Don't Aim too High for Your Kids:

Parental Over-Aspiration Undermines Students' Learning in Mathematics

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Abstract

Previous research has suggested that parents' aspirations for their children's academic attainment can have a positive influence on children's actual academic performance. Possible negative effects of parental over-aspiration, however, have found little attention in the psychological literature. Employing a dual-change score model with longitudinal data from a representative sample of German schoolchildren and their parents (*N* = 3,530; grades 5 to 10), we showed that parental aspiration and children's mathematical achievement were linked by positive reciprocal relations over time. Importantly, we also found that parental aspiration that exceeded their expectation (i.e., over-aspiration) had negative reciprocal relations with children's mathematical achievement. These results were fairly robust after controlling for a variety of demographic and cognitive variables such as children's gender, age, intelligence, school type, and family SES. The results were also replicated with an independent sample of US parents and their children. These findings suggest that unrealistically high parental aspiration can be detrimental for children's achievement.

Keywords: Parental expectation, mathematical achievement, latent difference score model, cross-lagged analysis, aspiration-expectation gap

It has been commonly recognized that parental beliefs and attitudes have substantive effects on their children's academic outcomes (Eccles, Wigfield, & Schiefele, 1998). Among many parental beliefs, parental aspiration for their children's academic achievements has received considerable attention over the past half century in the literature of both psychology and sociology (for a review, see Yamamoto & Holloway, 2010). In psychology, for example, several social-cognitive models like the expectancy-value theory (Parsons-Eccles, Adler, & Kaczala, 1982; see also Bronfenbrener & Morris, 1998; Grolnick & Slowiaczek, 1994; Oyserman, 2013) have suggested that parental aspiration can influence children's academic achievement through a socialization processes. In the Wisconsin model of status attainment proposed by sociologists (Swell, Haller, & Ohlendorf, 1970; Sewell, Haller, & Portes, 1969; see also Kerckhoff, 1976), parental aspiration has been posited to be one of the critical mediators that link family social background to children's educational and occupational attainment.

In accordance with these theoretical predictions, the positive associations between parental aspiration and children's academic attainment have been investigated in numerous empirical studies. The findings indicate a strong positive link between the two variables (Bandura, Barbaranelli, Caprara, & Pastorelli, 1996; De Civita et al., 2004; Frome & Eccles, 1998; Okagaki & Sternberg, 1993), and this relationship seems robust across cultures and age groups (Aston & McLanahan, 1991; De Civita, Pagani, Vitaro, & Tremblay, 2004; Halle, Kurtz-Costes, & Mahoney, 1997; Neuenschwander, Vida, Garrett, & Eccles, 2007). In fact, among the various specific components of parental involvement, parental aspiration yielded the largest effect size in relation to academic performance, as shown by meta-analytic findings (Fan & Chen, 2001; Jeynes, 2005, 2007). From a practical perspective, this evidence suggests that it may be important to enhance parents' aspirations to promote children's academic performance (Jeynes, 2011).

Issues in Empirical Research on Parental Aspiration and Academic Achievement

The existing literature provides strong evidence for a positive association between parental aspiration and academic achievement. These previous studies may lead people to think that there is nothing to question about the beneficial effects of holding high aspirations for their children. However, there are two critical issues that have not been sufficiently considered in the existing literature.

Temporal Ordering and Possible Reciprocal Effects

First, many of the previous studies tested the relation between parental aspiration and student's academic achievement using cross-sectional or prospective designs (e.g., Bandura et al., 1996; Davis-Kean, 2005; De Civita et al., 2004; Frome & Eccles, 1998; Okagaki & Sternberg, 1993; Pearce, 2006). Such designs leave the temporal order of aspiration and achievement unclear. The positive relation between parental aspiration and children's academic performance may well be due to reverse order effects --- children's high academic achievement may lead parents to adopt high aspirations. Only a limited number of longitudinal studies have strictly controlled students' past academic achievement to examine the temporal ordering of aspirations and academic achievement (for a similar note, see Yamamoto & Holloway, 2010). Moreover, these longitudinal studies have several methodological limitations, such as a small sample size (e.g., N = 81 in Goldenberg et al., 2001) or designs including only two waves (Carpenter, 2008; Zhang et al, 2011). In addition, some studies used school grades as a proxy for academic achievement (e.g., Neuenschwander et al., 2007), although grades have been argued to not be an adequate or valid measure of academic achievement (Graham, 2015). Likely due to these methodological problems, the results of these longitudinal studies have been inconsistent (Carpenter, 2008; Goldenberg, Gallimore, Reese, & Garnier, 2001; Zhang, Haddad, Torres, & Chen, 2011).

To our knowledge, the only exception is a recent study by Briley, Harden, and Tucker-Drob (2014). This study tested possible reciprocal effects between parental expectations and US students' achievement in mathematics and reading with a large, nationally representative sample and used a longitudinal design including four waves (Kindergarten through fifth-grade). The results of cross-lagged analysis showed that parental expectation had positive effects on students' academic achievement even after controlling for their past academic achievement. It is worth noting that the authors also found positive effects of academic achievement on parental expectation (after controlling for previous parental expectation). These reciprocal positive relationships between parental expectation and academic achievement (see also Zhang et al., 2011) support the idea that parent-child socialization processes can be characterized as a transactional (i.e., bidirectional), not a one-way transmission (Bell, 1968). This research seemed to provide the strong evidence for the facilitative effects of parental aspiration on children's academic achievement (and vice versa). However, they focused on parental expectation, and did not directly examine the effects of parental aspiration --- as we will later elaborate, this distinction is of particular theoretical importance to understand the dynamic parental-children relationships. In addition, the robustness and the generalizability of the findings (e.g., research in different cultures or with different age groups) are still left as an open question.

Potential Negative Effects of Parental Over-Aspiration

Second, and more importantly, in contrast to the large body of literature showing positive links between parental aspiration and children's academic performance, there is a surprising lack of research that has examined possible *adverse* effects of parental aspiration (Yamamoto & Holloway, 2010). Parents with high aspirations for their children's academic attainment are likely to be committed to and highly involved with their children, which will typically enhance children's academic achievement (Halle et al., 1997). However, excessively high parental aspiration that exceeds realistic expectations of the children's performance (i.e., parental *over-aspiration*) may lead to over-involvement, excessive pressure to achieve, and high levels of control over a child's behavior. Such parental control behavior is likely to contribute to a child's maladjustment (Grolnick, 2003; Roth, Assor, Niemiec, Ryan, & Deci, 2009). Other lines of research also indicate that unrealistically positive perceptions can increase the risk of negative outcomes (e.g., Baumeister, 1989; Robins & Beer, 2001; Weinstein, 1980). Thus, it is possible that parental over-aspiration can have deleterious effects on children's academic achievement.

We define parental over-aspiration as the extent to which parental aspiration ("We *want* our child to obtain this grade") exceeds parental expectation ("We believe our child *can* obtain this grade"). Parental aspiration and expectation both focus on potential future achievement (i.e., the constructs are different from current or prior achievement), but distinct in their specific foci. Parental aspiration is defined as the desires, wishes, or goals that parents have formed regarding their children's future attainment; parental expectation is characterized as beliefs or judgments that parents have about how their children's achievement will develop realistically (Hanson, 1994). Despite this conceptual difference, in the psychological literature, the constructs of parental aspiration and expectation have often been used interchangeably (Shute, Hansen, Underwood, & Razzouk, 2011; Trusty, 2002; Yamamoto & Holloway, 2010). In fact, some researchers regarded an aspiration item as an index of parental expectation (e.g., Juang & Silbereisen, 2002; Zhang et al., 2011). Some other researchers assessed parental aspirations and expectations separately but combined them into a single measure (e.g., Bandura et al. 1996).

This indiscreet treatment of the two constructs in empirical research is somewhat surprising, given that several theories in psychology actually suggest the importance of distinguishing them. For example, in their framework of possible selves, Markus and Nurius (1986; see also Oyserman & Markus, 1990) argued that motivation and behavior are guided by several different types of self-concepts, including hoped-for-selves (akin to aspiration) and expected selves (akin to expectation). Self-discrepancy theory (Higgins, 1987; see also identity discrepancy theory, Large & Marcussen, 2000) indicates that people have differentiated self-representations of “actual-self” (akin to expectation) and “ideal-self” (akin to aspiration). Notably, self-discrepancy theory argues that the incongruence between actual-self and ideal-self could produce lower self-esteem and negative emotions such as dejection and frustration (Strauman & Higgins, 1987; but see Scalas, Marsh, Morin, & Nagengast, 2014), suggesting potential problems of having over-aspiration.

In contrast to research in psychology, researchers in sociology have long made a clear distinction between expectation and aspiration, especially for students’ occupational attainment. Stephenson (1957), for example, distinguished between occupational aspirations (i.e., what one would like to achieve) and plans (what one expects to do), and found a larger gap between occupational aspiration and expectation in students from lower social background. In fact, the “aspiration-expectation gap” in minority groups or those with low socioeconomic status has long been one of the major topics in sociology (e.g., Arbona, 1990; Holloway & Berreman, 1959; Kirk et al., 2012). There is also a long line of research examining an apparent paradox that African American parents tend to have high aspiration for their children despite their poor academic achievement or low parental expectations (Mickelson, 1990). The majority of these studies, however, considered the gap between aspirations and expectations as a consequence of minority status or impoverished socioeconomic background (Cook et al., 1996; Elliott, 2009; Kirk et al., 2012; Metz, Fouad, & Ihle-Helledy, 2009); Little attention has been paid to the potential harmful effects of having such a gap.

Only a few recent studies explored possible negative consequences of over-aspiration. Boxer, Goldstein, DeLorenzo, Savoy, and Mercado (2011) compared students whose self-reported aspiration was greater than their self-reported expectation (over-aspired students) and students whose aspiration matched their expectation. Results showed that over-aspired students exhibited several academic and social risks, such as lower levels of school bonding, higher levels of test anxiety, elevated behavioral/emotional difficulties, and lower self-reported school grades. Rutherford (2014) found that the mismatch between students' self-reported aspiration and expectation negatively predicted students' emotional well-being. However, these studies used cross-sectional designs, making it impossible to determine the temporal ordering of the variables. In addition, these studies did not examine objective academic achievement. Furthermore, their primary focus was on students' self-reported aspiration and expectation; thus the data do not speak to whether *parental* over-aspiration influences children's academic performance (i.e., intergenerational effects). In order to examine possible adverse or beneficial effects of parental over-aspiration on children's academic achievement, we need a more rigorous examination.

Present Research

The current research aimed to advance our understanding of the relations between parents' aspiration and their children's academic achievement by addressing the number of critical issues laid out above. Specifically, we first aimed to rigorously examine the effects of parents' aspirations on their children's achievement, as well as possible reciprocal effects of children's achievement on their parents' aspirations. We did so by analyzing a large-sample, multi-wave, intergenerational longitudinal dataset with an advanced quantitative methodology: the dual-change score model (McArdle, 2009; McArdle & Hamagami, 2001). This methodology makes full use of information from multi-wave data and allows us to examine the temporal ordering of the variables in a more sophisticated manner than the standard cross-lagged model (for limitations of the cross-lagged model, see e.g., Hamaker, Kuiper, & Grasman, 2015; Rogosa, 1980). We then highlighted possible *negative* aspects of parental aspiration with regard to children's achievement. Specifically, we applied the same dual-change score model with parental over-aspiration (i.e., parental aspiration relative to parental expectation) as an alternative predictor variable, and investigated whether parental over-aspiration would negatively predict the change in academic achievement over time (and vice versa). To our knowledge, this is the first multi-wave study examining the negative reciprocal relations of parental over-aspiration and children's achievement. To demonstrate the robustness and generalizability of our findings, we also attempted to replicate the main findings of the study with another large sample of US parents and children.

Method

Participants and Design

The sample consisted of German children who participated in the *Project for the Analysis of Learning and Achievement in Mathematics* (PALMA; see Frenzel, Pekrun, Dicke, & Goetz, 2012; Murayama, Pekrun, Lichtenfeld, & vom Hofe, 2013; Pekrun et al., 2007). This project included a longitudinal study involving annual assessments during the secondary school years (grades 5 to 10; 2002 to 2007) to investigate adolescents' development in mathematics. At each grade level, the PALMA math achievement test and a parental questionnaire were administered towards the end of the school year during the same day.

Samples were drawn from secondary schools in the state of Bavaria, and were drawn so that they were representative of the child population of Bavaria in terms of student demographics such as gender, urban versus rural location, and family background (socioeconomic status; for details, see Pekrun et al., 2007). The samples included children from all three major school types within the German public school system, including lower-track schools (Hauptschule), intermediate-track schools (Realschule), and higher-track schools (Gymnasium). These three school types differ in academic demands and children's entry-level academic ability. At the first assessment (grade 5), the sample comprised 2,070 children from 42 schools (49.6% female, mean age = 11.7 years; 37.2% lower-track school children, 27.1% intermediate-track school children, and 35.7% higher-track school children). In each subsequent year, the study not only tracked the children who had participated in previous assessments, but also included those children who had not yet participated in the study but had become children of PALMA classrooms at the time of the assessment (see Pekrun et al., 2007). This sampling strategy resulted in the following sample sizes for the subsequent years: 2,059 students in grade 6 (50.0% female, mean age = 12.7 years); 2,397 students at grade 7 (50.1% female, mean age = 13.7 years); 2,410 students at grade 8 (50.5% female, mean age = 14.8 years); 2,528 students at grade 9 (51.1% female, mean age = 15.6 years); 1,946 students at grade 10 (51.5% female, mean age = 16.5 years). Across all assessments (i.e., grades 5 to 10), a total of 3,530 students (49.7% female) took part in the study. 40.7% of the total sample completed all six assessments, and 19.8%, 21.7%, 11.7%, 5.1%, and 1.1% completed five, four, three, two, or one assessment(s), respectively.

Measures

All variables that were analyzed for this research are reported. The PALMA project included various assessments of children, teachers, and parents (for an overview, see Pekrun et al., 2007). For the purpose of investigating the effects of parental aspiration, the current study focused on the following measures:

Mathematics achievement. Mathematics achievement was assessed by the PALMA Mathematical Achievement Test (vom Hofe, Pekrun, Kline, & Götz, 2002). Using both multiple-choice and open-ended items, this test measures children's modeling competencies and algorithmic competencies in arithmetics, algebra, and geometry.

The test was constructed using multi-matrix sampling with a balanced incomplete block design. Specifically, for each time point/wave, there were two different test versions consisting of approximately 60-90 items each, and each child completed one of these two test booklets. Anchor items were included to link the test versions within and across the six different measurement points. As in our previous research (Murayama et al., 2013), the obtained achievement scores were scaled using one-parameter logistic item response theory (Rasch scaling), with M = 100 and SD = 15 at grade 5 (i.e., the first measurement point). Additional analyses confirmed the unidimensionality and longitudinal invariance of the test scales (Murayama et al., 2013).

Parental aspiration and expectation. Parental aspiration was assessed by a single item in which parents reported the degree to which they wanted their child to perform well in mathematics at school (“We want our daughter/our son to get the following grade in mathematics”). The item was answered on a 6-point scale indicating the grade parents wanted their child to get, using grades as defined in the German school system (1 = *excellent* to 6 = *unsatisfactory*). In addition, parental expectation was assessed by an item asking parents to report their belief of how well their child will perform in mathematics (one single item; “We believe that our daughter/son can get the following grade in mathematics”). The expectation item was answered on the same 6-point scale (1 = *excellent* to 6 = *unsatisfactory*). For the present analysis, scores for these items were reversed to ease interpretation. The phrasing of these two items was adopted from the previous literature (e.g., Goldenberg et al., 2001; Okagaki & Frensch, 1997).

Control variables. Control variables included children’s gender, age in months at Time 1 (grade 5), intelligence, school type (Hauptschule, Realschule, and Gymnasium), and family socioeconomic status (SES). Students’ age in months at grade 5 was included because previous research indicated that the age variability within grades (i.e., whether they were born earlier or later within a grade) can be associated with achievement scores (e.g., Cahan & Cohen, 1989). This variable was anchored to the youngest student in the sample (i.e., all the students have a value of 0 or above 0). Intelligence was measured at every annual wave using the 25-item nonverbal reasoning subtest of the German adaptation of Thorndike's Cognitive Abilities Test (Kognitiver Fäigkeitstest, KFT 4-12+R; Heller & Perleth, 2000). Family SES was assessed by parent report using the EGP classification (Erikson, Goldthorpe, & Portocarero, 1979), which consists of six ordered categories of parental occupational status.

Data Analysis

To address longitudinal change and reciprocal effects of parental aspiration (or over-aspiration) and mathematics achievement, a bivariate dual-change score model (McArdle & Hamagami, 2001) using structural equation modeling was applied. Traditionally, multivariate longitudinal data are analyzed using either cross-lagged regression models (Finkel, 1995) or latent growth-curve models (McArdle, Anderson, Birren, & Schaie, 1990). Cross-lagged regression models address the temporal ordering of variables, thus providing a strong basis for causal inference. Latent growth-curve models, on the other hand, address overall mean growth trends and related individual differences by incorporating latent growth factors. Dual-change score models can be viewed as a hybrid of these two classes of models, combining cross-lagged effects and growth factors in a single model to delineate the dynamic nature of longitudinal trajectories (Ferrer & McArdle, 2003; McArdle, 2009; McArdle & Hamagami, 2001).

A bivariate dual-change score model is depicted in Figure 1. The key variables of the model are Δx_t and Δy_t, which represent scores for true change in *x* and *y* between the previous time point (*t* – 1) and the current time point (*t*). Importantly, a latent change variable (e.g., Δx_t) is a function of (a) a constant change effect of an overall slope factor (S_x), (b) an autoproportional effect (β_x) of a latent factor representing the same variable at the previous time point (x_{t-1}), (c) a coupling effect ($\gamma_{y \to x}$) of a latent factor representing the other variable at the previous time point

(y_{t-1}), and (d) an effect of disturbance (δ_t). Note that the model also includes an intercept factor (e.g., I_x), representing the baseline scores (i.e., scores at grade 5 in our context) of each variable. Equality constraints are imposed on coupling coefficients ($\gamma_{x\to y}$ and $\gamma_{y\to x}$), autoproportional coefficients (β_x and β_y), disturbance variances, and error variances over time.

Of particular interest in our current study is the predictive relation between parental aspiration (or over-aspiration) and subsequent improvement in mathematics achievement, as well as the predictive relation between mathematics achievement and subsequent growth in aspirations, which are reflected in the coupling coefficients ($\gamma_{x\to y}$ and $\gamma_{y\to x}$). Note that, unlike the procedure in traditional cross-lagged regression modeling, coupling coefficients in dual-change score models are estimated while controlling for the effect of individual differences in an overall mean value (I_x) and an overall growth component (S_x). This makes it possible to precisely estimate the effect of a variable at the preceding time point on the change of the other variable (Usami, Hayes, & McArdle, in press; see also Hamaker, Kuiper, & Grasman, 2015). In addition, as our primary variables use a metric that makes scores comparable over time (for example, achievement scores are scaled across time points using Rasch scaling), their change scores provide useful information to understand people's change over time; thus, bivariate dual-change score modeling has many advantages in light of the main purpose of our study.

We assessed the fit of the data to bivariate dual-change score models with standard fit indices including the comparative fit index (CFI), the Tucker-Lewis index (TLI), and the root-mean-square error of approximation (RMSEA). We report unstandardized estimates for ease of interpretation. In the analysis, we adjusted the standard errors and chi-square statistics to correct for potential statistical biases resulting from non-normality of the data (MLR estimator; Muthén & Muthén, 2004). Due to the longitudinal design of the study, there is missing data due to participant attrition. Accordingly, in order to make full use of the data from children and parents who only participated in part of the investigation, we applied the full information maximum likelihood method to deal with missing data (Enders, 2010).

Results

Parental Aspiration and Children's Mathematical Achievement

We first examined the reciprocal relation between parental aspiration and children's mathematical achievement. Parental aspiration showed a slight decrease over time from 5th grade to 10th grade, *M*s (*SD*s) = 4.87 (0.63), 4.79 (0.65), 4.72 (0.68), 4.69 (0.71), 4.69 (0.73), and 4.70 (0.75) --- the linear decreasing trend was statistically significant, $p < .01$. Not surprisingly, Rasch-scaled math achievement scores increased over time from 5th grade to 10th grade, *Ms* (*SDs*) = 100.0 (15.0), 111.1 (16.5), 115.3 (17.3), 125.7 (18.6), 131.0 (20.0), and 147.0 (15.4) (the linear increasing trend was statistically significant, $p < .01$).

Table S1 in Online Supplemental Material reports the correlations of parental aspiration scores with the other study variables. Consistent with previous studies, parents' aspiration was positively correlated with their children's math achievement scores at each time point (r_{mean} = 0.23, *ps* < .01). Parental aspiration was also correlated with children's intelligence but the relationship seemed somewhat weaker (r_{mean} = 0.16, *ps* < .01). Parents of children from higher- or intermediate-track school and parents of female children were found to have slightly lower aspiration scores (see Table S1).

Reciprocal effects. A bivariate dual-change score model (Figure 1) was applied to address the reciprocal relations between parental aspiration and mathematical achievement. A preliminary analysis indicated that the variance of the aspiration slope factor and the covariance between the aspiration intercept and mathematical achievement slope factors were small, and that the small size of these estimates caused improper solutions in the basic model and subsequent more complicated models tested later. Therefore, we fixed these parameters to zero. The model showed a good fit to the data, χ^2 (72) = 680.2, $p < .01$, CFI = .95, TLI = .95, RMSEA = .049.

Table 1 reports parameter estimates from the dual-change score model (see Table S2 in Online Supplemental Material for the full parameter estimates). The model clearly shows that parental aspiration and children's math performance were linked by positive reciprocal effects. Specifically, the coupling effect of parental aspiration on growth of math achievement was positive and statistically significant, $\gamma_{aspiration \rightarrow math} = 0.811$, $p < .01$, meaning that a unit difference in the aspiration score adds a 0.811 point increase to the change score in the math achievement. In addition, the coupling effect of math achievement on change of parental aspiration was also positive and statistically significant $\gamma_{math \rightarrow aspiration} = 0.001$, $p < .01$. These findings provide empirical evidence that the extent to which parents want their children to perform well at school does not only affect children's growth in mathematics achievement, but is also influenced by children's previous math achievement (Zhang et al., 2011).

Analysis including control variables. To ensure that the obtained findings were not an artifact produced by other plausible variables, we conducted a series of analyses that included control variables. First, we included children's gender, age at the first time point in months, intelligence (also assessed at the first time point), school type (with two orthogonally coded variables), and SES as time-invariant covariates by regressing the intercept and slope factors on these covariates, which is a standard method to control for participant-level variables in latent growth curve models (see Duncan, Duncan, & Strycker, 2006). The positive reciprocal coupling effects remained statistically significant ($\gamma_{aspiration \rightarrow math} = 1.195$, $p < .01$, $\gamma_{math \rightarrow aspiration} = 0.002$, $p < .01$).

Second, we conducted multi-group analyses to examine possible differences in the parameter estimates between genders, school types, and family SES. Note that the data from the lower-track school did not sufficiently cover the covariance involving grade 10 variables, because most children from the lower-track schools had graduated after grade 9. Accordingly, it is not possible to conduct a multi-group analysis using the lower-track children as an independent group. Thus, we combined the lower-track school and intermediate-track school children for the multi-group analysis. For family SES, students were divided into a high SES group (those who were in the top three categories) and a low SES groups (those who were in the bottom three categories).

Table 1 reports the results from models that allowed parameter estimates to differ between groups. The results showed that there were generally significant positive effects of parental aspiration on mathematics achievement regardless of children's gender and family SES ($\gamma_{aspiration \rightarrow math}$ = 0.538 to 1.082, *ps* < .054). In fact, chi-square difference tests indicated that the coupling effects ($\gamma_{aspiration \rightarrow math}$) did not statistically differ between male and female children, χ^2 (1) = 2.12, *ns*, and between low SES and high SES groups, χ^2 (1) = 2.05, *ns*. School type is the only exception: Whereas the effects of parental aspirations on mathematics achievement were positive and statistically significant for children from higher track schools, $\gamma_{aspiration \rightarrow math}$ = 1.550, *p* < .01, the effect did not reach statistical significance for children from intermediate- and lower-track schools, $\gamma_{aspiration \rightarrow math}$ = 0.369, *ns*. Chi-square difference tests indicated that the coupling effects were indeed larger for children from higher track schools than for children from intermediate- and lower- track schools, χ^2 (1) = 12.19, *p* < .01.

The effects of children's math achievement on parental aspirations showed more variation across groups. Specifically, whereas the coupling effects were positive and statistically significant for female children, higher track schools, and the low SES group ($\gamma_{math \rightarrow aspiration}$ =

0.001 to 0.003, *ps* < .01), the same effects were not significant for males, intermediate- and lower- track schools, and the high SES group ($\gamma_{math \rightarrow aspiration}$ = 0.000 to 0.001). Note, however, that the group differences were statistically significant only for school type and family SES, χ^2s (1) > 4.21, *ps* < .05. For gender, the difference did not attain statistical significance χ^2 (1) > 2.12, *ns*.

Finally, we ran a trivariate dual-change score model including parental aspiration, mathematics achievement, and intelligence as assessed at grades 5 through 10 in order to examine whether the reciprocal effects hold after controlling for intelligence as a time-varying variable. As in the main analysis, the variance of the intelligence slope factor and the covariance between the intelligence intercept and math achievement slope factors were fixed to zero to avoid improper solutions. The results showed substantial reduction in the effect of parental aspiration, indicating the importance of controlling for basic cognitive ability to examine parenting and academic growth, but the positive reciprocal coupling effects were still statistically significant ($\gamma_{aspiration \rightarrow math}$ = 0.413, $p < .05$, and $\gamma_{math \rightarrow aspiration}$ = 0.001, $p < .01$). These results provide further strong support for the reciprocal relations between parental aspiration and children's mathematical achievement.

Robustness check. To demonstrate that our results do not depend on a specific model that we applied (i.e., the bivariate dual-change score model), we ran a traditional cross-lagged model in which one variable at *T*-1 predicts the other variable at *T* after controlling for autoregressive (*T*-1) effects. To align the model with the dual-change score model, we did not incorporate any higher-order autoregressive and cross-lagged effects (e.g., the effects of parental aspiration at *T*-2 on children's mathematics achievement at *T*) and assumed stationarity of residuals and cross-lagged effects (i.e., the cross-lagged effects were fixed to be invariant across time points). Consistent with the findings obtained for the dual-change score model, the analysis showed that parental aspiration and children's math performance were linked by positive reciprocal effects. Specifically, the lagged effect of parental aspiration on math achievement was positive and statistically significant, $\gamma_{aspiration \rightarrow math} = 1.268$, $p < .01$, and the effect of math achievement on parental aspiration was also positive and statistically significant $\gamma_{math \rightarrow aspiration} = 0.005$, $p < .01$.

Parental Over-Aspiration and Children's Mathematics Achievement

To examine the relation between parental over-aspiration and children's mathematical achievement, we computed the extent to which parents' aspiration exceeded their expectation for their children (i.e., parental aspiration minus parental expectation). For cases in which parental expectation was higher than parental aspiration (i.e., under-aspiration), the value was set to zero as our focus was parental "over-aspiration", not "under-aspiration" (see the "Robustness Check" section for further analyses using alternative indices). The newly created variable representing parental over-aspiration showed a slight decrease over time, indicating that parents may become more realistic as their children grow up, *Ms* (*SDs*) = 0.35 (0.52), 0.35 (0.52), 0.34 (0.52), 0.32 (0.52), 0.27 (0.48), and 0.20 (0.42) for 5th grade to 10th grade --- the linear decreasing trend was statistically significant, $p < .01$. Unlike parental aspirations that decreased over time as noted earlier, parental expectation did not increase or decrease over time, *Ms* (*SDs*) = 4.62 (0.74), 4.55 (0.79), 4.51 (0.80), 4.53 (0.85), 4.59 (0.83), and 4.70 (0.87) for 5th to 10th grade --- the linear trend was not statistically significant, $p = .28$. This pattern indicates that parents adjusted their aspiration rather than their expectation over time, implying that the change in over-aspiration scores mainly reflects change in parental aspiration.

To illustrate how parental aspirations and parental expectations were associated, Table 2 includes a cross table of these two variables at grade 5 (see Table S3 in Online Supplemental Material for crosstabs for the other grade levels). More than half of the parents (57.8%) exhibited aspirations that matched their expectations, but more than 30% of the parents showed over-aspiration.

Table S4 in Online Supplemental Material reports the correlations of parental over-aspiration scores with the other study variables. One remarkable observation is that parental over-aspiration was negatively correlated with math achievement scores (r_{mean} = -0.21, *ps* < .01). This correlation suggests that parental over-aspiration could have a detrimental effects on children's math achievement. Parental over-aspiration was also negatively correlated with intelligence, but again, the relationship with intelligence seemed weaker (r_{mean} = -0.16, *ps* < .01). Consistent with previous studies (e.g., Boxer et al., 2011), parental over-aspiration (i.e., the aspiration-expectation gap) was larger for parents from low SES families (r_{mean} = -0.09, *ps* < .01). Parents' over-aspiration did not differ depending on the gender of their children, but parents of children from higher- or intermediate-track school tended to have slightly smaller over-aspiration scores than parents of children from lower-track schools (see Table S4).

Reciprocal effects. We again applied a bivariate dual-change score model to address the reciprocal relations between parental over-aspiration and children's mathematical achievement. As in the analysis for parental aspiration, a preliminary analysis indicated that the variance of the over-aspiration slope factor and the covariance between the over-aspiration intercept and mathematical achievement slope factors were small, and that the small size of these estimates caused improper solutions in the basic model and more complicated models tested later. Therefore, we again fixed these parameters to zero. The dual-change score model fitted the data well, χ^2 (72) = 740.0, *p* < .01, CFI = .94, TLI = .94, RMSEA = .051.

Table 3 reports unstandardized parameter estimates from the dual-change score model (see Table S5 in Online Supplemental Material for the full parameter estimates; for completeness, the full parameter estimates of a dual-change score model for parental expectations are also reported in Table S6). Importantly, the model showed reciprocal negative effects linking parental over-aspiration and children's mathematical achievement performance over time. Specifically, the coupling effect of parental over-aspiration on growth of math achievement was negative and statistically significant, $\gamma_{over\text{-}spiration \rightarrow math}$ = -3.319, $p < .01$, indicating that a unit difference in parental over-aspiration predicted a 3.319 point decrease in the change (i.e., growth) score of a child's mathematics achievement. Interestingly, the coupling effect of math achievement on change of parental over-aspiration was also negative and statistically significant $\gamma_{math \rightarrow over\text{-}aspiration}$ = -0.001, $p < .01$, suggesting that higher achievement scores predicted a stronger decrease of parental over-aspiration. These findings suggest that excessive parental aspiration can do harm to children's mathematical achievement over time.

Analysis with control variables. To ensure that the obtained findings were not an artifact produced by other variables, we conducted the same set of control variable analyses as with the aspiration data. First, we included children's gender, age at the first time point in months, intelligence at the first time point, school type, and family SES as time-invariant covariates by regressing slope and intercept factors on these control variables. The negative influence of parental over-aspiration on the change in mathematics achievement remained statistically significant ($\gamma_{over\text{-}spiration \rightarrow math}$ = -1.987, $p < .01$). The reverse negative effect also remained statistically significant ($\gamma_{math \rightarrow over\text{-}aspiration}$ = -0.001, $p < .01$).

Second, we conducted multi-group analyses to examine if the parameter estimates differed between genders, school types, or families with different SES. As can be seen from

Table 3, the results showed that the negative effects of parental over-aspiration on change in mathematics achievement were robustly consistent across genders, school types, and SES: The negative coupling effects were statistically significant for all of the subgroups in these analyses, that is, for both male and female students, for students from all school tracks, and for students from high versus low SES families ($\gamma_{over\text{-}aspiration \rightarrow math}$ = -4.124 to -1.486, *ps* < .01). The negative coupling effects of math achievement on parental over-aspiration also remained significant across groups, but not male students (p = .12) and higher-track schools (p = .09). Further analyses with chi-square difference tests indicated that the coupling effects ($\gamma_{over\text{-}aspiration \rightarrow math}$ and $\gamma_{math \rightarrow over\text{-}aspiration}$) did not statistically differ between males and females, χ^2s (1) < 2.68, *ns*, and between low and high SES groups, χ^2s (1) < 0.32, *ns*. The negative coupling effect of parental over-aspiration on mathematics achievement, however, was significantly larger in higher-track schools as compared with intermediate- and lower- track schools, $\gamma_{over\text{-}aspiration \rightarrow math}$ = -3.502 and -1.486, respectively, χ^2 (1) = 4.87, p < .05, suggesting that parental over-aspiration may have a more deleterious influence for higher-track school children. The reverse coupling effect ($\gamma_{math \rightarrow over\text{-}aspiration}$) did not significantly differ between the school types, χ^2 (1) = 0.88, *ns*.

Finally, we ran a trivariate dual-change score model including parental over-aspiration, mathematical achievement, and intelligence as assessed at grades 5 through 10 to examine whether the reciprocal effects remain after controlling for intelligence as a time-varying variable. The variance of the intelligence slope factor and the covariance between the intelligence intercept and math achievement slope factors were again fixed to zero. The results showed a substantial reduction in the effects of parental over-aspiration, again indicating the importance of controlling for basic cognitive ability to examine parenting and academic growth, but the negative reciprocal coupling effects were still statistically significant ($\gamma_{over\text{-}apiration \rightarrow math}$ = -2.417, $p < .01$, and $\gamma_{math \rightarrow over\text{-}aspiration}$ = -0.001, *ps* < .01). These results provide further strong support for the negative effect of parental over-aspiration on children's mathematical achievement.

Robustness check. Again, to demonstrate that our results do not depend on the specific modeling approach we applied (i.e., the bivariate dual-change score model), we ran a traditional cross-lagged model. The model was specified in the same way as the cross-lagged model with parental aspirations. Consistent with the findings obtained in the dual-change score model, the analysis showed that parental over-aspiration and children's math performance were linked by negative reciprocal effects. Specifically, the lagged effect of parental over-aspiration on math achievement was negative and statistically significant, $\gamma_{over\text{-}aspiration \rightarrow math}$ = -1.839, $p < .01$, and the effect of math achievement on parental over-aspiration was also negative and statistically significant $\gamma_{math \rightarrow over\text{-}aspiration}$ = -0.005, $p < .01$.

Our operationalization of over-aspiration does not allow parents who exhibited the highest level of parental expectations to have non-zero over-aspiration scores (a version of a ceiling effect). To address this potential problem, and to address more general concerns about differences between difference score approaches and residual score approaches (e.g., Cohen, Cohen, West, & Aiken, 2003), we regressed parental aspiration on parental expectation and used positive residual scores as an alternative index of parental over-aspiration. This new index also showed a significant negative coupling effect on growth of math achievement, $\gamma_{over\text{-}aspiration \rightarrow math}$ = -4.054, $p < .01$. A set of analyses including control variables did not change the results. To further examine the potential impact of ceiling effects, we estimated the dual-change score model after excluding parents who had the highest possible parental expectation scores (i.e., a score of 6) at any single point of time (i.e., parents who cannot have positive over-aspiration scores). The analysis with this restricted sample (N = 2,947) still showed statistically significant negative reciprocal effects ($\gamma_{over\text{-}aspiration \rightarrow math}$ = -2.426, $p < .01$ and $\gamma_{math \rightarrow over\text{-}aspiration}$ = -0.001, $p < .05$). These results indicate that our findings are not an artifact of using difference scores to operationalize parental over-aspiration.

In addition, we examined whether parental “under-aspiration” had an effect on achievement scores in order to examine whether our findings were caused by parental over-aspiration specifically rather than an aspiration-expectation gap more generally. We computed the extent to which parental aspiration was smaller than parental expectation (i.e., parental expectation minus parental aspiration, with values smaller than zero being truncated to zero), and applied a dual-change score model. The results showed no significant effects of parental under-aspiration on math achievement scores, $\gamma_{under\text{-}apiration \rightarrow math}$ = -1.178, *ns*. This finding indicates that the observed effect is specific to parental over-aspiration, rather than being a case of more general aspiration-expectation discrepancy effects.

Replication with a New Data Set

Replication data and procedure. We further aimed to replicate the main findings with another data set. For that purpose, we used data from the Educational Longitudinal Study 2002 (ELS:2002; Ingels, Pratt, Rogers, Siegel, & Stutts, 2004) database. The publicly available database comes from a large-sample U.S. longitudinal study of 10th graders in 2002 and 12th graders in 2004, and this is the fourth in a series of longitudinal studies which was conducted by the National Center for Educational Statistics (NCES). Importantly, the data include both parental aspiration and expectation (parent reports) as well as students’ mathematical achievement scores, making it possible to examine the effects of parental aspiration and over-aspiration.

The study included a nationally representative sample of 16,197 10th graders (50.3% female) assessed in 2002 (at the time of the baseline assessment, mean age = 15.7 years). In the baseline assessment, mathematics achievement was assessed using a mix of multiple choice and open-ended items addressing simple mathematical skills, comprehension of mathematical concepts, and mathematical problem solving ability. We used the standardized scores available in the dataset (*M* = 50.71, *SD* = 9.91). Parental aspiration was assessed by a single Likert-scale item asking how far in school the parent *wanted* their child to go (1 = less than high school graduation, 2 = high school graduation or GED (General Educational Development) only, 3 = attend or complete 2-year school course in a community or vocational school, 4 = attend college, but not complete a 4-year degree, 5 = graduate from college, 6 = obtain master's degree or equivalent, 7 = obtain Ph. D., MD, or other advanced degree). Parental expectations were assessed by a single item asking how far in school the parent *expected* their child to go, using the same Likert-type scale (1 - 7).

Math achievement scores were assessed again in a two-year follow up in 2004 (*N* = 12,801, 50.6% female), and this variable was used as the dependent variable. We also selected several control variables from the dataset prior to the data analysis, including gender (male = 0, female = 1), school regions (two dummy variables: urban = 0, not urban = 1, and rural = 0, not rural = 1), school type (private = 0, public = 1), and family SES (constructed from information about mother's and father's education, mother's and father's occupation, and family income; *M* = -0.27, *SD* = 1.52).

Results. As the data included only two time points and parental reports were obtained only at the baseline assessment, we conducted a simple lagged regression analysis. The full information maximum likelihood method was used to deal with missing data. Specifically, we examined parental aspiration (or over-aspiration) as a predictor of mathematical achievement scores in the follow-up while controlling for mathematical achievement scores at the baseline. We included all of the control variables to address possible confounding effects.

The results are summarized in Table 4. In the parental aspiration regression analysis, gender, school region, school type, and family SES significantly predicted mathematics achievement at follow-up (*ps* < .05). Not surprisingly, baseline mathematics achievement also strongly predicted mathematics achievement, indicating the (inter-individual) stability of math achievement scores over time ($B = 0.86$, $p < .01$). Importantly, parental aspiration positively predicted the follow-up mathematical achievement scores above and beyond the effects of the control variables ($B = 0.30$, $p < .01$), suggesting that parental aspiration had positive effects on change in children's mathematics achievement. These results replicate our findings on positive aspiration effects from the PALMA data.

Importantly, when we repeated the analysis by replacing parental aspiration with parental over-aspiration (computed in the same manner as in the main study), this parental over-aspiration model showed that parental over-aspiration negatively predicted children's mathematical achievement scores at follow-up, above and beyond effects of the control variables ($B = -0.26$, $p < .01$). These results replicate the main results on the negative effects of over-aspiration based on the PALMA data, demonstrating the robustness and cross-cultural generalizability of our findings.

Discussion

Previous research has repeatedly found a positive link between parental aspiration and children's attainment (Fan & Chen, 2001; Jeynes, 2007). The current research advanced these findings by investigating the issues that have not been sufficiently considered in the existing literature: the causal ordering of aspiration and achievement and potential adverse effects of parental over-aspiration. Using large, intergenerational samples from Germany and the US, multi-wave study designs, and dual-change score modeling, we obtained support for the proposed reciprocal temporal ordering between parental aspiration and children's academic mathematical performance in a methodologically rigorous manner. More importantly, the findings also showed that parental aspiration can be *detrimental* for children's performance when aspiration exceeds expectation. These effects were robust across different types of analyses and after controlling for a variety of demographic and cognitive variables including children's gender, age, intelligence, school type, and family SES. Use of dual-change score modeling allowed us to eliminate possible confounds inherent in standard cross-lagged analysis (see Hamaker et al., 2015). It is also worth noting that our work examined intergenerational relations between parental reports and children's actual academic achievement --- this design feature enabled us to control for any systematic method or response bias, which typically substantially inflates estimated effects (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003).

Effects of Aspiration: Theoretical and Practical Implications

Aspiration has been one of the key constructs over the past half century to understand how parents influence their children's academic attainment. In the 1960's, the importance of educational aspirations was highlighted by the influential Wisconsin model proposed by Sewell et al. (1969; see also Sewell & Shan, 1968). This model posited aspiration to be a crucial intervening variable that can explain intergenerational educational and occupational mobility (Blau & Duncan, 1967), thus adding perspectives on "soft" psychological factors to the "hard" structural relationship between SES and educational attainment. Sewell and colleagues indeed demonstrated that a substantial portion of the effects of SES and ability on occupational attainment is mediated by aspiration --- the inclusion of aspiration considerably increased the explanatory power of the model.

Relatively independent from this line of research in sociology, the emergence of social-cognitive models in psychology also shed light on the important role of parental aspiration (or expectation) for children’s academic achievement and behavior (e.g., Bandura et al., 1996; Parsons-Eccles et al., 1982). Parental aspiration or expectation was deemed to be a critical construct, because research on achievement motivation had demonstrated the critical role of expectancy beliefs in motivating human behavior (Atkinson, 1957; Bandura, 1977; Marsh & Parker, 1984; Pekrun, 1993; Rotter, 1966). In addition, research has shown that expectancy beliefs are sensitive to environmental cues, even in educational contexts (see Dustin & Oyserman, 2009), suggesting the suitability of these constructs for designing educational interventions to improve children’s performance. Given these long-standing research traditions in both psychology and sociology, it is rather surprising that the possible double-edged consequences of parental aspiration have not been scrutinized in empirical work. Our research represents a pioneering first step to investigate this possibility, thus opening a new avenue of research on this traditional topic.

Our research implies that it is essential to distinguish between “parental aspiration” and “parental expectation” to empirically understand the effects of parents’ beliefs on their children. The importance of distinguishing parental aspiration from expectation has been discussed in the sociological literature, but was not sufficiently attended to in psychology (Yamamoto & Holloway, 2010). One potentially interesting direction for future research would be to examine unique correlates that are specific to parental aspiration versus expectation (other than academic achievement), which could further clarify the specific roles of these constructs in children’s socialization. Such studies could further reinforce the importance of clearly distinguishing between parental aspiration and expectation in empirical work. In that respect, it was intriguing that we found a negative effect of parental aspiration on math achievement after partialling out the variance explained by parental expectation (i.e., analysis with residual scores). This observation suggests that it may be the effects of the parental expectation component of parental aspiration, not parental aspiration *per se*, that drove the positive effects of parental aspiration observed in previous studies.

On a practical front, the current study findings highlight the danger of simply raising parental aspirations to promote children's academic achievement and behavioral adjustment. Much of the previous literature in psychology conveyed a simple, straightforward message to parents who want to enhance their children's academic performance --- aim high for your children, and your aim will come true. In fact, aspiration has often been a main target for educational intervention programs. For example, during 2008, the UK government identified aspiration as a policy focus to improve students' engagement and academic achievement, and this initiative encouraged a number of educational intervention programs that aimed to enhance parental (and children's) aspiration (Lupton & Kintrea, 2011). Echoing this initiative, Cummings et al. (2011) conducted a literature review to evaluate the effectiveness of intervention programs that focused on attitudes (including educational aspiration) and academic attainment. This review, however, concluded that there was little evidence suggesting that the impact of intervention on academic achievement was mediated by changes in academic aspiration (although the authors were only able to find few relevant studies in the review). The review also argued that the focus of interventions should not be on changing aspirations of parents and children per se --- rather, it recommended focusing on facilitating opportunities and information for parents and children to develop realistic expectations. This recommendation is in line with the nuanced relationship between academic aspiration and achievement revealed in our study --- unrealistically high aspiration may hinder academic performance; therefore, simply raising aspiration cannot be an effective solution to improve success in education.

Reciprocal Effects and Differences Between Groups

In addition to the findings on the effects of parents' aspirations, our results provided several interesting observations. First, we found *reciprocal* effects of children's academic achievement on their parents' aspiration (or over-aspiration). Briley et al. (2015) called for research examining the positive reciprocal relationship between parental expectation and academic achievement and provided evidence in support of this hypothesis, which highlights the dynamic roles of both parents and children in socialization processes (Bell, 1968; Jacobs & Eccles, 2000). The current study not only replicated these findings, but also uncovered negative reciprocal relationship between parental over-aspiration and children's achievement. Such a "vicious cycle" of reciprocal negative effects linking over-aspiration and achievement may accumulate over years, possibly producing prolonged inimical consequences. As the negative effect of children's academic achievement on parental over-aspiration seems somewhat weaker than the negative effect of parental over-aspiration (i.e., effects of achievement on aspiration were not statistically significant in some of the analyses), further research is needed to examine the robustness and psychological mechanisms of these reverse effects.

Second, the effects of parental aspiration and over-aspiration were even stronger for children in higher-track schools compared with those in intermediate- or lower- track schools. This finding may reflect a more competitive atmosphere in higher-track schools --- in these schools, parental aspiration may be helpful to some extent but parental over-aspiration could easily turn into excessive pressure to achieve (see Murayama & Elliot, 2012, for the double-edged effects of competitive climate). This observation is also consistent with the idea in educational sociology that the effects of parental involvement on children's behavior would be magnified, whether positive or negative, for upper-middle class families (Lareau, 1989; McNeal, 1991). This is partly because lower class families do not have enough resources to effectively translate their parental involvement (i.e., social capitals) into educational outcomes. It should be noted, however, that we did not find significant differences between low SES and high SES groups, despite the differences between school tracks. Thus, these explanations require further scrutiny in future research. Nevertheless, our findings suggest the importance of taking into account people’s demographic background information whilst investigating the relationship between parental aspiration and children’s outcomes.

Finally, our results were replicated with another large-sample longitudinal dataset. These two datasets were different in several respects, suggesting generalizability of our findings. Most importantly, the two datasets differed in socio-cultural context (Germany versus the US). Research has shown considerable cultural differences in parenting styles (Keller & Greenfield, 2000), but our findings suggest that the relations between parental aspiration (or over-aspiration) and children’s academic achievement are consistent across different cultural contexts. Furthermore, the two datasets are based on different items to assess parental aspiration and expectations. Our main dataset (PALMA) asked for parental aspiration and expectations in terms of children’s numeric grades (“We want our daughter/our son to get the following grade in mathematics”; “We believe that our daughter/our son can get the following grade in mathematics”). The replication dataset (ELS:2002) assessed the same constructs more broadly using an extended time frame --- that is, aspirations and expectations were assessed in relation to children’s long-term educational career (i.e., how far in school do parents want their child to go, how far in school do parents expect their child will go). The fact that we observed similar results for these two types of variables may indicate that our findings are not dependent on the wording of items or the time scope of parental aspiration and expectations.

Conclusion

In summary, the present research revealed both positive and negative aspects of parents’ aspiration for their children’s academic performance. While parental aspiration is an important vehicle through which children’s academic potential can be realized, excessive parental aspiration can be poisonous. A possible next step would be to examine the mechanisms underlying this detrimental effect. Excessive parental control (Grolnick, 2003) or parental over-involvement (Hudson & Dodd, 2012) could be factors that may mediate the negative relation between parental over-aspiration and children’s achievement. On the children’s side, decreased self-efficacy (Chorpita & Barlow, 1998) and negative achievement emotions, such as achievement anxiety (Pekrun, 2006) or frustration (Higgins, 1987), may contribute to the negative effects resulting from parental over-aspiration and control. Parent-child conflict (see Fuligni & Eccles, 1993) may also be an important intergenerational factor driving the effect. Developing theoretical models and pursuing empirical research that incorporates these factors would provide a more fine-grained picture and could open a new avenue for research on the relevance of parental aspirations for children’s academic achievement and their personality development more broadly.

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Table 1

Effects of Aspiration: Unstandardized Parameter Estimates for the Dual-change Score Model and the Multi-group Analyses Including Gender, School Type and Family SES

	Total	Children's gender		School type		Family SES	
		Male	Female	Lower and intermediate track	Higher track	Low SES	High SES
$\gamma_{aspiration \rightarrow math}$	0.811**	0.538†	1.082**	0.369	1.550**	0.868**	0.929**
$\gamma_{math \rightarrow aspiration}$	0.001**	0.001	0.001**	0.000	0.003**	0.001	0.002**
$\beta_{aspiration}$	-0.044*	-0.034	-0.049**	-0.032†	-0.055**	-0.041†	-0.054**
β_{math}	-0.041**	-0.024*	-0.061**	0.013	-0.100**	-0.030*	-0.060**

Note. ** $p < .01$. * $p < .05$. † $p < .10$.

Table 2

Cross Table for Parental Aspiration and Parental Expectation at Grade 5 (in %)

		5th Grade Aspiration					
		1	2	3	4	5	6
5th Grade Expectation	1	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%
	2	0.1%	0.0%	0.1%	0.3%	0.0%	0.0%
	3	0.0%	0.0%	0.4%	3.5%	0.7%	0.0%
	4	0.0%	0.0%	0.1%	14.8%	21.2%	1.0%
	5	0.0%	0.0%	0.1%	5.0%	37.4%	6.5%
	6	0.0%	0.0%	0.0%	0.2%	3.6%	5.1%

Note. Range of scores for aspiration and expectation: 1= worst grade to 6 = best grade.

Table 3
Effects of Over-Aspiration: Unstandardized Parameter Estimates for the Dual-change Score Model and the Multi-group Analyses Including Gender, School Type and Family SES

	Total	Children's gender		School type		Family SES	
		Male	Female	Lower + intermediate track	Higher track	Low SES	High SES
$\gamma_{over\text{-}aspiration \rightarrow math}$	-3.319**	-2.537**	-4.124**	-1.486**	-3.502**	-2.918**	-3.442**
$\gamma_{math \rightarrow over\text{-}aspiration}$	-0.001**	-0.001	-0.001*	-0.001**	-0.001†	-0.001*	-0.001*
$\beta_{over\text{-}aspiration}$	-0.157**	-0.138**	-0.169**	-0.154**	-0.193**	-0.139**	-0.183**
β_{math}	-0.055**	-0.036**	-0.077**	0.006	-0.119**	-0.042**	-0.076**

Note. ** $p < .01$. * $p < .05$. † $p < .10$.

Table 4

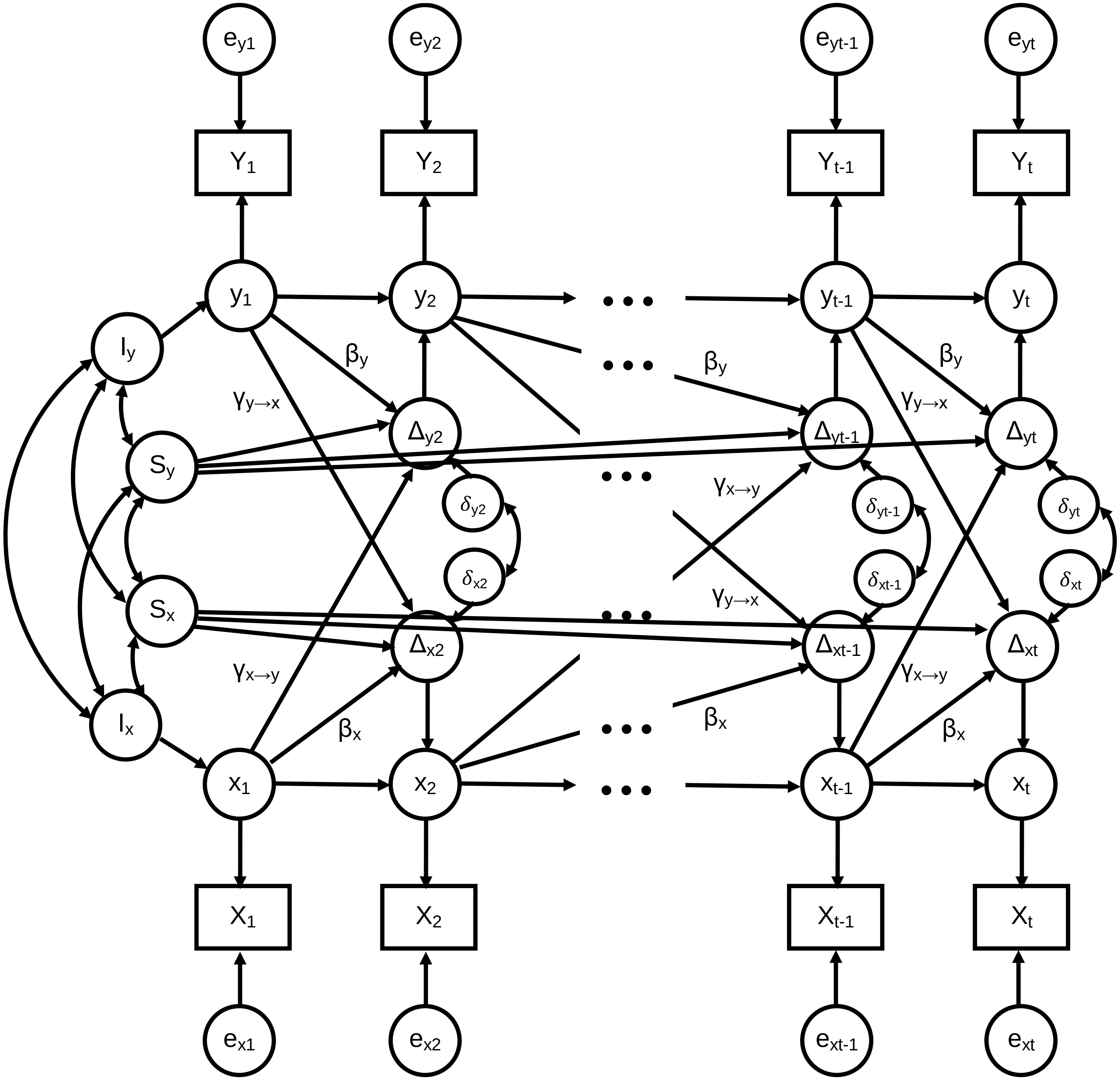
Replication Study: Unstandardized Parameter Estimates in Regression Analysis Predicting T2 Math Achievement From T1 Variables

	Aspiration Model	Over-aspiration model
Baseline math achievement	0.864**	0.871**
Gender (female = 1, male = 0)	-0.411**	-0.424**
School region (not urban = 1, urban = 0)	0.036	0.113
School region (not rural = 1, rural = 0)	-0.278*	-0.358**
School type (public = 1, private = 0)	-0.881**	-0.856**
SES	0.899**	0.922**
Parental aspiration	0.297**	-
Parental over-aspiration	-	-0.260**

Note. SES = Socioeconomic status. ** $p < .01$. * $p < .05$.

Figure Captions

Figure 1 Bivariate dual-change score model. Squares represent observed variables; circles represent latent variables; dots represent an implied repetition of a time series. Paths (one-headed arrors) without coefficients (e.g., β) are all fixed to one.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S_x
I_x
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Fig. 1

Online Supplemental Material

Analysis Accounting for the Nested Structure of the Data

To account for potential bias resulting from the nested structure of the data (Raudenbush & Bryk, 2002; i.e., individuals are clustered within schools), we re-estimated the aspiration and over-aspiration models after adjusting standard errors based on the information about clustering (Skinner, Holt, & Smith, 1989). The analysis replicated both the positive reciprocal effects of parental aspiration on children's math achievement and of achievement on aspiration (*ps* < .05; note that parameter estimates were unchanged) and the negative reciprocal effects of parental over-aspiration on children's math achievement and of achievement on over-aspiration (*ps* < .05). It should be noted, however, that a number of students changed schools grades 6 to 7 in the dataset, making it difficult to appropriately define level-2 units over time (see Murayama et al., 2013). The current analysis tentatively defined the level 2 units as the schools that participants attended when they first entered the study, but caution should be made in interpreting these findings.

Analysis Using School Grades

The PALMA dataset includes students' end-of-year school grades as retrieved from school documents. These grades can be used an alternative index of students' academic attainment. As such, we examined whether the positive effects of parental aspiration and the negative effects of parental over-aspiration would be observed with students' grades in mathematics. Specifically, we tested the main bivariate dual-change score models for aspiration and over-aspiration (Tables 1 and 3) with math achievement scores being replaced by math grades. Because end-of-year grades were available for grades 5 to 9 only, we did this analysis for grades 5 to 9.

The results replicate our main findings: Parental aspirations positively predicted change in math grades from the present to the next year ($\gamma_{math \rightarrow aspiration}$ = 0.317, p < .05), whereas parental over-aspiration had a negative impact on change in math grades ($\gamma_{math \rightarrow over\text{-}aspiration}$ = -0.401, p < .01). There are some limitations to using grades as an index of academic achievement (e.g., in terms of both validity and reliability). In addition, school grades reflect students' performance during the term, rather than the time of the assessment of parental aspiration (this violates the assumption of dual-score change model). These results, however, provide further evidence for the robustness of our findings.

Additional Analyses on Parental Over-aspiration

We conducted two additional analyses to further scrutinize the effects of parental over-aspiration on the math achievement scores. First, we ran a trivariate dual-change score model that included not only linear but also quadratic effects of parental over-aspiration. This analysis was done in order to investigate possible curvilinear effects of parental over-aspiration --- having mild over-aspiration could be a beneficial (i.e., achievable over-aspiration) whereas unrealistic over-aspiration could be detrimental. The quadratic effect, however, was not statistically significant (p = .36).

Second, to investigate the potential effects of outliers in parental over-aspiration, we capped all non-zero parental over-aspiration scores to 1 (i.e., all the positive parental over-aspiration scores were coded as 1) and re-ran the same set of analyses. The reciprocal negative effects of parental over-aspiration were still statistically significant ($\gamma_{over\text{-}aspiration \rightarrow math}$ = -3.575, p < .01; $\gamma_{math \rightarrow over\text{-}aspiration}$ = -0.001, p < .01), documenting the robustness of the results when eliminating extreme scores.

Table S1 *Correlations Between Parental Aspiration and Other Variables*

	Aspiration 5th	Aspiration 6th	Aspiration 7th	Aspiration 8th	Aspiration 9th	Aspiration 10th
Math 5th	.226**	.217**	.182**	.127**	.136**	.224**
Math 6th	.219**	.218**	.222**	.168**	.182**	.255**
Math 7th	.216**	.223**	.204**	.177**	.177**	.254**
Math 8th	.219**	.202**	.185**	.173**	.197**	.291**
Math 9th	.194**	.201**	.172**	.170**	.199**	.262**
Math 10th	.234**	.231**	.216**	.213**	.258**	.346**
Gender (0 = female, 1 = male)	.074**	.089**	.071**	.082**	.068**	.038
School Type 1 (intermediate vs. lower)	-.050*	-.073**	-.140**	-.122**	-.125**	-.071*
School Type 2 (higher vs. intermediate or lower)	.001	-.059**	-.021	-.069**	-.066**	-.034
SES	.024	-.035	-.018	-.021	-.039†	.007
Age in months	-.014	-.029	.003	.027	.058*	.107**
Intelligence 5th	.127**	.121**	.120**	.116**	.106**	.163**
Intelligence 6th	.130**	.122**	.115**	.127**	.099**	.192**
Intelligence 7th	.140**	.141**	.163**	.138**	.127**	.217**
Intelligence 8th	.141**	.127**	.153**	.139**	.157**	.204**
Intelligence 9th	.164**	.153**	.156**	.145**	.163**	.223**
Intelligence 10th	.183**	.175**	.182**	.158**	.156**	.239**

Note. ** $p < .01$ * $p < .05$; SES = Socioeconomic status

Table S2 *Parameter Estimates of Dual-change Score Model For Parental Aspiration and Mathematics Achievement*

	Estimate	SE
$I_{aspiration}$	5.860**	0.013
$S_{aspiration}$	0.101	0.091
I_{math}	100.522**	0.284
S_{math}	7.575**	1.234
$\gamma_{aspiration \rightarrow math}$	0.811**	0.189
$\gamma_{math \rightarrow aspiration}$	0.001**	0.000
$\beta_{aspiration}$	-0.044*	0.017
β_{math}	-0.041**	0.009
$\phi^2{}_{I\ aspiration}$	0.199**	0.013
$\phi^2{}_{I\ math}$	180.255**	7.273
$\phi^2{}_{S\ math}$	2.029†	1.108
$\phi^2{}_{I\ aspiration,\ I\ math}$	1.955**	0.202
$\phi^2{}_{I\ math,\ S\ math}$	13.614**	2.184
$e^2{}_{aspiration}$	0.206**	0.010
$e^2{}_{math}$	48.414**	2.102
$\delta^2{}_{aspiration}$	0.049**	0.008
$\delta^2{}_{math}$	18.852**	3.655
$\delta^2{}_{aspiration,\ math}$	0.172**	0.054
CFI	.945	
TLI	.949	
RMSEA	.049	

Table S3 *Cross Tables Between Parental Aspiration and Parental Expectation for Grades 6-10 (in %)*

		6th Grade Aspiration					
		1	2	3	4	5	6
6th Grade Expectation	1	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%
	2	0.1%	0.0%	0.0%	0.1%	0.1%	0.0%
	3	0.0%	0.1%	0.8%	5.8%	0.9%	0.0%
	4	0.0%	0.0%	0.4%	17.3%	20.8%	1.1%
	5	0.0%	0.0%	0.1%	5.6%	32.7%	4.1%
	6	0.0%	0.0%	0.1%	0.1%	4.2%	5.9%

		7th Grade Aspiration					
		1	2	3	4	5	6
7th Grade Expectation	1	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	2	0.1%	0.0%	0.2%	0.3%	0.1%	0.0%
	3	0.0%	0.1%	0.6%	7.1%	0.7%	0.1%
	4	0.1%	0.0%	0.8%	20.3%	18.6%	0.9%
	5	0.0%	0.0%	0.1%	6.8%	29.4%	4.4%
	6	0.0%	0.0%	0.1%	0.4%	4.0%	5.2%

		8th Grade Aspiration					
		1	2	3	4	5	6
8th Grade Expectation	1	0.1%	0.1%	0.1%	0.0%	0.0%	0.1%
	2	0.0%	0.0%	0.1%	0.3%	0.1%	0.0%
	3	0.0%	0.0%	1.3%	6.6%	0.4%	0.2%
	4	0.0%	0.0%	0.7%	20.6%	17.8%	0.7%
	5	0.1%	0.0%	0.1%	8.0%	27.3%	3.5%
	6	0.1%	0.0%	0.1%	0.5%	5.3%	5.8%

		9th Grade Aspiration					
		1	2	3	4	5	6
9th Grade Expectation	1	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%
	2	0.0%	0.1%	0.2%	0.2%	0.0%	0.0%
	3	0.0%	0.1%	1.2%	5.6%	0.4%	0.1%
	4	0.0%	0.1%	1.4%	20.9%	14.0%	0.6%
	5	0.0%	0.0%	0.1%	7.7%	30.2%	4.1%
	6	0.0%	0.0%	0.1%	0.3%	5.8%	6.6%

		10th Grade Aspiration					
		1	2	3	4	5	6
10th Grade Expectation	1	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%
	2	0.0%	0.0%	0.3%	0.0%	0.0%	0.0%
	3	0.0%	0.1%	1.4%	5.6%	0.2%	0.0%
	4	0.0%	0.1%	1.1%	20.8%	10.3%	0.4%
	5	0.0%	0.1%	0.2%	8.1%	30.1%	2.7%
	6	0.0%	0.0%	0.1%	0.9%	7.5%	9.9%

Note. Range of scores for aspiration and expectation: 1= worst grade to 6 = best grade.

Table S4 *Correlations Between Parental Over-aspiration and Other Variables*

	Over-Aspiration 5th	Over-Aspiration 6th	Over-Aspiration 7th	Over-Aspiration 8th	Over-Aspiration 9th	Over-Aspiration 10th
Math 5th	-.212**	-.240**	-.181**	-.180**	-.134**	-.174**
Math 6th	-.227**	-.227**	-.168**	-.181**	-.136**	-.199**
Math 7th	-.215**	-.246**	-.195**	-.197**	-.144**	-.234**
Math 8th	-.218**	-.215**	-.201**	-.203**	-.148**	-.250**
Math 9th	-.208**	-.213**	-.200**	-.200**	-.150**	-.269**
Math 10th	-.200**	-.244**	-.214**	-.215**	-.144**	-.262**
Gender (0 = female, 1 = male)	.001	.034	.016	.027	.018	-.008
School Type 1 (intermediate vs. lower)	-.079**	-.085**	-.043†	-.062**	-.012	-.131**
School Type 2 (higher vs. intermediate or lower)	-.067**	-.108**	-.127**	-.093**	-.051*	-.099**
SES	-.093**	-.108**	-.091**	-.077**	-.088**	-.094**
Age in months	-.054†	-.096**	-.059*	-.101**	-.093**	-.131**
Intelligence 5th	-.177**	-.172**	-.124**	-.157**	-.073*	-.160**
Intelligence 6th	-.145**	-.160**	-.120**	-.122**	-.097**	-.173**
Intelligence 7th	-.214**	-.219**	-.161**	-.165**	-.127**	-.169**
Intelligence 8th	-.173**	-.190**	-.135**	-.142**	-.125**	-.172**
Intelligence 9th	-.184**	-.186**	-.139**	-.157**	-.111**	-.209**
Intelligence 10th	-.198**	-.211**	-.114**	-.166**	-.115**	-.200**

Table S5 *Parameter Estimates of Dual-change Score Model for Parental Over-aspiration and Mathematics Achievement*

	Estimate	SE
$I_{over\text{-}aspiration}$	0.368**	0.012
$S_{over\text{-}aspiration}$	0.125*	0.051
I_{math}	100.489**	0.285
S_{math}	15.039**	1.257
$\gamma_{over\text{-}aspiration \rightarrow math}$	-3.319**	0.588
$\gamma_{math \rightarrow over\text{-}aspiration}$	-0.001*	0.000
$\beta_{over\text{-}aspiration}$	-0.157**	0.040
β_{math}	-0.055**	0.010
$\phi^2_{I\ over\text{-}aspiration}$	0.094**	0.008
$\phi^2_{I\ math}$	178.952**	7.262
$\phi^2_{S\ math}$	2.716*	1.104
$\phi^2_{I\ over\text{-}aspiration,\ I\ math}$	-1.707**	0.149
$\phi^2_{I\ math,\ S\ math}$	13.114**	2.103
$e^2_{over\text{-}aspiration}$	0.180**	0.007
e^2_{math}	49.081**	2.110
$\delta^2_{over\text{-}aspiration}$	0.013*	0.006
δ^2_{math}	16.828**	3.629
$\delta^2_{over\text{-}aspiration,\ math}$	0.000	0.045
CFI	.936	
TLI	.941	
RMSEA	.051	

Table S6 *Parameter Estimates of Dual-change Score Model for Parental Expectation and Mathematics Achievement*

	Estimate	SE
$I_{expectation}$	5.584**	0.015
$S_{expectation}$	0.327**	0.065
I_{math}	100.530**	0.284
S_{math}	5.491**	0.820
$\gamma_{expectation \rightarrow math}$	1.173**	0.176
$\gamma_{math \rightarrow expectation}$	0.002**	0.000
$\beta_{expectation}$	-0.094**	0.015
β_{math}	-0.038**	0.009
$\phi^2_{I\ expectation}$	0.364**	0.017
$\phi^2_{I\ math}$	180.368**	7.302
$\phi^2_{S\ math}$	1.548	1.041
$\phi^2_{I\ expectation,\ I\ math}$	4.690**	0.254
$\phi^2_{I\ math,\ S\ math}$	9.111**	1.818
$e^2_{expectation}$	0.197**	0.009
e^2_{math}	48.730**	2.098
$\delta^2_{expectation}$	0.105**	0.011
δ^2_{math}	18.302**	3.653
$\delta^2_{expectation,\ math}$	0.168**	0.061
CFI	.948	
TLI	.952	
RMSEA	.052	