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Strive to succeed? The role of persistence in the process of educational attainment

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Abstract

This paper examines the role of effort in the process of educational attainment. First, I analyze the impact of effort on future tertiary educational attainment. Then, I test two sociological theories that argue that effort transmits educational inequality across generations. According to the first theory, parental background shapes the effort that children exert in education-related activities. The second theory argues that the drivers of effort in this context are educational expectations. I use a variable for effort that is measured directly over the course of the PISA test. Using a longitudinal dataset from Australia, I estimate different hierarchical and structural equations models. I find that the measure of effort is positively and significantly associated with the probability of having obtained a tertiary degree ten years later. Furthermore, the results show partial support for the second theory but not for the first one.

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1. Introduction

Effort is often viewed as one of the main pillars of a meritocratic society. In this context, Michael Young coined the term meritocracy, meaning a system in which socioeconomic status is determined by the sum of intelligence and effort.[2] The concept of meritocracy is the idealistic basis of Western society, although we know that in reality, social mobility is also shaped by inequality (Bowles and Gintis, 2002). Hence, in the original conception of meritocracy, it is argued that the inequality that arises from differences in intelligence and/or effort is fair, assuming that intelligence and effort depend only on the individual. For example, in the debates surrounding the existing meritocracy in the UK between Saunders (1995, 1997) and Breen and Goldthorpe (1999, 2002), the authors argue about the extent to which social mobility is explained by those two variables relative to the influence of parental background. However, we do not know much about effort and its determinants since little research has been conducted on the topic, partly because of the difficulty in measuring it.

This paper examines the role of effort in the process of educational attainment over the life course. Constituting a black box that is not yet fully understood, the transmission of social inequality has always been a main topic in sociology (Breen and Jonsson, 2005). Therefore, this paper attempts to shed light on the mechanisms through which effort impacts future educational attainment and the extent to which effort might constitute a factor that tends to perpetuate social inequality across generations. To explore this previously neglected research gap, I investigate the potential socioeconomic gradient of effort and its impact on education, since educational attainment is considered the main mediating factor in class mobility by many scholars (Ishida et al., 1995; Marshall et al., 1997; Erikson and Goldthorpe, 2002). Hence, if the socioeconomic background of children plays a role in the effort they exert, as some sociological theories suggest (Bourdieu and Passeron, 1977), this might constitute one of the channels through which social inequality is transmitted across generations (Radl and Miller, this issue).

The Wisconsin status attainment model developed by Sewell, Haller and Portes (1969) provides an explanation for the determination of educational attainment. In this seminal model, the main explanatory factor is the student's educational expectations since they are shaped by parental socioeconomic backgrounds and social relationships. In this context, effort acts as the mediator between educational expectations and educational attainment, as higher expectations should incentivize children to put more effort into education-related activities and thus achieve better grades. Hence, I analyze the importance of effort as a predictor of tertiary education. Furthermore, I test whether effort transmits educational inequality due to (a) parental education and (b) educational expectations.

Despite the difficulties in measuring noncognitive skills (called personality traits in psychology), in recent years, numerous scholars have shown their importance in

[2] The term was coined in the book "The Rise of Meritocracy" published in 1958.

predicting future life outcomes such as educational attainment or occupation (Heckman et al., 2006; Blanden et al., 2007; Roberts et al., 2007)). Some of these self-reported traits, such as *locus of control* (LoC) or *conscientiousness,* are similar to some aspects of effort but do not constitute a complete measure of it since they rely on self-reporting, and there might be differences between saying and doing (Apascaritei, Demel and Radl, this issue).[3]

Here, I use an alternative measure of effort, directly observed while being exerted during the Programme for International Student Assessment (PISA) test, a program carried out by the OECD. Borghans et al. (2016) show that exams capture both cognitive and noncognitive skills. The measure that I use, originally developed by Borghans and Schils (2012), is based on decreases in performance throughout the test, which are observable in most test results. They show that this measurement is related to some noncognitive skills such as LoC and to future life outcomes. Furthermore, this measure of declining effort has also been shown to account for a significant part of the variation across countries in PISA test scores (Debeer et al., 2014; Zamarro et al., 2019). Following Azzolini et al. (2019), I argue that the measure that I use reflects one key aspect of effort: persistence. For example, keeping up a certain level of effort is crucial for studying or performing well on exams. Hence, this measure of effort exerted while individuals complete the PISA test allows us to analyze the impact of this key element.

I use the Longitudinal Surveys of Australian Youth (LSAY), an Australian longitudinal dataset that follows the participants of the 2003 PISA test for the next 10 years. This allows for tracking individuals beginning when they were 15 years old and observing how variables such as effort, educational expectations and parental education at that age have influenced their educational outcomes years later. I find that the measure of effort I use has a positive and significant association with the probability of having obtained a tertiary degree ten years later. I also observe that parental education and students' own educational expectations have significant and strong positive effects on student effort, especially the latter. However, the effect of effort as a mediator between parental education and future educational attainment is not significant. In contrast, I find that effort mediates educational expectations and the probability of having completed tertiary education in the future.

The paper is structured as follows. Section 2 summarizes the relevant literature on the determinants of future life outcomes, the determinants of the transmission of educational inequality and the Wisconsin model of educational attainment. Section 3 provides details about the LSAY dataset, explains the construction of the effort measure and presents the methodological strategy. Section 4 explains the results and discusses the implications for the tested hypothesis. Finally, the last section provides a summary of the conclusions.

[3] Locus of Control and Conscientiousness are psychological constructs. LoC is the perception of control over the outcomes during your life course created by Rotter (1966). Conscientiousness is one of the Big Five personality traits. It reflects self-discipline and diligence.

2. Literature and hypothesis

2.1 Later life outcomes

Over the last few years, an important strand of literature has emerged, both in economics and to a lesser extent in sociology, which explores the importance of cognitive and noncognitive skills for life outcomes. There is robust empirical evidence showing that both cognitive and noncognitive skills have a significant influence on educational attainment and future employment (Bowles et al., 2001; Heckman et al., 2006; Blanden et al., 2007, Carneiro et al., 2007).

The impact of cognitive skills is more straightforward and has been more widely studied than that of noncognitive skills (Boissiere et al., 1985; Farkas and Vicknair, 1996). One of the reasons is that the use of IQ as a measure of cognitive skills is highly standardized and available in many surveys. Another reason is that the channel through which cognitive skills have a positive impact on future life outcomes is more intuitive. A higher IQ improves educational attainment, which enhances the probability of getting a better job in the future.

Research on noncognitive skills such as effort, leadership, and extraversion has shown that they might also positively influence educational attainment (Groves, 2005; DiPrete and Jennings, 2012). However, the effect of these traits is more difficult to measure since there is no standardized way to do so. Most research concerning noncognitive skills uses psychological measures as a proxy. For example, Heckman et al. (2006) and Hall and Farkas (2011) use self-esteem and the locus of control; Borghans et al. (2008) use risk preferences, motivation and the Big Five personality traits; Hsin and Xie (2017) use the Social Ratings Scale. In the previous articles, a higher level of conscientiousness and a more internal LoC (the concepts closest to effort) are associated with a higher level of educational attainment in the future. However, these proxies capture very different aspects of human personality, as for instance, some aspects measured by conscientiousness differ from those captured by the locus of control. Hence, the channels through which these noncognitive skills influence future life outcomes are not sufficiently well understood. To make a clear case, I focus on one selected noncognitive skill, namely, effort. Furthermore, it is interesting to use a directly observable measure because differences between self-reports and actually what people do might exist, as Apascaritei, Demel and Radl (this issue) show.

Borghans and Schils (2012), using a directly observable measure, show that it is positively associated with future life outcomes in the Netherlands. Therefore, I test the relevance of this measure in other settings. My hypothesis is that this measure positively predicts the completion of tertiary education ten years later.

H1: Student effort predicts the probability of completing tertiary education in the long run.

2.2 Effort and social stratification

Already decades ago, prominent sociologists such as Boudon (1974) and Bourdieu and Passeron (1977) argued that since parents play a key role in the socialization of their children, they shape the development of their noncognitive skills and expectations on the basis of their socioeconomic status (SES). The theory states that parents from higher SES backgrounds take advantage of their social and cultural capital to foster the positive aspects of personality that will help their offspring be successful in life. Thus, the distribution of noncognitive skills would not be normally distributed within the population.

As mentioned in the previous section, some noncognitive skills have a positive influence on future life outcomes. If parents with a high SES manage to influence the noncognitive skills of their offspring, as Farkas (2003) argues, those variables might play an important role in the stratification process. For example, Gil-Hernandez (this issue) shows that the returns to noncognitive skills are higher among high SES parents. Some studies find that noncognitive skills are not equally distributed across social classes (Hsin and Xie, 2017). However, other existing studies claim these skills to be less directly transmittable than cognitive skills and that the transmission is not influenced by the socioeconomic background of the family (Loehlin, 2005; Duncan et al., 2005). However, the level of intergenerational transmission found varies by the noncognitive skill and the country analyzed (e.g., Anger (2012) shows that transmission is stronger in Germany than in the US). Moreover, Holtmann, Menze & Solga (this issue) find that, in the context of Germany, personality traits do not mediate the association between parents' and children's educational attainment. Overall, the literature is not entirely conclusive about the effect of parental SES on the development of the noncognitive skills of their offspring.

Hence, following Bourdieu and Passeron (1977), I aim to test whether effort, a variable that so far has been assumed to be solely individually determined, plays a role in the process of inequality transmission. My hypothesis is that children of parents with higher education tend to exert more effort in education-related activities due to their socialization. At the same time, higher effort enhances their chances of completing tertiary education in the future.

> H2: Student effort is a mediator between parental education and future educational attainment.

Students' educational expectations are one of the main predictors of future educational attainment. Students with higher educational expectations are more likely to obtain a bachelor's degree in the future than those with lower expectations (Messersmith and Schulenberg, 2008; Ou and Reynolds, 2008). Furthermore, during the last 20 years, there has been a sharp increase in educational expectations among students (Goyette, 2008), although some research shows that negative economic scenarios depress educational expectations (Salazar

et al., 2019). The wide expansion of education that has taken place during the end of the 20th century has caused a decrease in the influence of parental background on educational expectations because tertiary education is becoming the norm.[4]

A long-standing model in sociology views educational expectations as the "strategic center" of a social psychological model of educational attainment, also known as the Wisconsin status attainment model (Haller and Portes, 1973). This model posits that social inequality is transmitted across generations through the educational expectations of the children, since the social environment in which they are raised shapes these expectations. Children build themselves an idea of their future educational prospects through interactions with their parents and family at home and with friends and teachers at school. Thus, children who were born into families with a high SES and who have many relatives with a high level of education most likely have friends from similar families. Therefore, those children are more likely to develop higher expectations about their own future education. On the other hand, children who were born in lower SES families are surrounded by fewer people with a high level of education, so it is less likely that they will develop higher educational expectations. Later, the higher expectations of the children are translated into increased educational attainment through higher levels of motivation and effort (Spenner and Featherman, 1978).

Nevertheless, an opposite view is that of Bayesian learning theory, which states that individuals adapt their expectations continuously as they gather new information concerning their academic performance (Morgan, 2005). According to Morgan (1998), educational expectations are not illusions or parental wishes but rational calculations of the costs and benefits of further education. Hence, he argues that expectations are not so stable over students' educational career because individuals adapt their educational expectations to the grades they obtain during the school period. Thus, the early influence of the socioeconomic environment is not as strong. However, some studies show that students do not truly update their expectations on the basis of new information about their performance and that expectations are quite persistent over time (Gabay-Egozi et al., 2009; Andrew and Hauser, 2011). Bozick et al. (2010) find that the expectations of children with higher SES and/or higher grades are more stable than those of other children during elementary school. Furthermore, the study argues that more stable expectations are stronger predictors of future college enrollment than volatile expectations. Alexander et al. (2008) and Johnson and Reynolds (2013) obtain the same result for young students during the transition from adolescence to adulthood.

[4] Rosenbaum (2001) argues that unrealistic educational expectations lead to negative effects in educational attainment. Students who try but fail to get a bachelor's degree (especially students with lower grades) might end up without any other educational degree after high school. Instead, they could have gone for a vocational training degree, which would have been more suitable for their characteristics. Hence, they end up with neither of the two degrees, which penalizes them in the future labor market (Rosenbaum, 2011).

However, although the connection between educational expectations and educational attainment is well established, the channels through which educational expectations operate are less clear and are worth studying. Effort is one of the channels that is mentioned as a potential mediator in the foundational articles of the Wisconsin model. Spenner and Featherman (1978) argue that students with higher educational expectations exert more effort during the school day to obtain better grades and to be more likely to reach college. Domina et al. (2011), using different proxies for effort, find that students in the US with higher educational expectations exert higher levels of effort.[5]

Following the Wisconsin model, I propose testing whether effort is a mediator between educational expectations and educational attainment. It is also interesting to measure the extent to which the influence of educational expectations on educational attainment is explained by effort. The hypothesis is that higher educational expectations lead to higher effort, which in turn leads to higher educational attainment in the future.

> H3: Student effort is a mediator between educational expectations and future educational attainment.

3. Data and methods

3.1 Data and measurement

The Longitudinal Surveys of Australian Youth (LSAY) is an Australian longitudinal study that follows the cohort that takes part in the country's PISA study over a period of ten years. The study is managed by the National Centre for Vocational Educational Research and focuses on the transition of young students from high school to further education and finally to their first jobs. For this paper, I use the cohort that participated in the 2003 PISA test. Hence, the LSAY data cover the period from 2003 to 2013, ending when the individuals are approximately 25 years old. I assume that at that point, most of the individuals have already completed their education. There are 10,370 individuals in the sample at the beginning of the study. However, due to attrition, the sample decreases to 3,741 individuals in the last round. Hence, I use the sampling weights recommended by the LSAY documentation.

Initially, the individuals in the sample were selected to participate in PISA, a study conducted and published by the OECD in most developed countries that focuses on the evaluation of the education system in each country. Therefore, 15-year-old students' performance is assessed in mathematics, science, reading and problem solving. In the 2003 PISA test, each individual had to fill in the booklet to which he or she was randomly assigned. Each booklet has four clusters, and the participants have two hours in total to answer all questions. Each cluster comprises a set of

[5] Domina et al. (2011) use three different measures of effort. The first measure is the teacher's rating of each student's regular behavior and attention. The second is the student's self-report about how many hours per week they spend on homework. The third is the student's self-report about how frequently they attend school with textbooks, pencils and homework completed.

questions, and in total, there are 13 different clusters that are arranged in different positions to form 13 different booklets. The position of the clusters differs between the various booklets, which are randomly assigned to students. In 2003, the PISA test was focused on math, so seven out of 13 clusters were math clusters. The rest of the test consisted of two clusters from each of the other fields: the sciences, reading and problem solving.

Previous studies, such as Borghans and Schils (2012) or Debeer et al. (2014), have found that in the PISA tests, there is a steady decline in performance throughout the test. The authors take advantage of the random allocation of booklets to students, which results in the same cluster being administered in a different position within the test to different students. Hence, the difficulty throughout the test is constant on average. This ensures that the difficulty of the clusters is not the driver of the observed decline. The same decreasing trend can be observed in the Australian data. As illustrated in Figure 1, there are differences in the average number of correct answers between clusters in different positions. All these differences are significant according to a t-test for paired samples. The mean of the correct answers at the beginning of the test, in Position 1, is 66.2%, and at the end, in Position 4, it is 60%; hence, there is an almost 10% decrease in relative terms.

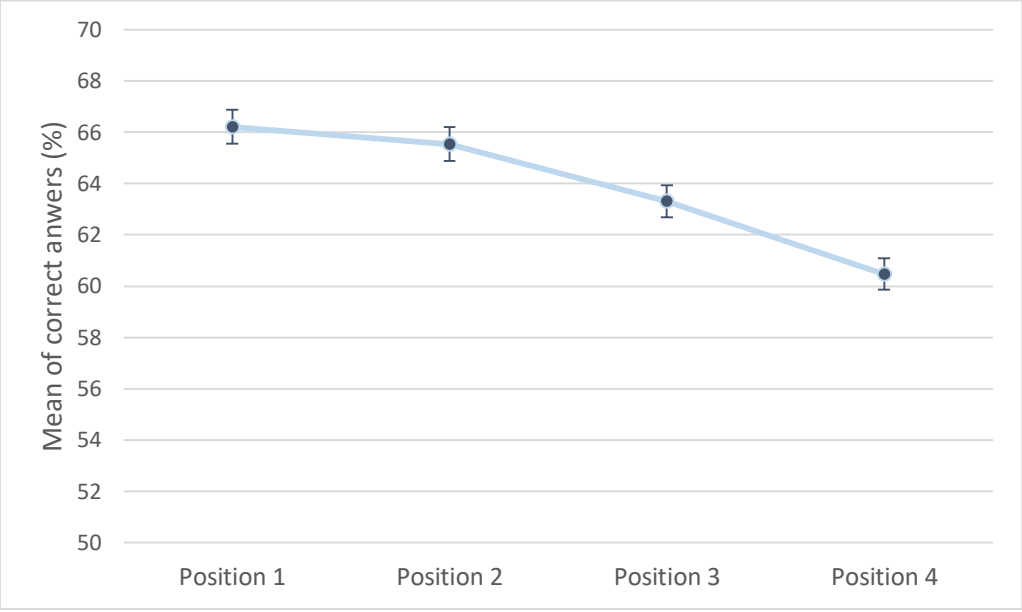


Figure 1. Average correct answers per cluster

Following the idea of Zamarro et al. (2019) and Borgonovi and Biecek (2016), I construct the measure for the decline in performance throughout the PISA test for each individual. Hence, for this measure, I calculate the difference in average correct answers between each cluster and the cluster in the first position.[6] Then, I calculate the average of the differences since not all individuals reach the last cluster. It is important to highlight that for calculating the average correct answers, I only consider the questions that were answered. Furthermore, some questions were designed in such a way that students could obtain partial credit. On those occasions, I gave them half a point. Thus, the equation for the effort measure is:

$$E_i = \frac{\sum_n (C_{ji} - C_{1i})}{n-1}$$

where n is the number of clusters reached by the individual i and C is the average number of correct answers for the cluster in position j. After calculating the variable, I adjust it by the booklet number. This is necessary, as the difficulty of the booklets might be somewhat heterogeneous despite the booklets having been designed to have the same level of difficulty. I also adjust by the percentage of correct answers in the cluster in position 1 since due to the methodology employed to calculate the effort variable, there is a threshold effect. This effect emerges as individuals with a higher rate of correct answers have a smaller margin within which to improve their performance, whereas individuals with lower rates have a smaller margin to worsen their performance and can only improve. Thus, the correlation between performance in cluster 1 and the effort variable is quite high (approximately -0.5) when it should not be. The correlation disappears after adjusting effort for performance in cluster 1. To ease the interpretation of the results, I standardize the variable after making this adjustment.

This effort variable requires making certain assumptions and has some limitations. The variable taps into one of the two aspects of cognitive effort, namely, persistence, the other being intensity. Persistence constitutes the ability to maintain performance over an extended period of time. The PISA test is a suitable setting since it lasts two hours and therefore resembles a regular exam in school or a period of study time. However, it is not possible to observe the other important aspect of effort, which is intensity. I cannot know the intensity of the effort exerted at the beginning of the test and I cannot make any assumptions on intensity since is a low-stakes exam. This means that my estimate of the impact of effort is a lower bound since the estimation does not fully capture the entire effect of effort.

Hence, as Gneezy et al. (2019) point out, the measure of effort in the PISA test only reflects intrinsic motivation since PISA is a low-stakes assessment. Moreover, cultural differences between countries (Asian countries tend to place more emphasis on effort and diligence) might explain part of the differences in results. Gneezy et al. (2019) conducted an experiment in the US and in Shanghai (China)

[6] To avoid spurious correlations, we construct an alternative effort variable using only the difference between the first and the last cluster, which is closer to Zamarro et al.'s (2019) measure. We use that measure for robustness tests in Appendix B.

with different schools where the students had to take some of the PISA test questions. Some students were allocated to the control group, where they had no extrinsic incentives for correctly completing the questions, and the rest of the students were placed in the treatment group, where the students received a monetary reward for each correct answer. They show that in the US, the difference in test performance between groups relying on intrinsic motivation and those relying on extrinsic motivation was quite large; meanwhile, in China, the difference in performance did not exist. This shows that intrinsic motivation varies across countries and cultures. However, studies such as Segal (2012) (for the US) and Borghans and Schils (2012) (for the Netherlands and the UK) indicate that motivation in low-stakes assessments is positively related to noncognitive skills (especially conscientiousness) and future life outcomes, such as years of education, wages and employment.

3.2 Variables

As Heckman et al. (2006) argue, both cognitive skills and noncognitive skills play a relevant role when predicting future life outcomes. Following Borghans and Schils (2012), I use accuracy in the first cluster as a proxy for cognitive skills. I assume that at the very beginning of the test, student performance mostly depends on cognitive skills. As Borghans and Schils (2012) show, performance at the beginning of the test is very closely correlated with IQ, the most common measure of cognitive skills. Furthermore, I again control for the booklet number to avoid having certain booklets drive the results. I also standardize this variable to allow for a straightforward interpretation of the results. To further control for the student's previous experience with mathematics, I use a dummy variable that indicates whether the student passed his or her last math exam or not.

To measure parental socioeconomic backgrounds, I follow Goyette (2008) and use a dummy variable that takes on the value one if any of the parents have obtained a tertiary education.[7] This measure is used because parental education better reflects the educational context of the family than a SES index. Furthermore, in countries such as Australia, the main difference lies between individuals with and without a tertiary education because very few people have less than a secondary education. Following the same reasoning, I construct a variable to measure the educational attainment of the individuals in 2013, consisting of a dummy for having completed tertiary education. In the sample, approximately 70% of the students declare that they expect to obtain a tertiary education. This division emerges as the most relevant for the research. Hence, I construct a dummy variable for expecting to complete a tertiary education as the variable for expectations.

I control for a standard set of individual covariates such as age, gender, household structure and whether the individual went to kindergarten, all measured in 2003, since these have been shown to have an impact on education. I also control for the

[7] It is referred to tertiary education as obtaining a certificate level of 5A, 5B or 6 according to ISCED 1997.

migration status of the parents if both parents were not originally from Australia. Specifically, I control for the country-region where they were born if it is different than Australia.

Table 1. Descriptive statistics

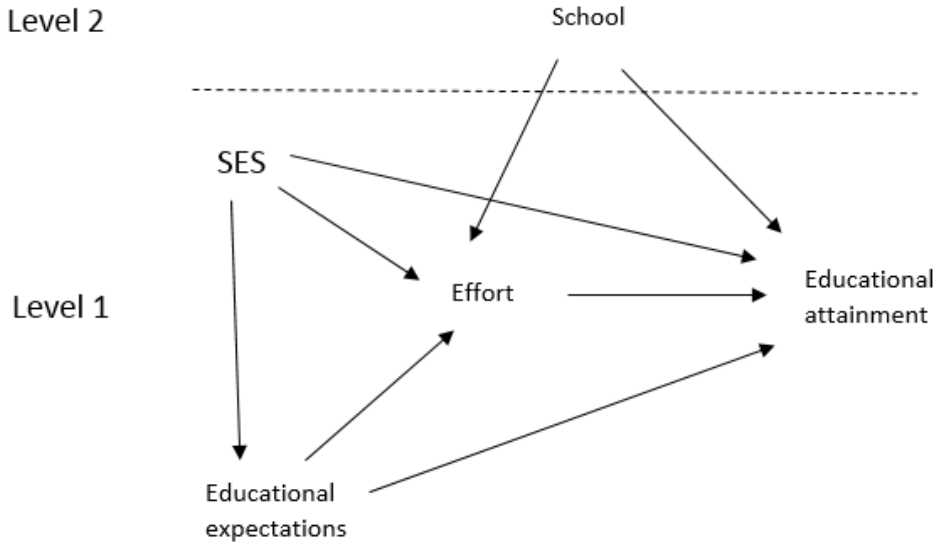
	Count	Mean	SD	Min	Max
Tertiary education in 2013	3485	.624	.484	0	1
Parental tertiary education	3485	.637	.480	0	1
Effort	3485	0	1	-3.60	3.06
Cognitive skills	3485	0	1	-3.41	1.91
Expectations for tertiary education	3485	.811	.391	0	1
Passed last math exam	3485	.887	.316	0	1
Female	3485	.505	.500	0	1
Family Structure	3485				
Single-parent family	537	0.154		0	1
Nuclear family	2688	0.771		0	1
Mixed family	260	0.075		0	1
Region of parents' birth	3485				
Australia	2763	0.792		0	1
Anglo-Saxon countries	205	0.058		0	1
Europe	101	0.029		0	1
Latin America	15	0.004		0	1
Middle East and Africa	108	0.031		0	1
Southeast Asia	220	0.063		0	1
Central and East Asia	73	0.020		0	1
Kindergarten	3485				
No	193	0.055		0	1
Yes, one year or less	1651	0.473		0	1
Yes, more than one year	1641	0.470		0	1
Speak foreign language at home	3485	.0748	.263	0	1

We can observe the descriptive statistics of the main covariates in Table 1. In the sample, 62.4% of the individuals had completed a tertiary education by 2013. This number is very similar to the share of families in which any of the parents have a tertiary education, which is 63.7%. This indicates that Australia is a developed country that had already undergone the educational expansion some decades ago. Furthermore, the share of individuals who expect to complete a tertiary education is remarkably high: 81.1%. It is interesting to note that there is almost a 20% gap between tertiary expectations and the actual completion of tertiary education.

The share of individuals with any parents born in Australia is 79.2%. The second most important region represented in this sample is Southeast Asia (6.3%), closely followed by other Anglo-Saxon countries (5.8%). The remaining regions are less represented in the sample. Most of the individuals live in nuclear families, 77.1%, and almost all of them went to kindergarten (only 4.5% did not). The sample is also very balanced in gender, with 50.5% of the individuals being female. Effort and cognitive skills have been standardized; thus, the mean is approximately 0, and the standard deviation is approximately 1.

3.3 Methods

Considering the structure of the dataset and the variables of interest that are observed in Graph 1, I use multilevel models (MLM) to account for the heterogeneity in the upper levels of observation. In this sample, the individuals are nested within schools since for the PISA test, schools are selected to participate. Hence, I allow for the random intercept to vary at the school level, avoiding potential biases when dealing with this type of data.



Graph 1. General framework

To test the first hypothesis (H1), I use the linear probability model given in Equation 1.[8] The dependent variable is a dummy that indicates whether individual *i* in the school in which he or she is nested, *j,* has completed a tertiary education in 2013 (D_i). Then, I also use as independent variables the set of covariates (X_i) explained in the previous section. My main independent variable in Equation 1 is the effort variable calculated from the PISA test in 2003.

$$D_{ij} = \alpha_{00} + \alpha_{1j}S_{1j} + \varepsilon_{0j} + \beta_2 X_i + \mu_i \qquad (1)$$

In line with the hierarchical approach, in Equation 1, in addition to having the general intercept α_{00}, there is a random intercept that controls for the particularities of each school α_{1j}. For the second and third hypotheses (H2 and H3), different methods are used to test for mediation in the clustered data. The most straightforward approach uses multilevel models (MLM), such as the previous model. However, recent literature (Zhang et al., 2009) has shown that the MLM might have potential biases leading to conflated estimates. Preacher et al. (2011) present empirical evidence that multilevel structural equation modeling (MSEM) overcomes those problems and outperforms MLM in terms of confidence intervals and potential biases. Hence, as the authors suggest, I use MSEM to test whether effort mediates the relationship between parental education and educational attainment (H2) and whether effort mediates the relationship between educational expectations and educational attainment (H3). Thus, the second equation of the MSEM is Equation 2, which is very similar to Equation 1. I change only the dependent variable, which is now effort (E_{ij}). The rest of the covariates are the same.

$$E_{ij} = \alpha_{00} + \alpha_{1j}S_{1j} + \varepsilon_{0j} + \beta_2 X_i + \mu_i \qquad (2)$$

One important assumption when using structural equation modeling is that the potential omitted variables that determine one dependent variable are not correlated with other potential omitted variables that determine the other dependent variable. In this case, that implies that *effort* is not determined by unobservable covariates that are correlated with other unobservable covariates that determine *future educational attainment*. If this assumption holds, it is possible to calculate the direct and indirect effects of covariates on *future educational attainment.*

The MSEM is composed of Equations 1 and 2, where Equation 1 is the outcome model and Equation 2 is the mediation model. Hence, I use the same model, only changing the main independent variable, to calculate the direct and indirect effect of *parental education* (H2) and *educational expectations* (H3) on *future educational attainment* as mediated by *effort*. Following Preacher and Hayes (2004), I use

[8] Further robustness checks with logit models are shown Table B.1. in Appendix B.

bootstrapped standard error to avoid potential biases that arise from assuming asymmetry in the confidence intervals associated with normal standard errors.

4. Results

Before presenting the results, it is important to further examine the relationship between effort and other important covariates, such as parental tertiary education and educational expectations. Figure 2 shows the differences in effort between such categories. Regarding parental tertiary education, we can see that those individuals with a parent who has a tertiary education have an effort of 0.1 on average on the standardized measure, in contrast to those who do not have such a parent and who have an average effort of -0.15. Remember that the overall mean is 0, so the difference is significant but not very stark. This finding is in line with the results of Balart and Cabrales (2014) when they use the ESCS index[9] as a predictor of persistence for students in Spain.

For educational expectations, the difference is larger. Having expectations of completing tertiary education is related to having 0.5 SD more effort than if you do not have such expectations (from -0.4 to +0.1). That difference is twice as large as the difference in effort based on parental education. This result resembles similar results obtained by Domina et al. (2011) for students in the US, using different measures of effort to find that educational expectations are the largest predictor of effort.[10]

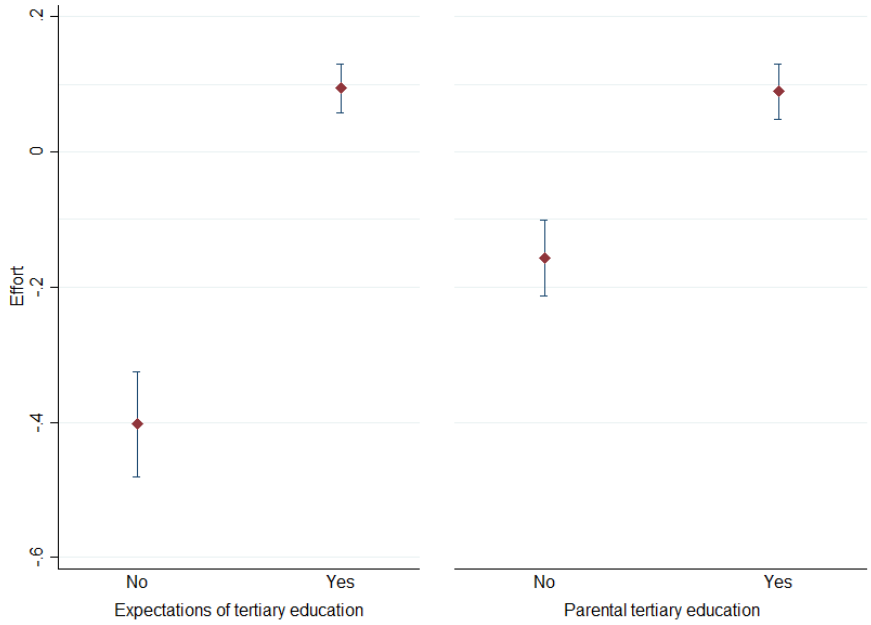


Figure 2. Effort by educational expectations and parental education

[9] The ESCS is an index of economic, social and cultural status created by the OECD with the PISA data. This index is created for the parental background of the students that participate in PISA.

[10] Another important variable that influences effort is country/region of origin of the parents. Previous literature such as Borghans and Schils (2012), Borgonovi and Biecek (2016) and Zamarro et al. (2019) show that individuals from East Asian countries tend to be more persistent than individuals from other regions. Gneezy et al. (2019) find that students in China are more intrinsically motivated than US students. Figure A.1 of Appendix A shows the different levels of effort by country/region.

The results are presented in the following tables. The first hypothesis (H1), that effort is positively associated with future tertiary educational attainment, is tested in Table 2. In specification 1, I use only the basic control variables parental tertiary education, cognitive skills, gender and educational expectations. Here, I find that effort has a very significant and positive correlation with future tertiary education. However, the magnitude is also important. I find that a one standard deviation increase in effort results in an increase of 4.24% in the probability of obtaining a tertiary education. This is almost half of the size of the effect of having parents with a tertiary education. It is a significant magnitude when taking into account the fact that parental education is one of the main predictors of offspring education (Erikson and Goldthorpe, 2002). For the rest of the covariates, I find few surprises. Most covariates have the associations predicted by the previous literature. Educational expectation is the variable with the largest impact on tertiary education. This is in line with the literature previously discussed (Messersmith and Schulenberg, 2008; Ou and Reynolds, 2008). Other covariates, such as parental education and cognitive skills, which have been shown to have a positive effect on educational attainment, also have a significant and positive association in this model. Moreover, being female is one of the most important predictors of future tertiary education, in line with the latest research.[11]

In specification 2, I add additional control variables such as the result of the last math exam, family structure, kindergarten attendance or the country/region of parents' birth. Nevertheless, the previous results are robust, and the significance and magnitude of the effect of effort remain unchanged as well as those of the other covariates, which exhibit minimum changes. In specification 3, I test whether there is a significant interaction effect between effort and parental tertiary education, and I find no significant effect. This result seems to confirm the first hypothesis, in line with the previous literature, meaning that effort is an important predictor of educational attainment in the future. Furthermore, it appears that the effect of effort is not influenced by parental education. Regarding the next hypothesis, I test whether effort is a mediator between parental tertiary education and having completed a tertiary education ten years later. I use an MSEM to calculate the indirect effect of effort. In Table 3, we can observe the results for H2.[12] I find the indirect effect of parental tertiary education through effort to be insignificant, in contrast with the direct effect, which is highly significant. This suggests that although parental tertiary education has a direct effect on the tertiary education of the child ten years later, that influence is not transmitted through effort. This result is line with the evidence shown by Holtmann, Menze & Solga (this issue) for Germany. However, we have to take into account that some of the other covariates that appear as controls may be partially determined by parental education, such as cognitive skills, results on previous exams or educational expectations.

[11] Figure A.2 of Appendix A also indicates a slight nonlinear effect of effort. However, this nonlinearity is only significant at the 10% level.

[12] We can observe the results of the full model in Table A.1 of Appendix A.

Table 2. Multilevel linear probability model for tertiary education in 2013

	(1)	(2)	(3)
Effort	0.0424***	0.0432***	0.0411**
	(0.0110)	(0.0108)	(0.0142)
Parental tertiary education	0.113***	0.113***	0.114***
	(0.0199)	(0.0195)	(0.0195)
Parental tertiary education*Effort			0.00388
			(0.0180)
Cognitive skills	0.0839***	0.0838***	0.0838***
	(0.0120)	(0.0117)	(0.0117)
Female	0.113***	0.124***	0.124***
	(0.0226)	(0.0213)	(0.0213)
Expectations for tertiary education	0.272***	0.250***	0.250***
	(0.0261)	(0.0255)	(0.0254)
Passed last math exam		0.0549+	0.0548+
		(0.0290)	(0.0290)
Family Structure: (Ref. nuclear family)		.	.
		(.)	(.)
Single-parent family		-0.115***	-0.115***
		(0.0253)	(0.0254)
Mixed family		-0.0683+	-0.0681+
		(0.0354)	(0.0354)
Kindergarten (Ref. Yes, more than one year)		.	.
		(.)	(.)
No		0.0612	0.0612
		(0.0446)	(0.0446)
Yes, one year or less		-0.0184	-0.0183
		(0.0201)	(0.0201)
Speak foreign language at home		0.0360	0.0362
		(0.0468)	(0.0468)
Region of parents' birth (Ref. Australia)		.	.
		(.)	(.)
Anglo-Saxon countries		0.00501	0.00512
		(0.0390)	(0.0391)
Europe		0.111+	0.111+
		(0.0603)	(0.0603)
Latin America		-0.0898	-0.0884
		(0.147)	(0.147)
Middle East and Africa		0.214***	0.214***
		(0.0546)	(0.0546)
South East Asia		0.196***	0.195***
		(0.0497)	(0.0494)
East Asia		0.261***	0.262***
		(0.0595)	(0.0596)
Observations	3,485	3,485	3,485
Number of groups	312	312	312

Robust standard errors in parentheses. *** p<0.001, ** p<0.01, * p<0.05, + p<0.1. Level 1 is the students; level 2 is the school cluster. Fixed effects for month and year of birth are included.

Table 3: Mediation of parental education and future educational attainment by effort

	MSEM (4)
Parental tertiary education	
Total effect on student's education	0.127***
	(0.019)
Direct effect on student's education	0.119***
	(0.02)
Indirect effect through effort on student's education	0.0071
	(0.004)
% of total effect mediated by Effort	5.6

Bootstrapped standard errors in parentheses. *** p<0.001, ** p<0.01, * p<0.05, + p<0.1. Level 1 is the students; level 2 is the school cluster. The effects are calculated with the MSEM. I compute the bootstrap using 1000 repetitions to calculate the standard errors of the indirect effect.

This implies that if any of those covariates have an effect on both effort and future educational attainment, they could constitute another channel through which parental education affects future educational attainment. However, as we see in Equation 2 of Table A.1, only educational expectations have a positive and significant association with effort. Hence, I use the same MSEM as before to test whether effort is a mediator between expectations for completing a tertiary education and having completed a tertiary education ten years later (H3). The only difference is that now, instead of parental education, I use the child's educational expectations. We can observe the results of the mediation analysis in Table 4.

Table 4: Mediation of educational expectations and educational attainment by effort

	MSEM (5)
Expectations of tertiary education	
Total effect on student's education	0.269***
	(0.026)
Direct effect on student's education	0.2484***
	(0.026)
Indirect effect through effort on student's education	0.0213*
	(0.010)
% of total effect mediated by Effort	7.8

Bootstrapped standard errors in parentheses. *** p<0.001, ** p<0.01, * p<0.05, + p<0.1. Level 1 is the students; level 2 is the school cluster. The effects are calculated with the MSEM. I compute the bootstrap using 1000 repetitions to calculate the standard errors of the indirect effect.

The indirect effect of educational expectations through effort is significant and positive. Mediation through effort accounts for 7.8% of the total effect of expectations on the probability of going to university 10 years later. This finding confirms the H3 and is consistent with the mechanism outlined in the Wisconsin Model of educational attainment. Hence, educational expectations shape the level of effort exerted in the educational context, which has an effect on educational attainment years later.

5. Conclusions

This paper examines the role of effort in the process of educational stratification. In particular, it explores the mechanisms through which effort might transmit social inequality across generations. I use a measure of effort originally created by Borghans and Schils (2012), which is directly observed while students complete the PISA test. This measure is based on decreases in performance over the course of the test. I use the LSAY, an Australian longitudinal database that allows me to follow the evolution of the students who took the PISA test in 2003 through 2013.

This study has three key results. First, I test the impact of effort at age 15 on educational attainment 10 years later. The result is significant, and the size of the impact is noteworthy. A one standard deviation increase in effort has an effect equivalent to half of the impact of having parents with a tertiary education. This is in line with the latest research on noncognitive skills (Heckman et al. 2006) and with what Borghans and Schils (2012) show with a similar measure for future life outcomes. Second, I analyze whether effort is a mediator between parental education and future educational attainment, as suggested by some sociological theories (Bourdieu and Passeron, 1977). I find that the indirect effect of parental education through effort is not significant. However, we have acknowledge that other controls used in the model might also be influenced by parental education, for example, educational expectations, which, according to the Wisconsin Model, are the main pillar of the process of educational stratification. This is because parents with a higher SES raise their children in an environment in which having a tertiary education is the norm. Those children will have higher expectations of completing a tertiary education than children from poorer backgrounds. Thus, I test whether effort is one of the channels through which educational expectations are transformed into higher educational attainment in the future. The third key finding is a significant and positive effect supporting this hypothesis. In line with the Wisconsin Model, effort seems to be one of the channels through which educational inequality is transmitted across generations. This also yields support to the results of Domina et al. (2011) on the positive effect of educational expectations on effort in school, suggesting that it is indeed one of the channels through which expectations have a positive effect on educational attainment (Messersmith and Schulenberg, 2008; Ou and Reynolds, 2008).

In terms of the scope of these findings, it is important to consider the limitations of this study when interpreting the results due to the inherent characteristics of the effort variable. As effort is measured when students are taking the PISA test, it

cannot be assumed that the intensity (i.e., the level of effort) is maximized since the PISA is a low-stakes test. The results show that the country of origin of the students matters when there is only intrinsic motivation. For example, students with East Asian backgrounds tend to perform better than average. However, as Gneezy et al. (2019) shows, adding extrinsic incentives make that difference almost disappear. Due to this particularity, it is reasonable to think that these results are a lower bound estimation of the full effect of effort. I would expect that a measure of effort in a situation with extrinsic incentives and/or that also captures initial intensity would account for a larger part of the effect, leaving this question open for future research. Moreover, these results are valid for Australia, and their external validity has to be taken with caution due to the particularities of the country.

The results hold in the robustness checks. Persistence is shown to be a significantly important determinant of tertiary education. The evidence suggests that the effect of persistence is homogenous across parental education and that the impact of parental education on children's future education is not channeled through persistence. Furthermore, children's educational expectations are the variable that seems to have the highest influence on future educational attainment. The results show that persistence is one of the mediators between educational expectations and future completion of a tertiary education. However, in the robustness checks, the mediation is only significant at the 10% level. This implies that this effect is not very strong. The expansion in tertiary education during the last decades in Western countries (Goyette, 2008) has boosted the educational expectations of young students. In the sample, almost 80% of the students declare that they expect to complete a tertiary education in the future. This suggests that if expectations are rising, their effect through effort might be weakening, and therefore, there is less room for expectations to remain one of the sources of educational inequality. However, Rosenbaum (2001, 2011) argues that unrealistic expectations have negative effects on educational attainment and future labor market outcomes due to discouragement, which might potentially offset the positive effect of rising expectations. Therefore, more research is needed to explore the new dynamics between rising educational expectations and educational attainment. In particular, it would be interesting to investigate the potential effects of disappointed educational expectations on effort due to demotivation and its impact on educational inequality. These questions remain possible avenues for future research.

6. References

Alexander, K., Bozick, R., & Entwisle, D. (2008). Warming up, cooling out, or holding steady? Persistence and change in educational expectations after high school. *Sociology of Education*, *81*(4), 371-396.

Andrew, M., & Hauser, R. M. (2011). Adoption? Adaptation? Evaluating the formation of educational expectations. *Social Forces*, *90*(2), 497-520.

Anger, S. (2012). The intergenerational transmission of cognitive and non-cognitive skills during adolescence and young adulthood.

Azzolini, D., Bazoli, N., Lievore, I., Schizzerotto, A., & Vergolini, L. (2019). Beyond achievement. A comparative look into 15-year-olds' school engagement, effort and perseverance in the European Union. European Commission.

Balart, P., & Cabrales, A. (2014). La maratón de PISA: la perseverancia como factor del éxito en una prueba de competencias. *Reflexiones sobre el sistema educativo español*, 75.

Blanden, J., Gregg, P., & Macmillan, L. (2007). Accounting for intergenerational income persistence: noncognitive skills, ability and education. *The Economic Journal*, *117*(519), C43-C60.

Boissiere, M., Knight, J. B., & Sabot, R. H. (1985). Earnings, schooling, ability, and cognitive skills. *The American Economic Review*, *75*(5), 1016-1030.

Borghans, L., Duckworth, A. L., Heckman, J. J., & Ter Weel, B. (2008). The economics and psychology of personality traits. *Journal of human Resources*, *43*(4), 972-1059.

Borghans, L., & Schils, T. (2012). The leaning tower of Pisa: decomposing achievement test scores into cognitive and noncognitive components. *Unpublished manuscript*.

Borghans, L., Golsteyn, B. H., Heckman J. J. & Humphries, J. E. (2016). What Grades and Achievement Tests Measure. *PNAS* 113(47): 13354-13359.

Boudon, R. (1974). Education, opportunity, and social inequality: Changing prospects in western society.

Bourdieu, P., & Passeron, J. C. (1977). Reproduction in education, culture and society.

Borgonovi, F., & Biecek, P. (2016). An international comparison of students' ability to endure fatigue and maintain motivation during a low-stakes test. *Learning and Individual Differences*, *49*, 128-137.

Bowles, S., Gintis, H., & Osborne, M. (2001). The determinants of earnings: A behavioral approach. *Journal of economic literature*, *39*(4), 1137-1176.

Bowles, S., & Gintis, H. (2002). The inheritance of inequality. *Journal of economic Perspectives*, *16*(3), 3-30.

Bozick, R., Alexander, K., Entwisle, D., Dauber, S., & Kerr, K. (2010). Framing the future: Revisiting the place of educational expectations in status attainment. *Social forces*, *88*(5), 2027-2052.

Breen, R., & Goldthorpe, J. H. (1999). Class inequality and meritocracy: a critique of Saunders and an alternative analysis1. *The British journal of sociology*, *50*(1), 1-27.

Breen, R., & Goldthorpe, J. H. (2002). Merit, mobility and method: another reply to Saunders. *The British journal of sociology*, *53*(4), 575-582.

Breen, R., & Jonsson, J. O. (2005). Inequality of opportunity in comparative perspective: Recent research on educational attainment and social mobility. *Annu. Rev. Sociol.*, *31*, 223-243.

Carneiro, P., Crawford, C., & Goodman, A. (2007). The impact of early cognitive and non-cognitive skills on later outcomes.

Debeer, D., Buchholz, J., Hartig, J., & Janssen, R. (2014). Student, school, and country differences in sustained test-taking effort in the 2009 PISA reading assessment. *Journal of Educational and Behavioral Statistics*, *39*(6), 502-523.

DiPrete, T. A., & Jennings, J. L. (2012). Social and behavioral skills and the gender gap in early educational achievement. *Social Science Research*, *41*(1), 1-15.

Domina, T., Conley, A., & Farkas, G. (2011). The link between educational expectations and effort in the college-for-all era. *Sociology of Education*, *84*(2), 93-112.

Duncan, G., Kalil, A., Mayer, S. E., Tepper, R., & Payne, M. R. (2005). The apple does not fall far from the tree. *Unequal chances: Family background and economic success*, 23-79.

Erikson, R., & Goldthorpe, J. H. (2002). Intergenerational inequality: A sociological perspective. *Journal of Economic Perspectives*, *16*(3), 31-44.

Farkas, G., & Vicknair, K. (1996). Appropriate tests of racial wage discrimination require controls for cognitive skill: Comment on Cancio, Evans, and Maume. *American Sociological Review*, *61*(4), 557-560.

Farkas, G. (2003). Cognitive skills and noncognitive traits and behaviors in stratification processes. *Annual review of sociology*, *29*(1), 541-562.

Gabay-Egozi, L., Shavit, Y., & Yaish, M. (2009). Curricular choice: A test of a rational choice model of education. *European Sociological Review*, *26*(4), 447-463.

Gneezy, U., List, J. A., Livingston, J. A., Qin, X., Sadoff, S., & Xu, Y. (2019). Measuring success in education: the role of effort on the test itself. *American Economic Review: Insights*, *1*(3), 291-308.

Goyette, K. A. (2008). College for some to college for all: Social background, occupational expectations, and educational expectations over time. *Social Science Research*, *37*(2), 461-484.

Groves, M. O. (2005). How important is your personality? Labor market returns to personality for women in the US and UK. *Journal of Economic Psychology*, *26*(6), 827-841.

Hall, M., & Farkas, G. (2011). Adolescent cognitive skills, attitudinal/behavioral traits and career wages. *Social Forces*, *89*(4), 1261-1285.

Haller, A. O., & Portes, A. (1973). Status attainment processes. *The structure of schooling readings in the sociology of education*, 23-31.

Heckman, J. J., Stixrud, J., & Urzua, S. (2006). The effects of cognitive and noncognitive abilities on labor market outcomes and social behavior. *Journal of Labor economics*, *24*(3), 411-482.

Hsin, A., & Xie, Y. (2017). Life-course changes in the mediation of cognitive and non-cognitive skills for parental effects on children's academic achievement. *Social science research*, *63*, 150-165.

Ishida, H., Muller, W., & Ridge, J. M. (1995). Class origin, class destination, and education: A cross-national study of ten industrial nations. *American Journal of Sociology*, *101*(1), 145-193.

Johnson, M. K., & Reynolds, J. R. (2013). Educational expectation trajectories and attainment in the transition to adulthood. *Social Science Research*, *42*(3), 818-835.

Loehlin, J. C. (2005). Resemblance in personality and attitudes between parents and their children. *Unequal chances: Family background and economic success*, 192-207.

Marshall, G., Swift, A., & Roberts, S. (1997). *Against the odds?: Social class and social justice in industrial societies*. Oxford University Press.

Messersmith, E. E., & Schulenberg, J. E. (2008). When can we expect the unexpected? Predicting educational attainment when it differs from previous expectations. *Journal of Social Issues*, *64*(1), 195-212.

Morgan, S. L. (1998). Adolescent educational expectations: Rationalized, fantasized, or both?. *Rationality and Society*, *10*(2), 131-162.

Morgan, S. L. (2005). *On the edge of commitment: Educational attainment and race in the United States*. Stanford University Press.

Ou, S. R., & Reynolds, A. J. (2008). Predictors of educational attainment in the Chicago Longitudinal Study. *School Psychology Quarterly*, *23*(2), 199.

Preacher, K. J., & Hayes, A. F. (2004). SPSS and SAS procedures for estimating indirect effects in simple mediation models. *Behavior research methods, instruments, & computers*, *36*(4), 717-731.

Preacher, K. J., Zhang, Z., & Zyphur, M. J. (2011). Alternative methods for assessing mediation in multilevel data: The advantages of multilevel SEM. *Structural Equation Modeling*, *18*(2), 161-182.

Roberts, B. W., Kuncel, N. R., Shiner, R., Caspi, A., & Goldberg, L. R. (2007). The power of personality: The comparative validity of personality traits, socioeconomic status, and cognitive ability for predicting important life outcomes. *Perspectives on Psychological science*, *2*(4), 313-345.

Rosenbaum, J. E. (2001). *Beyond college for all: Career paths for the forgotten half*. Russell Sage Foundation.

Rosenbaum, J. E. (2011). The complexities of college for all: Beyond fairy-tale dreams. *Sociology of Education*, *84*(2), 113-117.

Rotter, J. B. (1966). Generalized expectancies for internal versus external control of reinforcement. *Psychological monographs: General and applied*, *80*(1), 1.

Salazar, L., Cebolla-Boado, H., & Radl, J. (2019). Educational expectations in the great recession: has the impact of family background become stronger?. *Socio-Economic Review*, *18*(2), 465-491.

Segal, C. (2012). Working when no one is watching: Motivation, test scores, and economic success. *Management Science*, *58*(8), 1438-1457.

Saunders, P. (1995). Might Britain be a meritocracy?. *Sociology*, *29*(1), 23-41.

Saunders, P. (1997). Social mobility in Britain: an empirical evaluation of two competing explanations. *Sociology*, *31*(2), 261-288.

Sewell, W. H., Haller, A. O., & Portes, A. (1969). The educational and early occupational attainment process. *American sociological review*, 82-92.

Spenner, K. I., & Featherman, D. L. (1978). Achievement ambitions. *Annual review of sociology*, *4*(1), 373-420.

Zamarro, G., Hitt, C., & Mendez, I. (2019). When Students Don't Care: Reexamining International Differences in Achievement and Student Effort. *Journal of Human Capital*, *13*(4), 000-000.

Zhang, Z., Zyphur, M. J., & Preacher, K. J. (2009). Testing multilevel mediation using hierarchical linear models: Problems and solutions. *Organizational Research Methods*, *12*(4), 695-719.