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### Abstract

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## Can children break the cycle of disadvantage? Structure and agency in the transmission of education across generations

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### Abstract

Research has shown that parents tend to pass educational advantage or disadvantage on to their children. However, little is known about the extent to which the intergenerational transmission of education involves children's agency. In this study we drew from two traditions in sociological and social psychological theorizing – the theory of cultural and social reproduction and the theory of human agency – to examine whether agency influences children's educational performance, and if so, whether this influence can be observed among children across social classes. We used data from the Spanish sample of the Program for International Student Assessment ( $N = 25,003$  15-year-olds). Results indicate that the level of child agency was weakly positively related to social class, that child agency impacted on a child's educational performance, and that the positive effect of agency on educational performance did not vary by social class. This suggests that strategies to enhance disadvantaged children's agency may prove useful in reducing social gradients in educational performance. More generally, our findings may ignite a debate about the role that social structure and human agency play in shaping social inequality and mobility.

### Keywords

inequality, structure/agency, cultural and social reproduction, educational stratification, PISA

### 1 Introduction

In modern societies, social hierarchies are grounded in meritocratic principles whereby selection into higher social positions is supposed to be granted on the basis of merit alone; and unequal access to valued resources is to be justified by individuals' unequal qualities, as revealed for instance at school, not by assets inherited from ancestors (Grusky 2001). Accordingly, education has become a prime instrument through which governments seek to create equitable societies. All children have a right to education on the basis of equal opportunity and without discrimination of any kind (UN General Assembly 1989). However, although educational policies consistently lay emphasis on equal opportunity in school, substantial gaps remain between the educational achievements of children of different social origins, with children of more highly educated parents outperforming their counterparts from educationally less advantaged families (e.g., Burger 2016; Schlicht et al. 2010). Recent evidence suggests that genetic inheritance only explains a small portion of these achievement gaps (Jerrim et al. 2015) and that differences in educational aspirations between children from different social strata tend to be small (Baker et al. 2014; Khattab 2003). As a consequence, the existence of social gradients in educational achievements challenges the notion of equal opportunity underlying meritocratic education systems. It is therefore important to examine the mechanisms which tend to reproduce social class inequalities across generations.

Research on social stratification has established that parents pass down educational advantage or disadvantage to children in any country for which data exist (Hertz et al. 2007). To explain how this transmission occurs,

scholars have particularly focused on the role of socialization practices (Lareau 2002), parenting styles (Roksa and Potter 2011), cultural, social and economic capital (Bourdieu and Passeron 1970), and parents' decisions regarding educational transitions and trajectories of their children (Boudon 1974). Whereas previous studies have shed light on contextual factors, research has widely disregarded the influence of the children themselves on their educational performance. What we lack, therefore, is research that addresses a child's own role – child agency – in the intergenerational transmission of education. Considering child agency is crucial because children cannot be understood as passive subjects in the reproduction of educational inequalities (Calarco 2014). Rather, they are agents capable of structuring their actions and of influencing their lives (e.g., Bandura 2006).

By drawing from two distinct traditions in sociological and social psychological theorizing – the theory of cultural and social reproduction and the theory of human agency – we seek to assess whether child agency influences the intergenerational transmission of education. The two theories rely on contrasting premises, stressing the intergenerational transfer of resources through social class-based childrearing and socialization practices (social structure) and the alteration of resources through children's agentic capacity (agency), respectively. So far, scholars have placed much emphasis on the theory of social and cultural reproduction when analyzing educational inequalities. However, the theory of human agency provides added value by considering children's own set of resources and capacities, including children's reactions to parents' class-bound parenting practices (Lareau 2002), their active resistance to parents' desires and attempts to manage their lives (Pugh 2009), and more generally children's own way of exerting influence within structured societal pathways (Bandura 2001; Elder 1994; Hitlin and Elder 2006; Parker et al. 2012). Researchers have argued that agency is more likely to originate in children's character than in their social class, and that character tends to be unrelated to social class (Chin and Phillips 2004). Furthermore, young people of different social origins seem to be able to cope with obstacles in their lives, suggesting that agency can override socioeconomic disadvantages, for instance, in terms of identity formation and achievement (Côté and Schwartz 2002). Accordingly, variations in children's agency should minimize social gradients in educational achievements. Today, there is some empirical evidence regarding the roles of structure and agency in young people's school-to-work transitions (Evans 2007; Rudd and Evans 1998) and transitions to adulthood (Lui et al. 2014). However, to our knowledge, no quantitative research exists focusing on the extent to which the transmission of educational advantage across generations involves children's agency. Against this backdrop, our study is the first to explicitly examine how agency affects children's educational performance, and whether children's agency plays a role in the intergenerational transmission of educational (dis-) advantage.

## **2 Theoretical background and hypotheses**

The theory of cultural and social reproduction, put forward by Bourdieu and Passeron (1970), posits that different forms of capital and socialized habits are transmitted across generations, serving to reproduce social hierarchies, with families and schools being the principal agents of cultural transmission (i.e., transmission of codes, values, and attitudes) and ultimately of the reproduction of the social structure. This theory offers an explanation for intergenerational associations in educational attainment and for achievement gaps between children of diverse social origins (e.g., Jaeger and Holm 2007). It emphasizes that by equipping children with cultural capital – which includes familiarizing them with a society's dominant culture – parents structure their children's educational performance and trajectories. According to the theory of cultural and social reproduction, parental education is a major determinant of children's educational performance. Empirical research has confirmed the significant impact of parental education on a child's educational performance and attainment (e.g., Dubow et al. 2009; Ou and Reynolds 2008). Against this background, we hypothesize that compared to other determinants of educational performance, such as occupational status and cultural possessions, parental education is a particularly strong predictor of children's educational performance (*hypothesis 1*).

Furthermore, in accordance with social psychological theory (e.g., Eccles 2008; Gecas 1989; Little et al. 1995) we argue that agency also influences children's educational outcomes. Theorists of human agency posit that individuals' are endowed with the capacity to shape their own lives (Prout and James 1990; Stoecklin 2013), to exercise control over their lives (Bandura 2001), and to bring about change (Sen 1999). Constitutive elements of agency include individuals' beliefs about their ability to control events (perceived control), their sense of self-efficacy (the conviction that they can master events and achieve success), and conscious goal setting as well as commitment to these goals (e.g., Bandura 2006). To the extent that children are understood as self-determining actors who structure their experiences and construct their lives, the notion of transmission of capital as a strategic process of intergenerational reproduction of social status becomes questionable. As such, the theory of human agency may enhance our understanding of educational stratification and mobility. Since agency has been conceptualized as individuals' capacity to gain control over their lives largely independently of social structure (Chin and Phillips 2004), it could be argued that children of more highly educated parents should not possess more agency than those of less educated parents. In this light, we will test three additional hypotheses: first, that children from diverse educational backgrounds possess the same level of agency, irrespective of the level of their

parents' education (*hypothesis 2*); second, that agency affects children's educational performance (*hypothesis 3*); and third, that potential effects of child agency do not vary by parental education, meaning that agency affects the educational performance of all children to the same degree, independently of the level of their parents' education (*hypothesis 4*).

We do not intend to misrepresent the theory of social and cultural reproduction as being mechanistic or deterministic, or as leaving no room for children's spontaneity and conflicts vis-à-vis social and cultural structures (see Mills 2008). Nor do we purport that agency is a characteristic that renders a child entirely autonomous or independent. Agency involves a degree of interdependence within families and wider social environments (including a balance between accepting a certain dependence on others and their authority, and obtaining a certain independence from them; Eneau 2012). However, we argue that the theory of social and cultural reproduction and the theory of agency are analytically distinct, and that incorporating both theories into the study of intergenerational transmission of education adds value and provides a more holistic perspective of how stratified societal structures emerge. To test our hypotheses, we focus on Spain where the issue of intergenerational transmission of education deserves particular scrutiny as the degree of educational inequality related to social origin has increased over the last years (OECD 2013).

### 3 Method

#### 3.1 Data and sample

We use data from the 2012 wave of the Program for International Student Assessment (PISA), which evaluates the performance of 15-year-old students in mathematics, reading, and science in a three-year cycle, placing special emphasis on one subject in each wave of the assessment (mathematics in 2012). The PISA assessment also provides data on students' family backgrounds and school characteristics. Data are collected in a two-stage sampling procedure. First, schools are selected with probabilities proportional to their size; second, students are selected randomly within schools. The Spanish sample includes 25,003 students, nested in 902 schools.

#### 3.2 Measures

##### 3.2.1 Dependent variable

To assure comparability with previous studies (e.g., Schlicht et al. 2010; Stadelmann-Steffen 2012) we use students' mathematical performance as an indicator of educational performance. This dependent variable is estimated in the form of five plausible values. Plausible values take into account that the measurement of students' educational performance contains uncertainty. They represent the range of abilities that a student is likely to have, given the student's item responses (Wu 2005). To estimate population parameters and their standard errors, we use each plausible value separately for any analysis and aggregate the individual results. We use the PISA final student weights to ensure that the sample represents the total population of 15-year-old students in Spain. By weighting the data we take into account that not all students had the same probability of being selected into the PISA sample. The weights are the inverse of the probability of selection into the sample.

##### 3.2.2 Independent variables

The central independent variables are the level of parental education and three indicators of child agency. We use the number of years of completed full-time schooling of the parent with the higher educational background as our measure of parental education. The three indicators of agency relate to a child's perceived control, sense of self-efficacy, and work ethic. Specifically, we assess the extent to which children agree with the notion (1) that doing well in education is completely up to them (perceived control), (2) that they can succeed in education with enough effort (self-efficacy), and (3) that they study until they understand everything (work ethic), using a 4-point scale which ranged from 'strongly disagree' to 'strongly agree'. These three indicators reflect important aspects of agency (e.g., Bandura 2006), and they constitute an original operationalization of the concept considering that, in spite of a growing body of theory on agency, researchers have rarely captured the concept in quantitative empirical analyses (for exceptions see Nordlander et al. 2015; Schwartz et al. 2005).

##### 3.2.3 Covariates

In addition, we include the following individual-level covariates in our analyses: Gender, immigrant status, primary language spoken at home (home language), educational resources at home, cultural possessions, parents' highest occupational status, and school grade at assessment. At the school level, we distinguish between private and public schools given that the proportion of private schools in Spain is high in comparison to most other European countries (30%, according to Eurydice 2012); and we use an aggregate indicator that assesses a school's average parental educational level, in order to take into account that the composition of a school's

student population also affects children's educational performance (Opdenakker and Van Damme 2001; Perry and McConney 2010). Detailed information on these variables, their operationalization, and descriptive statistics can be found in Appendix 1.

### 3.3 Analytical strategy

Besides descriptive analysis and analysis of variance, we use multilevel linear regression modelling (e.g., Snijders and Bosker 2012). Specifically, we perform two-level random intercept and random slope models which take into account that students' educational performance varies not only between students but also between schools, and which allow us to model variables at individual and school levels simultaneously. We include interaction terms to evaluate whether the relationships between parents' educational background and children's educational performance are moderated by child agency. If agency affects children's performance independently of parental education, as hypothesized, the interaction between parental education and child agency should not be significant, or only of trivial magnitude and, thus, substantively meaningless. In sum, we estimate a child's educational performance as a function of child characteristics, school characteristics, and an interaction between parental education and child agency, as denoted in the following equation:

$$Y_{ij} = \beta_{00} + \beta_1 X_{1ij} + \dots + \beta_d X_{dij} + \dots + \beta_n X_{nij} + \delta_1 S_{1j} + \dots + \delta_n S_{nj} + \dots + \gamma_1 X_{mij} \cdot X_{nij} + (\beta_{10} + v_{1j}) X_{mij} + v_{0j} + \varepsilon_{0ij}. \quad (1)$$

The educational performance  $Y$  of a child  $i$  in school  $j$  is explained by the overall mean ( $\beta_{00}$ ), characteristics of the child ( $X_1$  to  $X_n$  and their coefficient estimates  $\beta_1$  to  $\beta_n$ ), school characteristics ( $S_1$  to  $S_n$  and their coefficient estimates  $\delta_1$  to  $\delta_n$ ), and an interaction between parental education  $X_{mij}$  and child agency  $X_{nij}$  (and its coefficient estimate  $\gamma_1$ ). By including a random slope  $v_{1j} \sim (0, \sigma_v^2_{1j})$  on parental education at the school level, we take into account that the effect of parental education on children's educational performance differs between schools. Specifically, we add a fixed effect for the school average on parental education and a random effect for parental education. The term  $(\beta_{10} + v_{1j}) X_{mij}$  denotes the random slope:  $\beta_{10}$  is the slope of parental education  $X_{mij}$  for the average school and  $\sigma_v^2_{1j}$  indicates the variation in this slope across schools. The model contains a residual  $v_{0j} \sim (0, \sigma_v^2_{0j})$  at the school level and a residual  $\varepsilon_{0ij} \sim (0, \sigma_\varepsilon^2_{0ij})$  at the individual level. The residuals are assumed to have zero means, to be mutually independent, and to be normally distributed. The population variances of the school- and individual-level residuals are specified as  $\sigma_v^2_{0j}$  and  $\sigma_\varepsilon^2_{0ij}$ , respectively. Note that equation (1) specifies the final model. Before arriving at this final model, we perform a set of less complex models, starting with an empty model and including additional variables step by step (see Table 2). We use grand-mean centered continuous as well as dichotomous variables in all our models. There are no multicollinearity issues among the central independent variables and the covariates (variance inflation factor values  $< 2.5$ ). Multilevel modeling is a standard method to analyze hierarchically structured data and has been applied in numerous studies based on PISA and other large-scale surveys (e.g., Byun et al. 2012; Le Donne 2014; Schlicht et al. 2010). Given that the PISA surveys provide cross-sectional data, some uncertainty remains as to the causal effects of the independent variables on students' educational performance. Today, much of the large-scale research measuring student performance is confronted with this challenge (e.g. Byun et al. 2014; Marteleto and Andrade 2014; Stadelmann-Steffen 2012; Van Doorn et al. 2011). In conformity with previous studies, we therefore include students' school grade at assessment as a proxy for prior student performance, assuming that being enrolled in a higher grade at the age of 15 means having performed better than peers who had repeated a grade during the preceding school years (Chiu 2010; Lee et al. 2005).

We perform separate analyses for each of the agency indicators, because three student questionnaire forms were used to collect information about students in the PISA 2012 cycle, each of which contained a common part and a rotated part. The common part was administered to all students. By contrast, the rotated part – which included information about attitudinal and non-cognitive characteristics of students – was administered only to two thirds of the students per question. Students had to respond to randomly assigned student questionnaire forms. Given that we derive our three indicators of child agency from the rotated part of the questionnaire, we do not operationalize agency as a multi-measure construct combining the three measures 'perceived control', 'sense of self-efficacy,' and 'work ethic' for each student. As a consequence of the rotation design, we would have a considerable number of missing data in each analysis, or no data left at all. Instead, we conduct separate versions of our models for each of the three agency indicators on the resulting random subsets of the data.

## 4 Results

We report the findings in two stages. First, we present findings of bivariate analyses regarding the degree of association between parental education and children's educational performance as well as regarding hypothesis 2 whereby children possess the same level of agency irrespective of the level of education of their parents. Second, we summarize the results of multivariate analyses which we used to test hypotheses 1, 3, and 4.

#### 4.1 Bivariate analyses

Figure 1 provides descriptive evidence relating to our first hypothesis about the degree of association between parents' educational attainment and children's educational performance. It shows that children of highly educated parents were more likely to perform well than their counterparts from less educated families. For instance, 41.7 per cent of the children of highly educated parents were within the upper (third) tertile in terms of their educational performance, whereas only 19.6 per cent of the children of low-educated parents were among these high-performing students. Conversely, no more than 24.9 per cent of the children of highly educated parents were within the lower (first) tertile, compared to 49.2 per cent of the children of low-educated parents.

- INSERT FIGURE 1 ABOUT HERE -

Table 1 presents results relating to hypothesis 2, showing that on average children of more highly educated parents possessed more agency than their counterparts of less educated parents, although the differences in the level of agency were relatively small and sensitive to the choice of indicator used. Analyses of variance indicated that these differences were statistically significant for work ethic,  $F(2, 16321) = 123.42, p < .001$ , and for self-efficacy,  $F(2, 16197) = 12.76, p < .001$ , but not for perceived control,  $F(2, 16369) = 2.77, p = 0.63$ . Given these results, our second hypothesis, whereby children possess the same level of agency irrespective of the level of their parents' education, could only partially be confirmed.

- INSERT TABLE 1 ABOUT HERE -

#### 4.2 Multivariate analyses

The multilevel models allow us to take into account relevant control variables, and to test hypotheses 1, 3, and 4. Table 2 displays the -2 log-likelihood model fit statistics of a series of models where we added variables subsequently (models I to VIII). We ran the models for each indicator of child agency individually: Model version 1 includes work ethic, model version 2 includes self-efficacy, and model version 3 includes perceived control. Improvements of the model fit are indicated by the difference in the fit statistics ( $\Delta$  -2 log-likelihood), which follows a  $\chi^2$ -distribution with degrees of freedom equal to the number of variables additionally included in each new model. Estimation of an empty model (I) with only a random intercept (varying across schools) resulted in an intra-class correlation of 0.18, revealing the variance component in children's performance at the school level and thereby confirming that the use of multilevel models is appropriate. The inclusion of characteristics of the children and their families in models II and III significantly improved the model fit. Model IV isolates the effect of parental education on children's performance and indicates that parental education influenced children's performance after controlling for other characteristics of the child, the family, and the school grade in which a child was enrolled at the time of assessment. Including covariates at the school level (model V) as well as a random slope on parental education at school level (model VI) resulted in an even better model fit, suggesting that school characteristics had a significant effect on student achievement and that the intergenerational associations in education varied across schools. Furthermore, child agency had a distinct net effect on children's performance, as hypothesized (see models VII-1 to VII-3), whereas the final models (VIII-1 to VIII-3) illustrate that the interactions between child agency and parental education did not significantly change the model fit. Given these non-significant interactions, we can interpret that the effect of child agency on children's educational performance did not vary substantially by parental education.

- INSERT TABLE 2 ABOUT HERE -

Table 3 summarizes the coefficient estimates and the variance components of the final models (denoted as models VIII-1 to VIII-3 in Table 2). These models illustrate that, on average, boys achieved higher scores in mathematics than girls, and first-generation immigrants performed below average. Furthermore, children performed above average when they were native speakers, attended higher grades, came from families with a higher occupational status and a higher educational background, and when they had more educational resources and cultural possessions at home. The models also provide evidence that children who possessed higher levels of agency displayed better educational performance, regardless of how agency was measured, and net of the effects of other variables. Children in private schools did not outperform their counterparts in public schools. However, those who attended schools with a population of students from more highly educated families performed better than their peers in schools with a less educationally advantaged student population. The non-significant interactions between parental education and either of the three indicators of agency suggest that the effect of agency on children's educational performance did not depend on the level of parental education. Finally, the random effects indicate that the unexplained variance at the individual level remained larger than the unexplained variance at the school level. This is in line with previous findings whereby characteristics of children and families are more powerful predictors of children's educational performance than characteristics of

schools (Stewart, 2008). In each model version, there is a weak positive correlation between the school level variance and the random slope on parental education at the school level ( $r = 0.17$ ,  $r = 0.13$ , and  $r = 0.17$ ). This suggests that the relationship between parental education and a child's educational performance was marginally stronger in schools with a higher average student performance. However, given the low correlation coefficients, these differences between schools were substantially inconsequential.

If we look more closely at the effect of parental education, we notice that an increase in parental education by one year increased children's performance by 1.16, 1.18, and 1.23 points respectively, depending on the model version. Thus, the difference in performance between children of the least educated (3 years) and the best educated (16.5 years) parents amounted to 15.66, 15.93, and 16.61 points respectively, which corresponds to a difference of approximately a 0.16 standard deviation. By comparison, the difference in performance between children of parents with the lowest occupational status and those of parents with the highest occupational status corresponded to roughly a 0.30 standard deviation, and the difference in terms of cultural possessions corresponded to roughly a 0.27 standard deviation. Accordingly, our results do not fully confirm our first hypothesis that, relative to other determinants of educational performance, parental education is a particularly strong determinant of children's performance, although parental education clearly did have a significant impact on children's educational performance. Additional analyses of variance showed that more highly educated parents provided children with more educational resources,  $F(6, 24699) = 124.47$ ,  $p < .001$ , and with more cultural resources,  $F(6, 24602) = 410.92$ ,  $p < .001$ , both of which have a significant positive effect on students' performance. This indicates that parental education may affect children's achievement indirectly – for instance through home environments (see also Davis-Kean, 2005; Savage and Egerton, 1997). To test this assumption further, we calculated multilevel models that additionally included an interaction between parental education and educational resources, as well as an interaction between parental education and cultural possessions. These models (not shown) confirmed that the effect of parental education on their offspring's educational performance was significantly stronger in families with more cultural possessions at home. The regression coefficients  $b$  (and standard errors) of the interactions between parental education and cultural possessions were 0.49 (0.16), 0.56 (0.16), and 0.43 (0.16) in the model versions 1, 2, and 3, respectively.

Regarding the effect of agency on educational performance, the results indicate that children with high levels of agency outperformed their counterparts with low levels of agency by up to 11.52 points, which equals improvements in performance of roughly a 0.12 standard deviation (see model version 2; note that agency was measured on a 4-point scale). This effect may be considered as relatively modest. However, given the wealth of factors that have been demonstrated to influence educational performance, it is far from meaningless. For instance, this effect almost corresponds to the average difference in performance between natives and first-generation immigrants. Consequently, the result supports our third hypothesis that agency influences children's educational performance. Agency had a positive impact on educational performance even when relevant family, child, and school characteristics were controlled for. Moreover, the impact of agency on children's performance did not depend significantly on parental education, which supports our fourth hypothesis.

- INSERT TABLE 3 ABOUT HERE -

Theoretically, agency might have substantively meaningful marginal effects on the association between parental education and a child's educational performance for a given level of parental education even if the coefficient of the interaction term is not statistically significant (Brambor et al. 2006). To test the robustness of our results, we therefore examined whether the marginal effects of agency on children's educational performance vary substantially across different levels of parental education. These analyses confirm that the effect of agency on children's educational performance remained virtually constant across the different levels of parental education. Furthermore, we tested for omitted variable bias by including additional variables in the models (e.g., the degree to which students intimidated or bullied other students, the degree to which teachers encouraged students to achieve their educational potential, the quality of the student-teacher relations, and the heterogeneity of the ability levels of students within school classes). These robustness tests supported our results and are available on request.

## 5 Discussion

Research concerned with intergenerational transmission of education needs to take into account both transmission and transformation of advantages as driving forces behind individual educational trajectories and, more generally, as components of the dynamics of educational stratification. While the influence of different types of resources and social-class stratified habits on children's educational achievements seems uncontested today (e.g., Andersen and Hansen 2012), recent findings from ethnographic research suggest that cultural transmission of advantages across generations may involve agency to a greater extent than has been as yet assumed (Calarco 2014). To the best of our knowledge, our study is the first to apply a quantitative design to

examine the degree to which the intergenerational transmission of educational advantage is influenced by child agency.

Our descriptive analysis confirms previous research indicating that children's educational performance is, to some extent, associated with that of their parents (e.g., Breen and Jonsson 2005). Thus, social inequality in education seems to be perpetuated, and eventually social class positions may be largely maintained across generations. However, results of multivariate analyses show that, although children from more highly educated families outperformed their counterparts from less educated families, the impact of parental education on children's school performance was far from exhaustive and substantively comparatively small (for similar findings see Barone 2006).<sup>1</sup> Yet, the impact of parental education on children's educational performance increased with the number of educational and cultural resources available in a household, a finding in line with the theory that parental education influences children's educational achievement indirectly through home learning environments (Linver et al. 2002).

Moreover, our results indicate a weak positive relationship between the level of child agency and parental education for two out of three indicators of child agency. Hence child agency was not equally distributed across diverse social backgrounds. However, differences in the level of agency between children from different backgrounds were small. In addition, we find that child agency significantly influenced children's educational performance. This implies that child agency is an empirically measurable predictor of performance, and that children should not be understood as "passive subjects of social structures and processes" (Prout and James 1990, p. 8). More importantly, from a statistical point of view the influence of child agency on educational performance did not vary by parental educational background. This finding is noteworthy because it suggests that child agency can be considered as a resource that benefits children across social classes.

In spite of the robustness of the results, limitations of this study should not be disregarded. Our analyses are based on cross-sectional data. Hence we recommend that future research investigate the effects of child agency on educational performance in a longitudinal design, taking into account prior ability and educational performance. Such a design will allow for assessing not only causal effects of child agency on educational outcomes, but also the extent to which effects of parental education on a child's outcomes are mediated by family characteristics such as home learning environments or parenting strategies. Furthermore, the impact of agency on an individual's life course might vary by cultural context, depending on the degree to which individual agency is culturally valued. Our study draws on large-scale data from Spain, and findings might differ in replication studies in other (for instance, more collectivist) societies. Hence our study also gives rise to new questions regarding the relative weight and stability of child agency as a determinant of educational trajectories and inequalities across different contexts.

It is clear that, although child agency plays a distinct role in the intergenerational transmission of education, child agency cannot be seen as a trait that can be activated at will to intervene in any process of structural determination or social constraint, and it is therefore unlikely that children can break the cycle of educational disadvantage simply owing to their agentic capacity (see also Gofen 2009). Yet, if we take into account that children who grow up in educationally disadvantaged families tend to possess somewhat less agency, and that agency improves educational performance, boosting disadvantaged children's agency may help them to become more successful at school. Research suggests that specific facets of agency are malleable (Gist and Mitchell 1992) and that individuals can be empowered to mobilize resources which eventually enhance human agency (e.g., Burger 2015; Sewell 1992). Thus, strengthening children's agency might constitute an avenue to reducing educational inequalities among children of diverse social origins. For instance, the degree of social support experienced by children can influence children's attitudes and perceptions of their academic abilities (Rice et al. 2013), suggesting that social support may increase their sense of competence and, thus, agency. However, to effectively improve children's agency in the domain of schooling, we believe that a better empirical understanding of child agency in educational stratification and mobility is important because as long as researchers and policymakers fail to recognize that children from all social classes possess capacities that are instrumental in coping with challenges in education, they run the risk of maintaining a "patronizing view of the very people whom they seem dedicated to 'liberating'" (Côté 2002, p. 132). By showing how both child agency and parents' resources (as well as their strategies of transmitting these resources) impact on educational achievement and attainment, we may arrive at a more nuanced view of the dynamics of social and cultural reproduction.

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<sup>1</sup> Previous studies indicated somewhat stronger associations between parental education and children's educational performance (e.g., Schlicht et al. 2010; Stadelmann-Steffen 2012). However, this can be explained by the fact that these studies measured parental education on an ordinal scale, using ISCED categories rather than the number of years of completed full-time schooling.



**Conflict of interest** We declare that we have no conflict of interest.

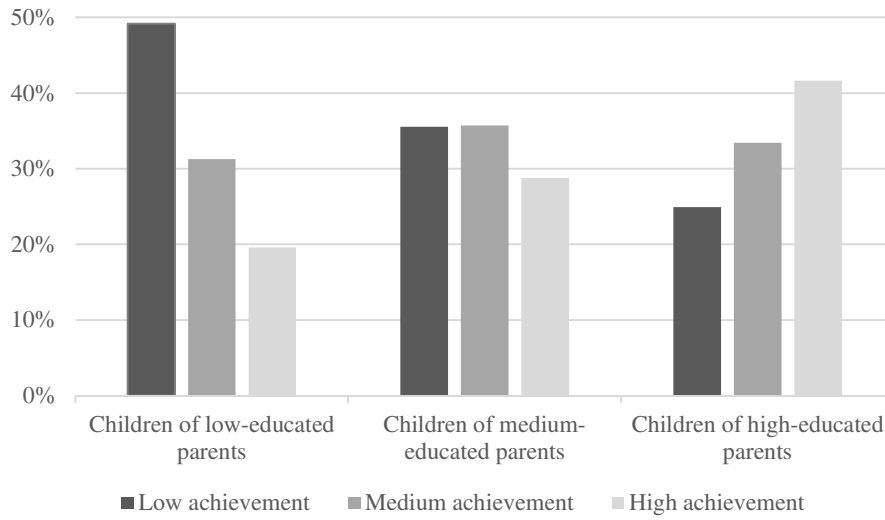
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**Fig. 1** Proportions of students who displayed low, medium, and high achievement (in tertiles), respectively, divided into three groups by parental education:  $n = 5,080$  children of low-educated parents (ISCED 0-2),  $n = 6,523$  children of medium-educated parents (ISCED 3-4), and  $n = 13,215$  children of highly-educated parents (ISCED 5-6). ISCED categories refer to levels of education according to the International Standard Classification of Education. Missing data were deleted listwise

**Table 1** Mean levels of the three indicators of child agency (work ethic, perceived control, and self-efficacy) as a function of parental education

Parental education	Work ethic		Perceived control		Self-efficacy	
	Mean	SE	Mean	SE	Mean	SE
ISCED 0-2	2.45	0.01	3.10	0.01	3.49	0.01
ISCED 3-4	2.54	0.01	3.12	0.01	3.50	0.01
ISCED 5-6	2.70	0.01	3.14	0.01	3.55	0.01

The indicators of child agency were measured on a 4-point scale which ranged from 1: strongly disagree to 4: strongly agree (see Method section for information about the wording of the questions). The ISCED (International Standard Classification of Education) categories refer to the levels of education from pre-primary education (ISCED 0) to the second stage of tertiary education (ISCED 6)

**Table 2** Model fit statistics of multilevel linear regression models accounting for students' educational performance

	Model version 1				Model version 2				Model version 3			
	<i>-2 log-likelihood</i>	$\Delta$ <i>-2 log-likelihood</i>	$\Delta$ <i>df</i>	<i>p-value</i>	<i>-2 log-likelihood</i>	$\Delta$ <i>-2 log-likelihood</i>	$\Delta$ <i>df</i>	<i>p-value</i>	<i>-2 log-likelihood</i>	$\Delta$ <i>-2 log-likelihood</i>	$\Delta$ <i>df</i>	<i>p-value</i>
I: Random variation at school level	203115.5				201318.4				203743.3			
II: I + Gender, immigrant status, language spoken at home, school grade, parental occupational status	187797.1	15318.4	5	< .001	185837.0	15481.4	5	< .001	188349.0	15394.3	5	< .001
III: II + Educational resources, cultural possessions	186502.2	1294.9	2	< .001	184433.9	1403.1	2	< .001	187016.1	1332.9	2	< .001
IV: III + Parental education	184288.6	2213.6	1	< .001	182353.2	2080.7	1	< .001	184797.6	2218.5	1	< .001
V: IV + Private school, school mean parental education	182025.0	2263.6	2	< .001	180220.6	2132.6	2	< .001	182510.8	2286.8	2	< .001
VI: V + Random slope on parental education at school level	181907.7	117.3	2	< .001	180064.2	156.4	2	< .001	182395.5	115.3	2	< .001
VII-1: VI + Agency: work ethic	181889.7	18.0	1	< .001	-	-	-	-	-	-	-	-
VII-2: VI + Agency: self-efficacy	-	-	-	-	180003.4	60.8	1	< .001	-	-	-	-
VII-3: VI + Agency: perceived control	-	-	-	-	-	-	-	-	182367.6	27.9	1	< .001
VIII-1: VII-1 + Par. educ. x Work ethic	181889.4	0.3	1	.584	-	-	-	-	-	-	-	-
VIII-2: VII-2 + Par. educ. x Self-efficacy	-	-	-	-	180000.4	3.0	1	.083	-	-	-	-
VIII-3: VII-3 + Par. educ. x Perceived control	-	-	-	-	-	-	-	-	182364.6	3.0	1	.083

Each model version draws on its own subset of data (see Method section)

**Table 3** Estimates of multilevel linear regression models accounting for students' educational performance

	Model version 1		Model version 2		Model version 3	
	<i>b</i>	SE	<i>b</i>	SE	<i>b</i>	SE
Fixed effects						
Intercept	520.44***	1.20	520.79***	1.20	520.81***	1.20
<i>Individual-level variables</i>						
Gender (ref. cat. female)	27.50***	1.02	26.75***	1.02	27.09***	1.02
First-generation immigrant	-13.82***	2.06	-13.29***	2.05	-13.98***	2.06
Home language	7.79***	1.69	6.23***	1.70	7.34***	1.69
School grade	60.48***	0.88	61.51***	0.87	61.32***	0.87
Parental occupational status	0.38***	0.03	0.38***	0.03	0.39***	0.03
Educational resources at home	2.76***	0.64	2.36***	0.64	2.74***	0.64
Cultural possessions at home	9.61***	0.60	9.78***	0.60	9.92***	0.60
Parental education	1.23***	0.22	1.16***	0.22	1.18***	0.22
Agency: work ethic	2.66***	0.63	-	-	-	-
Agency: self-efficacy	-	-	3.84***	0.68	-	-
Agency: perceived control	-	-	-	-	3.17***	0.63
<i>School-level variables</i>						
Private school	-0.80	1.25	-0.88	1.25	-0.63	1.25
School educational composition	3.14***	0.94	3.15***	0.94	3.10***	0.94
<i>Interaction effects</i>						
Parental education x Work ethic	0.07	0.17	-	-	-	-
Parental education x Self-efficacy	-	-	-0.18	0.18	-	-
Parental education x Perceived control	-	-	-	-	-0.25	0.17
Random effects						
Individual level variance (SD)	54,451.51	(233.35)	54,368.99	(233.17)	54,544.47	(233.55)
School level variance (SD)	513.77	(22.67)	512.91	(22.65)	511.30	(22.61)
Random slope on parental education at the school level (SD)	6.67	(2.58)	6.56	(2.56)	6.51	(2.55)
Correlation between the school level variance and the random slope on parental education	0.17		0.13		0.17	

Coefficient estimates *b* with standard errors and variance estimates with standard deviations,  $n_{\text{children}} = 15,454$ ,  $n_{\text{schools}} = 894$  in model 1;  $n_{\text{children}} = 15,297$ ,  $n_{\text{schools}} = 899$  in model 2;  $n_{\text{children}} = 15,494$ ,  $n_{\text{schools}} = 895$  in model 3. \* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$

## Appendix 1 Variables, operationalization, descriptive statistics

Variables	Operationalization	Descriptive statistics
<i>Dependent variables</i>		
Math performance score in PISA 2012	Plausible value 1	<i>M</i> : 495.36, <i>SD</i> : 88.44 Min: 98.23, Max: 811.82
	Plausible value 2	<i>M</i> : 495.63, <i>SD</i> : 88.67 Min: 145.12, Max: 815.71
	Plausible value 3	<i>M</i> : 495.59, <i>SD</i> : 88.35 Min: 139.52, Max: 821.94
	Plausible value 4	<i>M</i> : 495.23, <i>SD</i> : 88.43 Min: 138.81, Max: 792.42
	Plausible value 5	<i>M</i> : 495.36, <i>SD</i> : 88.50 Min: 128.61, Max: 829.65
<i>Independent variables</i>		
Gender	0: female, 1: male	Male: 49.87%
Immigrant status	0: native or 2nd-generation immigrant 1: 1st-generation immigrant	1st-generation: 8.88%
Language spoken at home	0: other than test language 1: test language	Test language: 85.79%
School grade	Attended school grade compared to modal grade in Spain	<i>M</i> : -0.38, <i>SD</i> : 0.64 Min: -3, Max: 1
Parental occupational status	Highest occupational status of parents, measured using the international socio-economic index of occupational status	<i>M</i> : 47.96, <i>SD</i> : 21.58 Min: 11.01, Max: 88.96
Parental education	Years of full-time schooling of the parent with the higher educational level	<i>M</i> : 12.79, <i>SD</i> : 3.57 Min: 3.00, Max: 16.50
Educational resources at home	Index measuring resources such as: a study desk, a quiet place to study, a computer, books to support school work	<i>M</i> : 0.07, <i>SD</i> : 0.88 Min: -3.93, Max: 1.12
Cultural possessions at home	Index measuring classical literature, books of poetry and works of art	<i>M</i> : 0.23, <i>SD</i> : 0.97 Min: -1.51, Max: 1.27
Agency: Work ethic	Degree to which students agree that they study until they understand everything, from 1: 'strongly disagree' to 4: 'strongly agree'	<i>M</i> : 2.40, <i>SD</i> : 0.84 Min: 1, Max: 4
Agency: Self-efficacy	Degree to which students agree that they can succeed with enough effort, from 1: 'strongly disagree' to 4: 'strongly agree'	<i>M</i> : 1.68, <i>SD</i> : 0.72 Min: 1, Max: 4
Agency: Perceived control	Degree to which students agree that doing well is completely up to them, from 1: 'strongly disagree' to 4: 'strongly agree'	<i>M</i> : 1.88, <i>SD</i> : 0.82 Min: 1, Max: 4
Private school	0: public, 1: private school (government-dependent and government-independent private schools are taken into account)	Private: 35.21%
School educational composition	Aggregate index measuring parents' average educational background of a school population in number of years	<i>M</i> : 12.79, <i>SD</i> : 1.62 Min: 5.00, Max: 16.50