes in kindergarten using an example of a non-U.S. sample. Overall, the results help to broaden our understanding of the associations between teacher–child relationship quality and pre-academic skills and interest across the kindergarten year. However, further research from different educational contexts is needed to tease out these associations. The results contribute to previous research by showing that these relationships are mostly driven

by teacher-perceived conflict. The associations between these variables were mainly the same for boys and girls. This study, however, opens the door for further examination of the mechanisms behind the phenomena found in this study, as the patterns of associations might change as children grow older.

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