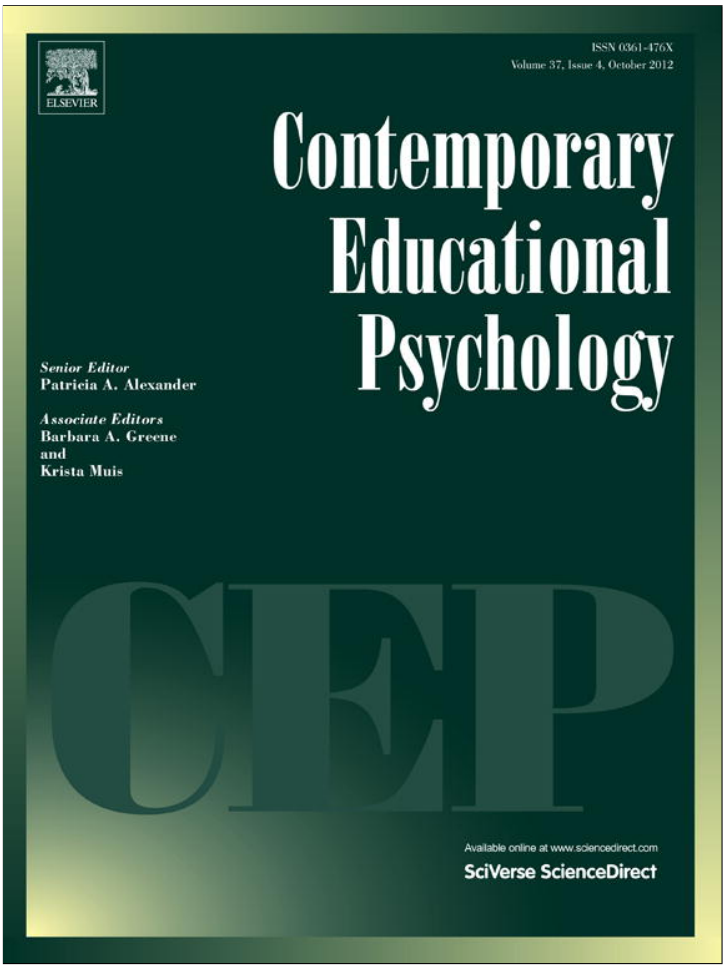

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The role of teaching practices in the development of children's interest in reading and mathematics in kindergarten

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ABSTRACT

This study examined the extent to which teaching practices observed in kindergarten classrooms predict children's interest in reading and mathematics. The pre-skills in reading and mathematics of 515 children were measured at the beginning of their kindergarten year, and their interest in reading and mathematics were assessed in the following spring. A pair of trained observers used the Early Childhood Classroom Observation Measure (ECCOM; Stipek & Byler, 2004) to observe the teaching practices used by 49 kindergarten teachers. The results revealed that in classrooms in which the teachers placed greater emphasis on child-centered teaching practices than on teacher-directed practices, the children showed more interest in reading and mathematics.

1. Introduction

While teachers' instruction and classroom practices have been shown to contribute to children's learning and academic outcomes (for reviews, see Davis, 2003; Perry & Weinstein, 1998; Rutter, 1983; Turner & Meyer, 2000), less research has been carried out on the role they play in young children's *motivation* and, in particular, in their interest in academic subjects (for a review, see Wigfield, Eccles, Schiefele, Roeser, & Davis-Kean, 2006). A few studies have shown, however, that teachers' instruction and classroom practices are of influence concerning children's interests in academic tasks. For example, Stipek, Feiler, Daniels, and Milburn (1995) found that, compared to children in didactic early childhood education programs that place emphasis on basic skills, children in child-centered programs had a higher score in most of the motivation measures. Furthermore, teachers' support for students' autonomy has been found to be associated with students' motivation (Guay, Boggiano, & Vallerand, 2001; Guthrie, Wigfield, & von Secker, 2000; Skinner & Belmont, 1993). While these findings suggest that teachers' instruction and classroom practices contribute to students' interest in various school subjects, the earlier research has at least two limitations. First, little research has been carried out among younger children, for example, among kindergarteners, and, second, few studies have examined how important teachers' observed practices in classroom situations are regarding children's interest in academic tasks (for an exception, see Stipek et al., 1995). Hence, the present study investigated whether teachers' child-centered versus teacher-directed instructional practices, as observed in kindergarten classroom situations, would predict children's interest in reading and mathematics.

1.1. Interest in academic subjects

Motivation plays an important role in academic performance because it directs students' behavior and effort in learning situations (Wigfield et al., 2006). For example, one widely used framework in the conceptualization of motivation in the school context is the question of how interested students are in various school subjects and academic topics, and how much they like and enjoy doing tasks related to these topics. There are many concepts that refer to this kind of interest and liking, with specific studies having focused on *interest* (Hidi & Renninger, 2006; Schiefele, 1996), *intrinsic motivation* (Deci & Ryan, 1985; Deci, Vallerand, Pelletier, & Ryan, 1991; Gottfried, 1990), *preference* (Stipek et al., 1995), and *task motivation* (Aunola, Leskinen, & Nurmi, 2006; Nurmi & Aunola, 2005). Among younger students, interest and liking have been measured by asking children, for example, whether they 'would prefer to work on some basic academic tasks' (e.g., letters or numbers) (Stipek et al., 1995), whether they 'liked learning new things' (in mathematics or language) (Gottfried, 1990; Gottfried, Fleming, & Gottfried, 1994), how they 'feel when looking at books' (Ecalle, Magnan, & Gibert, 2006), or how much they 'like doing math' (or tasks in other subjects) (Eccles, Wigfield, Harold, & Blumenfield, 1993).

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The present study focuses on how much a child reports "enjoying" or "liking" a certain school subject. Children's interest in two school subjects is investigated, i.e., Reading and Mathematics. In our study, an interest in reading could be defined as "an interest in letters and pre-reading," and an interest in mathematics as "an interest in numbers and arithmetics." There are two reasons for the choice of these particular subjects. First, learning to read and learning mathematics are particularly challenging for school beginners and can have significant consequences for their later school career (Landerl & Wimmer, 2008; Williamson, Appelbaum, & Epanchin, 1991). Second, children's motivation often varies across different subjects. For instance, a child who is highly motivated in reading may not be as highly motivated in math (e.g., Nurmi & Aunola, 2005; Wigfield & Eccles, 1992; Wigfield, Eccles, MacIver, Reuman, & Midgley, 1991).

Besides interests, many other conceptualizations of motivation have been introduced in the literature. For example, according to the Achievement Goal Theory (Ames & Archer, 1988; Pintrich, 2000), different kinds of goals and behavior, such as *mastery*, *performance-approach* or *performance–avoidance*, direct students' engagement in achievement tasks. Other conceptualizations, such as *achievement beliefs* (Pintrich & De Groot, 1990; Valentine, DuBois, & Cooper, 2004), *expectancies* related to academic situations, and *motivational strategies* (Onatsu-Arvilommi & Nurmi, 2000), have also been used to describe motivational patterns in academic environments. Although these other conceptions have been fruitful, we chose interest because of its important developmental ramifications (Hidi & Renninger, 2006).

Previous research has shown that the development of interest in academic subjects already starts at the very beginning of the school career. For example, students' interest in various subjects is relatively high at the beginning of school, but often diminishes during the elementary school years (Gottfried, Fleming, & Gottfried, 2001; Jacobs, Lanza, Osgood, Eccles, & Wigfield, 2002; Wigfield et al., 1997). Furthermore, individual differences in interest start to emerge early on in the school career, after which they show increasing inter-individual stability (Aunola et al., 2006; Eccles et al., 1993; Gottfried et al., 2001; Wigfield et al., 1997).

Students' interests in academic subjects play a role not only in their overall academic achievement but also in the development of more specific skills, such as reading and mathematics (Baker & Wigfield, 1999; Gottfried, 1990). For example, *interest in reading* predicts subsequent reading performance and improvement in reading skills already among first graders, as well as among older elementary school students (e.g., Ecalle et al., 2006; Gottfried, 1990; Wigfield, 1997). Interest in reading has also been reported to contribute to reading activity and to the amount of reading among 4th, 5th and 6th graders (Baker & Wigfield, 1999; Wigfield & Guthrie, 1997) which, in turn, promotes students' reading performance (Anderson, Wilson, & Fielding, 1984; Cipielewski & Stanovich, 1992). Similarly, *interest in mathematics* has been found to play an important role in the development of arithmetic skills (Gottfried, 1990). For example, children's early interest in math-related learning predicts good performance in mathematics later on, during the first school years (Aunola et al., 2006; Gottfried et al., 1994).

Although a large body of research has investigated the role of children's interests in developing academic skills, less is known about the antecedents of the development of interest in various school subjects. It might be assumed that children's previous success in learning the basics of reading and mathematics has provided them with positive feedback about the learning situation, and has thereby also strengthened their interest in these particular school subjects. A few studies have also shown that previous learning outcomes pertaining to a particular school subject may provide a basis for the development of students' interest in a particular subject. For example, Aunola et al. (2006) found that good math performance in primary school predicted subsequent interest in mathematics. Gottfried (1990) found a similar result for both math and reading. Viljaranta, Lerkkanen, Poikkeus, Aunola, and Nurmi (2009) showed that kindergarten children's previous level of math-related skills predicted their subsequent interest in that particular subject. However, few studies have examined the role of teachers' observed teaching practices in regard to children's interest in academic subjects.

1.2. The influence of teaching practices on children's interest in school subjects

Teachers differ widely in their teaching practices and classroom instruction (Connor, Morrison, & Slominski, 2006; Howes et al., 2008; Stipek, 2004). In the measurement of these phenomena, classroom observation has been shown to be a more valid tool than teachers' self-reports (Connor, Son, Hindman, & Morrison, 2005; Pianta & Hamre, 2009). Several measurement tools have been developed for observational assessments in the classroom. In studies of early childhood, the most widely used assessment tools are the Early Childhood Environment Rating Scale (ECERS; Harms, Clifford, & Cryer, 1998), the Classroom Assessment Scoring System (CLASS; Pianta, La Paro, & Hamre, 2008), and the Early Childhood Classroom Observation Measure (ECCOM; Stipek & Byler, 2005). In the present study, the ECCOM procedure was utilized to assess the *instructional practices*, *management* and *social climate* in kindergarten classrooms, reflected in the three subscales labeled Instruction, Management, and Climate (see Table 1).

The ECCOM is designed to facilitate an overall quality analysis of preschool and kindergarten instructional processes (Hauser-Cram, Sirin, & Stipek, 2003) by assessing two types of classroom practices at the same time, that is, the use of child-centered practices and teacher-directed practices. The mix of classroom practices investigated along these two dimensions is unique to this measure. Table 1 provides an overview of the types of teaching practices and the three subscales (Instruction, Management, and Climate) that can be formed based on the scale items. Each scale item is rated on a range from 1 ("*practices are rarely seen*") to 5 ("*practices predominate*"), based on a single half-day (3-h) observation in the classroom (Stipek & Byler, 2005).

The origins of the concepts of Child-Centered and Teacher-Directed practices can be found in early childhood education literature. Presently, a complete consensus on what is the most beneficial mix of the various practices in different contexts has not yet been achieved. The majority of the early childhood education literature and guidelines lean heavily towards *child-centered practices*. The notion of child-centered practices is based on the work of both Piaget and Vygotsky, who subscribed strongly to the recognition of children as active knowledge constructors. In early childhood education literature, these practices are characterized by relying on the professional guidelines for 'developmentally appropriate practices' (DAP, Bredekamp & Copple, 1997). In child-centered classrooms, teachers assist and facilitate children's learning by providing them with both guidance and opportunities to direct their own exploration of objects and academic topics, making teaching akin to a partnership between the teacher and the children (Schweinhart & Weikart, 1988). Classrooms scoring high on child-centered practices are characterized by shared responsibility for both management and learning, active teacher support for the children's learning efforts and social skills, and teaching practices that are sensitive to children's needs and interests (Stipek & Byler, 2005).

Conversely, the notion of *teacher-directed practices* is based on the premise that basic academic skills need to be mastered before more advanced learning can occur (Stipek, 2004). In this didactically-oriented kind of teaching, teachers emphasize the provision of

Table 1
Description of the ECCOM dimensions, subscales and scale items (based on Stipek & Byler, 2005).

Subscales and scale items	Dimensions	
	Child-centered teaching practices	Teacher-directed teaching practices
Management		
1. Child responsibility	Children are allowed to take responsibility to the degree that they are able	Children do not have opportunities to take responsibility (teacher control dominates)
2. Management	The teacher has clear but somewhat flexible classroom rules and routines	The teacher has clearly communicated expectations and classroom rules that are rigidly adhered to
3. Choice of activities	Mixture of teacher and children making choices	The teacher makes most of the choices
4. Discipline strategies	Conflict resolution is smooth; consequences are appropriate and apply equally	Discipline is imposed without explanation or discussion; consequences are inconsistent
Climate		
5. Support for communication skills	The teacher encourages children to engage in conversation and elaborate on their thoughts	The teacher does not encourage children to engage in conversation (conversation is teacher-controlled)
6. Support for interpersonal skills	The teacher provides opportunities for cooperative, small-group activities that promote peer interaction	The teacher does not provide opportunities for children to develop interpersonal skills
7. Student engagement	The teacher attempts to engage all children in ways that will improve their skills and understanding	The teacher engages children in rote activities (e.g., has rigid expectations about on-task behavior)
8. Individualization of learning activities	Teacher is attentive to children's individual skill level and adapts tasks accordingly	Tasks are not flexible or adapted to children's individual needs (e.g., all do the same tasks)
Instruction		
9. Learning standards	The teacher only holds children accountable for attaining some individualized standards (assists and challenges children at their respective level)	The teacher rigidly holds children accountable for completing work and for attaining a universal standard (e.g., standards are rigid and invariable)
10. Coherence of instructional activities	Attention is given to connections occurring between/within academic lessons (concepts/skills are embedded in a broader set of goals)	Academic lessons are distinct and disconnected (concepts/skills are presented as an isolated set of facts or skills to be learned)
11. Teaching concepts	Tasks and lessons are designed to teach identifiable concepts and to develop comprehension	Tasks are designed to help children learn facts or procedures. Problem solving is constrained
12. Instructional conversation	The teacher solicits children's questions, ideas, solutions, or interpretations around a clearly defined topic	The teacher dominates instructional conversation; children's participation is limited

Note: Observers rate classrooms on each of the 12 scale items, giving one score for Child-Centered and one for Teacher-Directed practices. All items are rated on a scale ranging from 1 to 5 [where 1 = *these practices are rarely seen* (*less than* 20*% of the time*), and 5 = *these practices predominate* (80–100% of the time)].

information and employ structured, drill-and-practice group lessons that are fast-paced, teach discrete skills in small steps, and include praise when predetermined goals are reached (Schweinhart & Weikart, 1988). High scores in the teacher-directed dimension are typical for teacher-controlled classrooms in which the acquisition of "basic" academic skills through oral recitation and worksheets is given considerable weight, whereas children's interests and social skill development receive little attention, and peer interaction is not applied (Stipek & Byler, 2004). Teacher-directed practice is based on the teacher's determination to proceed with predetermined instructional content rather than adhering to children's needs and interests which are the priority in the more child-centered classrooms.

Although child-centered practices have often been regarded as being the 'best practices' in early education, a wide consensus on the most beneficial mix of instruction for advancing the children's development and motivation has not yet been achieved. Previous research on the benefits of Child-Centered and Teacher-Directed practices varies, depending on the field of interest and the age of the children (Connor, Morrison, & Katch, 2004; Huffman & Speer, 2000; Marcon, 1999; Stipek et al., 1995, 1998). For example, Marcon (1999) found that preschool children showed greater mastery of basic skills in classrooms where the teaching practices were more child-centered than teacher-directed. Stipek and her colleagues (1995, 1998) showed that children in primarily teacher-directed kindergarten classrooms had higher scores on letter and reading tests, and made greater gains in both reading and mathematics than children in classrooms with a high degree of child-centered practices. While Huffman and Speer (2000) found that, although letter-word identification and applied problem solving skills were actually significantly better in the more child-centered classrooms in kindergarten, no differences were obtained for skills in solving mathematical calculations. Moreover, highly teacher-directed programs have been shown to improve the basic skill development of school-age children with a history of low performance or with learning disabilities (e.g., Adams & Carnine, 2003; Connor et al., 2004; Lovett, Barron, & Benson, 2003).

There are also several studies that have investigated the associations between classroom practices and students' motivation and related constructs. For example, classroom practices and environments have been found to be related to achievement goals (Ames, 1992; Greene, Miller, Crowson, Duke, & Akey, 2004), effective strategies and ability beliefs (Ames & Archer, 1988), self-efficacy (Greene et al., 2004), involvement (Turner et al., 1998), and avoidance strategies (Turner et al., 2002) during later elementary school years and among adolescents. However, previous research in the field includes some limitations. First, only few studies have examined the influence of teachers' observed instruction and teaching practices on students' motivation. In one study, Stipek et al. (1995) found that children in child-centered programs evidenced a higher level of motivation in comparison to children in didactic programs. Second, little research has been carried out on younger children, such as kindergarteners. Third, although many studies have focused on investigating the influence of teaching practices on the motivation of older students, few studies have investigated how observed teaching practices are associated with younger children's interest in various school subjects – which is the key objective of the present study.

The paucity of research on the influence of teachers' instructional practices on children's interest in various school subjects is surprising, given that teachers and their instruction provide an

important environment for children's learning and motivation. For example, educational contexts that allow children autonomy to initiate tasks and complete them, without applying strict performance criteria, can be assumed to strengthen the children's interest in different school subjects; conversely, a stricter and more didactic approach, emphasizing correct answers and particular modes of learning, may lead to a waning of the children's intrinsic motivation and interest in school subjects (Guay et al., 2001; Guthrie et al., 2000; Stipek et al., 1995).

From several possible alternatives, we chose to use the ECCOM in the present study. The reason for this is that the ECCOM focuses on measuring key characteristics of teaching practices that have been suggested to be of importance in promoting students' interest in academic situations. Such dimensions include autonomy-granting, encouragement, positive affection, and quality of the teacher–child relationship, all of which are typical of a child-centered practice (Deci & Ryan, 1985; Ladd, Birch, & Buhs, 1999; Pianta, Hamre, & Stuhlman, 2002; Ryan & Grolnick, 1986; Stipek et al., 1995). In contrast, in a teacher-directed learning environment emphasis is typically placed on quality of performance and academic content, as well as on a didactic approach to teaching.

The present study made an effort to examine the extent to which teaching practices observed in kindergarten classrooms would predict children's interest in reading and mathematics. We expected that child-centered teaching practices, being sensitive to children's needs and interests, would increase their autonomy in initiating tasks and completing them, and by doing so, also strengthen children's interest in reading and mathematics (Stipek et al., 1995, 1998). Conversely, teacher-directed practices that emphasize a stricter and more didactic approach were expected to lead to a waning of the children's intrinsic motivation and interest in reading and mathematics (Guay et al., 2001; Guthrie et al., 2000; Stipek et al., 1995).

1.3. Aims and hypotheses

The present study aimed to answer the following research questions:

(1) To what extent do kindergarten classrooms differ with respect to children's interest in reading and mathematics? We expected, in accordance with previous findings in elementary school classrooms (Anderman et al., 2001), that kindergarten classrooms would differ in the interest shown by children in reading and mathematics (Hypothesis 1).
(2) To what extent do observed teaching practices predict classroom differences found in children's interest in reading and mathematics, after controlling for classroom differences in pre-skills in reading and math? We expected that child-centered teaching practices (compared to teacher-directed practices) would predict a high level of interest in both reading and math (Stipek et al., 1995, 1998) (Hypothesis 2).

1.4. Kindergarten education in Finland

In Finland, compulsory education begins in the year of the child's seventh birthday. All 6-year-olds are entitled to kindergarten education for 1 year, free of charge, before starting their 9-year career of comprehensive school. At present, about 98% of all 6-year-olds in Finland attend kindergarten education, which is provided in daycare centers and elementary schools (Organization for Economic Cooperation and Development [OECD], 2006). The kindergarten curriculum contains seven subject areas, but instruction and activities are integrated in thematic learning and play throughout the day. The goals of the kindergarten education curriculum place greater emphasis on fostering the child's personal and social development than on the formal or systematic teaching of academic skills. However, children are read to and encouraged to play with letters, words, and numbers; and through these playful activities, 25% of children learn to read during the kindergarten year (e.g., Lerkkanen, Rasku-Puttonen, Aunola, & Nurmi, 2004). Moreover, special attention is given to children's school-readiness and their development of pre-literacy and pre-math skills in order to avoid the risk of later academic failure.

2. Method

2.1. Participants

2.1.1. Children

The present study is part of the First Steps Study (Lerkkanen, Niemi, et al., 2006) comprising a total of 1268 children from three municipalities, two of them located in Central Finland and one in Eastern Finland. The participants of the present study represent a subsample of the original sample and include 515 (244 girls, 271 boys) kindergarten-aged children (M = 73.59 months old, SD = 3.37 months). Their teachers, precisely 49 kindergarten teachers (47 females and 2 males), also participated the study. Parents were asked to provide written consent for their child's participation in the study. The children's family background was representative of the general Finnish population. The majority of the children, 76%, came from nuclear families, 13% were from single parent families, 9% from patchwork families, and 2% from families where the child's parents are divorced and the child has two homes.

2.1.2. Teachers

Of the total 137 kindergarten teachers participating in the First Steps Study, 49 teachers were selected for classroom observation on a voluntary basis. Teachers were asked to provide their written consent before the observation of their teaching practices. All teachers had at least a bachelor's degree, or an equivalent diploma, and their teaching experience in early childhood education ranged from less than a year to more than 15 years (*Mode* = more than 15 years). When kindergarten teachers who participated in the classroom observations were compared to those who chose not to participate, no statistically significant differences were found in teachers' teaching experience, teacher stress, or teacher efficacy. Those who participated in the classroom observations did not differ from those who chose not to participate in regard to whether their kindergarten classroom was situated in a daycare center or elementary school.

Of the total of 38 kindergartens containing 49 classroom groups, 72% were situated in daycare centers and 26% in elementary schools. All groups were Finnish-speaking. Although most of the groups were composed exclusively of kindergarten-age children (6-year-olds), the age composition was wider in some groups; some of the groups taught in daycare centers also enrolled 5-year-olds, and some of the groups taught in elementary schools also enrolled 1st and 2nd graders. The sizes of the observed kindergarten classroom groups ranged from 3 to 24 children (M = 13.85; SD = 5.92). Around 11 (statistically 10.89, SD = 3.35) children were present during an observation session. Only kindergarten-age children were included in the present study.

2.2. Procedure

The kindergarten children's *pre-skills* in reading and mathematics were investigated during the Fall term (Time 1, T1, September; n = 515 children), whereas their *interest* in these two fields was investigated during the Spring term (Time 3, T3, April; n = 498

children). The time interval between the Fall and Spring measurements was approximately half a year. All of the tests and ratings were administered individually by a researcher at the children's kindergarten, in a room separate from their classroom. Complete data on all of the kindergarten Fall and Spring variables were obtained for 498 (97%) out of the 515 children.

Each kindergarten classroom was observed in regard to Child-Centered and Teacher-Directed teaching practices on two different days, by a pair of observers using the ECCOM (Stipek & Byler, 2005), during the early Spring term (Time 2, T2, February). The observations commenced in the morning with the start of the instructional activity, usually at around 9 a.m., and lasted approximately 3 h (up to naptime in full-time programs, and up to the time the children left the kindergarten in part-time programs).

2.3. Measurements

2.3.1. Children's skill and interest measurements

Phoneme Identification. Initial phoneme identification was assessed using an individually administered subtest of the *Luku-ja kirjoitustaidon arviointimateriaali* 1. *luokalle* [ARMI] (Lerkkanen, Poikkeus, & Ketonen, 2006) at Time 1 (Fall term, kindergarten). Each child was shown four pictures of objects with simultaneous presentation of their names. Each child was then required to select the correct picture on the basis of the oral presentation of the initial phoneme of the name of the target object (e.g., "*At the beginning of which word do you hear [. . .]?*"). The sum score was based on the number of correct items (min./max. = 0/10). The *mean* of this 10-item scale was 7.41 ($SD = 2.37$, *skewness* = −0.74, *kurtosis* = −0.20). Girls ($M = 7.73$, $SD = 2.38$) showed better phoneme identification skills than boys ($M = 7.13$, $SD = 2.32$, $t(498) = 2.87$, $p < .01$, *Cohen d* = 0.26). Cronbach's alpha for Phoneme Identification was .77.

Letter Knowledge. Children were asked to name 29 uppercase letters shown by the researcher at Time 1 (Fall term, kindergarten). The letters were in random order, arranged in three rows, and shown one row at a time (subtest of the ARMI; Lerkkanen, Poikkeus, et al., 2006). As children in Finnish kindergartens are exposed only to capital letters, only uppercase letters were used in this test. Each child received one point for each correct response (min./max. = 0/29). The *mean* of this 29-item scale was 16.63 ($SD = 8.81$, *skewness* = −0.20, *kurtosis* = −1.23). Girls ($M = 17.99$, $SD = 8.60$) showed better letter knowledge than boys ($M = 15.42$, $SD = 8.83$, $t(505) = 3.31$, $p < .01$, *Cohen d* = 0.29). Cronbach's alpha for Letter Knowledge was .96.

Number Sequences. Children's pre-math skills at Time 1 were assessed using a number sequences test (for similar tasks, see Aunola, Nurmi, Lerkkanen, & Rasku-Puttonen, 2003; Koponen, Aunola, Ahonen, & Nurmi, 2007; Räsänen, Salminen, Wilson, Aunio, & Dehaene, 2009). Knowledge of number sequences was assessed by means of four tasks in which children were asked to count aloud, forwards and backwards: Counting forwards from number 1 to 31, counting backwards from number 12 to 7, counting backwards from number 23 to 18, and counting forwards from number 6 to 13. In each of these four subtasks, children received one point when they made only a small error, and two points when they counted aloud with no errors (min./max. = 0/8 points). The *mean* of this scale was 4.33 ($SD = 2.85$, *skewness* = −0.18, *kurtosis* = −1.36). Boys ($M = 4.76$, $SD = 2.75$) showed better number sequences skills than girls ($M = 3.84$, $SD = 2.88$, $t(505) = -3.70$, $p < .001$, *Cohen d* = 0.33). The *split-half reliability* for Number Sequences was .63.

Interest in reading and mathematics. Children's interest in reading and mathematics was assessed in an interview using the Task Value Scale for Children (TVS-C; Aunola & Nurmi, 1999; see also Aunola et al., 2006; Nurmi & Aunola, 2005) at Time 3 (Spring term, kindergarten). This scale was based on the ideas presented by Eccles et al. (1983) concerning the interest that children show in relation to particular school subjects. The interest scale consisted of two items measuring children's interest in, or liking of, reading-related tasks ("*How much do you like letter and pre-reading tasks?*"; "*How much do you like doing letter and pre-reading tasks in kindergarten?*"), and two items measuring children's interest in, or liking of, math-related tasks ("*How much do you like number and arithmetic tasks?*"; "*How much do you like doing number and arithmetic tasks in kindergarten?*"). All the questions were read aloud to the children. The children were asked to indicate, by pointing to one of five faces ranging from a big frown to a big smile, which best described their interest 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*"). This measurement system was practiced and explained to the children prior to presenting the actual test items, so that the children would know how to make proper use of the faces (practice items were the words "ice cream," "snake," and "onion"). Separate sum scores for Interest in Reading and for Interest in Math were calculated as *means*. The *mean* of the two-item scale for Interest in Reading was 3.99 ($SD = 1.09$, *skewness* = −1.09, *kurtosis* = 0.39), while that for Interest in Math was 3.87 ($SD = 1.15$, *skewness* = −0.89, *kurtosis* = −0.15). Girls and boys did not differ in their amount of interest in math. However, girls showed higher interest in reading ($M = 4.13$, $SD = 1.02$) than boys ($M = 3.88$, $SD = 1.15$, $t(495.77) = 2.57$, $p < .05$, *Cohen d* = 0.23). Cronbach's alpha for Interest in Reading was .73, and for Interest in Math it was .72.

2.3.2. Classroom observations of teaching practices

The classroom observations were conducted in the Spring term of the kindergarten year (Time 2, February 2007) and used the ECCOM measure (Stipek & Byler, 2004, 2005). Each teacher was observed on two different days and each observation session lasted half a day (about 3 h). The observers made notes about the instructional practice, climate and management during the observation session. After each half-day session, the two observers scored each classroom independently using their own score sheet. The same pair of observers repeated the observation session of the same classroom a second time within a week of the first observation. Inter-rater reliabilities estimated as intraclass correlations (ICCs) were high, ranging from .82 to .90.

The ECCOM ratings were conducted using a two-column format (Table 1). In this format, two dimensions, i.e., *Child-Centered Practices* and *Teacher-Directed Practices* are each assessed on a 5-point scale along the following three subscales: (1) The *Management* subscale (4 items: Child Responsibility, Management, Choice of Activities, Discipline Strategies); (2) the *Climate* subscale (4 items: Support for Communication Skills, Support for Interpersonal Skills, Student Engagement, Individualization of Learning Activities); and (3) the *Instruction* subscale (4 items: Learning Standards, Coherence of Instructional Activities, Teaching Concepts, Instructional Conversation). The subscales consisted of 12 items, as the observer rated each dimension (items described in Table 1) giving one code on a 5-point scale for the Child-Centered dimension and one code, also on a 5-point scale, for the Teacher-Directed dimension regarding each item, making a total of 24 ratings. The rating scale is based on the percentage of time the described teaching practices are noted during the observation session [1 = *practices are rarely seen* (0–20% *of the time*), to 5 = *practices predominate* (80–100% *of the time*)]. For example, for a specific item (e.g., Child Responsibility), an observed classroom practice might receive a score of 3 points in the Child-Centered dimension and a score of 5 points in the Teacher-Directed dimension (Stipek & Byler, 2005).

After having rated the ECCOM scales independently, the raters discussed and agreed a *consensus-rating*. The final scores of the ECCOM scales were calculated as *mean* scores of the consensus-ratings

across the two different observation sessions. For rating purposes, the ECCOM (Stipek & Byler, 2005) provides detailed indicators for each category and examples of teacher behavior in the two teaching orientations. Table 2 shows the *means*, standard deviations (SD), and correlations for the 12 items used in measuring Child-Centered and Teacher-Directed teaching practices.

The 17 observers (students in Education or Psychology) who participated in the present study were carefully trained. The first training session (4 h) consisted of an introduction to the dimensions and subscales used in the ECCOM, and overall guidelines for making observations and scoring. The observers were asked to read the scoring manual carefully, beforehand. In the second training session (3 h), a 30-min video recording of a kindergarten classroom was watched and scored independently. The independent ratings made regarding the video used for practice, were compared and discrepancies discussed. Next, the observers went in pairs to conduct their practice coding (3 h) in kindergarten classrooms which were not participating in the study. After the practice coding sessions, the observers' inter-rater reliability was calculated (correlations, differences between observers). Ratings of the two observers that did not differ by more than 1 point (1 *SD*) were considered to reflect an acceptable degree of accuracy (see Pianta et al., 2008). On two occasions out of 17, the discrepancies between the codings were greater than one point. For these two observers, additional classroom scoring practice was required and a meeting was arranged to monitor their subsequent inter-rater agreement. At the end of the training, the two observers' inter-rater reliability was .81, and subsequently all observers who had done the training were allowed to participate in the study. Before the final data collection, new training (including rereading of the ECCOM manual and a discussion on inter-rater differences) was conducted to enhance reliability. It is noteworthy that the translated ECCOM manual and the scoring procedure were tested in five kindergarten classrooms in a pilot study conducted 1 year prior to the onset of the present study.

For the purpose of the present study, *mean* scores for the subscales of Instruction, Management, and Climate were calculated separately for Child-Centered and Teacher-Directed teaching practices. Moreover, since the subscales correlated highly (see Table 2), we calculated *overall mean* scores for Child-Centered and Teacher-Directed teaching practices across all 12 items (see also Stipek, 2004; Stipek & Byler, 1997). The preliminary analyses further showed that the variable for Child-Centered practices correlated to a degree of −.90 with the Teacher-Directed variable, indicating measurement of the same construct. The items for the three subscales (Instruction, Management, and Climate) measuring Child-Centered and Teacher-Directed teaching practices also correlated highly; correlations ranged from −.65° to −.87° (see Table 2). Consequently, the scale for Teacher-Directed teaching practices was reversed and a *composite mean* score measuring the *overall level of Child-Centered versus Teacher-Directed teaching practices*, based on the scores for Child-Centered and reversed Teacher-Directed teaching practices, was calculated (see also Perry, Donohue, & Weinstein, 2007). In classrooms scoring high on this global scale, the teaching practices were predominantly child-centered, while teaching practices were predominantly teacher-directed in classrooms scoring low on this scale. Table 3 shows the Cronbach's alpha reliabilities for the *subscales*, *overall scales* and the *composite scale* of the ECCOM.

2.3.3. Mothers' level of education

To account for the mothers' level of vocational education, they were asked to report their education on a 7-point scale (1 = *no occupational education*, 2 = *vocational courses*, 3 = *vocational school degree*, 4 = *vocational college degree*, 5 = *polytechnic degree or bachelor's degree*, 6 = *university degree*, 7 = *licentiate or doctoral degree*). The scale was reduced before analysis from 7 points down to 4 points as follows: 1 = *no occupational education or only short courses*, 2 = *vocational college degree*, 3 = *polytechnic or bachelor's degree* (*BA*), 4 = *university degree* (*MA*) *or licentiate or doctoral degree*. The resulting data showed that 23% of the children's mothers had a master's degree or higher, 36% a polytechnic or bachelor's degree, 32% a vocational college degree, and 9% had no education beyond 9 years comprehensive school.

2.4. Analytical strategy

The aim of the present study was to examine the extent to which kindergarten classrooms differ in respect to children's interest in reading and mathematics, and the extent to which observed teaching practices predict these group differences in children's interests, after controlling for classroom differences in pre-skills in reading and math. *One-tailed significance testing* was used for the hypothesized associations at the *between-group* classroom level (see Section 1.3. *Aims and Hypotheses*, near the end of the present study's *Introduction*).

The Multilevel Modeling technique (Duncan et al., 1997; Heck & Thomas, 2009) is an ideal tool for pursuing these research aims for the following reasons. First, it enables the variance of the observed variables to be divided into two components: Variation that is due to entire kindergarten classrooms (*between-group variation*) and variation that is due to individual children within a kindergarten classroom (*within-group variation*). Second, multilevel modeling functions as a tool for predicting *between-level variation* (that is, *between-group variation*) in certain variables using *between-level predictors* (e.g., type of teaching practices), and for predicting *within-level variation* in certain variables using *within-level predictors* (e.g., child-related variables).

In the theoretical model for Reading (see Fig. 1a), classroom differences in Interest in Reading (i.e., random intercept) were predicted by teaching practices when having controlled for classroom differences in pre-skills in reading at the beginning of kindergarten (i.e., phoneme identification and letter knowledge) and for gender composition. In the theoretical model for Mathematics (see Fig. 1b), in turn, Interest in Math typical of the kindergarten classroom was predicted by teaching practices when having controlled for classroom differences in pre-skills in mathematics (i.e., number sequences) and for gender composition. At the individual level (*within-group variation*), Interest in Reading was predicted by phoneme identification, letter knowledge and gender, whereas Interest in Math was predicted by number sequences and gender.

The empirical analyses were carried out in the following steps. First, intraclass correlations were calculated for each interest with background variables measured at the individual level by using kindergarten groupings as clustering variables in order to determine what proportion of the total variance is due to specific kindergarten classrooms (see also Heck, 2001). Only those individual-level variables (*within-group variations*) in which classroom differences were statistically significant were included at the classroom level (analysis of *between-group variation*) in the further multilevel analyses. Second, separate multilevel models were explored in order to predict Interest in Reading and Interest in Math. Only statistically significant paths were included in the final models, so that only significant predictors would contribute to the explained variance.

The analyses were performed using the Mplus statistical package (version 5.0; Muthén & Muthén, 1998–2008). The standard Missing At Random (MAR) approach was applied (Muthén & Muthén, 1998–2008). The parameters of the models were estimated using the Full Information Maximum Likelihood (FIML) estimation with non-normality robust standard errors (MLR estimator;

Table 2
Correlations of items of Child-Centered and Teacher-Directed teaching practices (n = 49 teachers).

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1. Child responsibility (CC; MA)	1.00																							
2. Management (CC; MA)	.87[a]	1.00																						
3. Choice of activities (CC; MA)	.69[a]	.77[a]	1.00																					
4. Discipline strategies (CC; MA)	.74[a]	.83[a]	.63[a]	1.00																				
5. Communication skills (CC; CL)	.63[a]	.73[a]	.54[a]	.74[a]	1.00																			
6. Interpersonal skills (CC; CL)	.60[a]	.66[a]	.54[a]	.68[a]	.73[a]	1.00																		
7. Student engagement (CC; CL)	.58[a]	.74[a]	.59[a]	.66[a]	.67[a]	.70[a]	1.00																	
8. Individualization of learning Activities (CC; CL)	.70[a]	.73[a]	.73[a]	.67[a]	.63[a]	.50[a]	.64[a]	1.00																
9. Learning standards (CC; IN)	.70[a]	.75[a]	.71[a]	.69[a]	.52[a]	.59[a]	.70[a]	.71[a]	1.00															
10. Coherence of instructional activities (CC; IN)	.44[b]	.43[b]	.23	.43[b]	.33[c]	.26[d]	30[c]	.40[b]	.32[c]	1.00														
11. Teaching concepts (CC; IN)	.51[a]	.49[a]	.25[d]	.54[a]	.66[a]	.52[a]	.51[a]	.32[c]	.36[c]	.38[b]	1.00													
12. Instructional conversation (CC; IN)	.62[a]	.66[a]	.49[a]	.64[a]	.72[a]	.65[a]	.62[a]	.49[a]	.63[a]	.36[c]	.58[a]	1.00												
13. Child responsibility (TD; MA)	−.**87**[a]	−.81[a]	−.63[a]	−.65[a]	−.54[a]	−.50[a]	−.59[a]	−.58[a]	−.62[a]	−.40[b]	−.38[b]	−.55[a]	1.00											
14. Management (TD; MA)	−.73[a]	−.**75**[a]	−.54[a]	−.60[a]	−.55[a]	−.45[b]	−.58[a]	−.54[a]	−.57[a]	−.35[c]	−.42[b]	−.51[a]	.82[a]	1.00										
15. Choice of activities (TD; MA)	−.69[a]	−.71[a]	−.**86**[a]	−.60[a]	−.54[a]	−.53[a]	−.56[a]	−.64[a]	−.69[a]	−.18	−.29[c]	−.57[a]	.65[a]	.59[a]	1.00									
16. Discipline strategies (TD; MA)	−.65[c]	−.66[a]	−.49[a]	−.**75**[a]	−.63[a]	−.45[b]	−.54[a]	−.60[a]	−.51[a]	−.41[b]	−.52[a]	−.50[a]	.67[a]	.69[a]	.45[a]	1.00								
17. Communication skills (TD; CL)	−.65[a]	−.69[a]	−.53[a]	−.68[a]	−.**83**[c]	−.58[a]	−.61[a]	−.66[a]	−.52[a]	−.31[c]	−.52[a]	−.74[c]	.65[a]	.66[a]	.59[a]	.66[a]	1.00							
18. Interpersonal skills (TD; CL)	−.65[a]	−.74[a]	−.63[a]	−.72[a]	−.77[a]	−.**65**[a]	−.68[a]	−.70[a]	−.53[a]	−.21	−.38[b]	−.64[a]	.66[a]	.61[a]	.63[a]	.67[a]	.79[a]	1.00						
19. Student engagement (TD; CL)	−.67[a]	−.72[a]	−.49[a]	−.64[a]	−.69[c]	−.59[a]	−.**79**[a]	−.64[a]	−.61[a]	−.28[d]	−.55[a]	−.52[c]	.69[a]	.71[a]	.57[a]	.68[a]	.69[a]	.73[a]	1.00					
20. Individualization of learning activities (TD; CL)	−.62[a]	−.67[a]	−.59[a]	−.65[a]	−.59[c]	−.35[c]	−.52[a]	−.**78**[a]	−.51[a]	−.31[c]	−.28[d]	−.44[b]	.65[a]	.66[a]	.62[a]	.68[a]	.76[a]	.72[a]	.69[a]	1.00				
21. Learning standards (TD; IN)	−.73[a]	−.79[a]	−.74[a]	−.72[a]	−.58[a]	−.52[a]	−.65[a]	−.73[a]	−.**76**[a]	−.34[c]	−.33[c]	−.54[a]	.78[a]	.74[a]	.73[a]	.63[a]	.63[a]	.68[a]	.74[a]	.81[a]	1.00			
22. Coherence of instructional activities (TD; IN)	−.50[a]	−.52[a]	−.25[d]	−.53[a]	−.46[b]	−.29[c]	−.39[b]	−.40[b]	−.31[c]	−.**82**[a]	−.49[a]	−.36[c]	.50[a]	.46[a]	.30[c]	.44[b]	.44[b]	.36[c]	.44[b]	.49[a]	.53[a]	1.00		
23. Teaching concepts (TD; IN)	−.56[a]	−.59[a]	−.37[b]	−.56[a]	−.59[a]	−.42[b]	−.59[a]	−.46[b]	−.47[b]	−.37[b]	−.**73**[a]	−.51[a]	.56[a]	.60[a]	.48[b]	.59[a]	.55[a]	.43[b]	.64[a]	.51[a]	.57[a]	.55[a]	1.00	
24. Instructional conversation (TD; IN)	−.62[a]	−.72[a]	−.53[a]	−.70[a]	−.82[a]	−.65[a]	−.61[a]	−.61[a]	−.61[a]	−.26[d]	−.46[b]	−.**75**[a]	.63[a]	.67[a]	.67[a]	.58[a]	.83[a]	.73[a]	.70[a]	.65[a]	.70[a]	.39[b]	.56	1.00
Mean	2.92	2.98	2.78	3.37	3.06	2.45	3.27	2.49	2.88	2.90	2.79	2.54	2.73	2.08	2.88	1.76	2.08	2.06	2.08	2.63	2.35	2.24	2.20	2.53
Standard deviation (SD)	1.12	1.28	1.23	1.25	1.14	1.12	1.10	1.18	1.12	1.12	1.10	1.20	1.13	1.22	1.27	1.05	1.02	0.78	1.08	1.30	1.28	1.07	1.14	1.08

Notes: CC, child-centered dimension; TD, teacher-directed dimension; MA, management subscale; CL, climate subscale; IN, instruction. subscale. Bold highlights represent correlations of an item for both Child-Centered and Teacher-Directed dimensions.

[a] $p < .001$.
[b] $p < .01$.
[c] $p < .05$.
[d] $p < .10$.

Table 3
Cronbach's alpha reliabilities for scales and subscales of the ECCOM (n = 49 teachers).

Variable	Reliability
Subscales of child-centered teaching practices	
Management (4 items)	.92
Climate (4 items)	.88
Instruction (4 items)	.76
Subscales of teacher-directed teaching practices	
Management (4 items)	.87
Climate (4 items)	.91
Instruction (4 items)	.83
Overall scale of child-centered teaching practices (12 items)	.94
Overall scale of teacher-directed teaching practices (12 items)	.95
Composite scale of child-centered teaching practices (i.e., Child-centered and reversed teacher-directed teaching practices)	.95

Muthén & Muthén, 1998–2008). MLR estimation was chosen because the distributions of the variables of the study were not typical throughout (see also the *skewness* and *kurtosis* values presented in the description of the measures). The *goodness-of-fit* of the estimated models were evaluated by four indicators: χ^2-test, Comparative Fit Index (*CFI*), Root Mean Square Error of Approximation (*RMSEA*), and Standardized Root Mean Square Residual (*SRMR*). The goodness-of-fit of the estimated models was evaluated using the following three indices for measuring *absolute goodness-of-fit*: (a) The chi-square test, (b) the Root Mean Square Error of Approximation (RMSEA), and (c) the Standardized Root Mean Square Residual (SRMR), as described by Browne and Cudeck (1993), and Hu and Bentler (1999).

3. Results

3.1. Intraclass correlations

First, to examine classroom differences in interest in reading and math, *intraclass correlations* and *variance estimates* at the *between-* and *within-group levels* were calculated by using kindergarten classrooms as clustering variables (see Table 4). The results for Interest in Reading and for Interest in Math showed that the *between-group variation* of the classrooms was statistically significant: The findings for Interest in Reading showed that 12% of the total variation was due to differences between kindergarten classrooms, and for Interest in Math this difference was only 4%. For the two background factors, i.e., *pre-skills* and *gender* (see Table 4), the intraclass correlations were not statistically significant. Consequently, these variables were treated only as individual level (*within-group*) variables in the further analyses, whereas the *interest* variables were included in subsequent analyses at both levels.

3.2. The Influence of teaching practices on children's interests

3.2.1. Interest in reading

Our next aim was to investigate whether the observed teaching practices would predict classroom differences in interest in reading, after controlling for classroom differences in pre-reading skills (i.e., phonemic identification, letter knowledge) and gender. At the classroom level (*between-group* comparison), we analyzed the relation of interest in reading to child-centered versus teacher-directed teaching practices, whereas at the individual level (*within-group* comparison), we analyzed the relation of interest in reading to gender and pre-skills in phonemic identification, and letter knowledge.

The *predictor* variables were allowed to correlate with each other. The final model included only statistically significant paths ($\chi^2(2, N_{within} = 515, \text{ and } N_{between} = 49) = 9.24$, $p = 0.01$; $CFI = 0.97$; $RMSEA = 0.08$; $SRMR_{between} = 0.001$, $SRMR_{within} = 0.02$). This model is presented in Fig. 2 (see classroom level, i.e. *between-group level*, shown above the dashed line, and individual level, i.e. *within-group level*, below the dashed line).

The results (Fig. 2) at the classroom level showed that child-centered teaching practices positively predicted interest in reading: The more child-centered and the less teacher-directed the observed teaching practices were (i.e., predominantly child-centered practices), the higher the reading motivation was among children in the particular classroom. The results at the classroom level remained the same when controlled for parents' educational

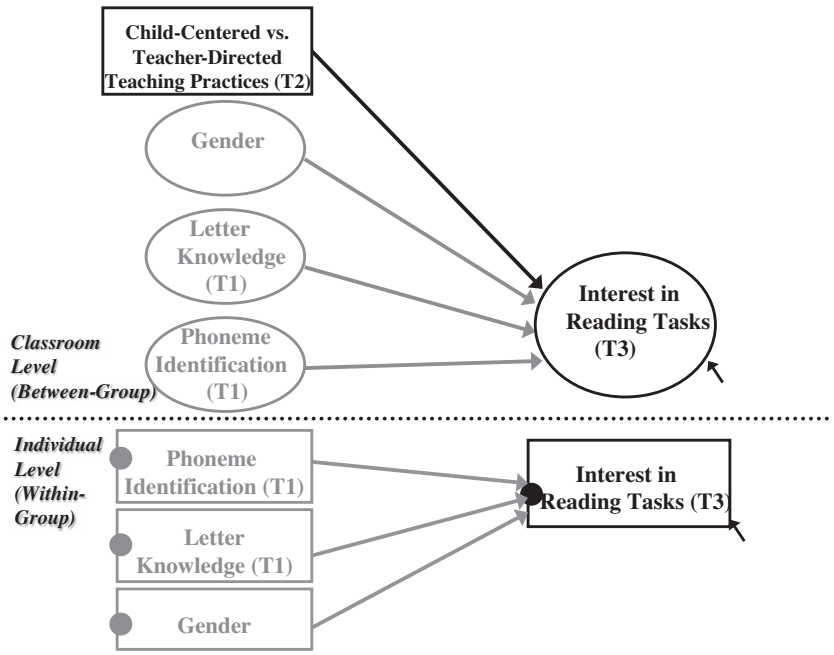

Fig. 1a. Theoretical multilevel model for kindergarten children's interest in reading.

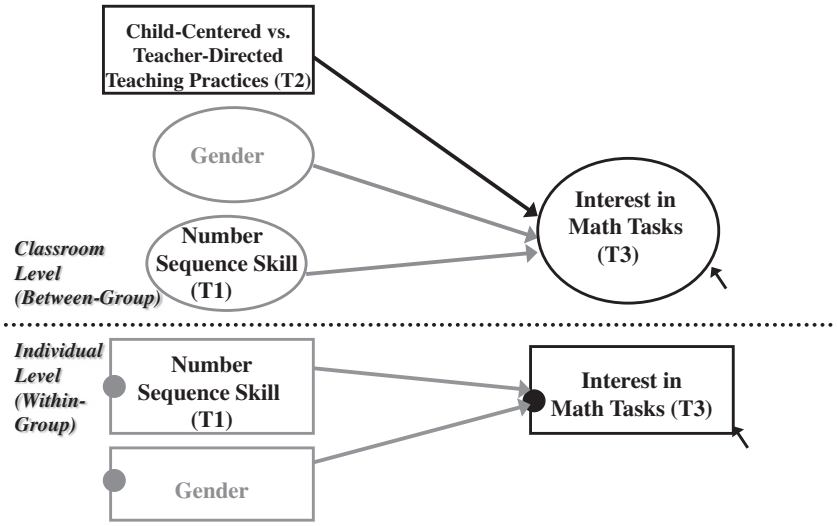

Fig. 1b. Theoretical multilevel model for kindergarten children's interest in mathematics.

Table 4
Intraclass correlations (ICC), and kindergarten classroom level (between-group level) and individual level (within-group level) variance estimates (standard errors in parentheses) using teacher identification (ID) as a clustering variable ($N_{between}$ = 49, N_{within} = 498–515).

Variables	ICC	Between-group variance (standard error)	Within-group variance (standard error)
Interest variables			
Interest in reading (T3)	.12***	0.14 (0.03)***	1.05 (0.10)***
Interest in math (T3)	.04*	0.06 (0.03)*	1.27 (0.09)***
Pre-skill variables			
Phoneme identification (T1)	.05	0.27 (0.17)	5.33 (0.39)***
Letter knowledge (T1)	.003	0.20 (1.80)	77.28 (3.31)***
Number sequences (T1)	.05	0.44 (0.30)	7.62 (0.44)***
Gender	.02	0.004 (0.005)	0.25 (0.005)***

* $p < .05$.
*** $p < .001$.

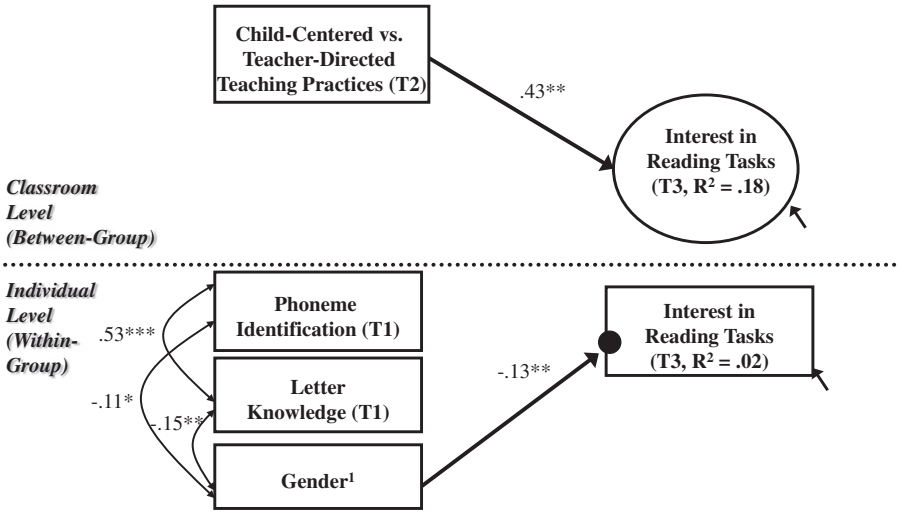

Fig. 2. Multilevel model for kindergarten children's interest in reading. The paths and associations between variables are presented as *standardized estimates*, $N_{between}$ = 49, N_{within} = 515. *Note 1:* * $p < .05$; ** $p < .01$; *** $p < .001$. *Note 2:* [1]1 = girl, 2 = boy.

level. At the individual level, the results (Fig. 2) showed that gender predicted interest in reading: Girls were more motivated than boys in reading. Gender also correlated with reading pre-skills: Girls showed both better phonemic awareness and better letter knowledge than boys. The results at the individual level remained the same when controlled for parents' education.

3.2.2. Interest in mathematics

Further, we investigated whether the observed teaching practices would predict classroom differences in interest in math, after controlling for classroom differences in math pre-skills (i.e., number sequences) and gender. At the classroom level, we analyzed the relation of interest in math to child-centered versus teacher-directed

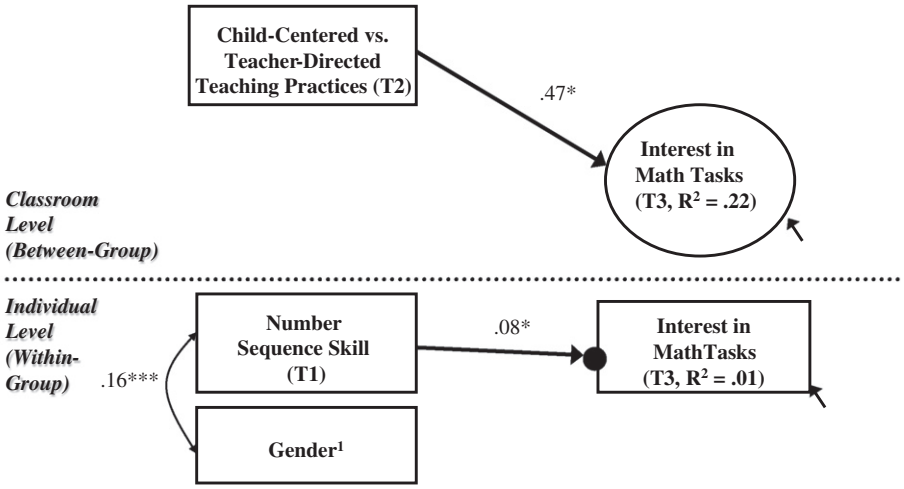

Fig. 3. Multilevel model for kindergarten children's interest in math. The paths and associations between variables are presented as *standardized estimates*, $N_{between} = 49$, $N_{within} = 515$. *Note 1:* * $p < .05$; ** $p < .01$; *** $p < .001$. *Note 2.* [1]1 = girl, 2 = boy.

teaching practices, whereas at the individual level, we analyzed the relation of interest in math to gender and pre-skills in number sequences. The *predictors* were allowed to correlate with each other. The final model included only statistically significant paths ($\chi^2(6, N_{within} = 515$, and $N_{between} = 49) = 3.05$, $p = 0.08$; $CFI = 0.93$; $RMSEA = 0.06$; $SRMR_{between} = 0.002$, $SRMR_{within} = 0.02$). This model is presented in Fig. 3 (as in Fig. 2, see classroom level, i.e. *between-group level*, shown above the dashed line, and individual level, i.e. *within-group level*, below the dashed line).

The results (Fig. 3) showed that the observed child-centered teaching practices positively predicted classroom differences in interest in math: The more child-centered and the less teacher-directed the observed teaching practices were (i.e., predominantly child-centered practices), the higher was the interest in math among children in the particular classroom. The results at the classroom level remained the same when controlled for parents' education. The results (Fig. 3) at the individual level also showed that pre-skills in number sequences positively predicted the level of children's interest in math: The better the child's pre-skills in number sequences, the higher their interest in math. Boys performed better than girls in tasks involving number sequences. The results at the individual level remained the same when controlled for parents' education.

Table 5
Classroom-level (between-group level) correlations of dimensions (i.e., teaching practices) and subscales of the ECCOM with interest in reading and math in the spring term of the kindergarten year (T2, $N_{between} = 49$, $N_{within} = 515$).

Variables	Interest in reading (T3)	Interest in math (T3)
Composite child-centered teaching practices (T2)	.45***	.42*
Child-centered teaching practices (T2)	.44**	.50**
Management (child-centered, T2)	.32*	.34
Climate (child-centered, T2)	.51***	.60**
Instruction (child-centered, T2)	.42**	.44**
Teacher-directed teaching practices (T2)	−.45***	−.31
Management (teacher-directed, T2)	−.34**	−.25
Climate (teacher-directed, T2)	−.42**	−.31
Instruction (teacher-directed, T2)	−.50***	−.37

* $p < .05$.
** $p < .01$.
*** $p < .001$.

3.3. Subcomponents of teaching practices and children's interest in reading and math

As our main analyses of the impact of teaching practices were conducted by using the overall scale for child-centered versus teacher-directed teaching practices, we also calculated the correlations between the subcomponents (Management, Climate, and Instruction) of teaching practices and children's interest in reading and math at the *between-group level* (see Table 5). The results showed that teaching practices that were predominantly *child-centred* were positively associated with interest in both reading and in math, whereas teaching practices that were predominantly *teacher-directed* were negatively associated with interest in reading and math. Moreover, the components of Climate and Instruction relating to child-centered teaching practices showed the highest positive correlation with the children's *interest*. The associations between the observed teaching practices and interest were somewhat stronger in reading than in math.

4. Discussion

Although the role of teachers and their teaching practices in children's motivation has gained increasing attention in recent years, only few studies have focused on young children's interests in reading and mathematics while using actual classroom observations for such analyses. Hence, the present study examined the extent to which teaching practices observed in kindergarten classrooms contributed to children's subsequent interest in reading and mathematics. The results showed that teaching practices make a difference in the early part of children's school careers: In the kindergarten classrooms in which teachers predominantly applied child-centered teaching practices, the children showed more interest in reading and in math than in classrooms with predominantly teacher-directed teaching practices.

As expected (Hypothesis 1), the results of the present study showed that children in different kindergarten classrooms differed in their interest in academic subjects, particularly in Reading. Moreover, the more child-centered practices and the less teacher-directed practices a teacher used in a particular kindergarten classroom, the more interest in reading was shown by the children. This result is in accordance with Hypothesis 2, and suggests that child-centered practices promote the positive development of children's interest in this central academic domain of early education, that is, Reading. The results for the Mathematics domain were similar,

although the differences between classrooms regarding the children's *interest* were smaller in math than in reading. The more child-centered teaching practices and the less teacher-directed practices a teacher applied in a kindergarten classroom, the more interest in mathematics was shown by the children in that classroom. It is important to note that the entry levels (i.e., children's pre-skills) in reading and mathematics were controlled for in the respective analyses to ensure that the results were not due to the selection of differently skilled children in the different kindergarten classrooms.

The debate of the effects of different instructional approaches has been ongoing for many decades. On the one hand, there are *constructivist* theories according to which children must construct essential information for themselves with a minimum of *didactic* instruction from the teacher. On the other hand, there are those theories that emphasize that novice learners need direct instructions on basic concepts and should not be left to have to discover those procedures by themselves (see Kirschner, Sweller, & Clark, 2006). Although a lesser number of previous studies have investigated the impact of observed teaching practices on kindergarten children's interest in reading and mathematics, our findings are in line with the results proclaimed by such related studies. For example, Stipek et al. (1995) found that, although children in didactic pre-kindergarten programs with emphasis on instructions in basic skills had significantly higher scores on letter and reading tests, children's *motivation* was revealed to be much lower compared to children in child-centered programs. If a teacher allowed children a lot of freedom to choose tasks and complete them without the pressure of getting the right answer, the effect was that children selected more challenging tasks, were less dependent on the teacher, and showed more pride in their performance (Stipek et al., 1995). The results of the present study, as those noted by Stipek et al., are in accordance with motivation theories which emphasize the importance of providing individual choices and creating opportunities for feeling competent (Deci & Ryan, 1985).

Further consideration has also been given to the *combination* of Child-Centered and Teacher-Directed teaching practices. A few years ago, Graue, Clements, Reynolds, and Niles (2004) found that preschool programs that were high in teacher-directed instruction in specific content areas, while being high in child-centered instruction in other areas of teaching, showed more positive short- and long-term academic and social outcomes in children's development than did practices that emphasized one approach over the other, or that emphasized neither of these two methods. An observation study by Connor et al. (2005) supports this view, showing that children whose teachers were "warmer" and more responsive in their teaching approach (as in child-centered practices), while also spending more time on academic activities (as in teacher-directed practices), demonstrated stronger vocabulary and basic reading skills at the end of the 1st grade. Therefore, the teacher's management of the right mix of instructional features for advancing both children's *academic skills* and *motivation* is essential, as some approaches seem to be more suitable than others for achieving various goals.

Overall, the findings of the present study add to previous research by suggesting that an emphasis on child-centered teaching practices plays an important role in the development of children's academic interests in key academic subjects from the very onset of their educational career in kindergarten. In child-centered classrooms, teachers support and facilitate children's learning by providing them with both guidance and opportunities to direct their own exploration of academic topics (see Bredekamp & Copple, 1997). Therefore, child-centered practices are characterized by shared responsibility for learning between the teacher and his/her young students, as well as teachers' active and sensitive "scaffolding" (Stipek & Byler, 2004). Conversely, our results suggest that teachers' emphasis on teacher-directed practices have detrimental effects on children's motivation in kindergarten classrooms. In teacher-directed classrooms, teachers focus on providing information, employ structured group lessons, teach discrete skills, and use praise when predetermined goals are attained. In this approach, the practice of basic academic skills through direct drill-and-practice instruction is given more emphasis, whereas only little attention is given to the children's motivation and autonomy (Stipek & Byler, 2004; Stipek et al., 1995).

The ECCOM is designed to assess two types of classroom practices, that is, the use of child-centered practices and teacher-directed practices (Stipek & Byler, 2004). Moreover, these two types of classroom practices were originally assumed to consist of three subscales (Instruction, Management, and Climate). Previous research has shown, however, that the two types of classroom practices, i.e., the Child-Centered score and the Teacher-Directed score, functions as two separate scores (see Hauser-Cram et al., 2003; Stipek, 2004), because the ratings of items forming the three subscales typically correlate highly (also Perry et al., 2007). For example, a previous validation study of ECCOM by Lerkkanen et al. (2012) showed that one-factor solution (separately for Child-Centered practice and Teacher-Directed practice) provided a better fit than the three-factor solution for both scales. These results demonstrate that if teaching practices are highly Child-Centered in one subscale (e.g. Climate) they are likely to be Child-Centered in the other subscales (e.g., Instruction and Management) too. The present study add to previous findings by showing further that also the scores for Child-Centered practices and Teacher-Directed practices correlated so highly that only methodologically sound solution was to calculate a summary score for Child-Centered practices versus Teacher-Directed practices (reversed). For future use of the ECCOM scale, the results of the present study suggest that researchers should use the summary score for Child-Centered practices versus Teacher-Directed practices, because it is only psychometrically sound solution. This decrease, of course, the richness of the information of the ECCOM measure, but also provides more reliable measure of teaching practices.

It has been also suggested recently (Stipek et al., 1995) that it is essential to find a balance between constructivist, child-centered practice and didactic, teacher-directed practice to affect positively both children's learning and motivation. In such balanced practice teachers use, at a same time, active constructive instruction and scaffolding of children's basic skills without engaging children too much in repetitious basic skills tasks. However, our results showed that the child-centered practices and teacher-directed practices correlated so highly that only methodologically sound solution is to calculate a summary score for Child-Centered practices versus Teacher-Directed practices. If the researchers of classroom interaction are interested in investigating the importance of the balance between these two teaching practices for students' learning and motivation, the best empirical strategy for it is an examination of the nonlinear associations between combined Child-Centered and Teacher-Directed practices variable and some outcome measures. In this case, scores that are close to mean in this summary score represent moderate levels of both Child-Centered and Teacher-Directed teaching practices. However, given a high correlation between Child-Centered and Teacher-Directed practices, there will be very few teachers who show high scores simultaneously in both teaching practice.

Our study also showed that the children in the various classrooms differed in respect to their phonemic awareness and number sequence skills, although the classroom differences were small in this regard compared to those concerning the children's interest in the overall content of the observed academic subjects (Reading and Mathematics). This result is likely to be due to different children attending different kindergarten classrooms on the

basis of their kindergarten catchment area, along with many other demographic factors.

The results of the present study at the level of individual children (*within-group level*) indicated that, after controlling for classroom differences in interest in reading, girls showed more interest than boys in reading at the beginning of kindergarten. Moreover, the results showed that the more knowledge of number sequences the children showed at the beginning of kindergarten, the more interest in mathematics they displayed later on. These results resemble some earlier results in the context of kindergarten (Viljaranta et al., 2009) and elementary school (Aunola et al., 2006). For example, the factor of children's previous level of academic performance has been found to be an important antecedent of students' task-focused behavior (Aunola et al., 2006; Onatsu-Arvilommi & Nurmi, 2000). Moreover, the result that girls were more interested than boys in reading is in accordance with many previous studies suggesting that literacy motivation is higher among girls than boys (Eccles et al., 1993; Jacobs et al., 2002; Viljaranta et al., 2009; Wigfield et al., 1997). However, no gender differences were found in regard to math-related interests among younger children, which is in accordance with findings of previous studies suggesting the same result (Jacobs et al., 2002; Viljaranta et al., 2009; Wigfield et al., 1997).

The present study has at least five limitations that need to be considered in any attempt to generalize the findings. First, although we interpreted the results as showing that teaching practices contribute to children's interest in reading and math, our study did not have a cross-lagged longitudinal design. Consequently, it is also possible that children's interest had an impact on their teachers' instruction and classroom practices (Nurmi, in press). Second, the number of kindergarten teachers observed in our study was relatively small, which is likely to have diminished the power of our statistical testing. Consequently, a large sample would be useful due to this limitation. Third, only two observations of each teacher were conducted within a week, and the ECCOM observation scores were aggregated across those two observation days; meaning, the present study did not examine the intra-individual variation of teaching practices among teachers. Furthermore, in other typical observational studies using the ECCOM, the teacher has been observed on only 1 day (see Stipek & Byler, 2004). In consideration of this, it would seem likely and beneficial that conducting such observations throughout the period of at least one whole year would render a more accurate picture of each teacher's teaching practices.

Fourth, it might be claimed that the ECCOM measure is biased towards the view that only child-centered practices are more beneficial for children than other practices. One reason for this is that, in the scoring of the ECCOM, child-centered classrooms tend to be operationalized on the assumption that a positive emotional climate prevails, while teacher-directed classrooms tend to be operationalized on the assumption that a less positive emotional climate prevails. Nonetheless, Stipek (Stipek et al., 1995) noted that, although child-centered practices tend to lead to a higher level of motivation among children, teacher-directed practices might contribute positively to children's skill development (see also, Connor et al., 2005; Graue et al., 2004). Finally, the present study was carried out in educational settings within a single country, Finland. The educational system in Finland differs from that of many other countries. For example, Finnish children experience their first educational transitions, kindergarten and 1st grade, a year or two later (kindergarten entry at the age of 6 years, and commencement of the 1st school grade at 7 years of age) than is the practice in many other countries. Hence, due to such international differences concerning educational foundations, our results cannot be realistically generalized across the globe.

Overall, the results of the present study add to previous research by showing that teaching practices already in kindergarten make a difference in the development of children's academic interests. In the classrooms in which teachers predominantly apply child-centered teaching practices, the children show more interest in reading and in math than in classrooms with predominantly teacher-directed teaching practices.

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