

**This is an electronic reprint of the original article.
This reprint *may differ* from the original in pagination and typographic detail.**

Author(s): Enlund, Emmi; Aunola, Kaisa; Tolvanen, Asko; Lerkkänen, Marja-Kristiina; Nurmi, Jari-Erik

Title: Parental ability attributions regarding children's academic performance : Person-oriented approach on longitudinal data

Year: 2017

Version:

Please cite the original version:

Enlund, E., Aunola, K., Tolvanen, A., Lerkkänen, M.-K., & Nurmi, J.-E. (2017). Parental ability attributions regarding children's academic performance : Person-oriented approach on longitudinal data. *Journal of Applied Developmental Psychology*, 52, 12-23. <https://doi.org/10.1016/j.appdev.2017.06.003>

All material supplied via JYX is protected by copyright and other intellectual property rights, and duplication or sale of all or part of any of the repository collections is not permitted, except that material may be duplicated by you for your research use or educational purposes in electronic or print form. You must obtain permission for any other use. Electronic or print copies may not be offered, whether for sale or otherwise to anyone who is not an authorised user.

Running head: PATTERNS OF PARENTAL ABILITY ATTRIBUTIONS

Parental Ability Attributions Regarding Children's Academic Performance:
Person-oriented Approach on Longitudinal Data

Emmi Enlund^a, Kaisa Aunola^a, Asko Tolvanen^a, Marja-Kristiina Lerkkanen^b,
and Jari-Erik Nurmi^a

^aDepartment of Psychology, University of Jyväskylä. PO Box 35, FI-40014 University of Jyväskylä, Finland. ^bDepartment of Teacher Education. University of Jyväskylä. PO Box 35, FI-40014 University of Jyväskylä, Finland. E-mails: emmi.k.enlund@jyu.fi, kaisa.aunola@jyu.fi, asko.j.tolvanen@jyu.fi, marja-kristiina.lerkkanen@jyu.fi, jari-erik.nurmi@jyu.fi.

Correspondence concerning this article should be addressed to Kaisa Aunola, Department of Psychology, University of Jyväskylä, PO Box 35, 40014 Jyväskylä, Finland. E-mail: kaisa.aunola@jyu.fi. Phone number: +358408053481.

Running head: PATTERNS OF PARENTAL ABILITY ATTRIBUTIONS

Parental Ability Attributions Regarding Children's Academic Performance:

Person-oriented Approach on Longitudinal Data

12 April, 2017

Abstract

The aim of this study was to identify subgroups of mothers and fathers who differ according to the patterns of causal attribution to ability for their children's academic success and failure across early school years. Moreover, the extent to which the mother and father of the same child share the same attribution pattern, and how the attribution patterns are associated with the parents' level of education, children's sex and children's academic performance was investigated. A total of 1,721 mothers and 1,198 fathers filled out a questionnaire concerning their child-related ability attributions when the children were in Grades 1–3. Five different attribution patterns were identified with latent profile analysis. The patterns were similar among the mothers and fathers, and the parents of the same child typically were represented by the same pattern. The attribution patterns were associated with the children's level of performance and, among mothers, parental level of education.

Keywords: parental ability attribution; latent profile analysis; reading; math; primary school

Parental Ability Attributions Regarding Children's Academic Performance:

Person-oriented Approach on Longitudinal Data

Ability is one of the most common causes that parents report for their children's success (Cashmore & Goodnow, 1986; Dunton, McDevitt, & Hess, 1988; Enlund, Aunola, & Nurmi, 2015; Natale et al., 2008; Weiner, 1992). Although studies suggest that parents differ in the amount they use ability as an explanation for their children's academic outcomes and in the changes in their use of ability attribution over time (Enlund, Aunola, Tolvanen, & Nurmi, 2015; Natale et al., 2008), the majority of the studies have been variable-oriented and, thus, treated the parents as one homogeneous group. As this type of approach assumes that the associations between attribution variables across time are similar for all parents, the possibility that different individuals may show different patterns of attributions has not been taken into account. In this study, we applied a person-oriented approach (Bergman & Magnusson, 1991; Bergman, Magnusson, & El-Khoury, 2003) to examine whether it is possible to statistically identify homogeneous subgroups of parents that differ according to the *pattern* of ability attributions they show for their children's academic success and failure across early primary school years. We also studied whether the parents of a particular child demonstrate the same patterns of ability attributions and how parents' level of education and children's level of academic performance are related to different patterns.

Parents' Ability Attributions for Their Children's Success and Failure

Parental beliefs and representations concerning their children's abilities form important developmental context for children (Miller, 1995; Murphey, 1992). In general, children are prone to adopt beliefs about themselves, as well as concomitant behaviors, which are consistent with their parents' beliefs (Murphey, 1992). Parental beliefs concerning children's academic abilities have, for example, been shown to predict children's self-perceptions of ability even more than children's school grades (Frome & Eccles, 1998).

According to *entity theory of intelligence* and *incremental theory of intelligence* parents can be divided into two groups based on how they understand ability (Dweck, 2000; Furnham, 2014): (a) parents who see ability as a fixed trait that one either has or has not (entity theory) and (b) parents who think that ability can be increased with effort and practice (incremental theory). Research based on these theories has focused on how parents' views of ability either as fixed or malleable can foster the child developing the entity or incremental theory of intelligence (Dweck, 2000; Haimovitz & Dweck, 2016). For parents, dispositional (biological based talent or giftedness) and effort-based explanations of intelligence have been shown to be the predominant modes, although there are also parents demonstrating a combined pattern (Räty & Kärkkäinen, 2011).

Whereas incremental theory defines ability as a controllable skill that can be developed through persistent effort (Dweck, 1999; Haimovitz & Dweck, 2016; see also Räty & Kärkkäinen, 2011), *attribution* theory is more in line with the entity theory defining ability as an internal, stable, and uncontrollable factor that can be related to academic success (i.e., one has ability) and failure (i.e., one lacks ability; Weiner, 1986, 1992). In addition to attributions people make for their own actions, attribution theory encompasses how other people, for example, parents, attribute the causes of their children's actions and the outcomes. Research on parental attributions has shown that mothers and fathers attribute their children's academic success most typically to ability (Cashmore & Goodnow, 1986; Enlund, Aunola, & Nurmi, 2015). Mothers have also been found to emphasize more the role of their children's ability than fathers (Jacobs, 1991; Rytönen, Aunola, & Nurmi, 2005). Attributing success to ability has been found to be typical especially among Western parents, whereas their Asian counterparts give more weight to effort (Phillipson, 2006; Stevenson & Stigler, 1992). Parental ability attributions for success have been shown to have beneficial outcomes. For example, children whose performance was attributed to high ability improved their performance more than children told that they had worked hard (Miller, Brickman, & Bolen, 1975; Natale, Aunola, & Nurmi, 2009).

Although it seems that attributing success to ability is beneficial for the children, attributing failure to lack of ability is associated with negative long-term motivational and achievement outcomes (Kiefer & Shih, 2006; Weiner, 1992). While one study found that parents have very similar ways of attributing their children's success and failure (Leung & Shek, 2015), other studies have shown that parents typically attribute failure to lack of effort or to situational factors instead of lack of ability (for a review, see Miller 1995; see also Enlund, Aunola, & Nurmi, 2015; Natale et al., 2008). Overall, lack of ability does not seem to be an easy attribution for parents to make (Miller, 1995). However, cultural differences have been found. Compared to Asian societies, parents in Western societies tend to emphasize lack of ability more when they explain low achievement compared to parents from Asian societies (Holloway, Kashiwagi, Hess, & Azuma, 1986).

Some studies have reported evidence that parents use *child-serving causal attributions* when success is typically attributed to a children's own characteristics, such as ability, whereas failure is attributed to properties that are more controllable or external causes (i.e., effort, other people) instead of to lack of ability (Enlund, Aunola, & Nurmi, 2015; Kärkkäinen, Rätty, & Kasanen, 2011; Miller, 1995; Rätty, Kasanen, & Honkalampi, 2006; Weiner, 1992; Yee & Eccles, 1988). In turn, *actor-observer bias* states that actors are more likely to emphasize situational or external factors as the cause of their performances while observers tend to view the actor's performance as resulting from dispositional or internal causes (Jones & Nisbett, 1971). This bias would lead the parents to attribute their children's success and failure to ability.

Stability and Change in Parental Ability Attributions

Longitudinal studies have shown that parents form their attributional beliefs early in their children's school career and that those beliefs continue to guide the parents' thinking later on (for a review, see Miller, 1995). Since the review by Miller (1995), some studies have examined the naturally occurring changes in parental ability attributions for children's academic success and

failure situations over time. Rytönen and colleagues (2005) found that parents increasingly attributed their children's success to ability during the child's transition from preschool to primary school, whereas the mean level of their ability attributions for failure did not change during this period. The mean level of ability attributions have further been shown to stay stable (i.e., at the same level) during the children's first school year (Natale et al., 2008), during the transition from kindergarten to Grade 2 (Natale et al., 2009), and even during 9-year comprehensive school career (Enlund, Aunola, & Nurmi, 2015).

Despite the stable mean level of parental ability attributions during comprehensive school there are, however, individual differences in these attributions (Enlund, Aunola, Tolvanen, & Nurmi, 2015). In the study by Enlund, Aunola and Nurmi (2015) individual differences in the level of parental ability attributions concerning their children's academic outcomes showed moderate stability over children's 9-year comprehensive school career. Furthermore, Natale et al. (2008) found significant individual differences not only in the level but also in the developmental trend of mothers' ability attribution for success. For failure, there were individual differences in the level but not in the developmental trend (Natale et al., 2008).

Overall, these studies suggest that parents differ in the amount they use ability as an explanation of their children's academic outcomes and for the changes that are evident in the use of ability attribution over time. These kinds of individual differences have traditionally been approached using variable-oriented research that focuses on analyzing relations between variables in a particular sample. The limitation of this variable-oriented approach is, however, that it assumes that the associations between attribution variables across time are similar or the same for all parents and, thus, the possibility that different individuals may show different patterns of attributions—and even different pattern of development—has not been taken into account (Bergman & Magnusson, 1991; Bergman et al., 2003). As suggested by the entity and incremental theories (Dweck, 2000), it might be assumed that there are different groups of parents who show different longitudinal patterns

of ability attributions. For example, whereas the entity theory would lead parents to rate ability constantly as an equally significant cause of their child's performance regardless of the children's age or level of performance, parents who see ability as a malleable trait, and thus represent the incremental theory of intelligence, might be assumed to attribute their children's success increasingly and failure decreasingly to ability as the child proceeds through school and gets more practice. However, parents with incremental theory may also see other causal attributions, such as effort, to be more central than ability and thus rarely attribute the children's performance to ability.

Consequently, the first aim of the present study was to identify subgroups of parents whose patterns of ability attributions for their children's academic success and failure across the first three years of primary school are similar within the groups but differ between the subgroups (i.e., *longitudinal patterns*). The focus was on children's early years of primary school because during this period parents start to receive increasing feedback on their children's academic progress, which may impact on their views of their children's abilities. Previous studies have shown that parents tend to form their attributional beliefs early in their children's school career and these beliefs then continue to guide the parents' thinking later on (for a review, see Miller, 1995). Moreover, early school years can be seen important period to study the formation of parental attributions because parental views of their children's abilities play a crucial role in the development of children's self-perceptions (Haimovitz & Dweck, 2016; Murphey, 1992). During early school years children become increasingly responsive to performance feedback (Dweck, 2002) and their self-concepts start to stabilize (Aunola, Leskinen, Onatsu-Arviolommi, & Nurmi, 2002). Parental perceptions of their children's competencies during this period have been shown to predict not only the development of self-efficacy beliefs but also related task-focused vs. task-avoidant behaviors in learning situations among children (Aunola, Nurmi, Niemi, Lerkkanen, & Rasku-Puttonen, 2002). In the present study, both mothers and fathers were included and, thus, the second aim was to

examine the extent to which the mother and father of a particular child share the same longitudinal pattern of ability attributions.

Antecedents of Parents' Ability Attributions

Parental ability attributions have been shown to be related to both children's and parental characteristics, such as children's sex and level of academic performance and parents' level of education. For example, several studies have shown that the higher the levels of children's performance, the more the parents attribute the children's success to ability. This result has been found for the performance in mathematics (Hess & McDevitt, 1986), reading (Natale et al., 2008), and both mathematics and reading (Enlund, Aunola, & Nurmi, 2015; Rytönen et al., 2005). It has been further shown that parental ability attributions were positively related to higher levels of children's academic performance in cross-sectional (Phillipson, 2006) and longitudinal (Natale et al., 2009) studies. However, contradictory results also show that regardless of their children's achievement level, parents did not place differential emphasis on their children's ability or lack of it as a cause of their academic performance (O'Sullivan & Howe, 1996).

The relation between children's performances and parental ability attribution for failure has rarely been examined. One study found a negative relation between Chinese students' performance in math and their parents' ability attribution for failure (Phillipson, 2006). Another study showed that mothers of low-performing children attributed their failures to lack of ability (Hess & McDevitt, 1986) whereas in other studies no relation has been found (Rytönen et al., 2005).

Besides of children's academic performance, also children's sex has been shown to play a role in parental attributions. Parents typically attribute boys' success in math to ability and girls' failure in math to lack of ability (e.g., Hess & McDevitt, 1986; Holloway et al., 1986; Jacobs & Eccles, 1992; Parsons, Adler, & Kaczala, 1982; Rouland, Rowley, & Kurtz-Costes, 2013; Rätty, Vänskä, Kasanen, & Kärkkäinen, 2002; Yee & Eccles, 1988), whereas girls' competence in their native language is rated more positively than boys' (e.g., Rouland et al., 2013; Rätty, Kasanen, &

Honkalampi, 2006; Rätty, Kasanen, & Kärkkäinen, 2006), and boys' literacy failures are more likely attributed to lack of ability than girls' (Rouland et al., 2013). The results concerning sex differences in studies that combined performance in math and reading have been contradictory. One study showed that mothers attributed daughters' success more to ability than sons' (Enlund, Aunola, & Nurmi, 2015), but other studies have not found any sex differences in parental ability attributions (Cashmore & Goodnow, 1986; Natale et al., 2009).

Regarding parental characteristics, parents' level of education has been shown to be related with the causal attributions they have concerning their children's academic performance. Various studies have shown, for example, that the higher the parents' education, the more they attribute their children's success to ability (Natale et al., 2008; Phillipson, 2006; Rätty, Kasanen, & Honkalampi, 2006; Rytönen et al., 2005). Moreover, highly educated parents seem to show a stronger child-serving bias by attributing their children's success more strongly to the children's ability than other parents do (Kärkkäinen et al., 2011; Rätty, Kasanen, & Honkalampi, 2006). A relation between parental education and ability attribution for failure has not, however, been found (see, for example, Rytönen et al., 2005).

Thus, our third aim was to examine whether parents' level of education, children's sex, and children's academic performance would distinguish between the subgroups of parents showing different patterns of parental ability attributions. Because children's performance in reading and mathematics have been shown to equally contribute to parents' causal attributions concerning their children's school performance (Rytönen et al., 2005), both math and reading performance were included in this study.

Aims of the Study

The present study examined the following research questions:

(1) What kinds of longitudinal patterns can be identified among mothers and fathers based on their ability attributions for their children's academic success and failure from Grades 1 to 3?

Based on the research on attributional biases, we expected to find a pattern in which success is attributed to ability, whereas failure is not attributed to lack of ability (child-serving bias; see, for example, Enlund, Aunola, & Nurmi, 2015; Kärkkäinen et al., 2011; Miller, 1995; Rätty, Kasanen, & Honkalampi, 2006; Rytönen et al., 2005; Yee & Eccles, 1988; Hypothesis 1a). Based on the actor-observer bias model (Jones & Nisbett, 1971), we assumed a pattern to exist in which success and failure are both attributed to ability (Hypothesis 1b). Based on the entity and incremental theories of intelligence (Dweck, 2000), we further expected that in some of the identified patterns ability attributions in success and failure situations would remain at the same level across time, that is, from Grade 1 to Grade 3 (Hypothesis 1c), whereas in the some other patterns the level of ability attribution would increase over time in success situations but decreases in failure situations (Hypothesis 1d).

(2) To what extent do the mother and father of a particular child show the same pattern of ability attributions? Based on the previous findings on the similarity of parents' causal attributions (for example, Enlund, Aunola, & Nurmi, 2015; Natale et al., 2009) and the shared changes in them (Rytönen et al., 2005), we assumed that spouses in most cases share the same pattern (Hypothesis 2).

(3) To what extent do the identified patterns differ in terms of parents' level of education, children's academic performance, and children's sex? First, we expected that the parents of high-performing children attribute their success more and failure less to ability than the parents of low-performing children (e.g., Hess & McDevitt, 1986; Natale et al., 2008; Natale et al., 2009; Rytönen et al., 2005; Hypothesis 3a). Second, we expected highly educated parent's to attribute their children's success more and failure less to ability than parent's with lower level of education (e.g., Natale et al., 2008; Phillipson, 2006; Rätty, Kasanen, & Honkalampi, 2006; Rytönen et al., 2005; Hypothesis 3b). Third, because previous studies have shown inconsistent results concerning the role of children's sex in parents' ability attributions regarding their children's general school

performance (see Enlund, Aunola, & Nurmi, 2015; Natale et al., 2009; Rytönen et al., 2005), no exact hypotheses were set regarding children's sex.

Method

Participants and Procedure

The present parental sample consisted of a total of 1,721 children (808 girls and 913 boys; 6–8 years old at the beginning of Grade 1, $M = 7.25$ years, $SD = 0.32$ months) and their mothers ($n = 1,721$) and fathers ($n = 1,198$) who participated in the study when the children were in Grade 1, Grade 2, or Grade 3. The study is part of an ongoing longitudinal study in Finland (AUTHORS, 2006). It included 1,880 children entering kindergarten in 2006 and in the first phase followed up the children to Grade 4. The children were recruited from three medium-sized towns and one smaller municipality located in central, western, and eastern Finland. The children represented the whole age cohort of three towns and about half of the age cohort from the smaller municipality. Parents were asked to give their written consent for their children's and their own participation in the study. Some parents decided not to complete parental questionnaires although they gave their permission for their children's participation. These families were excluded from the final sample. In addition, the number of participants changed during the years due to moves to and away from the districts under study. The sample was highly homogeneous in ethnic and cultural background, which is characteristic of school populations outside the metropolitan region in Finland.

The data for the present study were collected in Grades 1, 2 and 3. Parents were asked to complete questionnaires on their ability attribution for their children's success and failure in school at the end of Grade 1 (T1; 1,474 mothers, 1,022 fathers), Grade 2 (T2; 1,456 mothers, 1,008 fathers), and Grade 3 (T3; 1,350 mothers, 897 fathers). Parents also reported their level of education at T1. Children's reading and math skills were assessed by trained testers at the end of Grade 1 by using group-administered tests in classroom situations.

The aim of our study was to identify what kinds of different longitudinal attributional patterns parents show regarding their ability attributions from Grade 1 to Grade 3. Consequently, information concerning parents' attributions from all three time points was used. However, children's level of performance at T1 was examined as an antecedent of these longitudinal attribution patterns, and, therefore, only T1 performance was included in the analyses.

Measurements

Parents' ability attributions. Parents' ability attributions for their children's success and failure in school were measured at all three time points (T1, T2, and T3) by a four-item questionnaire (Rytkönen et al., 2005) that was based on items used in previous studies, using open-ended statements to be completed by the participants (Ames & Archer, 1987; Parsons, 1980). Two of the four statements concerned parent's ability attribution for their children's success in school (*If my child does well on a school assignment, it is probably because . . . ; If my child does well in school, it is probably because . . .*), and the other two statements concerned their children's failure in school (*If my child does not do well on his/her school assignment, it is probably because . . . ; If my child does not know how to do some school assignments, it is probably because . . .*). After each statement, the parents were asked to assess the influence of the children's ability (*My child has abilities / My child lacks abilities*) by using a 5-point Likert scale (1 = *no influence at all* and 5 = *much influence*). Based on the parents' answers, a mean score was calculated for each grade separately for success and failure situations and separately for mothers and fathers. The internal consistency coefficients (Cronbach's alphas) across the three measurement points for parents' ability attribution for success situations were respectively .87, .90, and .90 among mothers, and .84, .88, and .90 among fathers. Analogous coefficients for failure situations were .79, .81, and .81 among mothers, and .77, .78, and .81 among fathers.

Parents' level of education. The parents 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 = *master's degree*, 7 = *licentiate or doctoral degree*. For further analysis, options 1 and 2 were combined to indicate parents with no occupational education. Of the mothers, 105 (6.4%) had no occupational education, 491 (30.1%) a vocational school degree, 385 (23.6%) a vocational college degree, 182 (11.1%) a bachelor's degree, 394 (24.1%) a master's degree, and 77 (4.7%) a licentiate or doctoral degree. Of the fathers, 82 (7.1%) had no vocational education, 392 (34%) a vocational school degree, 271 (23.5%) a vocational college degree, 113 (9.8%) a bachelor's degree, 221 (19.1%) a master's degree, and 75 (6.5%) a licentiate or doctoral degree. The parents in the study were somewhat more educated than the Finnish population overall (Official Statistics of Finland, 2010).

Children's math performance. Children's math performance was assessed by using the Basic Arithmetic Test (Aunola & Räsänen, 2007). On the test, a total of 28 items containing 14 addition (e.g., $2 + 1 =$; $3 + 4 + 6 =$) and 14 subtraction (e.g., $4 - 1 =$; $20 - 2 - 4 =$) items can be attempted within a 3-min time limit (maximum score: 28). Task difficulty increases gradually across the test. The test indexed a combination of speed and accuracy of performance of arithmetic. The Cronbach's alpha coefficient was .85.

Children's reading performance. Children's reading performance was assessed with two tests: reading fluency and reading comprehension. Reading fluency was tested with a subtest of the nationally normed reading test battery Reading Test for Primary School (ALLU—Ala-asteen Lukutesti; Lindeman, 1998). On this speed test, a maximum of 80 items consisted of a picture with four phonologically similar words attached to it. The words and pictures were easy and frequently used words familiar to very young children. The task was to draw a line between the picture and the word that semantically matched it. The score was the number of correct answers within a 2-min time limit (maximum score 80; Kuder–Richardson reliability = .97).

Reading comprehension was tested with the test of Sentence Reading Efficiency and Comprehension (Wagner, Torgesen, Rashotte, & Pearson, 2009; for the Finnish version, see

AUTHORS, 2009). In this test, students were instructed to read 60 sentences one by one and evaluate whether they were true or false by circling the correct alternative. The score was the number of correct answers within 3-min time limit (maximum score 60; Kuder–Richardson reliability = .94).

The scales for reading fluency and reading comprehension were first standardized, and then a mean score was calculated from the two scores to measure the children’s reading performance.

The correlation between reading fluency and reading comprehension was .76 ($p < .001$).

Analysis Strategy

First, to identify latent classes of mothers and fathers who show different longitudinal patterns of ability attributions regarding their children’s success and failure over the first three school years, we conducted latent profile analysis (LPA) separately for the mothers and fathers. The profiles were based on the mean values of the observed variables across all three measurement points (when the child was in first, second, and third grade). The analyses were performed using the maximum likelihood with robust standard errors estimation method (MLR) implemented in Mplus Version 7 (Muthén & Muthén, 1998–2011). The use of the missing data method with the models allowed us to include all of the observations that were available in the data set to estimate the model parameters.

The estimation was performed step by step, starting from 1 class solution and continuing to estimate the parameters for 2, 3, . . . , k -class solutions. To ensure the validity of each class solution, several different starting values (see, Muthén & Muthén, 1998–2011) varying from 500 to 2,000 were used to produce the models. Eight statistical criteria were used to evaluate the fit of the model in order to decide the optimal number of latent classes (i.e., ability attribution patterns): (a) log likelihood (Log L); (b) Akaike’s information criterion (AIC); (c) the sample size–adjusted Bayesian information criterion (aBIC); (d) the Vuong-Lo-Mendel-Rubin test (VLMR); (e) the Lo-Mendel-Rubin test (LMR); (f) the parametric bootstrapped likelihood ratio test (BLRT; Muthén & Muthén,

1998–2007); (g) the reliability of classification by entropy; and (h) average latent class posterior probabilities (AvePP; Muthén & Muthén, 1998–2007). The lower the log L, AIC, and aBIC values, the better the model. The likelihood ratio tests (VLMR, LMR, and BLRT) compare solutions with different numbers of latent classes. A low p value ($p < .05$) indicates that a number of latent classes defined in terms of k fit the data better than $k-1$. The entropy and AvePP indices indicate each individual's probability of belonging to the most likely class. Possible values range from 0 to 1.0, and values closer to 1.0 indicate more reliable classification and distinguishable classes. Values greater than .70 are used as a rule of thumb to indicate that the found solution can be interpretable using the mean trajectories (Nagin, 2005). However, often there is no perfect agreement across these criteria regarding the optimal model to select.

Second, the found patterns of ability attributions among mothers and fathers were compared by using cross-tabulations, with Pearson's chi-square test as an indicator of significant differences and adjusted standardized residuals as indicators of significant differences between observed and expected counts. The cross-tabulation was performed with IBM SPSS Statistics 20.

Finally, the subgroups of parents showing different patterns of ability attributions were compared according to different criterion variables (i.e., parents' level of education, children's sex, and children's reading and math performance) separately for mothers and fathers by using IBM SPSS Statistics 20. Differences in children's reading and math performance between the groups were assessed by means of ANOVAs. Differences between the groups in the level of parental education and in children's sex were assessed with cross-tabulations, with Pearson's chi-square test as an indicator of significant differences and adjusted standardized residuals as indicators of significant differences between observed and expected counts. Because it is possible that differences between subgroups in parental education are due to the children's level of performance, log linear models were also carried out to examine whether the association of attribution pattern and parental education would remain statistically significant after controlling for the impacts of

children's reading and math performance. Because a considerable number of statistical analyses were carried out, a significance level of 0.01 (adjusted standardized residuals higher than 2.6 or lower than -2.6), and two-way significance tests were used in all analyses.

Results

Longitudinal Patterns of Ability Attributions

LPA was used to identify subgroups of mothers and fathers showing different longitudinal patterns of ability attributions for their children's success and failure when the children were in the first, second, and third grade. The model fit indices and class sizes of one- to seven-class solutions are provided in Table 1. Comparison of the class solutions with different numbers of classes showed that no solution was clearly superior to others. Eventually, the five-class solution was selected for further analyses. The decision was based on the assessments of the statistical fit information of LPA and on the fact that all five classes were meaningful in terms of the content. Furthermore, the five-class solution revealed similar longitudinal patterns among the mothers and fathers in regard to the combination of the ability attributions (i.e. relative level of ability attributions in children's success and failure situations), which indicated the external validity of the solution.

The log L, AIC, and aBIC values decreased when the number of classes increased suggesting that even more than seven classes should be added. However, the change in the AIC and BIC values got smaller the more classes were added, especially among the mothers, indicating that the improvement of the fit was decreasing. The VLMR and the LMR showed that among mothers the fit of the model increased until the six-class solution, which was no longer better than the five-class solution. Among the fathers, the VLMR and the LMR suggested that three classes could be enough. However, the BLRT suggested that even more than seven classes should be added among mothers and fathers.

The entropy value was acceptable in the three- to seven-class solutions among the mothers and four- to seven-class solutions among the fathers. The AvePP was also acceptable ($< .70$) in all

tested class solutions. However, small class sizes appeared in the six-class solution and onward among the mothers and fathers. In addition, among the fathers, the four-class solution was not acceptable, because one class consisted of only 17 individuals. Thus, acceptable solutions were three- to five-class solutions among the mothers and the five-class solution among the fathers¹.

The means and estimated class probabilities for the selected five-class solution are listed in Table 2. The patterns of ability attributions are depicted in Figure 1 for the mothers and in Figure 2 for the fathers. The patterns were labeled based on the level (high, medium, low) of the ability attribution in success situations (the first part of the profile name) and on the level (high, medium, low) of the ability attribution in failure situations (the latter part of the pattern name). Accordingly, a high level of the ability attribution means that the parent tends to use ability as an explanation for his or her child's performance, whereas a low level of the ability attribution signifies that the parent does not see ability as an important cause of his or her child's performance. For example, if the level of ability is high in a child's failure situations, the parent thinks that the child fails because of his or her ability; that is, the child lack ability. Similarly, if the level of ability is low in a child's success situations, then the parent thinks that the child's success is not based on his or her ability;

¹ Because log L, AIC, aBIC, and BLRT suggested that even more than seven classes should be added, we performed a hierarchical cluster analysis with IBM SPSS Statistics 20 to get an optional view of the data and to ensure the validity of the results gathered with the LPA. We chose Ward's method of clustering using the squared Euclidean distance to the clustering to form clusters of those cases with the smallest increase in the overall sum of the squared within-cluster distances (or error sum of squares; Ward, 1963). The results showed that the sample consists of many small and homogeneous subgroups, which the LPA recognizes when the number of classes is high. These small groups, however, were not found to be interpretable. The Euclidean distances suggested that combining the small groups is meaningful until a five- or four-class solution among the mothers and fathers.

that is, ability is not an important cause for the child's success.

Pattern 1, High-Low, consisted of 201 (12.2%) mothers and 106 (7.9%) fathers, who had the highest level of ability attributions in success situations and the lowest level in failure situations. Pattern 2, High-High, was the smallest group, consisting of 184 (10.8%) mothers and 78 (7.2%) fathers. They reported high levels of ability attribution in success and failure situations. Pattern 3, Medium-High, comprised 459 (27.0%) mothers and 315 (27.0%) fathers. Their use of ability attribution was in the middle in success situations and high in failure situations. The biggest group was Pattern 4, Medium-Low, with 525 (29.4%) mothers and 425 (33.0%) fathers. Their ability attribution in success situations was also at the middle, but in failure situations, the level was low. Pattern 5, Low-Medium, showed the lowest level of ability attribution in success situations, and the parents' use of ability attribution in failure situations was in the middle. This pattern consisted of 352 (20.7%) mothers and 274 (23.1%) fathers.

Changes in the Level of Ability within Patterns of Ability Attributions

Overall, there were changes in the level of the mothers' ability attribution for success across the three measurement points from Grade 1 to Grade 3 in the following patterns: High-Low, High-High, Medium-High, and Low-Medium (see Table 2 for the test results). In the High-Low and High-High patterns, the level first increased between T1 and T2 and then decreased between T2 and T3 back to a level that did not differ from T1. In the Medium-High profile, the level increased from T2 to T3, but the level at T3 was not higher than at T1. In the Low-Medium pattern, the level first decreased between T1 and T2 and then increased between T2 and T3 back to a level that did not differ from the T1. Regarding the changes in the level of ability attribution for failure, there were changes only in the High-High pattern in which the level increased from T1 to T2. The only stable pattern across the three measurement points regarding the ability attributions in success and failure was the Medium-Low profile.

Among the fathers, there were changes in the level of ability attribution regarding success

across the three measurement points in the following patterns: High-Low, High-High, Medium-Low, and Low-Medium (see Table 2 for the test results). More specifically, all the changes were evident between T2 and T3. In the High-Low, High-High, and Medium-Low patterns, the level increased, whereas in the Low-Medium pattern the level decreased. Regarding ability attribution for failure, there were changes only in the High-High pattern in which the level increased from T1 to T3. Among the fathers, the only stable pattern regarding the ability attributions in success and failure was the Medium-High pattern.

Similarities between Mothers' and Fathers' Patterns of Ability Attributions

The cross-tabulation of the mothers' and fathers' patterns of ability attributions showed that parents of the same child typically reported similar kind of patterns: $\chi^2 (16, N = 1,155) = 190.79, p < .001$ (see Table 3). In addition, fathers represented by the Low-Medium pattern were underrepresented in mothers' High-Low, High-High, and Medium-Low patterns. Furthermore, fathers in the Medium-Low pattern were underrepresented among the mothers' Medium-High pattern and fathers in the High-Low pattern were underrepresented among the mothers' Low-Medium pattern.

Differences in the Patterns of Ability Attributions according to Criterion Variables

Children's performance. Statistically significant differences between the subgroups of parents showing different patterns of ability attributions were found regarding the children's reading and math performance both among the mothers and fathers (see Table 4). Children of mothers or fathers characterized by the High-Low attribution pattern showed statistically significantly ($p < .001$) higher level of reading performance than children of the mothers or fathers characterized by Medium-High, Medium-Low or Low-Medium patterns. They did not, however, differ regarding their reading performance from children of mothers or fathers showing High-high attribution pattern. Children of mothers or fathers characterized by Low-Medium pattern, in turn, had statistically significantly ($p < .001$) lower level of reading performance than the other children (as

an exception, children of fathers showing Low-Medium pattern did not differ regarding their reading performance from those whose fathers showed Medium-High pattern). The results concerning children's level of math performance were in the same direction as those found for reading performance. However, there were fewer group differences in math performance than in reading performance (see more detailed results from the Table 4).

Parent's level of education. There was a significant association between the mothers' patterns of ability attributions and their level of education: $\chi^2 (20, N = 1,634) = 76.53, p < .001$. Mothers with a master's degree were overrepresented in subgroups showing the High-Low and Medium-Low attribution patterns and underrepresented in the groups showing Medium-High and Low-Medium patterns (see Table 5). Respectively, mothers with a vocational school degree were underrepresented in the same subgroups in which mothers with a master's degree were overrepresented and overrepresented in the subgroup showing Medium-High attribution pattern. In addition, mothers with no occupational education were overrepresented in subgroup characterized by the Low-Medium attribution pattern. There was also one significant association between the fathers' ability attribution patterns and the fathers' level of education [$\chi^2 (20, N = 1,154) = 43.49, p = .002$]: Fathers with vocational school degrees were overrepresented in group showing the Low-Medium pattern of attribution (see Table 5).

In order to examine whether the differences between parental attributional patterns in parental level of education would be due to the level of children's performance, the associations of parental patterns of ability attributions and level of education were analyzed by log linear models including children's reading and math performance as covariates. The results showed that after controlling for the children's performance in reading and math, parental education was not anymore associated with the pattern of ability attributions typical for fathers [Pearson $\chi^2 (18) = 22.75, p = .20$]. Among mothers, the association of maternal education with the pattern of ability attributions remained significant [Pearson $\chi^2 (18) = 64.66, p < .001$]. However, after taking into account the

covariates, mothers with a master's degree were not anymore underrepresented in the subgroup showing Low-Medium pattern of ability attributions and mothers with a vocational school degree were not anymore underrepresented in the Medium-Low pattern of ability attributions. Overall, these results suggest that among fathers the found educational differences between subgroups were due to the children's academic performance, whereas among mothers children's performance explained some but not all effects of the level of education.

Children's sex. For children's sex, there were no differences at the significance level $p < .01$ between subgroups of mothers [$\chi^2(4, N = 1,721) = 4.54, p = .34$] or fathers [$\chi^2(4, N = 1,198) = 10.70, p = .03$] showing different patterns of ability attributions.

Discussion

Previous research on parents' causal attributions for their children's academic performance has mainly focused on the kinds of causal attributions parents report, and what are the major antecedents and consequences of such attributions (Natale et al., 2008, 2009). These studies have typically used a variable-oriented approach. Past studies based on mean comparisons have shown that in Western countries ability is the most commonly used parental attribution for children's success, whereas parents rarely use ability to explain children's failures (Cashmore & Goodnow, 1986; Enlund, Aunola, & Nurmi, 2015; Miller, 1995; Natale et al., 2009). The present study broadens our understanding of parental thinking by applying a person-oriented approach to identify different subgroups of mothers and fathers who differ in the longitudinal patterns they show in their ability attributions concerning their offspring's academic success and failure. Five different longitudinal patterns of parental ability attributions were identified. In the High-Low and Medium-Low patterns, ability was seen as a more important cause of success than of failure, whereas in the Low-Medium and Medium-High patterns, ability was seen as a more important cause of failure than of success. In the High-High pattern ability was seen an equally important cause of success and failure. Among fathers, group differences in the levels of ability attributions for success increased

across time, whereas among mothers the group differences in the levels of attributions remained similar across time. In addition, the lower the children's academic performance, the more likely their parents were to demonstrate a pattern in which the level of ability attribution was low for success but high for failure. Furthermore, having a master's degree increased mothers' probability of using ability attributions in a child-serving manner (i.e., ability was seen as more important cause of success than of failure), whereas mothers with a vocational school degree as well as mothers without occupational education did not give credit for their children's abilities after success situations (i.e., they saw ability as a more important cause of failure than of success).

The Longitudinal Patterns of Ability Attributions

This study aimed to identify latent subgroups of parents who differ in their use of ability attributions as explanation for their children's success and failure during Grades 1, 2 and 3. Five latent longitudinal patterns, which were similar in regard to the combination of the ability attributions (i.e. relative level of ability attributions in a child's success and failure situations) for mothers and fathers, were identified. The patterns were labeled High-Low, Medium-Low, Medium-High, Low-Medium, and High-High. The first part of the name describes the relative level of the ability attribution in success situations, and the latter part of the name describes the relative level of the ability attribution in failure situations. In two of the patterns, High-Low and Medium-Low, including 41 % of the mothers and 43 % of the fathers, ability was seen as a more important cause of success than of failure. It could be interpreted that the parents represented by these attribution patterns think that their children have abilities: The child is seen to succeed because of ability, whereas failure is not explained by lack of ability. The identified High-Low and Medium-Low patterns match well with the theory of child-serving bias (Hypothesis 1a): The parents represented by these patterns attribute their children's success to the child's ability, whereas the parents do not see failure as due to lack of ability. This kind of parental pattern of ability attributions can be assumed to provide a positive developmental environment for the child development (Kiefer & Shih, 2006;

Natale et al., 2009; Weiner, 1992) and contribute the development of positive academic self-concept and learning strategies. For example, parents who think that their children are competent and have abilities despite of temporal failures and setbacks in school may foster the development of self-efficacy beliefs and task-focused behaviors among their children by investing more effort in encouraging their children to deal with demanding learning tasks (Aunola, Nurmi, et al., 2002). From a practical point of view, the fact that in the present study a large proportion of mothers and fathers showed this kind of child-serving pattern of ability attributions is encouraging.

In the Medium-High and Low-Medium patterns, which included 48 % of the mothers and 50 % of the fathers, lack of ability is seen as an important cause of failure, but ability is not seen as an important cause of success. It can be assumed that the parents represented by these patterns do not have strong faith in their children's abilities: The parents do not give credit for their children's abilities after success, and they believe that lack of ability causes the children to fail. Because children are prone to internalize the expectations of their parents (Parsons et al., 1982; Phillips, 1993), this kind of parental pattern of attribution may lead children in the risk of developing negative academic self-beliefs (Haimovitz & Dweck, 2016; Kiefer & Shih, 2006). Also, when parents have negative views of their children's competencies, they may focus more on children's performance than on learning possibilities in failure situations, which focus may then have harmful consequences for children's learning motivation (Haimovitz & Dweck, 2016). Overall, the fact that in the present study such a large proportion of parents demonstrated maladaptive attributional pattern characterized by lack of faith in their children's abilities is far from ideal state of affairs. In fact, any interventions for parents aiming to help parents to support their offspring's learning and self-concept development should include efforts to change parents' negative causal attributions towards more positive direction. These interventions could include, for example, teaching parents how failure can be beneficial learning opportunity rather than reflection of lack of ability, and how

to react to their children's setbacks so as to maintain their children's motivation and learning (Haimovitz & Dweck, 2016).

The fifth pattern, High-High, including 11% of the mothers and 7% of the fathers, is in accordance with actor-observer bias (Hypothesis 1b): Parents represented by that pattern hold ability as an equally important cause of success and failure. In other words, these parents believe their children succeed because of ability and at the same time fail because they lack ability. Parents represented by this pattern seem to be very focused on ability as an explanation for their children's performance. These parents may not be aware of the contradictory nature of explaining success and failure by ability because the attributions in these situations are typically made in different times. From practical point of view, also these parents would benefit of intervention that provides information concerning the negative effects of parental ability attributions in failure situations on children's academic functioning and adjustment.

Regarding the changes in the level of parental ability attributions across school years, we hypothesized we would find patterns in which the levels of ability attributions in success and failure situations remain stable over the time (Hypothesis 1c). Typical examples of these kinds of stable patterns were the Medium-Low profile among the mothers and the Medium-High profile among the fathers. However, if we consider only the changes that were evident from Grade 1 to Grade 3 (i.e., not the changes between Grade 1 and Grade 2, and Grade 2 and Grade 3), the levels of ability attributions in success and failure situations were stable in all of the mothers' profiles, while among the fathers the Medium-High profile was still the only profile with stable levels. Based on the incremental theory of intelligence (Dweck, 2000), we hypothesized we would find a pattern in which the use of ability attribution increases over time in success situations but decreases in failure situations (Hypothesis 1d). We did not find this pattern in the present study. Instead, the level differences of ability attribution for success increased over time between the patterns. This was evident particularly between Grades 1 and 2 among mothers and between Grades 1 and 3 among

fathers. Thus, the results suggest that parents differ in particular in the amount they use ability attributions as an explanation for their children's success and failure, not for changes over time. In fact, the results are in accordance with one previous study that reported high interindividual stability in parental ability attributions (Enlund, Aunola, & Nurmi, 2015). This interindividual stability in parental ability attribution may also reflect interindividual stability of children's abilities, although this hypothesis was not tested in the present study.

In respect to the changes in the patterns of parental ability attributions across school years, we need to keep in mind that parental attributions were measured when children were moving from grade 1 to grade 3, that is, early primary school years. This period has some particular features. For example, during this period, children's basic academic skills develop rapidly and parents get first time feedback from teachers concerning their offspring's academic development. Although this is the time when parental beliefs concerning their children's abilities are first time formed (Miller, 1995), it is possible that during later school years, for example in the context of school transition from primary to secondary school, parents' causal attributions concerning their children's academic failures and successes will be revised due to challenges and demands that children face in different stages of their school career, the amount of support and instructions teachers give to the children, the degree of curriculum difficulty, and feedback from new teachers and children's grade point average.

Congruence of Mothers and Fathers' Patterns of Ability Attributions

The second research question concerned the extent to which the mother and father of a particular child are represented by the same pattern of ability attributions. The results confirmed Hypothesis 2 by showing that the mother and father of the same child typically had a similar pattern regarding the relative level of ability attributions. It was particularly unlikely that parents of the same child would be represented by the High-Low and Low-Medium patterns or the Medium-Low and Medium-High patterns. In addition, it was unlikely that the mother of a particular child was

represented by the High-High pattern or the Medium-Low pattern if the father of that child was represented by the Low-Medium pattern. Previous studies have also shown similarities in parents' ability attributions (Enlund, Aunola, & Nurmi, 2015; Natale et al., 2009; Rytönen et al., 2005). This may be due to both parents' realistic evaluations of their children's abilities that lead the parents to similar conclusions. In addition, the parents presumably discuss information concerning their children (e.g., the feedback given by the children's teachers), and the other parent may adopt the view of the other parent if she or he, for example, participates more actively in school activities or spends more time with the particular child and thus has more information regarding the child's abilities.

The Role of Background and Child-related Factors in Parents' Patterns of Ability

Attributions

The objective of the present study was not only to determine longitudinal patterns based on parental ability attributions but also to examine the relations of the attribution patterns with parental education, children's level of performance, and children's sex. The results concerning associations of parents' attribution patterns and their children's level of academic performance were in accordance with earlier research and Hypothesis 3a: Those parents whose children showed the lowest academic performance were overrepresented in the Low-Medium and Medium-High patterns. Moreover, the parents of high-performing children were overrepresented in the High-Low and High-High patterns in which success was attributed to high ability. These results suggest that parents are realistic in their views of their children's abilities as they assume that their children's performance in math and reading genuinely reflects the children's abilities. The parents of high-performing children may also have high expectations for their children and therefore typically attribute success to ability. Attributing children's success to ability (Miller et al., 1975; Natale et al., 2009) and not attributing failure to lack of ability (Kiefer & Shih, 2006; Weiner, 1992) have been shown to be the most beneficial ways of using the ability attribution to promote children's positive

academic self-concept. Therefore, the High-Low pattern of ability attributions can be considered the most advantageous: Parents in that pattern have the highest level of ability attribution in children's success situations and the lowest level of ability attribution in children's failure situations. The most harmful pattern can be assumed to be Low-Medium because the parents in that pattern have the lowest level of ability attribution in their children's success situations and a high level of ability attribution in their children's failure situations. From a practical point of view, even in the case of low performing children, parents should be informed about the possible negative effects of attributing children poor performance to lack of ability.

The results showed further, partly according to Hypothesis 3b, that parents' patterns of their ability attributions differed according to the level of parental education: Mothers with a master's degree were more likely to report child-serving patterns, evidenced in the High-Low and Medium-Low patterns, whereas mothers and fathers with a vocational school degree, as well as mothers without occupational education, were more likely to be represented by patterns that underestimated the role of child's ability in success situations, that is, the Low-Medium and Medium-High patterns.

Based on our results, it cannot be stated that the higher the parents' education, the more child-serving attributions parents use, as suggested by previous studies (Natale et al., 2008; Phillipson 2006; Rätty, Kasanen, & Honkalampi, 2006; Rytönen et al., 2005), because parents with the highest possible education, a licentiate or doctoral degree, were evenly distributed in all of the patterns. According to the results of the present study, it seems more evident that the lower the parents' education, the less they use ability attribution in a child-serving manner: the less they attribute success to ability, and the more they attribute failure to lack of ability. However, even this result was not consistent because, for example, the fathers without occupational education were not overrepresented in the Low-Medium and Medium-High patterns. Moreover, after taking account the role of children's performance fathers' education was not anymore related with their attribution patterns although mothers' education was. This result suggests that children of less educated

fathers have a lower level of academic performance, and this low level of performance is also reflected in the fathers' ability attributions. However, in order to make any generalizations, future studies replicating the found differential mediational role of child performance on paternal and maternal attributions are needed.

Among mothers, the results concerning the role of education in attribution patterns were not totally explained by children's level of performance suggesting that there are other explanations behind the found association. One explanation for the result that especially mothers with low levels of education doubt their children's ability might be that these mothers have weak trust on their own abilities because of their low level of education. Therefore, they may also use a similar pattern of attribution for their children. Instead, highly educated mothers probably have trust in their child's abilities and possibly have higher expectations for their performance, which may lead these parents to attribute success more to ability. The fact that the high-educated mothers are apt to use ability explanations for their children's successes may be reflected also in maternal confidence on their children's educational potential and future prospects. From this point of view, middle-class children may have an 'attributional advantage' as a social-psychological resource to their further schooling. These results suggest that any interventions that aim to impact on children's academic outcomes and adjustment among children from underprivileged background should include information for parents concerning the negative impacts of ability attributions after failure, and also, positive consequences of effort attributions (Haimovitz & Dweck, 2016).

The result concerning children's sex showed that the mothers of girls and boys were equally represented in all of the identified attribution patterns. One reason for the fact that in the present study no sex differences were found is that previous studies have shown that sex differences are subject specific (i.e., girls' abilities are rated higher in reading and boys' abilities in mathematics; e.g., Hess & McDevitt, 1986; Holloway et al, 1986; Jacobs & Eccles, 1992; Parsons et al., 1982; Rouland et al., 2013; Rätty et al., 2002; Rätty, Kasanen, & Honkalampi, 2006; Rätty,

Kasanen, & Kärkkäinen, 2006; Yee & Eccles, 1988). However, in the present study, parents' ability attributions regarding their children's performance in mathematics and in reading were not separated.

Limitations

This study has some limitations that must be considered when generalizing the findings. First, due to the lack of precise hypotheses, our LPA was exploratory; thus, these results should be generalized with caution. Second, only parental causal attribution to ability was studied. This approach does not consider the possibility that parents may use different attributions in different combinations (Räty & Kärkkäinen, 2011). Including other common causal attributions, such as effort and help, would have provided a broader picture of the interaction between different kinds of causal attributions among particular parents. Third, the present study focused on parental ability attributions but no information was available concerning parental views of the malleability of ability. Whereas attribution theory defines ability as uncontrollable factor, some other theories suggest that ability can be seen also as a controllable skill that can be developed through persistent effort (Dweck, 1999; Haimovitz & Dweck, 2016; see also Räty & Kärkkäinen, 2011). Thus, further studies are needed where also parental perception of controllability of ability is assessed in order to get a deeper view of the different patterns of ability attributions. Fourth, the present study did not focus on the developmental dynamics between parental ability attributions and child performance. Consequently, further studies are needed to examine the role of parental patterns of ability attributions in children's skill development across school years. Finally, the present study was carried out in one Western country, Finland. The profiles might be different in different cultural contexts due to the different parental beliefs and sex differences.

Conclusions

In this study, five different patterns based on parents' ability attributions for their children's successes and failures were identified. The patterns differentiated from each other especially in the

combination of the level of ability attribution in children's success situations and the level of ability attribution in their failure situations. The relative levels of ability attributions in the patterns remained similar over the study period (i.e., from Grade 1 to Grade 3) in success and failure situations and the changes that were evident within patterns only intensified the level differences between the patterns. Thus, the results suggest that parents differ in particular in the amount they use ability attributions as an explanation for their children's success and failure, not in the changes over the time. Overall, the results suggest that parents tend to be rather set in their views already during the children's first grade in school. The stable level of parents' causal attributions over a longer period can be assumed to be important for children's academic achievement and adjustment, because such attributions form a stable developmental environment for children that does not only include parents' thinking but also their parenting practices.

References

- Ames, C., & Archer, J. (1987). Mothers' beliefs about the role of ability and effort in school learning. *Journal of Educational Psychology, 79*, 409–414. doi:10.1037/0022-0663.79.4.409
- Aunola, K., & Räsänen, P. (2007). *The Basic Arithmetic Test*. Jyväskylä, Finland: University of Jyväskylä.
- Aunola, K., Leskinen, E., Onatsu-Arviolommi, T., & Nurmi, J.-E. (2002). Three methods for studying developmental change: A case of reading skills and self-concept. *British Journal of Educational Psychology, 72*, 343-364.
- Aunola, K., Nurmi, J. -E., Niemi, P., Lerkkanen, M.-K., & Rasku-Puttonen, H. (2002). Developmental dynamics of achievement strategies, reading performance, and parental beliefs. *Reading Research Quarterly, 37*, 310-327.
- Bergman, L. R., & Magnusson, D. (1991). Stability and change in patterns of extrinsic adjustment problems. In D. Magnusson, L. R. Bergman, G. Rudinger, & B. Törestad (Eds.), *Problems and methods in longitudinal research: Stability and change* (pp. 323–346). Cambridge: Cambridge University Press.
- Bergman, L. R., Magnusson, D., & El-Khoury, B.-M. (2003). *Paths through life, Vol. 4: Studying individual development in an interindividual context: A person-oriented approach*. Mahwah, NJ: Lawrence Erlbaum Associates.
- Cashmore, J. A., & Goodnow, J. J. (1986). Parent–child agreement on attributional beliefs. *International Journal of Behavioral Development, 9*, 191–204.
- Dunton, K. J., McDevitt, T. M., & Hess, R. D. (1988). Origins of mothers' attributions about their daughters' and sons' performance in mathematics in sixth grade. *Merrill-Palmer Quarterly, 34*, 47–70.
- Dweck, C. (2000). *Self-theories: Their role in motivation, personality, and development*. Philadelphia, PA: Taylor & Francis.

- Dweck, C. S. (2002). The development of ability conceptions. In A. Wigfield, & J. S. Eccles (Eds.), *Development of Achievement Motivation* (pp. 57–88). San Diego, CA: Academic Press.
- Enlund, E., Aunola, K., & Nurmi, J-E. (2015). Stability in parents' causal attributions for their children's academic performance: A nine-year follow-up. *Merrill-Palmer Quarterly*, *61*, 509–536. doi: 10.13110/merrpalmquar1982.61.4.0509
- Enlund, E., Aunola, K., Tolvanen, A., & Nurmi, J-E. (2015). Parental causal attributions and emotions in daily learning situations with the child. *Journal of Family Psychology*, *29*, 568–575. doi: 10.1037/fam0000130
- Frome, P. M., & Eccles, J. S. (1998). Parents' influence on children's achievement-related perceptions. *Journal of Personality and Social Psychology*, *74*, 435–452. doi: 10.1037/0022-3514.74.2.435
- Furnham, A. (2014). Increasing your intelligence: Entity and incremental beliefs about the multiple “intelligences”. *Learning and Individual Differences*, *32*, 163-167. doi: 10.1016/j.lindif.2014.03.001
- Haimovitz, K., & Dweck, C. S. (2016). What predicts children's fixed and growth intelligence mind-sets? Not their parents' views of intelligence but their parents' views of failure. *Psychological Science*, *27*, 859-869. doi: 10.1177/09567976166639727
- Hess, R. D., & McDevitt, T. M. (1986). Some antecedents of maternal attributions about children's performance in mathematics. In R.D. Ashmore & D.M. Brodzinsky (Eds.), *Thinking about the family: Views of parents and children*. Hillsdale, NJ: Erlbaum.
- Holloway, S. D., Kashiwagi, K., Hess, R. D., & Azuma, H. (1986). Causal attributions by Japanese and American mothers and children about performance in mathematics. *International Journal of Psychology*, *21*, 269-286. doi: 10.1080/00207598608247590
- Jacobs, J. E. (1991). Influence of gender stereotypes on parent and child mathematics attitudes. *Journal of Educational Psychology*, *83*, 518-527. doi: 10.1037/0022-0663.83.4.518

- Jacobs, J. E., & Eccles, J. S. (1992). The impact of mothers' gender-role stereotypic beliefs on mothers' and children's ability perceptions. *Journal of Personality and Social Psychology, 63*, 932–944. doi: 10.1037/0022-3514.63.6.932
- Jones, E.E., & Nisbett, R.E. (1971). *The actor and the observer: Divergent perceptions of the causes of behavior*. Morristown, NJ: General Learning Press.
- Kiefer, A., & Shih, M. (2006). Gender differences in persistence and attributions in stereotype relevant contexts. *Sex Roles, 54*, 859–868. doi: 10.1007/s11199-006-9051-x
- Kärkkäinen, R., Rätty, H., & Kasanen, K. (2011). Parents' perceptions of the malleability of their child's academic competencies. *Scandinavian Journal of Educational Research, 55*, 213–224. doi: 10.1080/00313831.2011.576875
- Leung, J. T. Y., & Shek, D. T. L. (2015). Parental attributions of children's success and failure and family processes in poor Chinese families. *Journal of Child and Family Studies, 24*, 2191–2203. doi: 10.1007/s10826-014-0022-5
- Lindeman, J. (1998). *Ala-asteen Lukutesti ALLU* [Reading Test for Primary School]. Turku, Finland: University of Turku, Oppimistutkimuksen keskus.
- Miller, S. A. (1995). Parents' attributions for their children's behaviour. *Child Development, 66*, 1557–1584. doi: 10.2307/1131897
- Miller, R. L., Brickman, P., & Bolen, D. (1975). Attribution versus persuasion as a means for modifying behavior. *Journal of Personality and Social Psychology, 31*, 430-441.
- Mezulis, A. H., Abramson, L. Y., Hyde, J. S., & Hankin, B. L. (2004). Is there a universal positivity bias in attributions? A meta-analytic review of individual, developmental, and cultural differences in the self-serving attributional bias. *Psychological Bulletin, 130*, 711–747. doi: 10.1037/0033-2909.130.5.711
- Murphey, D. (1992). Constructing the child: Relations between parents' beliefs and child outcomes. *Developmental Review, 12*, 199-232.

- Muthén, L. K., & Muthén, B. O. (1998–2011). *Mplus user's guide* (6th ed.). Los Angeles: Muthén & Muthén.
- Nagin, D. S. (2005). *Group-based modeling of development*. Cambridge, MA: Harvard University Press.
- Natale, K., Aunola, K., & Nurmi, J-E. (2009). Children's school performance and their parents' causal attributions to ability and effort: A longitudinal study. *Journal of Applied Developmental Psychology, 30*, 14–22. doi: 10.1016/j.appdev.2008.10.002
- Natale, K., Aunola, K., Nurmi, J-E., Poikkeus, A-M., Lyytinen, P., & Lyytinen, H. (2008). Mothers' causal attributions concerning the reading achievement of their children with and without familial risk for dyslexia. *Journal of Learning Disabilities, 41*, 274–285. doi: 10.1177/0022219408316094
- Official Statistics of Finland (2010). Appendix Table 1: Population aged 15 or over by level of education and gender 2010. In *Educational structure of population* [E-publication]. Helsinki: Statistics Finland. Retrieved March 1, 2016, from http://www.stat.fi/til/vkour/2010/vkour_2010_2011-12-02_tau_001_en.html
- O'sullivan, J. T., & Howe, M. L. (1996). Causal attributions and reading achievement: Individual differences in low-income families. *Contemporary Educational Psychology, 21*, 363-387. doi:10.1006/ceps.1996.0027
- Parsons, J. E. (1980). *Instrumentation: Final report*. Ann Arbor: University of Michigan.
- Parsons, J., Adler, T. F., & Kaczala, C. M. (1982). Socialization of achievement attitudes and beliefs: Parental influences. *Child Development, 53*, 310–321. doi: 10.2307/1128973
- Phillipson, S. (2006). Cultural variability in parent and child achievement attributions: A study from Hong Kong. *Educational Psychology, 26*, 625–642. doi: 10.1080/01443410500390772

- Rouland, K. K., Rowley, S. J., & Kurtz-Costes, B. (2013). Self-views of African-American youth are related to the gender stereotypes and ability attributions of their parents. *Self and Identity, 12*, 382-399. doi:10.1080/15298868.2012.682360
- Räty, H., Kasanen, K., & Honkalampi, K. (2006). Three years later: A follow-up study of parents' assessments of their children's competencies. *Journal of Applied Social Psychology, 36*, 2079–2099. doi: 10.1111/j.0021-9029.2006.00095.x
- Räty, H., Kasanen, K., & Kärkkäinen, R. (2006). School subjects as social categorizations. *Social Psychology of Education, 9*, 5–25. doi: 10.1007/s11218-005-2439-6
- Räty, H., & Kärkkäinen, H. (2011). Talent or effort? Parents' explanations of their children's mathematical performance in relation to mathematical competence. *Social Behavior and Personality, 39*, 691-700. doi: 10.2224/sbp.2011.39.5.691
- Räty, H., Vänskä, J., Kasanen, K., & Kärkkäinen, R. (2002). Parents' explanations of their child's performance in mathematics and reading: A replication and extension of Yee and Eccles. *Sex Roles, 46*, 121–128. doi: 10.1023/A:1016573627828
- Rytkönen, K., Aunola, K., & Nurmi, J-E. (2005). Parents' causal attributions concerning their children's school achievement: A longitudinal study. *Merrill-Palmer Quarterly, 51*, 494–522. doi: 10.1353/mpq.2005.0027
- Stevenson, H. W., & Stigler, J. W. (1992). *The Learning Gap: why our schools are failing and what we can learn from Japanese and Chinese education*. New York, NY: Summit Books.
- Wagner, R. K., Torgesen, J.K., Rashotte, C.A., & Pearson, N.A. (2009). *TOSREC: Test of Sentence Reading Efficiency and Comprehension*. Austin, TX: Pro-Ed.
- Ward, J. H. (1963). Hierarchical grouping to optimize an objective function. *Journal of the American Statistical Association, 58*(301), 236–244.
- Weiner, B. (1992). *Human motivation: Metaphors, theories, and research*. Thousand Oaks, CA: Sage.

Weiner, B. (1986). *An attributional theory of motivation and emotion*. New York: Springer-Verlag.

Yee, D. K., & Eccles, J. S. (1988). Parent perceptions and attributions for children's math achievement. *Sex Roles, 19*, 317–333. doi: 10.1007/BF00289840

Table 1

Comparison of the Latent Profile Analysis Solutions with One to Seven Classes.

Number of Classes	Log L	AIC	aBIC	VLMR (p)	LMR (p)	BLRT (p)	Entropy	AvePP	Group sizes (n)
Mothers									
1	-11988.86	24001.72	24029.01						1721
2	-11629.35	23296.69	23339.89	.000	.000	.000	.66	.87-.92	476/1245
3	-11137.08	22326.16	22385.28	.000	.000	.000	.85	.92-.93	341/376/1004
4	-10964.73	21995.46	22070.49	.000	.000	.000	.84	.84-.93	1010/339/176/196
5	-10803.58	21687.15	21778.10	.001	.001	.000	.75	.78-.91	525/352/201/459/184
6	-10682.73	21459.47	21566.33	.119	.123	.000	.77	.77-.92	23/507/374/431/201/185
7	-10626.88	21361.75	21484.54	.006	.007	.000	.79	.77-.92	23/88/201/706/144/371/188
Fathers									
1	-8270.68	16565.37	16588.31						1198
2	-8067.34	16172.68	16209.01	.000	.000	.000	.62	.85-.92	370/828
3	-7864.44	15780.89	15830.60	.002	.003	.000	.61	.81-.83	432/481/285

PATTERNS OF PARENTAL ABILITY ATTRIBUTIONS

4	-7761.78	15589.55	15652.65	.209	.213	.000	.85	.89-.94	17/295/722/164
5	-7636.77	15353.54	15430.02	.000	.000	.000	.71	.75-.88	274/106/315/425/78
6	-7489.35	15072.70	15162.56	.000	.000	.000	.74	.75-.87	16/425/282/108/285/82
7	-6989.871	14087.74	14190.99	.000	.000	.000	.82	.74-1.0	14/129/472/232/146/157/48

Note. Log L = log-likelihood value; AIC = Akaike’s information criterion; aBIC = adjusted Bayesian information criterion; VLMR = Vuong-Lo-Mendell-Rubin likelihood ratio test; LMR = Lo-Mendell-Rubin adjusted likelihood test; BLRT = Bootstrapped Likelihood Ratio Test; AvePP = Average Latent Class Posterior Probabilities.

Table 2

The Results of the Final Five-Class Solution: Standardized Means, Changes in the Means, and Estimated Class Probabilities for Each Latent Attribution Pattern.

Patterns	Ability Attribution for Success						Ability Attribution for Failure						Ave
	Standardized Mean			Change in the Means			Standardized Mean			Change in the Means			PP
	T1	T2	T3	T1 vs. T2	T2 vs. T3	T1 vs. T3	T1	T2	T3	T1 vs. T2	T2 vs. T3	T1 vs. T3	
Mothers:													
High-Low	0.81	1.37	0.95	F(1, 135) = 73.19***	F(1, 135) = 55.22***	F(1, 135) = 0.99	-0.68	-0.81	-0.85	F(1, 129) = 1.38	F(1, 129) = 0.09	F(1, 129) = 1.10	.87
High-High	0.70	1.30	0.82	F(1, 117) = 43.53***	F(1, 117) = 18.22***	F(1, 117) = 1.66	0.69	1.06	0.86	F(1, 116) = 10.77**	F(1, 116) = 3.59	F(1, 116) = 1.66	.83
Medium-High	0.02	-0.05	0.09	F(1, 304) = 2.22	F(1, 304) = 12.98***	F(1, 304) = 2.94	0.58	0.65	0.70	F(1, 300) = 1.16	F(1, 300) = 1.10	F(1, 300) = 4.03	.78
Medium-Low	0.04	-0.05	0.03	F(1, 328) = 3.52	F(1, 328) = 1.88	F(1, 328) = 0.29	-0.50	-0.50	-0.48	F(1, 318) = 0.02	F(1, 318) = 0.27	F(1, 318) = 0.40	.78

PATTERNS OF PARENTAL ABILITY ATTRIBUTIONS

Low-	-0.90	-1.48	-0.92	F(1, 207) =	F(1, 207) =	F(1, 207) =	-0.00	0.04	0.12	F(1, 203) =	F(1, 203) =	F(1, 203) =	.91
Medium				80.41***	84.94***	0.19				0.37	4.22	1.87	
<hr/>													
Fathers:													
High-Low	0.79	0.91	1.61	F(1, 69) =	F(1, 69) =	F(1, 69) =	-0.61	-0.76	-0.97	F(1, 66) =	F(1, 66) =	F(1, 66) =	.87
				0.53	36.13***	45.59***				1.87	1.09	5.09	
High-High	0.81	0.80	1.57	F(1, 57) =	F(1, 57) =	F(1, 57) =	0.83	1.23	1.47	F(1, 56) =	F(1, 56) =	F(1, 56) =	.87
				0.82	49.76***	34.23***				3.84	3.07	18.57***	
Medium-	0.07	0.11	0.16	F(1, 191) =	F(1, 191) =	F(1, 191) =	0.59	0.62	0.64	F(1, 189) =	F(1, 189) =	F(1, 189) =	.75
High				0.03	0.36	0.63				0.12	0.40	0.89	
Medium-	0.06	0.03	0.19	F(1, 249) =	F(1, 249) =	F(1, 249) =	-0.46	-0.43	-0.52	F(1, 246) =	F(1, 246) =	F(1, 246) =	.76
Low				0.02	9.65**	8.64**				0.02	0.83	1.03	
Low-	-0.75	-0.75	-1.34	F(1, 157) =	F(1, 157) =	F(1, 157) =	-0.03	0.11	-0.05	F(1, 155) =	F(1, 155) =	F(1, 155) =	.88
Medium				0.01	70.59***	60.04***				4.52	5.14	0.01	

Note. The first part of the name of the attribution pattern refers to the level of the ability attribution in children's success situations and the latter part to the level of the ability attribution in children's failure situations.

** $p < .01$, *** $p < .001$, two-tailed test

Table 3

Congruence of Mothers' and Fathers' Patterns of Ability Attributions.

Mothers' patterns	Fathers' patterns											
	High-Low		High-High		Medium-High		Medium-Low		Low-Medium		Total sample	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
High-Low	39	38.6^b	7	9.1	27	8.9	59	14.2	9	3.5^a	141	12.2
High-High	14	13.9	17	22.1^b	34	11.2	43	10.4	16	6.2^a	124	10.7
Medium-High	16	15.8	23	29.9	104	34.2^b	80	19.3^a	79	30.6	302	26.1
Medium-Low	28	27.7	23	29.9	92	30.3	169	40.7^b	62	24.0^a	374	32.4
Low-Medium	4	4.0^a	7	9.1	47	15.5	64	15.4	92	35.7^b	214	18.5
Total sample	101	100	77	100	304	100	415	100	258	100	1155	100

Note. The first part of the name of the attribution pattern refers to the level of the ability attribution in children's success situations and the latter part to the level of the ability attribution in children's failure situations.

^a Underrepresented (adjusted residual < -2.6). ^b Overrepresented (adjusted residual > 2.6).

Table 4

Means (M) and Standard Deviations (SD) of the Children’s Reading and Math Performance for the Latent Attribution Patterns and Statistically Significant Differences between the Patterns.

	Ability Attribution Pattern					
	High-Low <i>M (SD)</i>	High-High <i>M (SD)</i>	Medium-High <i>M (SD)</i>	Medium-Low <i>M (SD)</i>	Low-Medium <i>M (SD)</i>	
<i>Results for Mothers</i>						
Reading performance	.48 (1.00) ^a	.23 (0.99) ^{ab}	-.13 (0.88) ^c	.13 (0.91) ^b	-.42 (0.77) ^d	$F(4, 1674) = 41.58^{***}$
Math performance	.31 (1.03) ^a	.15 (1.20) ^{ab}	-.10 (0.96) ^{bc}	.11 (0.95) ^a	-.30 (0.90) ^c	$F(4, 1673) = 16.69^{***}$
<i>Results for Fathers</i>						
Reading performance	.62 (1.01) ^a	.31 (0.93) ^{ab}	-.02 (0.92) ^{cd}	.19 (0.90) ^{bc}	-.26 (0.85) ^d	$F(4, 1173) = 22.43^{***}$
Math performance	.57 (1.06) ^a	.27 (0.98) ^{ab}	-.01 (0.97) ^{bc}	.16 (0.96) ^b	-.17 (0.98) ^c	$F(4, 1172) = 13.18^{***}$

Note 1. The first part of the name of the attribution pattern refers to the level of the ability attribution in children's success situations and the latter part to the level of the ability attribution in children's failure situations.

Note 2. Group means with different superscripts show a statistically significant difference ($p < .01$).

Note 3. *** $p < .001$.

PATTERNS OF PARENTAL ABILITY ATTRIBUTIONS

Table 5

Sizes of Parents' Ability Attribution Patterns on the Categorical Criterion Variables.

	High-Low		High-High		Medium-High		Medium-Low		Low-Medium		Total sample	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Mothers:												
Children's sex												
Girls	107	13.2	81	10	211	26.1	250	31	159	19.7	808	100
Boys	94	10.3	103	11.3	248	27.2	275	30.1	193	21.1	913	100
Total sample	201	11.7	184	10.7	459	26.7	525	30.5	352	20.4	1721	100
Education												
No vocational education	13	12.4	7	6.7	21	20	26	24.7	38	36.2^b	105	100
Vocational school degree	37	7.5^a	51	10.4	160	32.6^b	127	25.9^a	116	23.6	491	100
Vocational college degree	38	9.9	35	9.1	120	31.2	123	31.9	69	17.9	385	100
Polytechnic or bachelor's degree	23	12.6	18	9.9	45	24.7	56	30.8	40	22	182	100
Master's degree	65	16.5^b	51	12.9	79	20.1^a	141	35.8^b	58	14.7^a	394	100
Doctoral or licentiate's degree	12	15.6	12	15.6	16	20.8	27	35	10	13	77	100
Total sample	188	11.5	174	10.6	441	27	500	30.6	331	20.3	1634	100

PATTERNS OF PARENTAL ABILITY ATTRIBUTIONS

Fathers:

Children's sex

Girls	61	11.2	<i>37</i>	6.8	<i>148</i>	27.1	<i>192</i>	35.1	<i>108</i>	19.8	<i>546</i>	100
Boys	45	6.9	<i>41</i>	6.3	<i>167</i>	25.6	<i>233</i>	35.7	<i>166</i>	25.5	<i>652</i>	100
Total sample	<i>106</i>	8.8	<i>78</i>	6.5	<i>315</i>	26.3	<i>425</i>	35.5	<i>274</i>	22.9	<i>1198</i>	100

Education

No vocational education	<i>5</i>	6.1	<i>1</i>	1.2	<i>26</i>	31.7	<i>28</i>	34.1	<i>22</i>	26.9	<i>82</i>	100
Vocational school degree	<i>24</i>	6.1	<i>26</i>	6.6	<i>101</i>	25.8	<i>125</i>	31.9	116	29.6^b	<i>392</i>	100
Vocational college degree	<i>27</i>	10.0	<i>16</i>	5.9	<i>71</i>	26.2	<i>103</i>	38.0	<i>54</i>	19.9	<i>271</i>	100
Polytechnic or bachelor's degree	<i>8</i>	7.1	<i>5</i>	4.4	<i>39</i>	34.5	<i>41</i>	36.3	<i>20</i>	17.7	<i>113</i>	100
Master's degree	<i>28</i>	12.7	<i>21</i>	9.5	<i>48</i>	21.7	<i>87</i>	39.4	<i>37</i>	16.7	<i>221</i>	100
Doctoral or licentiate's degree	<i>9</i>	12.0	<i>8</i>	10.6	<i>14</i>	18.7	<i>29</i>	38.7	<i>15</i>	20	<i>75</i>	100
Total sample	<i>101</i>	8.7	<i>77</i>	6.7	<i>299</i>	25.9	<i>413</i>	35.8	<i>264</i>	22.9	<i>1154</i>	100

Note 1. The first part of the name of the attribution pattern refers to the level of the ability attribution in children's success situations and the latter part to the level of the ability attribution in children's failure situations.

Note 2. Underlined associations remained statistically significant ($p < .01$) after controlling for the effects of children's reading and math performance. ^a Underrepresented (adjusted residual < -2.6). ^b Overrepresented (adjusted residual > 2.6).

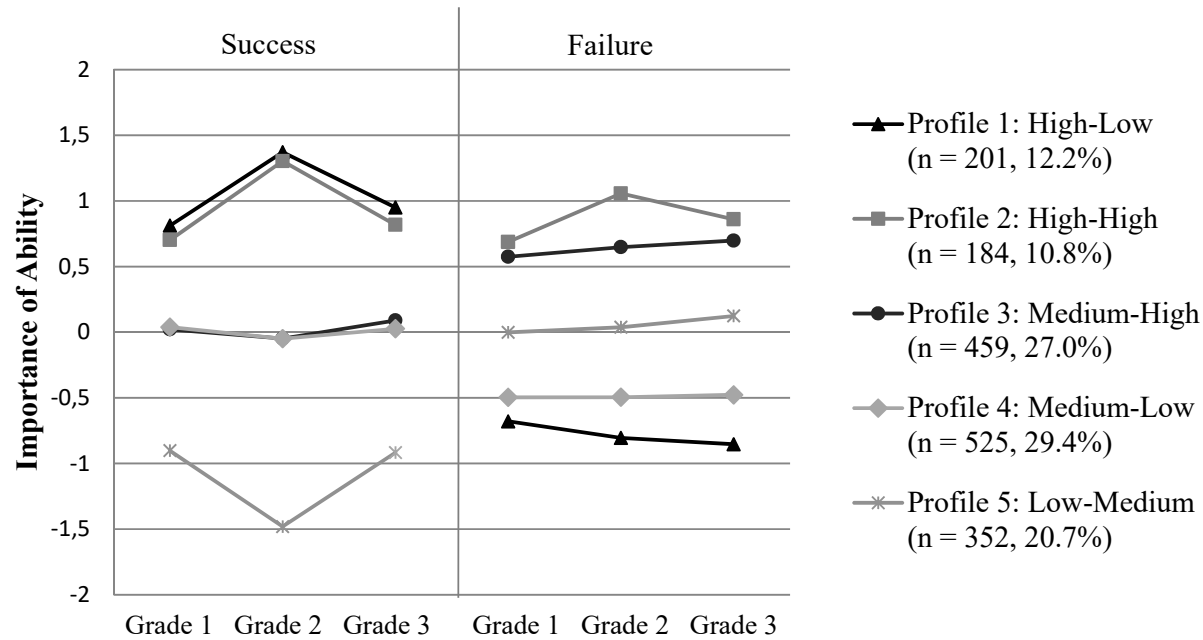


Figure 1

The Patterns of Ability Attributions for Mothers. The patterns are based on the standardized estimated means. Standardization was done by using the sample means and standard deviations at Grade 1. Note. The first part of the pattern name refers to the level of the ability attribution in children’s success situations and the latter part to the level of the ability attribution in children’s failure situations.

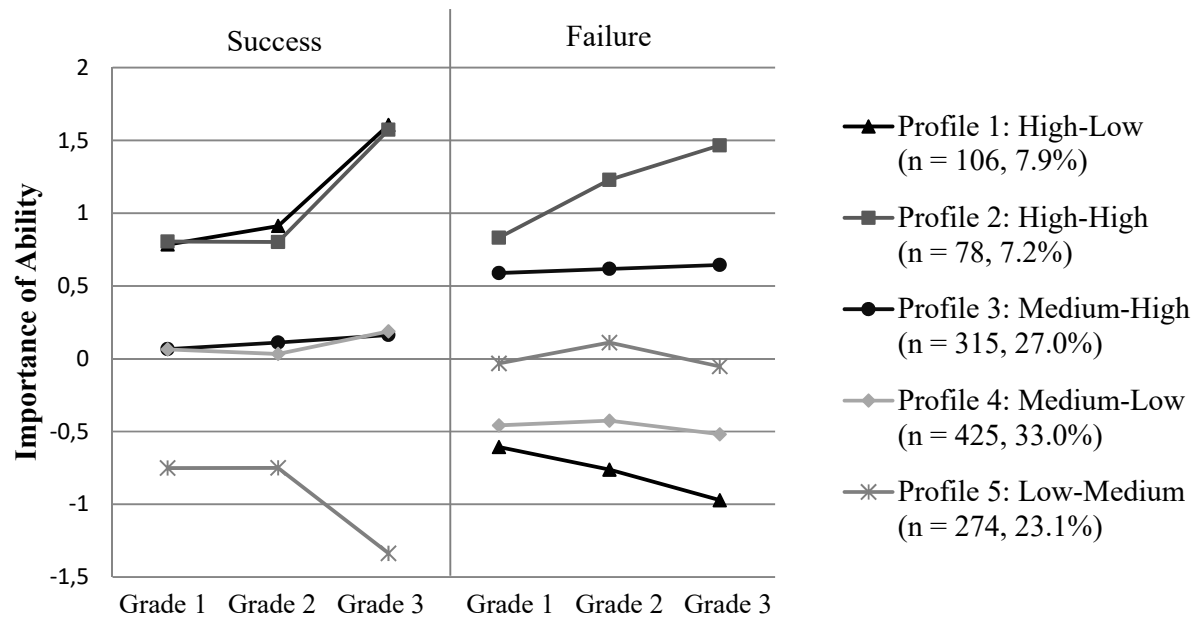


Figure 2

The Patterns of Ability Attributions for Fathers. The patterns are based on the standardized estimated means. Standardization was done by using the sample means and standard deviations at Grade 1. Note. The first part of the pattern name refers to the level of the ability attribution in children’s success situations and the latter part to the level of the ability attribution in children’s failure situations.