Soc Psychol Educ (2012) 15:181–206
DOI 10.1007/s11218-011-9171-1

Cross-lagged relations between kindergarten teachers' causal attributions, and children's interest value and performance in mathematics

Katja Upadyaya · Jaana Viljaranta · Marja-Kristiina Lerkkanen · Anna-Maija Poikkeus · Jari-Erik Nurmi

Received: 2 November 2009 / Accepted: 20 September 2011 / Published online: 26 October 2011

Abstract The present study investigated mathematics performance and related interest value as the antecedents and consequences of teachers' causal attributions concerning children's academic outcomes during their kindergarten year. Sixty-nine children (5–6 years old at the baseline) and their teachers were examined twice during the kindergarten year. Children were tested in mathematics performance and interviewed about their interest value. Teachers rated their causal attributions in the fall and spring. The results showed that the higher the interest value in mathematics children showed, the more the teacher attributed their success to ability and effort. Teachers' ability attributions for success, in turn, contributed to an increase in children's interest value in mathematics. Moreover, attributing children's success and failure to external causes decreased children's mathematics-related interest value.

Keywords Teachers' causal attributions · Intrinsic motivation · Interest value · Mathematics performance · Kindergarten

The study was undertaken within the projects Learning and Motivation (Finnish Center of Excellence Programme Nr. 213486 for 2006–2011) and Developmental Dynamics of Literacy Skills (Nr. 213353 for 2005–2008) financed by the Academy of Finland, and supported by a fund from the Finnish Cultural Foundation and Academy of Finland (Nr. 126971).

K. Upadyaya (✉)
Institute for Social Research (Room 5112), University of Michigan, 426 Thompson Street, P.O. Box 1248, Ann Arbor, MI 48106, USA
e-mail: kmarian@umich.edu

J. Viljaranta · J.-E. Nurmi
Department of Psychology, University of Jyväskylä, P.O. Box 35, 40014 Jyväskylä, Finland

M.-K. Lerkkanen · A.-M. Poikkeus
Department of Teacher Education, University of Jyväskylä, P.O. Box 35, 40014 Jyväskylä, Finland

1 Introduction

Teachers begin to seek possible causes for their pupils' academic successes and failures early on during children's school career (Clark and Artiles 2000). Such causal attributions may influence children's subsequent academic self-perceptions, motivation and performance (Clark 1997; Graham 1984, 1990; Jussim 1989; Jussim and Eccles 1992), all of which are particularly sensitive to environmental changes during the early school career (Jacobs et al. 2002). According to the expectancy-value model of motivation (Eccles et al. 1983; Wigfield and Eccles 2000), teachers are significant socializers whose perceptions may impact children's competence beliefs and interests (Eccles et al. 1983). However, only few studies have investigated the possible relationships between teachers' causal attributions and children's academic motivation and performance (Holloway and Hess 1985; Jussim 1989; Jussim and Eccles 1992; Smith et al. 1998) and the cross-lagged relations between them (Natale et al. 2009). Consequently, the present study sought to clarify the extent to which children's interest value and performance in mathematics explain teachers' causal attributions for children's success and failure, and the extent to which teachers' causal attributions explain children's subsequent mathematics interest value and performance.

2 Children's interest value

Previous research indicates that children's motivation plays an important role in learning at school. According to Eccles and Wigfield (1995, see also Wigfield and Eccles 2000), motivation can be divided into (1) ability beliefs and expectancies and (2) subjective task values. The majority of the research has so far focused on the expectancy aspects of motivation. The results of this research have suggested that a motivated student who believes in his or her abilities is likely to attend to the task and show high levels of effort and persistence, even when the task is a challenging one (for a review, see Murphy and Alexander 2000; Vallerand and Losier 1999). By contrast, a student with low ability beliefs is likely to be evidenced in lower levels of effort and persistence.

However, little is known about the value aspect of motivation. Even if children's beliefs in their abilities in a specific task are high, they may not involve themselves in that task if they do not value it (Ryan and Deci 2000). Eccles et al. (1983) described this value aspect as *intrinsic or interest value* which refers to the inherent, immediate enjoyment one gets from engaging in an activity. This concept resembles others used in the field that refers to being motivated towards a particular task for its own sake, like intrinsic motivation (Deci et al. 1991; Gottfried 1985, 1990; Harter 1981) and interest (Schiefele 1996). The few studies that have examined motivation and interest have shown that among younger children, interest value is the most important determinant of their subjective task choices and academic activities (Wigfield and Eccles 1992; Eccles et al. 1983; Wigfield and Eccles 2000). Consequently, in the present study, we use the concept interest value (Eccles et al. 1983) to refer to how much a child enjoys or likes a specific school subject.

3 Interest value and mathematics performance

Learning mathematics is perceived to be more difficult and demanding than many other school subjects (see also Stodolsky et al. 1991) and it therefore, requires a high degree of intrinsic motivation (Gottfried 1990). The first school years are particularly important for the development of pupils' interest in different school subjects (Nurmi and Aunola 2005; Viljaranta et al. 2009) and kindergarten is where the first academic learning experiences occur. Previous research has shown that high interest towards mathematics is associated with high mathematics performance both in kindergarten (Viljaranta et al. 2009) and during the first 2 years of primary school (Aunola et al. 2006). Moreover, interest value begins to develop and become more stable during the beginning of the school career (Gottfried 1990; Gottfried et al. 2001; Wigfield et al. 1997). As few studies have examined interest values before formal education begins, the present study investigated interest values of kindergarten children.

4 Teachers' causal attributions and children's performance and interest value in mathematics

Following Weiner's (1985, 1986) attributional theory of achievement motivation, research has shown that the most common causes to which teachers typically attribute children's academic success and failure are ability, effort, task difficulty, and help from teachers or parents (Burger et al. 1982; Clark and Artiles 2000; Fennema et al. 1990; Georgiou et al. 2002; Hall et al. 1989; Holloway and Hess 1985; Natale et al. 2009). Teachers start seeking for possible causes of children's achievement early on during the children's school career (Clark and Artiles 2000). For example, at the beginning of children's school career, teachers typically emphasize the importance of effort for success more than the role of ability (Rosenholtz and Simpson 1984). Teachers' causal attributions concerning their pupils' academic outcomes may also have consequences on children's self-concept and motivation (Madon et al. 2001; Natale et al. 2009; Rosenholtz and Simpson 1984; Tiedemann 2000). Similarly, it has been found that teachers' expectations concerning students' achievement predict students' achievement at school (Jussim and Harber 2005; Madon et al. 1997).

The literature regarding teachers' causal attributions has mostly concentrated on investigating the associations between teachers' causal attributions and their emotional responses to children (Butler 1994; Clark and Artiles 2000; Georgiou et al. 2002; Graham 1984, 1990; Hall et al. 1989). These studies have shown, for example, that when teachers' attribute children's failure to lack of ability, they often experience feelings of pity towards the failing student, which the latter often takes as a sign that he or she lacks ability (Graham 1984, 1990). Teachers' attributions to lack of effort, in turn, often lead to blame, which children easily infer as a sign of lack of effort (Graham 1984, 1990).

Previous research has also shown that when children's academic performance is high, teachers tend to attribute their success to their abilities and avoid attributing their success to external causes such as help from their teacher (Cooper and Burger 1980; Holloway and Hess 1985; Hughes et al. 2005; Natale et al. 2009). In addition,

when children's performance is high, teachers tend to attribute children's failure to lack of effort (Cooper and Burger 1980). However, it is possible that children's interest towards the task impacts their teachers' causal attributions. Consequently, the present study investigated whether children's interest value and performance in mathematics would contribute to teachers' causal attributions concerning children's success and failure, or rather whether kindergarten teachers' causal attributions would contribute to children's subsequent interest value and performance in mathematics.

Some studies have found that boys' success in mathematics is usually attributed to ability and girls' success in mathematics is attributed to effort (Fennema et al. 1990). Teachers also perceive girls as working harder and producing higher quality work than boys (Siegle and Reis 1998). However, not all studies have found gender differences in teachers' causal attributions (Holloway and Hess 1985). Consequently, the present study also investigated the impact of children's gender on teachers' causal attributions.

5 Aims

The present study examined the following research questions:

(1) Do children's mathematics-related interest value and performance in kindergarten explain their teachers' causal attributions concerning their academic success and failure?
(2) Do kindergarten teachers' causal attributions concerning children's academic success and failure explain children's mathematics-related interest value and performance?
(3) Do teachers' causal attributions concerning children's academic performance vary with respect to the child's gender?

6 Methods

6.1 Participants and procedure

The present study is part of The First Steps Pilot Study (Lerkkanen and Poikkeus 2005) in which a total of 69 children (36 girls, 33 boys) and their kindergarten teachers ($N = 16$, 15 females, and one male) participated. Parents' consent concerning their child's participation was requested from 157 children, of whom the parents of 139 children gave their consent. Each teacher rated three to eight children from their classroom rendering a final sample of 69. The children ranged in age from five to six years old at the baseline. Children and their teachers were sampled from 13 kindergartens situated in a semi-rural commune in Central Finland. Six of the kindergartens were situated in day care centres and seven of them were situated in primary schools. Teaching methods and curricula do not typically show substantial variation across Finnish kindergarten classrooms. The sample was homogeneous in terms of ethnicity and cultural background, as all the participants of the study were native Finns.

Information about the children's interest value and performance in mathematics was gathered twice: at the beginning (Time 1) and at the end (Time 4) of their kindergarten year, October 2005 and April 2006, respectively. At both times, the children

were tested on their mathematics performance and interviewed on their mathematics-related interest value. All mathematics tests were carried out by the child's teacher in their classrooms. The teachers were trained to use the tests according to detailed instructions and were blind to the research questions. In Finland, any classroom tests for kindergarten children do not exist, thus special tests needed to be used in mathematics performance for research purposes. The structured interviews were individually conducted by investigators with each child in a private classroom setting. Teachers were asked for their causal attributions by a posted questionnaire on two occasions, in November 2005 (Time 2), and in March 2006 (Time 3).

6.2 Measurements

6.2.1 Children's measures

6.2.1.1 Mathematics performance Children's basic mathematics skills were measured twice (Times 1 and 4) by two different subtests.

(1) *Number sequences.* Knowledge of number sequences was assessed with four tasks in which children were asked to count aloud forward and backwards as far as they could. Counting forward was stopped when children reached the number 31. Counting backward began from the number 12 and was stopped after 5 numbers were counted. If the children correctly completed this task, they were then asked to count backward from the number 23, and again were stopped after 5 numbers. Finally, children were asked to count even numbers (2, 4, 6,…) and were stopped when they reached the number 16. Scoring was based on the number of correct answers (maximum 2 points for each task), and the total maximum score for the test was 8.

(2) *Basic arithmetic.* Knowledge of basic arithmetic was assessed by visual addition tasks from the BANUCA test battery (Räsänen 2005). The test was group-administrated by the children's teacher and given as a calculus on a paper sheet. The children were given 4 min to answer 8 addition tasks (e.g. $2 + 3 = ?$; $9 + 7 = ?$). Scoring was calculated by the number of correct items and the total maximum score for the test was 8.

A sum score for mathematics performance was calculated by summing the standardized scores of the two tests. The internal consistency coefficient (Cronbach's alpha) for the standardized sum score was .71 for Time 1 and .73 for Time 4.

6.2.1.2 Interest value in mathematics Children's mathematics-related interest value was assessed twice (Times 1 and 4) in an interview using the Task Value Scale for Children (TVS-C; Appendix A; Nurmi and Aunola 1999; see also Aunola et al. 2006; Nurmi and Aunola 2005). This scale is based on the ideas presented by Eccles et al. (1983) concerning the value or interest that children show in relation to particular school subjects. The scale consisted of three items: *"How much do you like number and counting tasks?"*; "*How much do you like doing number and counting tasks at kindergarten?"*; and *"How much do you like doing number and counting tasks at home?"*. In the measurement procedure, the question was first read to the child. They were then shown a set of five faces drawn to depict an evaluative scale running from

very positive to very negative. The children were asked to point to the picture which best described their feelings toward mathematics related tasks (an unhappy face / 1 = *"I do not like them at all;"* a picture of a very happy face / 5 = *"I like them very much")*. A sum score for mathematics-related interest value was calculated as the mean of the three items. The Cronbach's alpha reliabilities at Times 1 and 4 were .63 and .68, respectively for mathematics-related interest value.

6.2.2 Teachers' measures

6.2.2.1 Teachers' causal attributions Teachers were asked twice during the children's kindergarten year (Times 2 and 3) for causal attributions concerning children's academic success and failure (Appendix B). At least three (3–8) children were randomly selected for each kindergarten teacher. The teachers were then asked to answer a set of questions concerning each target child. The questions focused on teachers' causal attributions for success (e.g. "*If the child does well at school, it is probably because,…*") and for failure ("*If the child does not do well in his/her school assignments, it is probably because,…*") of the target child. Teachers answered these questions by using a 5-point Likert scale (1 = *totally disagree*, and 5 = *totally agree*) to rate the importance of ability / lack of ability, effort / lack of effort, task easiness / difficulty, teachers' help / lack of help, and parents' help / lack of help in the target children's academic success / failure. During the fall term of the kindergarten year (Time 2), the questions for teachers' causal attributions were domain-specific (i.e. for mathematics and reading separately). However, as the correlations for teachers' domain-specific attributions were relatively high (varying from .79 to .95), a sum score describing teachers' causal attributions for children's overall success and failure in kindergarten was calculated for each causal attribution type across these two domains. Based on the high correlations at Time 2, during the spring term (Time 3) teachers were asked only for their causal attributions concerning the target children's overall success and failure of kindergarten tasks. The internal consistency coefficients (Cronbach's alpha) for teachers' causal attributions varied from .87 and .95 for success attributions and .91 and .98 for failure attributions.

6.3 Analysis strategy

All the analyses were carried out using the Mplus statistical package (Muthén and Muthén 1998–2007). The data analyses were started by calculating intraclass correlations (ICC) for teachers' causal attributions to find out what proportion of the variance in these variables was due to overall differences between teachers *(between-level variation)* and what proportion was due to the particular child *(within-level variation)*. As the teacher-report data had a hierarchical structure that could distort the results at the level of children, the research questions were analyzed by path modelling using the Complex-method (Muthén and Muthén 1998–2007) which estimates the model at the level of the whole sample but corrects the distortions in estimations caused by the clustering of observations (i.e., between-level variation). In addition, the missing data method enabled us to utilize all the observations in the data set (Muthén and Muthén

1998–2007). Because the distributions of the variables were skewed, the model parameters were estimated using the MLR estimator (Muthén and Muthén 1998–2007). MLR produces standard errors and a chi-square test statistic for missing data with nonnormal outcomes by means of a sandwich estimator (Muthén and Muthén 1998–2007). For all the models, goodness-of-fit was evaluated using five indicators: χ^2, Bentler (1990) comparative fit index (CFI), the Tucker-Lewis Index (TLI), Root Mean Square Error of Approximation (RMSEA), and the Standardized Root Mean Square Residual (SRMR). According to Hu and Bentler (1999), TLI and CFI values above .95, RMSEA values below .06, and SRMR values close to .08 can be considered as indicating good fit between the hypothesized model and the observed data.

7 Results

7.1 Teachers' causal attributions

We first calculated the intraclass correlations and the variance estimates at the between- and within-levels separately for each causal attribution (Table 1). The results for teachers' causal attributions for children's success showed that 1–52% of the variability in the observed variables was due to overall differences between teachers *(between-level variation)* and the rest was due to individual differences among children *(within-level variation)*. The results for teachers' causal attributions concerning children's failure showed that 24–80% of the variability in the observed variables was due to similarity in teachers' causal attributions, while the rest was due to individual differences among children. A full correlation matrix including all the variables used in the study is presented in Appendix C.

Table 1 Intraclass Correlations for teachers' causal attributions for children's academic success and failure and between-level variance estimates (SE in paranthesis)

Attribution	Intraclass correlations		Between variance estimate (SE)	
	Success	Failure	Success	Failure
Ability 2[1]	0.01	0.24	–	0.27 (1.36)
Ability 3[2]	0.21	0.25	0.13 (1.33)	0.26 (1.49)
Effort 2	0.20	0.54	0.12 (1.57)	0.65 (2.72)[b]
Effort 3	0.24	0.62	0.11 (1.34)	0.85 (3.80)[c]
Task 2	0.20	0.55	0.18 (1.62)	0.54 (2.29)[a]
Task 3	0.52	0.56	0.43 (1.85)	0.56 (3.13)[b]
Teacher 2	0.36	0.72	0.28 (1.34)	0.76 (3.48)[b]
Teacher 3	0.17	0.80	0.10 (1.94)	1.16 (3.17)[b]
Parent 2	0.52	0.47	0.61 (2.57)[a]	0.35 (1.65)
Parent 3	0.46	0.57	0.24 (2.49)[b]	0.46 (2.26)[a]

[1] Time 2, [2] Time 3
[a] $p < .05$; [b] $p < .01$; [c] $p < .001$

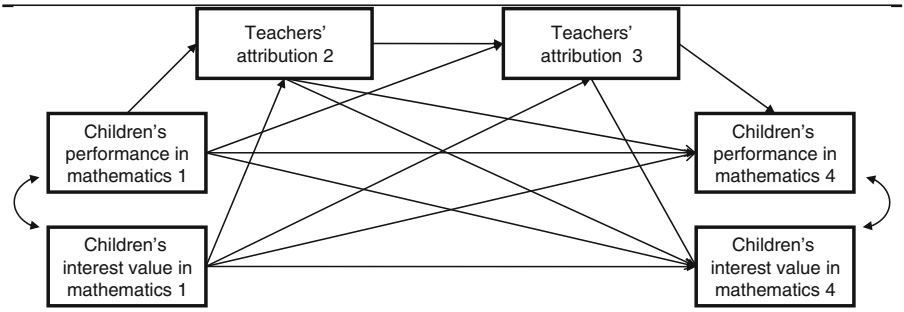


Fig. 1 Theoretical model including all the paths that were tested in the initial models

7.1.1 Teachers' causal attributions and children's interest value and performance in mathematics

Cross-lagged path models for teachers' causal attributions and children's performance and interest value in mathematics were constructed next. Because the preliminary results showed significant intraclass correlations, the research questions were analyzed by path modelling using the Complex-method (Muthén and Muthén 1998–2007).

To examine the cross-lagged relations between teachers' causal attributions for children's academic performance and children's mathematics-related interest value and performance, path models were constructed separately for each causal attribution (Fig. 1). The tested models included stability coefficients for teachers' causal attributions and for children's interest value and performance in mathematics, as well as cross-lagged paths from children's previous performance and interest value to subsequent teachers' causal attributions. Paths from teachers' causal attributions to children's subsequent interest value and performance in mathematics were also included. When all the paths from children's interest value and performance in mathematics to teachers' causal attributions and vice versa were included in the models, all the models were saturated. As saturated models have zero degrees of freedom, it was not possible to test their fit. However, to identify the final models, all the statistically non-significant paths were set to zero. These models also provided the fit indices. All the paths that were statistically significant in the initial models remained statistically significant also in the final models. In all the tested models the children's performance in mathematics and teachers' causal attributions, with the exception of teachers' task difficulty attribution for success, showed substantial stability. Thus, these stabilities between the variables are not presented in the following text.

7.1.2 Causal attributions for success

7.1.2.1 Teachers' ability attributions The model for teachers' ability attributions for success fit the data well (Table 2; Fig. 2). The results showed that the better the children performed in mathematics-related tasks and the higher their interest value in mathematics was (Time 1), the more the teachers attributed their success to ability (Time 2 and 3). Furthermore, the more teachers attributed the children's success to

Table 2 Goodness-of-fit summary of the models for teachers' causal attributions for success and failure

Model	χ^2	*df*	*p*	CFI	TLI	RMSEA	SRMR
Success							
Ability	5.36	7	0.62	1.00	1.04	0.00	0.06
Effort	6.90	8	0.55	1.00	1.03	0.00	0.08
Task	10.70	11	0.47	1.00	1.01	0.00	0.10
Teachers' help	4.15	8	0.84	1.00	1.31	0.00	0.06
Parents' help	5.43	10	0.86	1.00	1.14	0.00	0.05
Failure							
Ability	7.89	8	0.44	1.00	1.00	0.00	0.06
Effort	5.68	9	0.77	1.00	1.09	0.00	0.07
Task	3.88	9	0.92	1.00	1.12	0.00	0.05
Teachers' help	10.04	8	0.26	0.97	0.95	0.06	0.07
Parents' help	7.78	9	0.56	1.00	1.04	0.00	0.06

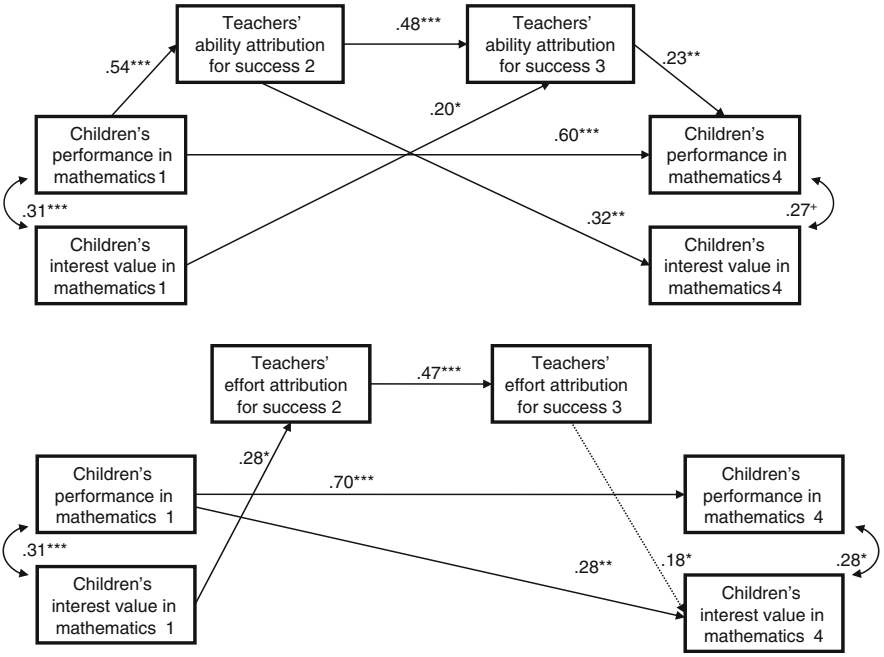


Fig. 2 The standardized estimates for the models of teachers' internal causal attributions (e.g. Ability and effort) for success and children's performance and interest in mathematics. $^{+}p < .10$; $^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$, *dashed line* = suppression effect

ability (Time 2 and 3), the higher the subsequent performance and interest value in mathematics the children showed (Time 4).

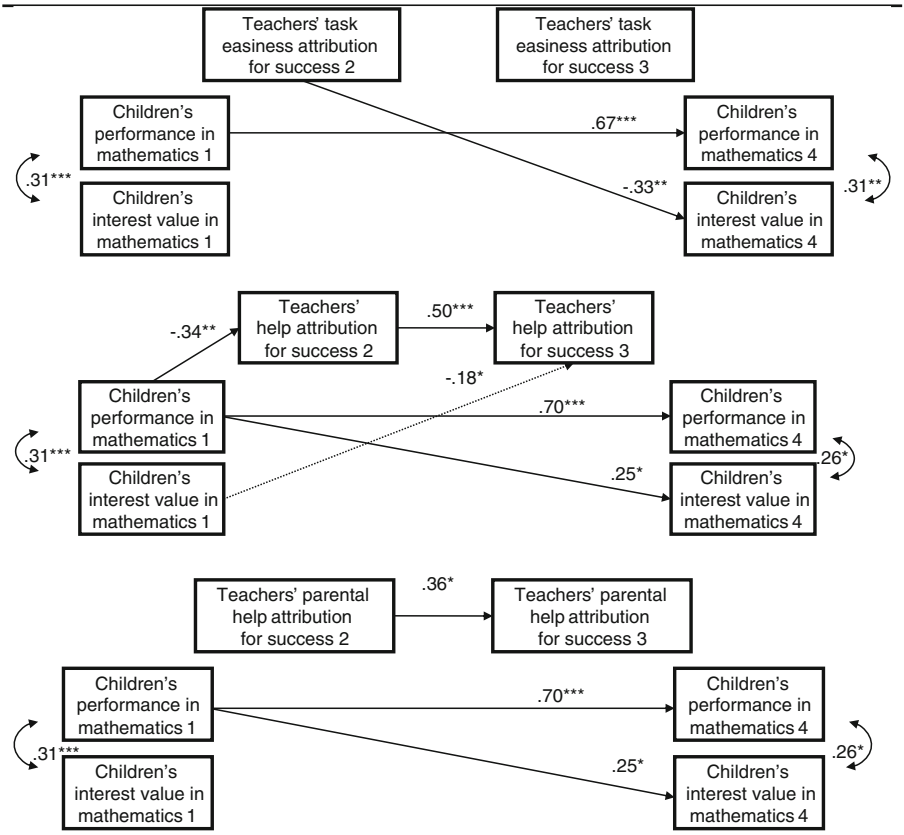


Fig. 3 The standardized estimates for the models of teachers' external causal attributions (e.g. Task easiness, teachers' help, and parents' help) for success and children's performance and interest in mathematics. $^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$, *dashed line* = suppression effect

7.1.2.2 Teachers' effort attributions The model for teachers' effort attributions fit the data well (Table 2; Fig. 2). The results showed that the higher the mathematics-related interest value the children showed (Time 1), the more their teachers attributed their success to effort (Time 2). Furthermore, the more teachers attributed children's success to effort (Time 3), the higher the interest value in mathematics the children showed later on (Time 4). However, further analyses indicated that this result was due to a suppression effect and there was no statistically significant correlation between teachers' effort attribution at Time 3 and children's interest value at Time 4 (Appendix C). Further, the better the children's performance in mathematics (Time 1), the higher their mathematics-related interest value was later on (Time 4).

7.1.2.3 Teachers' task easiness attributions The model for teachers' task easiness attributions for success fit the data well (Table 2; Fig. 3). The results showed that the more the teachers attributed children's success to the easiness of the tasks (Time 3), the less the children were interested in mathematics-related tasks later on (Time 4).

7.1.2.4 Teachers' help attributions The model for teachers' help attributions for success fit the data well (Table 2; Fig. 3). The results showed that the higher the performance the children showed in mathematics (Time 1), the less their teachers attributed their success to teachers' help (Time 2). Moreover, the results showed that the higher the interest value the children showed in mathematics-related tasks (Time 1), the less their teachers attributed their success to teachers' help (Time 3). However, further analyses indicated that these results were due to a suppression effect and there was no statistically significant correlation between these variables (Appendix C). Further, the better the performance the children showed (Time 1), the more they were interested in mathematics-related tasks later on (Time 4).

7.1.2.5 Teachers' parental help attributions The model for teachers' parental help attributions for success fit the data well (Table 2; Fig. 3). These results indicated that the better children performed in mathematics (Time 1), the more they were interested in mathematics-related tasks later on (Time 4).

7.1.3 Causal attributions for failure

7.1.3.1 Teachers' ability attributions The model for teachers' ability attributions for failure fit the data well (Table 2; Fig. 4). The results showed that the higher the performance the children showed in mathematics (Time 1), the less their teachers attributed their failure to lack of ability (Time 2). Moreover, the higher the task value the children showed in mathematics (Time 1), the less their teachers attributed their failure to lack of ability (Time 3). However, further analyses indicated that these results were due to a suppression effect and there was no statistically significant correlation between these variables (Appendix C). Moreover, the more the teachers attributed children's failure to lack of ability (Time 2), the more the children were interested in mathematics-related tasks later on (Time 4). However, further analyses indicated that these results were due to a suppression effect and there was no statistically significant correlation between these variables (Appendix C). Also, the better the performance children showed in mathematics (Time 1), the more they were interested in mathematics-related tasks later on (Time 4).

7.1.3.2 Teachers' effort attributions The model for teachers' effort attributions for failure fit the data well (Table 2; Fig. 4). The results showed that the more the teachers attributed children's failure to lack of effort (Time 3), the less the children were interested in mathematics-related tasks later on (Time 4). Also, the better the performance children showed (Time 1), the more they were interested in mathematics-related tasks later on (Time 4).

7.1.3.3 Teachers' task difficulty attributions The model for teachers' task difficulty attributions for failure fit the data well (Table 2; Fig. 5). The results showed that the higher the performance the children showed in mathematics (Time 1), the more their teachers attributed their failure to the task difficulty (Time 3). The results also

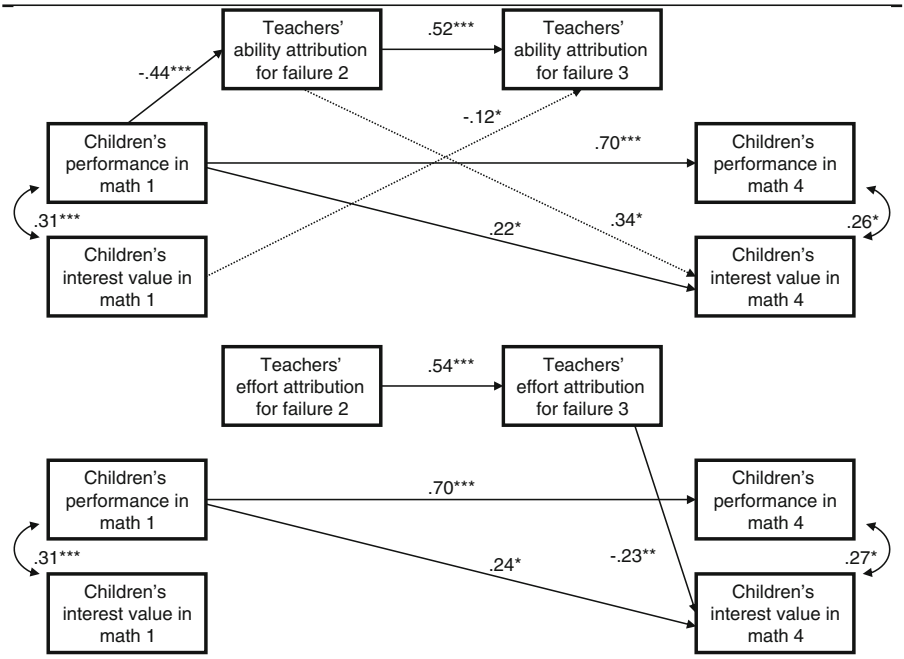


Fig. 4 The standardized estimates for the models of teachers' internal causal attributions (e.g. Ability and effort) for failure and children's performance and interest in mathematics. $^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$, *dashed line* = suppression effect

showed that the better the performance children showed (Time 1), the more they were interested in mathematics-related tasks later on (Time 4).

7.1.3.4 Teachers' help attributions The model for teachers' help attributions for failure fit the data moderately (Table 2; Fig. 5). The results showed that the more the teachers attributed children's failure to the lack of teachers' help (Time 2 and 3), the poorer the performance and lower the interest value in mathematics the children showed later on (Time 4). The results also showed that the better the performance children showed (Time 1), the more they were interested in mathematics-related tasks later on (Time 4).

7.1.3.4 Teachers' parental help attributions The model for teachers' parental help attributions for failure fit the data well (Table 2; Fig. 5). The results showed that the more the teachers attributed the children's failure to lack of parental help (Time 3), the less the children were interested in mathematics later on (Time 4). The results also showed that the better the performance children showed (Time 1), the more they were interested in mathematics-related tasks later on (Time 4).

7.1.3.5 Gender differences All of the models were carried out by controlling for the children's gender as a predictive variable for the initial level of teachers' causal attributions (Time 2) and children's mathematics-related interest value and performance

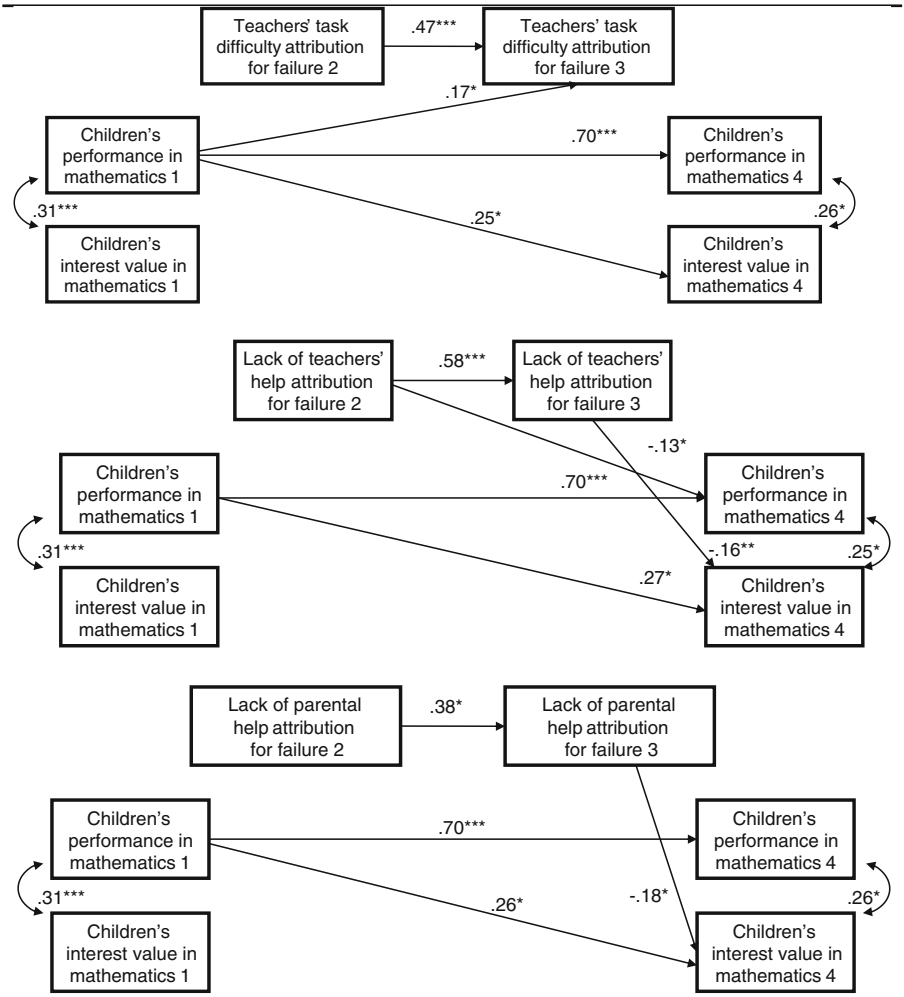


Fig. 5 The standardized estimates for the models of teachers' external causal attributions (e.g. Task difficulty, lack of teachers' help, and lack of parental help) for failure and children's performance and interest in mathematics. $^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$

(Time 1). All the models remained the same, with one exception: The results showed that children's gender predicted (*standardized estimate* = 0.33, $p < .01$) teachers' effort attributions for failure at the beginning of the kindergarten year (Time 2). Specifically, teachers attributed boys' failure more often than girls' failure to lack of effort.

8 Discussion

The present study sought to clarify whether children's interest value and performance in mathematics would contribute to kindergarten teachers' causal attributions for

children's academic success and failure, or rather whether teachers' causal attributions would contribute to children's mathematics-related interest value and performance. The results showed that children's high interest value and performance in mathematics showed positive relationships with teachers' internal attributions for success: the higher the interest and performance in mathematics the children showed, the more the teachers attributed their success to ability and effort (Fig. 2). Moreover, when teachers attributed children's success to ability, children's subsequent interest value and performance in mathematics increased.

8.1 The impact of children's mathematics-related interest value and performance on teachers' causal attributions

The results of the present study showed, first, that the better the children performed in mathematics-related tasks, the more their teachers attributed their success to ability (Fig. 2) and less to teachers' help (Fig. 3). These results confirm the results of previous studies (Cooper and Burger 1980; Holloway and Hess 1985; Hughes et al. 2005; Natale et al. 2009). Similarly, when the children showed high interest value in mathematics, teachers tended to attribute their success to internal characteristics, that is, to the child's ability or effort (Fig. 2). One possible explanation for this finding is that children's high interest toward the task increases teachers' confidence in the children's achievement, thus compelling teachers to credit the success to the child. Another possible explanation for these results is that teachers' attributions concerning children's academic success accurately reflect children's characteristics (Wigfield et al. 1999): children who are highly interested in the tasks usually are hard working, invest high effort in their tasks, and perform well (Aunola et al. 2006; Hulleman et al. 2008).

The results also indicated that the better the children performed and the higher the interest value in mathematics they showed, the more their teachers attributed their failure to the task's difficulty (Fig. 5). Similar results have been found in previous studies (Cooper and Burger 1980). These results may reflect the fact that when teachers notice children's performance and interest value in mathematics are high, they have more confidence in children's skills and therefore, emphasize the role of external causes in children's failure.

8.2 The impact of teachers' causal attributions on children's mathematics-related interest value and performance

The findings also revealed that teachers' ability attributions for success predicted an increase in children's subsequent mathematics performance (Fig. 2). Similar results have been found previously among parents of primary school children: when parents emphasize the role of ability rather than effort in success, children's subsequent academic performance usually increases (Natale et al. 2009). The results of the present study could be explained by the concept that ability attributions are important for maintaining children's high belief in their competence (Eccles and Wigfield 2002): teachers' confidence in children's abilities enhance children's competence beliefs and self-concept of ability, which later on contribute to an increase in children's mathematics performance (Aunola et al. 2002; Upadyaya et al. 2011).

Teachers' ability attributions for success were also found to contribute to an increase in children's subsequent interest value in mathematics (Fig. 2). Moreover, when teachers attributed children's success to external causes, such as task easiness, children's subsequent mathematics-related interest value decreased (Fig. 3). These results have at least two possible explanations. First, when teachers attribute children's success to internal causes (e.g. ability and effort), they give the credit for success to the children themselves. This is likely to increase children's subsequent mathematics interest. By contrast, if teachers attribute children's success to external causes, such as task easiness, this may increase the feelings of mathematics-related helplessness which may then decrease their interest value in mathematics. The second possible explanation concerns the kind of feedback teachers give their pupils concerning their achievement (Graham 1990). Teachers typically praise children when they succeed because of their high ability (Graham 1990), which may subsequently increase children's interest values in different domains.

The results also indicated that teachers' help attributions for success did not contribute to children's mathematics-related interest value or performance (Fig. 3). These results may reflect the fact that internal, rather than external causal attributions, are typically more beneficial for learning (Weiner 1992). Furthermore, no statistically significant paths were found between the attributions teachers made to parental help for children's success and child-related variables (Fig. 3). It is possible that kindergarten teachers are simply not aware of how often children practice their mathematics skills at home with their parents.

The results of the present study support the expectancy-value model of motivation (Eccles et al. 1983; Wigfield and Eccles 2000) which asserts that perceptions of significant adults, such as parents, influence children's interest values and academic performance. In addition to parents, teachers also serve as interpreters of experience to children by helping them understand the possible causes behind their academic successes and failures (Eccles and Harold 1991). Children easily infer the perceptions of their significant others, such as those of teachers, as a part of their own perceptions and interest values in different domains (Eccles et al. 1983). This, in turn, may be reflected in children's subsequent performance and motivation.

The results for failure situations showed that attributing children's failure to external causes, such as lack of teachers' or parents' help, decreased children's subsequent performance and interest value in mathematics (Fig. 5). These results are in line with the theory of causal attributions suggesting that attributing failure to internal causes, such as lack of effort, is more beneficial for learning than attributing it to external causes, such as adults' help (Weiner 1992). When children's failure is attributed to external causes that they cannot control, children may feel that they cannot do anything to improve their future achievement. This, in turn, may lower their motivation and performance.

The results further revealed that when teachers attributed children's failure to lack of effort, children's mathematics-related interest value decreased later on (Fig. 4). These results may be due to the ways in which children interpret teachers' feedback to them. Previously, it has been found that after attributing children's failure to lack of effort, teachers usually blame the failing child (Graham 1990). This, in turn, may decrease children's subsequent interest in mathematics.

In general, the results of the present study suggested that some mediation effects might occur in the associations between children's mathematics-related performance and task values. For example, it is possible that the positive impact of children's initial mathematics performance on their subsequent interest value is mediated by teachers' ability attributions as shown in Fig. 2. Kindergarten children may perform well in mathematics although they may not necessarily have yet developed accurate perceptions of their skills (Aunola et al. 2002; Bouffard et al. 1998; Eccles et al. 1997). However, teachers' confidence in children's abilities may provide children with a better understanding of their skills, which, in turn, increase the level of their mathematics interest value.

Overall, the results revealed that teachers typically attributed boys' and girls' success and failure similarly during their kindergarten year. This result conflicts with some previous findings suggesting that teachers attribute boys' and girls' achievement to different causes (Fennema et al. 1990; Siegle and Reis 1998). One explanation for the conflicting findings of the present study and those of previous research is that previous studies have typically examined children who have already started their formal education at school (Fennema et al. 1990; Siegle and Reis 1998) while we studied children in play-oriented kindergartens. It is possible that gender differences in teachers' causal attributions become stronger after children enter primary school (Burger et al. 1982; Rosenholtz and Simpson 1984). However, the results showed one gender difference: teachers attributed boys' failure more often than girls' failure to lack of effort. Teachers usually perceive girls as hard working and putting forth a lot of effort in their school work (Fennema et al. 1990; Siegle and Reis 1998). Thus, it is possible that if teachers think that boys do not put as much effort as girls into their school work, they usually fail because of that lack of effort.

8.3 Directions for future research

The results of the present study suggest that reciprocal paths can be found between teachers' causal attributions and children's interest value and performance in mathematics already in kindergarten. However, less is known about the mechanisms through which teachers' causal attributions interact with children's motivation and performance. One possibility is that teachers' causal attributions impact the child's performance and interest value through their emotional responses, such as blame and pride, especially when they are communicating the attributions of ability and effort (Graham 1984, 1990). Less is known, however, whether other causal attributions, such as attributions to task easiness or teachers' or parents' help, are expressed to children via teachers' emotions in academic settings. Another possibility is that the impact of teachers' causal attributions on children performance and motivation is mediated by teachers' teaching styles and practices, such as teachers' emotional or instructional support, and teacher- or child-centered teaching practices (Pianta et al. 2008; Stipek and Byler 1997). Thus, in future studies, it would be important to study how teachers' causal attributions are communicated to children in the classrooms and how they are evidenced in daily interactions between teachers and their pupils. It would also be important to study the impact of different combinations of teachers' causal attributions

on children's learning and motivation. For example, it is possible that emphasizing the role of both ability and effort in success would be more beneficial for learning and motivation than the role of other causes or one of them alone. Similarly, an important topic for future research will be to investigate the long-term effects of teachers' causal attributions on children's developing skills and motivation. For example, it is possible that teachers' causal attributions explain the developmental changes in children's motivation later on in their school career, as they do explain pupils' self-concept of ability (Madon et al. 2001; Upadyaya et al. 2011). This may then be reflected in children's academic achievement and self-perceptions. Furthermore, the results of the present study also suggested that there was a considerable amount of variation in teachers' causal attributions. Thus, it is possible that teachers' causal attributions reflect their other personal characteristics, such as their years of education, self-efficacy beliefs, and cultural values (Clark and Artiles 2000; Georgiou et al. 2002; Tschannen-Moran et al. 1998). As relatively little research has focused on this topic, there is an evident need for future research on these relationships.

9 Limitations

There are several limitations that should be considered when generalizing the findings of the present study. First, the number of teachers in this study was relatively small, thus a larger study would be necessary to confirm the findings. Second, as the present study examined the relationships between teachers' causal attributions and children's mathematics-related interest value and performance, it is possible that the relationships between teachers' causal attributions and children's interest value and performance may be different in other areas, such as reading performance. Third, the time period during which the study was conducted was relatively short (1 year). Consequently, there is an evident need to investigate the relationships between teachers' causal attributions and children's mathematics-related interest value and performance over a longer time period. Fourth, as the mathematics performance tests were conducted by teachers, this may have biased their perceptions concerning children's abilities, especially when the number sequence tasks were conducted individually which each child. This should be taken into consideration when interpreting the results of the present study. Fifth, the Cronbach's alpha reliabilities for children's interest value in mathematics were relatively low. It is possible, for example, that the question concerning children's interest in number tasks at home was not relevant for children at the kindergarten age. As kindergarten children have no homework, they may not frequently practice number and counting tasks at home so it may have been difficult for them to answer to these questions. Finally, previous studies have found that teachers' causal attributions vary by culture (Clark and Artiles 2000). Thus, it is possible that the findings of this study would have been different, had it been conducted in another sociocultural context.

10 Conclusions

The results of the present study revealed evidence of a cumulative cycle between teachers' causal attributions and children performance and motivation before children

enter primary school. On the one hand, teachers' causal attributions had consequences on children's mathematics-related interest value and performance in kindergarten. Especially internal rather than external attributions for success were beneficial for children's learning. The results of the present study suggested that a beneficial way for kindergarten teachers to support children's future achievement and motivation in mathematics would be to communicate children teachers' confidence in their internal abilities. On the other hand the results showed that children's characteristics, e.g. children's interest value and performance in mathematics, contributed to their teachers' causal attributions. Consequently, for kindergarten teachers and practitioners it would be important to be aware of these effects and how they may impact teachers' beliefs concerning children's achievement and their interaction with children in daily learning situations.

Acknowledgments We would also like to express our gratitude to all the children participating this study, as well as their kindergarten teachers and local school authorities. We would also like to thank Dr. Noona Kiuru for her advice on statistics.

Appendix A

Task-value Scale for Children (TVS-C; Nurmi and Aunola 1999).

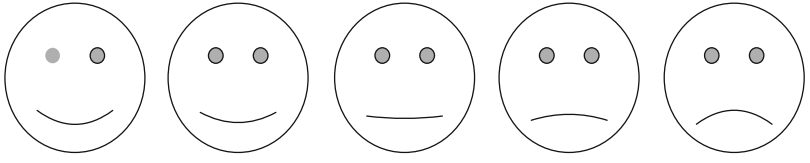
Instructions and material for the Task-value Scale for Children (TVS-C; Nurmi and Aunola 1999).

Instructions:

"You learn and do many things at school, such as reading, writing and mathematics. I am going to ask you some questions concerning different kind of school tasks and how much you like them. At the same time, I will show you a picture which has on it five different faces. The faces go from happy to unhappy and reflect your liking of tasks. The happier the face is, the more you like the task. This, the happiest face means that you like the task very much and you enjoy doing things like that. This second face means that you quite like the task; this one means that you neither like it nor dislike it; this one means that you don't like the task and this last one means that you really dislike the task and don't enjoy doing tasks like that at all. So, your job is to answer my questions by pointing out the picture which best describes how you feel. There are no right or wrong answers. I just want to know how much you like different things and what do you think about them. Do you understand? Good. Lets start."

	I do not like it at all/I dislike doing those tasks		I like it very much/I really enjoy doing those task		
1. How much do you like reading?	1	2	3	4	5
2. How much do you like mathematics?	1	2	3	4	5
3. How much do you like writing?	1	2	3	4	5
4. How much do you like doing reading-related tasks at school?	1	2	3	4	5
5. How much do you like doing math-related tasks at school?	1	2	3	4	5
6. How much do you like doing writing-related tasks at school?	1	2	3	4	5
7. How much do you like doing reading-related tasks at home?	1	2	3	4	5
8. How much do you like doing math-related tasks at home?	1	2	3	4	5
9. How much do you like doing writing-related tasks at home?	1	2	3	4	5

Schematic pictures



Points:	5	4	3	2	1

Appendix B

Teachers' causal attributions: questionnaire

Below there are different events related to kindergarten assignments and possible causes for them. Kindergarten assignments can, for example, refer to recognizing letters and numbers, and practicing reading or counting. Please respond according to your own perception how well each of them fits to describe the child. Rate each alternative from 1 to 5 (1 = fully disagree, 5 = fully agree).

Appendix C

See Table 3.

	Fully disagree	Disagree	Neither disagree or agree	Agree	Fully agree
1. When the child does well in some assignment[a] in kindergarten, it is probably because					
1.2. He / she has ability	1	2	3	4	5
1.2. He / she tries hard	1	2	3	4	5
1.3. Tasks are easy for him /her	1	2	3	4	5
1.4. He / she gets help from teacher	1	2	3	4	5
1.5. He / she gets help from parents	1	2	3	4	5
2. When the child is progressing well in kindergarten[a], it is probably because					
2.1. He / she has ability	1	2	3	4	5
2.2. He / she tries hard	1	2	3	4	5
2.3 Tasks are easy for him /her	1	2	3	4	5
2.4. He / she gets help from teacher	1	2	3	4	5
2.5. He / she gets help from parents	1	2	3	4	5
3. When the child is progressing poorly in kindergarten[a], it is probably because					
3.1. He / she lacks ability	1	2	3	4	5
3.2. He / she has not invested effort	1	2	3	4	5
3.3. Tasks are too difficult for him / her	1	2	3	4	5
3.4. He / she does not get enough help from teacher	1	2	3	4	5
3.5. He / she does not get enough help from parents	1	2	3	4	5
4. When the child does not do well in some kindergarten assignments[a], it is probably because					
4.1. He / she lacks ability	1	2	3	4	5
4.2. He / she has not invested effort	1	2	3	4	5
4.3. Tasks are too difficult for him / her	1	2	3	4	5
4.4. He / she does not get enough help from teacher	1	2	3	4	5
4.5. He / she does not get enough help from parents	1	2	3	4	5

[a] At Time 2 this questions was asked separately for children's progress in mathematics- and reading related assignments

Table 3 Pearson correlation coefficients between teachers' causal attributions for success and failure children's mathematics interest value and performance, and gender

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
1. Ability^{2S}	1.00											
2. Effort^{2S}	0.34**	1.00										
3. Task^{2S}	−0.09	0.13	1.00									
4. Teacher^{2S}	−0.28*	−0.51***	0.18^{+}	1.00								
5. Parents^{2S}	0.16	0.34***	−0.40**	0.17	1.00							
6. Ability^{3S}	0.39***	−0.05	0.17	−0.09	−0.07	1.00						
7. Effort^{3S}	−0.07	0.32***	0.07	0.02	0.17	0.16	1.00					
8. Task^{3S}	−0.28**	0.09	0.11	−0.15	−0.35*	−0.29*	0.19*	1.00				
9. Teacher^{3S}	−0.03	0.10	0.16	0.35*	0.02	−0.25^{+}	−0.01	0.17	1.00			
10. Parents^{3S}	0.04	−0.08	−0.03	−0.16	0.19^{+}	0.17	0.22	−0.21	0.15	1.00		
11. Ability^{2F}	−0.20	0.08	−0.14	0.48***	0.16	−0.28*	0.28*	0.05	−0.12	−0.09	.00	
12. Effort^{2F}	−0.07	−0.09	0.00	−0.22*	−0.25	−0.15	−0.33**	−0.19	0.09	−0.04	0.30**	1.00
13. Task^{2F}	0.07	0.02	−0.09	0.05	−0.15	0.03	0.24*	−0.14	0.16	−0.32**	−0.10	0.14
14. Teacher^{2F}	0.05	−0.20^{+}	0.30**	−0.17	0.23	−0.26	−0.03	0.06	−0.17	−0.35***	−0.03	−0.06
15. Parents^{2F}	0.00	0.16	−0.19	0.26*	−0.05	0.22	0.12	−0.06	0.02	0.05	−0.10	−0.10
16. Ability^{3F}	0.08	0.01	0.08	−0.24	0.07	−0.11	−0.19	0.50***	0.59**	0.34**	0.59***	−0.06
17. Effort^{3F}	0.20	0.01	−0.02	−0.05	−0.10	−0.08	−0.02	0.27^{+}	−0.11	0.05	−0.19	0.60***
18. Task^{3F}	−0.08	−0.24*	0.15	−0.16	−0.23^{+}	0.28	−0.11	0.15	−0.23^{+}	0.22*	0.04	0.05
19. Teacher^{3F}	−0.19	0.19	−0.20	−0.06	−0.22	−0.13	0.02	0.09	−0.18	−0.24	−0.11	0.31
20. Parents^{3F}	0.07	−0.03	0.34*	0.03	0.32^{+}	0.13	−0.40***	−0.13	0.14	0.10	0.39**	−0.17
21. Interest^{1} value^{1}	0.10	0.22^{+}	−0.01	0.25*	0.06	0.18*	0.13	−0.09	−0.13	0.07	0.11	−0.07
22. Interest^{4} value^{4}	0.19*	−0.00	−0.36**	−0.01	0.17	−0.03	0.15	0.07	−0.01	−0.04	0.12	−0.03
23. Math^{1} performance^{1}	0.57***	0.23^{+}	−0.10	−0.48**	−0.03	−0.06	−0.38**	−0.07	−0.03	0.01	−0.62***	−0.38***
24. Math^{4} performance^{2}	−0.19	−0.38**	0.25	0.09	−0.17	0.51***	0.08	−0.19	−0.20	−0.07	0.13	0.26*
25. Gender	−0.09	−0.17*	0.08	0.03	−0.25**	−0.24***	−0.01	0.01	0.16	0.30**	0.04	0.24*

Table 3 continued

	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	24.	25.
14. Teacher^{2F}	0.20	1.00											
15. Parents^{2F}	0.14	0.58***	1.00										
16. Ability^{3F}	0.08	−0.13	0.18*	1.00									
17. Effort^{3F}	−0.15	−0.06	0.24**	0.01	1.00								
18. Task^{3F}	0.27	−0.02	−0.14	0.27	−0.07	1.00							
19. Teacher^{3F}	0.08	0.48**	0.54***	−0.63***	−0.29*	0.64***	1.00						
20. Parents^{3F}	0.24	−0.21	−0.15	0.32***	0.61***	−0.10	0.59**	1.00					
21. Interest^{1} value^{1}	−0.08	−0.24*	0.06	−0.08	0.04	−0.08	0.14	0.06	1.00				
22. Interest^{4} value^{4}	0.04	−0.03	−0.02	0.13	−0.22^{+}	0.01	−0.16*	−0.21*	0.19	1.00			
23. Math^{1} performance^{1}	−0.35***	0.42***	0.24	0.21*	0.29**	0.35***	−0.20^{+}	−0.15	0.29**	−0.05	1.00		
24. Math^{4} performance^{2}	0.26**	−0.34***	−0.39**	−0.45***	−0.18	−0.17	0.31**	0.32***	0.02	0.37**	0.69***	1.00	
25. Gender	−0.09	−0.01	0.07	0.13	0.17^{+}	−0.05	−0.09	−0.03	−0.15	−0.07	−0.06	−0.15	1.00

Teacher = Teachers' help / lack of help attribution, Parents = Parents' help / lack of help attribution

$^{+}p < .10$;* $p < .05$; ** $p < .01$;*** $p < .001$

[1] Time 1, [2] Time 2, [3] Time 3, [4] Time 4

S = Success, F = Failure

References

Aunola, K., Leskinen, E., & Nurmi, J.-E. (2006). Developmental dynamics between mathematical performance, task motivation, and teachers' goals during the transition to primary school. *British Journal of Educational Psychology, 76*, 21–40.

Aunola, K., Leskinen, E., Onatsu-Arvilommi, T., & Nurmi, J.-E. (2002). Three methods for studying developmental change: A case of reading skills and self-concept. *British Journal of Educational Psychology, 72*, 343–364.

Bentler, P. M. (1990). Comparative fit indexes in structural models. *Psychological Bulletin, 99*, 229–246.

Bouffard, T., Markovits, H., Vezeau, C., Boisvert, M., & Dumas, C. (1998). The relation between accuracy of self-perception and cognitive development. *British Journal of Educational Psychology, 68*, 321–330.

Burger, J. M., Cooper, H. M., & Good, T. L. (1982). Teacher attributions of student performance: Effects of outcome. *Personality and Social Psychology Bulletin, 8*, 685–690.

Butler, R. (1994). Teacher communications and student interpretations: Effects of teacher responses to failing students attributional inferences in two age groups. *British Journal of Educational Psychology, 64*, 277–294.

Clark, M. D. (1997). Teacher response to learning disability: A test of attributional principles. *Journal of Learning Disabilities, 30*, 69–79.

Clark, M. D., & Artiles, A. J. (2000). A cross-national study of teachers' attributional pattern. *The Journal of Special Education, 34*, 77–89.

Cooper, H. M., & Burger, J. M. (1980). How teachers explain students' academic performance: A categorization of free response academic attributions. *American Educational Research Journal, 17*, 95–109.

Deci, E. L., Vallerand, R. J., Pelletier, L. G., & Ryan, R. M. (1991). Motivation and education: The self-determination perspective. *Educational Psychologist, 26*, 325–346.

Eccles, J. S., Adler, T. F., Futterman, R., Goff, S. B., Kaczala, C. M., Meece, J. L., & Midgley, C. (1983). Expectancies, values, and academic behaviors. In J. T. Spence (Ed.), *Achievement and achievement motives* (pp. 75–146). San Francisco: Freeman.

Eccles, J. S., & Harold, R. D. (1991). Gender differences in sport involvement: Applyinig the Eccles' expectancy-value model. *Journal of Applied Sport Psychology, 3*, 7–35.

Eccles, J. S., & Wigfield, A. (1995). In the mind of the actor: The structure of adolescents' achievement task value and expectancy-related beliefs. *Personality and Social Psychology Bulletin, 21*, 215–225.

Eccles, J. S., & Wigfield, A. (2002). Motivational beliefs, values, and goals. *Annual Review of Psychology, 53*, 109–132.

Eccles, J. S., Wigfield, A., & Schiefele, U. (1997). Motivation to succeed. In W. Damon & N. Eisenberg (Eds.), *Handbook of child psychology* (Vol. 3). New York: John Wiley & Sons, Inc.

Fennema, E., Peterson, P. L., Carpenter, T. P., & Lubinski, C. A. (1990). Teachers' attributions and beliefs about girls, boys, and math. *Educational Studies in Mathematics, 21*, 55–69.

Georgiou, S., Christou, C., Stavrinides, P., & Panaoura, G. (2002). Teacher attributions of student failure and teacher behavior toward the failing student. *Psychology in the Schools, 39*, 583–595.

Gottfried, A. E. (1985). Academic intrinsic motivation in elementary and junior high school students. *Journal of Educational Psychology, 77*, 631–645.

Gottfried, A. E. (1990). Academic intrinsic motivation in young elementary school children. *Journal of Educational Psychology, 82*, 525–538.

Gottfried, A. E., Fleming, J. S., & Gottfried, A. W. (2001). Continuity of academic Intrinsic motivation from childhood through late adolescence: A longitudinal study. *Journal of Educational Psychology, 93*, 3–13.

Graham, S. (1984). Teachers feelings and student thoughts: An attributional approach to affect in the classroom. *The Elementary School Journal, 85*, 90–104.

Graham, S. (1990). Communicating low ability in the classroom: Bad things good teachers sometimes do. In S. Graham & V. S. Folkes (Eds.), *Attribution theory: Applications to achievement, mental health, and interpersonal conflict*. Hillsdale: Lawrence Erlbaum.

Hall, B. W., Villeme, M. G., & Burley, W. W. (1989). Teachers' attributions for students' academic success and failure and the relationship to teaching level and teacher feedback practices. *Contemporary Educational Psychology, 14*, 133–144.

Harter, S. (1981). A new self-report scale of intrinsic versus extrinsic orientation in the classroom: Motivational and informational components. *Developmental Psychology, 17*, 300–312.

Holloway, S. D., & Hess, R. D. (1985). Mothers' and teachers' attributions about children's mathematical performance. In I. E. Siegel (Ed.), *Parental belief systems: The psychological consequences for children* (pp. 177–199). Hillsdale: Lawrence Erlbaum.

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling, 6*, 1–55.

Hughes, J. N., Gleason, K. A., & Zhang, D. (2005). Relationship influences on teachers' perceptions of academic competence in academically at-risk minority and majority first grade students. *Journal of School Psychology, 43*, 303–320.

Hulleman, C. S., Durik, A. M., Schweigert, S. A., & Harackiewicz, J. M. (2008). Task values, achievement goals, and interest: An integrative analysis. *Journal of Educational Psychology, 100*, 398–416.

Jacobs, J. E., Lanza, S., Osgood, D. W., Eccles, J. E., & Wigfield, A. (2002). Changes in children's self-competence and values: Gender and domain differences across grades one through twelve. *Child Development, 73*, 509–527.

Jussim, L. (1989). Teacher expectations: Self-fulfilling prophecies, perceptual biases, and accuracy. *Journal of Personality and Social Psychology, 57*, 469–480.

Jussim, L., & Eccles, J. S. (1992). Teacher expectations II: Construction and reflection of student achievement. *Journal of Personality and Social Psychology, 63*, 947–961.

Jussim, L., & Harber, K. D. (2005). Teacher expectations and self-fulfilling prophecies: Knowns and unknowns, resolved and unresolved controversies. *Personality and Social Psychology Review, 9*, 131–155.

Lerkkanen, M.-K., & Poikkeus, A.-M. (2005). First steps study: Learning and interactions between child-parent-teacher triangle. (Ongoing research project).

Madon, S., Jussim, L., & Eccles, J. E. (1997). In search of the powerful self-fulfilling prophecy. *Journal of Personality and Social Psychology, 72*, 791–809.

Madon, S., Smith, A., Jussim, L., Russell, D. W., Eccles, J., Palumbo, P., & Walkiewicz, M. (2001). Am I as you see me or do you see me as I am? Self-fulfilling prophecies and self-verification. *Personality and Social Psychology Bulletin, 27*, 1214–1224.

Murphy, P. K., & Alexander, P. A. (2000). A motivational exploration of motivation terminology. *Contemporary Educational Psychology, 25*, 3–53.

Muthén, L., & Muthén, B. O. (1998–2007). *Mplus. User's guide*. Los Angeles, CA: Muthén & Muthén.

Natale, K., Aunola, K., & Nurmi, J.-E. (2009). The role of children's school performance in their parents' ability and effort attributions: A longitudinal study. *Journal of Applied Developmental Psychology, 30*, 14–22.

Natale, K., Viljaranta, J., Lerkkanen, M.-K., Poikkeus, A.-M., & Nurmi, J.-E. (2009). Cross-lagged associations between kindergarten teachers' causal attributions and children's task motivation and performance in reading. *Educational Psychology, 29*, 603–619.

Nurmi, J.-E., & Aunola, K. (1999). *Jyväskylä Entrance into Primary School study (JEPS) (ongoing)*. Finland: University of Jyväskylä.

Nurmi, J.-E., & Aunola, K. (2005). Task motivation during the first school years: A person-oriented approach to longitudinal data. *Learning and Instruction, 14*, 103–122.

Pianta, R. C., La Paro, K. M., & Hamre, B. K. (2008). *The classroom assessment scoring system—CLASS. Manual, Pre-K*. Baltimore, MD: Brookes.

Rosenholtz, S. J., & Simpson, C. (1984). The formation of ability conceptions: Developmental trend or social construction?. *Review of Educational Research, 54*, 31–63.

Ryan, R. M., & Deci, E. L. (2000). Intrinsic and extrinsic motivations: Classic definitions and new directions. *Contemporary Educational Psychology, 25*, 54–67.

Räsänen, P. (2005). *BANUCA—Basic numerical and calculation abilities*. Jyväskylä: Niilo Mäki Institution.

Schiefele, U. (1996). Topic interest, text representation, and quality of experience. *Contemporary Educational Psychology, 2*, 237–244.

Siegle, D., & Reis, S. M. (1998). Gender differences in teacher and student perceptions of gifted students' ability and effort. *Gifted Child Quarterly, 42*, 39–47.

Smith, A. E., Jussim, L., Eccles, J., VanNoy, M., Madon, S., & Palumbo, P. (1998). Self- Fulfilling prophecies, perceptual biases, and accuracy at the individual and group levels. *Journal of Experimental Social Psychology, 34*, 530–561.

Stipek, D., & Byler, P. (1997). Early childhood education teachers: Do they practice what they preach?. *Early Childhood Research Quarterly, 12*, 305–325.

Stodolsky, S., Salk, S., & Glaessner, B. (1991). Student view about learning math and social studies. *American Educational Research Journal, 28*, 89–116.
Tiedemann, J. (2000). Parents' gender stereotypes and teachers' beliefs as predictors of children's concept of their mathematical ability in elementary school. *Journal of Educational Psychology, 92*, 144–151.
Tschannen-Moran, M., Woolfolk, A., & Hoy, W. K. (1998). Teacher efficacy: Its meaning and measure. *Review of Educational Research, 68*, 202–248.
Upadyaya, K., Vida, M., & Eccles, J. S. (2011). Do teachers' perceptions of children's math and reading related ability and effort predict children's self-concept of ability in math and reading? (Manuscript under review).
Vallerand, R. J., & Losier, G. F. (1999). An integrative analysis of intrinsic and extrinsic motivation in sport. *Journal of Applied Sport Psychology, 11*, 142–169.
Viljaranta, J., Lerkkanen, M.-K., Poikkeus, A.-M., Aunola, K., & Nurmi, J.-E. (2009). Cross-lagged relations between task motivation and performance in arithmetic and literacy in kindergarten. *Learning and Instruction, 19*, 335–344.
Weiner, B. (1985). An attributional theory of achievement motivation and emotion. *Psychological Review, 92*, 548–573.
Weiner, B. (1986). *An attributional theory of motivation and emotion*. New York: Springler.
Weiner, B. (1992). *Human motivation. Metaphors, theories, and research*. Newbury Park: Sage Publications.
Wigfield, A., & Eccles, J. S. (1992). The development of achievement task values: A theoretical analysis. *Developmental Review, 12*, 265–310.
Wigfield, A., & Eccles, J. S. (2000). Expectancy-value theory of achievement motivation. *Contemporary Educational Psychology, 25*, 68–81.
Wigfield, A., Galper, A., Denton, K., & Seefeldt, C. (1999). Teachers' beliefs about former head start and non-head start first-grade children's motivation, performance, and future educational prospects. *Journal of Educational Pscyhology, 91*, 98–104.
Wigfield, A., Harold, R. D, Freedman-Doan, C., Eccles, J. S., Suk Yoon, K., Arbreton, A. J. A., & Blumenfield, P. C. (1997). Change in children's competence beliefs and subjective task values across the elementary school years: A 3-year study. *Journal of Educational Psychology, 89*, 451–469.

Author Biographies

Katja Upadyaya Ph.D., is a researcher at the Institute for Social Research, University of Michigan, USA. Her research interests include teacher-student interactions, development of academic motivation, performance, and school engagement, and parenting and teaching young children and adolescents.

Jaana Viljaranta Ph.D., is a researcher at the Department of Psychology, University of Jyväskylä, Finland. Her research interests include students' task motivation and values, and the development of academic performance and self-concept in different domains.

Marja-Kristiina Lerkkanen Ph.D., is an Adjunct Professor at the Department of Teacher Education, University of 719 Jyväskylä, Finland. Her research interests include teaching practices and the developmental processes of children's learning and motivation of literacy and math skills at early school years.

Anna-Maija Poikkeus is a Professor of early and primary education at the University of Jyväskylä, Finland. Her research interests include early language learning and prediction of learning disabilities, and motivational and classroom factors contributing to academic skill development.

Jari-Erik Nurmi is a Professor of Psychology at the University of Jyväskylä, Finland, and the director of the Finnish Center of Excellence in Learning and Motivation Research. His research interests include topics, such as motivation and learning, future orientation, classroom interaction, and modelling of developmental processes.