Educational Aspirations of IB Diploma Programme Students

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April 2021

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Prepared under contract to
International Baccalaureate Organization

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April 2021

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Executive Summary

The International Baccalaureate (IB) Diploma Programme (DP) is a rigorous course of study organized around six subject groups and the three core elements of the extended essay; theory of knowledge; and creativity, action, and service. The majority of DP participants continue to postsecondary education immediately after high school graduation. However, little is known as to what factors, both student and school-level, shape the educational aspirations of DP students. To help answer these questions, IB commissioned RTI International to rigorously investigate factors associated with the change over time in DP participants' educational aspirations while taking into account both student- and school-level factors. Findings include the following:

Details on the sample and measures include the following:

- We used data collected by the IB as part of the longitudinal survey of DP students experience and outcomes (2016-2018). Students were sampled twice, at the beginning and end of the DP. These student-level data are supplemented with a school-level survey.
- Our sample included 699 students from 91 schools in 32 countries. The dataset contained data on the outcomes of interest at both the start and end of the DP for all students included in the analysis.
- There were two outcome measures included in the study. We operationalized educational aspirations by focusing on:
    - level of degree a student aspires to (doctoral or not).
    - level of university a student aspires to (very good/ top-level or other).

Our **descriptive** results show that DP students have high educational aspirations at both the beginning and end of the DP.

- At the beginning of the DP, almost all students aspired to at least a bachelor's degree (97%) and most students (approximately 80%) aspired to at least a master's degree; moreover, a high percentage of students (42%) aspired to a doctoral or professional degree. By the end of the DP, the degree aspirations continued to be high with 98% of students aspiring to at least a bachelor's degree, 81% aspiring to at least a master's degree and 38% aspiring to a doctoral degree. There was no statistically significant decrease in student's degree aspirations over time.
- Almost three-quarters of students aspired to a very good or top-level university at the beginning of the DP; at the conclusion of the DP that percentage had decreased

to approximately 61%, which was statistically significant. Thus, aspirations to attend a very good or top-level university decreased by 46% from the beginning to end of the DP (odds ratio= .54).

The report presents results from the separate student- and school-level models. We focus on the results of our full multilevel models here as those present the most accurate picture of student's aspirations. When examining student- and school-level predictors **together**, in a combined model, we identified factors which predicted the initial degree (doctoral or not) and university (very good/ top-level or other) aspirations of DP participants and one variable that predicted the change in university aspirations.

- The likelihood of aspiring to a doctoral degree at the beginning of the DP was positively associated with three variables: academic ability before the DP (odds ratio= 1.34, increase of 34% in predicted odds), parental expectations for academic performance (odds ratio= 1.33, increase of 33% in predicted odds), and proportion of first language students (odds ratio= 1.01, increase of 1% in predicted odds). It was negatively associated with the total hours of the school day (odds ratio= .89, decrease of 11% in predicted odds).
- The likelihood of aspiring to a very good or top-level university at the beginning of the DP was positively associated with seven variables. The variables with the largest odds ratios were father's education (odds ratio= 1.72, increase of 72% in predicted odds), academic abilities before the DP (odds ratio= 1.47, increase of 47% in predicted odds), and average grade before the DP (odds ratio= 1.43, increase of 43% in predicted odds). It was negatively associated with it being a state school (odds ratio= .55, decrease of 45% in predicted odds).
- There were no predictors identified for the change in degree aspirations over the DP.
- One predictor—parental expectations for academic performance (odds ratio= .65, decrease of 35% in the predicted odds)—negatively predicted change in university aspirations during the DP.

We also performed an exploratory analysis to investigate predictors by **geographic region**.

- Due to limited sample (n=32 countries) we had to group schools into two regions for this exploratory analysis, North America (n=2) and non-North America (n=30). North America included 31 schools and non-North America included 59 schools. Since these were exploratory analyses, we do no report odds ratios here, but they are available in Table 9.
- Within North American schools, the likelihood of aspiring to a doctoral degree prior to participation in the DP was negatively associated with total hours of the school day. Likelihood of aspiring to a very good or top-level university was positively

associated with academic ability before DP, parental expectation for school enjoyment, and self-perceived academic abilities and language proficiency.

- Within schools outside of North America, the likelihood of aspiring to a doctoral degree prior to participation in the DP was positively associated with parental expectations for academic performance, academic abilities before DP, if the school was a state school, and the proportion of first language students at a school. Likelihood of aspiring to a very good or top-level university was positively related to father's education, average grade before DP, academic abilities before DP and proportion of teachers teaching in the DP. It was negatively associated with if it was a state school or not.
- One predictor was found to significantly predict the pre-post change in degree or university aspirations. For schools outside of North America, parental expectations for academic performance negatively predicted changes in university aspirations.

Conclusions from our findings include the following:

- Overall, DP students' degree and university aspirations were very high both at the start and at the end of the programme. The vast majority of students aspired to study at university and approximately 80% aspired to continue their studies aiming for master's and doctoral or professional degrees.
- Consistent with prior research, we find that student's educational aspirations at the beginning of the DP are predicted by student-level factors such as academic and family background and expectations.
- Parent expectations of academic performance were negatively related to the change in university aspirations, while also positively predicting initial university aspirations. We interpret this finding as being the result of high, potentially inflated, aspirations at the start of the programme and the timing of the second survey wave in the spring of students' 12th grade.
- Related to practice, we encourage stakeholders to not assume that a "decline" in aspirations is a negative outcome. Rather, as previous research (Schneider, Kim, & Klager, 2017; Sabates, 2011) suggests, a closer alignment of education and occupation aspirations—as opposed to just higher aspirations—can be beneficial for students' postsecondary success. We recommend additional research into this area for DP students as well.

Executive Summary Table of Main Findings

Combined		
	Beginning DP	**Change over DP**
Degree	Parent expectation for academic performance (1.33)	None
	Academic ability before DP (1.34)	
	Proportion of first language students (1.01)	
	Total hours of school day (0.89)	
University	Father's education (1.72)	Parent expectation for academic performance (0.65)
	Parent expectation for school enjoyment (1.22)	
	Average grade before DP (1.43)	
	Academic ability before DP (1.47)	
	Language proficiency (1.26)	
	State school (0.55)	
	Proportion of teachers teaching DP (1.01)	
	Total hours of school day (1.13)	

Notes: Paratheatrical values are odds ratios. Odds ratios less than 1 should be interpreted as negative. For additional information to how to interpret odds ratios please see the Appendix.

Introduction

The nonprofit International Baccalaureate (IB) was founded in 1968 with the mission to "develop inquiring, knowledgeable and caring young people who help to create a better and more peaceful world through intercultural understanding and respect." The IB primarily implements its mission through its four programmes of study—the Primary Years Programme, the Middle Years Programme, the Diploma Programme (DP), and the Career-related Programme—offered in 157 different countries and over 5,000 schools. Established in 1968, the DP was the first programme offered by the IB. It serves students aged 16–19 and is offered at over 3,000 schools in over 150 different countries (IB, 2020).

The DP course of study is organized around six subject groups and the three core elements of the extended essay; theory of knowledge; and creativity, action, and service. Each of the six subject groups—studies in language and literature, language acquisition, individuals and societies, sciences, mathematics, and the arts—requires coursework that is most often followed by an external written examination (IB, 2020). Given the focus of the DP, it is not surprising that a majority of participants continue their education by enrolling in a postsecondary institution. Previous research indicates that among DP candidates who graduated from U.S. high schools in 2013, over 85% enrolled immediately in a university, compared with about 66% of all high school graduates nationally (Pilchen, Caspary, & Woodworth, 2020). What factors, both student and school, shape the educational aspirations of DP students to attend specific institutions and aspire to certain degree levels, however, is an area of study that has yet to be investigated.

The IB commissioned RTI International to rigorously investigate this question by examining the change over time in DP participants' educational aspirations as well as identify predictors of the change in participants' educational aspirations while taking into account both student- and school-level factors. This report addresses the following research questions:

1. What are the patterns of changes in DP students' educational and occupational aspirations over the course of the programme? How are students distributed over different patterns?
2. How do aspirations change over time and vary across individuals and/or schools?
3. How do student-level characteristics predict initial educational aspirations and the changes in educational aspirations?
4. How do school-level characteristics predict initial educational aspirations and the changes in educational aspirations?
5. How do student- and school-level characteristics simultaneously predict initial educational aspirations and the changes in educational aspirations?

6. What are the student- and school-level predictors of initial educational aspirations and changes in educational aspirations by geographic regions?

Review of Literature

Educational aspirations of high school students have increased generally over time (Goyette, 2008), and now approximately 70% of American high school students enroll in postsecondary education immediately after high school (Condition of Education, 2020). Given that some form of a postsecondary credential is almost required to earn a living wage in today's information economy, increasing postsecondary enrollments are not a surprise. One recent report recounted that the economy has added over 11 million jobs since the end of the Great Recession; of those new jobs, 99% have gone to individuals with at least some college education (Carnevale, Jayasundera, & Gulish, 2016). A precursor to enrolling in postsecondary education is the formation and shaping of students' educational aspirations, the subject of this report.

Educational Aspirations

Theories related to educational aspirations generally emerged from the fields of sociology and economics. In sociology, the focus centered on experiences students have (e.g., going to museums with parents, being read to) and how those experiences can shape aspirations (Bourdieu, 1986). Economics primarily focused on the human capital framework theory that college is a means to the end of a good-paying job and that individuals will invest in additional education when the perceived benefits outweigh the costs (Becker, 1964). More recently, integrated theories have been proposed as a way to more accurately reflect the nuanced way individuals make decisions within their own unique context and constraints (see Perna, 2006; Toutkoushian & Paulsen, 2016).

In addition to theoretical considerations related to educational aspirations, there are operational considerations as well. For example, studies operationalize educational aspirations differently. The two general categories used include a metric related to the institution a student expects to attend (e.g., 2- or 4-year institution) or a measure of the selectivity of the institution, often based on the percentage of students an institution rejects or the average SAT/ACT scores of incoming students (Kuh & Pascarella, 2004). In addition to institution-related variables, aspirations are often evaluated based on the level of highest degree level a student expects to earn (e.g., bachelor's, master's).

In general, previous researchers have examined two levels of factors thought to influence educational aspirations, student-level and school-level. Below we briefly review the justification for examining factors at each level.

Student-Level Attributes

There are multiple factors that can influence a high school student's educational aspiration including socioeconomic status (SES), race/ethnicity, perceptions of college and occupation, and parents' level of education (Chenoweth & Galliher, 2004). Parental involvement in a student's life can also play a significant role in the decision of whether a student desires to pursue a college education (Qian & Blair, 1999). How these factors influence aspirations can vary.

Research by Bozick et al. (2010) shows that expectations vary little over time for those students from higher SES classes. These higher SES students tend to form their college aspirations as early as elementary school due to exposure to college going from parents who have attended postsecondary education. These higher SES students develop what Grodsky and Riegle-Crumb (2010) term a "college-going habitus" that is both strong and consistent across time. On the other hand, Goyette (2008), using U.S. nationally representative data from different decades, found that as the college population has become more diverse, educational aspirations of high schoolers are not as closely coupled with social background as they were in the 1980s. Rather, students of all backgrounds are now aspiring to some form of postsecondary education. Her findings help explain the emergence of the "College for All" norm that is demonstrated by the fact that almost 7 in 10 high school graduates immediately enroll in postsecondary education.

The measurement of aspirations, until recently, was modeled as a single, fixed event in the life of students. However, more recent research has explored aspirations as being longitudinal in nature, given that expectations are constantly being renegotiated given the addition of new information or contexts and experiences that students have (DesJardins et al., 2019). In fact, research indicates that a decline in college aspirations can be a positive development for students as educational and occupational aspirations often develop in tandem. For example, adolescents who are more attuned to their abilities and skills are more likely to develop a "realistic strategy" that aligns their educational expectations with their career interests (Schneider, Kim, & Klager, 2017). Students with "aligned aspirations" have a clear understanding of the types of jobs to which they aspire and the education needed to attain these occupations. For students with misaligned ambitions, they are less likely to enroll in postsecondary education, and conditional on enrollment, less likely to be successful (Schneider, Kim, & Klager, 2017; Sabates, 2011). Thus, a decrease in educational aspirations cannot be seen as a universally negative outcome as it might simply be the result of a more realistic alignment of ability, aspirations, and occupation.

School-level Attributes

Students operate in multiple contexts that can shape their aspirations. In addition to their familial context, another potential important influence is the school they attend. A school has contextual factors—such as tracking policies, a culture of achievement or parental involvement, and composition of the study body—that may influence student's aspirations (Buchmann & Dalton, 2002). More recent research hypothesizes that a high school that a student attends can be seen as an important "information channel" for students about college, which in turn can influence their aspirations. The information that a student acquires from teachers, guidance counselors, peers, and college fairs held at schools can influence a student's aspirations (Avery, 2010; Ceja, 2006).

From the previous research, both empirical and theoretical, it is clear that both student- and school-level factors have the potential to shape students' educational aspirations. As such, traditional statistical techniques such as multiple regression and ANOVA are not appropriate. Rather, we employ a series of multilevel models, which we detail in the methodological section below.

Methods

Data Sources

This project analyzes secondary data collected through the longitudinal survey of DP students experience and outcomes by IB Research during 2016–2018. The study surveyed approximately 4,800 students who were enrolled in DP in 2016 in multiple countries and tracked them over time with data collected at three points in time: at the beginning and the end of the first year in the DP and at the end of the second year in DP (i.e., completion of the program). The current study employs two waves of student surveys administered at the beginning of students' DP participation (December 2016) and upon completion of the DP exams (May 2018) and one wave of online school survey data collected from DP Coordinators and Heads of the Schools. We focus on 699 students who responded to both surveys and who provided information about their educational aspirations for university and degree attainment. These students were sampled from 91 schools located in 32 countries. Table 1 summarizes the data structure.

Table 1: Selected Key Measures in the Data

Measures		Data Sources
Student Academic Outcomes		
Degree aspirations	Measured by level of degree	Student Survey
University aspirations	Measured by level of university	
Selected Student-level Predictors		
Personal background	Gender, age, parental involvement, parental educational level, school enjoyment, etc.	Student Survey
Academic background	Academic performance, prior IB experience, etc.	
Academic perception	Language proficiency, academic abilities before DP, etc.	
Selected School-level Predictors		
School policy	Selective DP, use of assessment results, instructional time, etc.	Student Survey
School environment	Teacher relations, teacher-student relations, disciplinary climate, student/teacher absenteeism, etc.	
School demographics	School type, school size, country indicator, # DP students, student-teacher ratio	

Measures

Outcomes

This study is interested in students' educational aspirations, which are operationalized into two constructs: degree aspiration and university aspiration. Students were asked to indicate the level of degree aspiration they expected to complete and the type of university they expected to attend at both the beginning and end of the DP. Based on the distribution of their responses (with the vast majority of students aspiring to at least a master's degree) we chose to focus on aspirations to a doctoral or professional degree and created two dichotomous variables, one indicating whether a student aspired to a doctoral degree (or not), and the other indicating whether a student aspired to attend a "Very Good" or "Top-Level University" or other type of institution. See Table 3 for detailed coding information.

Predictors

We consider predictors at both the student and school-levels. Student-level predictors are measured in the first wave of the student survey and capture student characteristics related to (a) personal background such as gender, age, parental education, family structure, parent

in-school and out-of-school involvement and their expectations for school enjoyment and academic performance; (b) academic background, in particular, any prior experience with IB programs; and (c) academic abilities and perception, including average grade (mark) on the most recent school report prior to the DP, perceived academic abilities in comparison with other students in the class, and self-rating of language proficiency.

School-level predictors are based on the school survey and include (a) school demographic characteristics such as state or private school, programme enrollment, and teacher composition; (b) school policy, including admission selectiveness, use of assessment results, other university preparation program, and instructional time; and (c) school environment, including DP academic pressure, DP student community, teacher collaboration, DP student-teacher relationship, student/teacher absenteeism, and parent expectation and involvement.

Table 2 lists the predictors considered for this study. Appendix Table A-1 describes each predictor and provides information on approaches for constructing composite measures as well as psychometric properties of the final selected scales.

Missing data

The data files contain missing data at the item level. Given the nested data structure of aspirations nested within students, students nested within schools, and schools nested within countries, we employed a multilevel imputation procedure proposed by Shin and Raudenbush (2013) to impute the selected predictors. Note that we did not impute outcomes data.

Analytic Procedure

Research Question 1

To understand how education and career aspirations develop over time in DP students, we first descriptively summarized the patterns of changes in each aspiration measure and examined how students are distributed across different change patterns. This initial investigation allowed us to assess the size of different subsamples defined by levels of aspiration and key predictors and informed strategies to effectively group students for the multilevel analysis.

Except for the descriptive analysis used in Research Question 1, we employed a series of multilevel models to investigate changes in aspirations and to account for the fact that measures are nested within students and students are nested within schools. Traditional statistical techniques, such as multiple regression and ANOVA, are not appropriate to address these questions because the assumption of independence of observations does not hold given that there are multiple observations of each educational aspiration per student;

and students in the same schools share the same environment and are exposed to the same teachers and classrooms and may be very similar in demographic and academic characteristics (Raudenbush & Bryk, 2002).

Research Question 2

We started from a three-level model with no student- or school-level predictors for each of the two aspiration measures. Using degree aspirations as an example, we modeled the repeated aspiration of student *i* from school *j* at time *t* as

$$\log\left[\frac{\varphi_{tij}}{1-\varphi_{tij}}\right] = \beta_0 + \beta_1 Post_{tij} + r_{ij} + u_j, \quad r_{ij} \sim (0, \sigma^2), \quad u_j \sim (0, \tau) \tag{1}$$

where φ refers to the probability of exhibiting the aspiration to doctoral degree, and *Post* takes a value of 1 if the aspiration was measured at the end of the DP and 0 if otherwise. Hence β_1 suggests how aspirations change positively or negatively over time. To examine how aspirations vary across individuals and school, we assessed the student-level variance r and school-level variance u as well as the intraclass correlation that measures the proportion of between-group (i.e., school-level) variance in the outcome.

Research Questions 3–5

To examine the predictive power of the proposed student- and school-level predictors, we built on Model 1 by adding one predictor at a time and conducting three sets of model comparisons: (a) between models with student predictors only, (b) between models with school predictors only, and (c) between models with both student and school predictors identified from (a) and (b). Predictors that led to significant change to the prior model were retained in the model, while those that did not lead to significant change to the prior model were dropped. To ensure consistent interpretation, a predictor was also retained if it significantly contributed to the modeling of either of the aspiration outcomes. The final combined model provides a comprehensive picture of how student- and school-level characteristics work together to predict student's educational aspirations.

The final model was specified as

$$\begin{aligned}\log\left[\frac{\varphi_{tij}}{1-\varphi_{tij}}\right] = {} & \beta_0 + \beta_1 Post_{tij} + \beta_p \mathbf{X}_{ij} + \beta_q \mathbf{W}_j + \beta_{1+2p+q} Post_{tij} * \mathbf{X}_{ij} + \\ & \beta_{1+2p+2q} Post_{tij} * \mathbf{W}_j + r_{ij} + u_j, \quad r_{ij} \sim (0, \sigma^2), \quad u_j \sim (0, \tau)\end{aligned} \tag{2}$$

where $\mathbf{X}$ is a vector of student-level predictors and $\mathbf{W}$ is a vector of school-level predictors. Hence, β_0 suggests the adjusted pre-programme aspiration after controlling for the predictors; β_1 examines the average pre-post change in the aspiration; β_p and β_q estimate the relationship between student- and school-level predictors and the pre-programme

aspiration respectively; and β_{1+2p+q} and $\beta_{1+2p+2q}$ estimate the relationship between the corresponding student- and school-level predictors and the pre-prost change in aspiration.

Research Question 6

We also conducted subgroup analysis and examined the relationship between the predictors and each of the outcomes in separate regions. We grouped schools into two categories: North America or non-North America. Model 2 was reanalyzed within each of the subgroups.

All analyses were performed in SAS. Results from multilevel modeling were judged not only by statistical significance but also by the resulting odds ratio for the understanding of their practical importance. Note that we highlight variables that our models identified as statistically significant at the $p<.05$ level. To get at practical importance, we also report variables that have an odds ratio smaller than .5 or greater than 2, regardless of statistical significance, as that represents a practical importance that is relevant to practitioners and policymakers. For information on how to interpret odds ratios please see the Appendix.

Findings

Sample Characteristics

Table 2 shows the distribution of all student and school predictors across the student sample. Approximately 68% of the sample was female, and the average age was 17 years old. A majority of those in the sample had a mother (69%) or father (74%) who earned a bachelor's degree or higher, and 85% of the respondents lived with both a mother and a father. Students reported that their parents were moderately involved in their children's schooling (2.88 out of 5) and more involved in their life outside of school (3.07 out of 5). Students reported that it was important to their parents that they enjoyed school (5.17 out of 6) and performed well (5.23 out of 6).

The majority of students did not have prior IB experience (54%) or had not repeated a grade in school (95%). Respondents' self-reported pre-DP academic measures were high: average grades prior to IB (4.1 out of 5), academic abilities (3.5 out of 5), and language proficiency (4 out of 5).

School-level variables were reported by either the IB Coordinator or the Head of the School. About half of the schools were state-sponsored schools, and just under 1 in 10 were boarding schools. Over a third of the schools were in North America. The total average size of DP student enrollment was 134 students, with 101 full DP students and 48 students

taking individual IB courses. Over a third of the teachers taught in the DP, and over 90% were fully certified teachers. The DP student-to-teacher ratio was under 1:6.

School policies related to IB include 85% of the schools having selective admissions to the DP. A high percentage of schools also reported using assessment data to shape instructional practices and attaching consequences to both formative assessments and DP exam results. The school environment was one where there was some pressure on academic performance (4.38 out of 6), yet students also felt a sense of community (3.97 out of 5). Teachers also reported a strong sense of community and met multiple times per month, on average, to plan. Neither teacher-student relationships, teacher absenteeism, nor student absenteeism hindered learning. In accordance with the student reports, administrators reported that parents had high expectations related to academic achievement yet also had high expectations for the schools to limit academic stress on students. Schools reported ample opportunities for parents to be involved at the school. Approximately a third of parents participated in school activities or organizations.

Table 2: Sample Description

	Mean (SD) / Proportion
Student-level (*n*=699)	
Personal Background	
Female (0/1)	0.68
Age (0/1)	16.99 (0.72)
Mother education-Bachelor's or above degree (0/1)	0.69
Father education-Bachelor's or above degree (0/1)	0.74
Living with both mother and father (0/1)	0.85
Parent involvement (1-5)	
In school	2.88 (1.04)
Out of school	3.07 (1)
Parent expectation (1-6)	
School enjoyment	5.17 (0.92)
Academic performance	5.23 (0.82)
Academic Background	
Prior IB experience (0/1)	0.46
Ever repeated grade (0/1)	0.05
Academic Perception	
Average grade before DP (1-5)	4.09 (0.96)
Academic abilities before DP (1-5)	3.52 (0.96)
Language proficiency (1-5)	4.03 (0.93)
School-level (*n*=90)	
School Demographic	
State school (0/1)	0.49

	Mean (SD) / Proportion
Boarding school (0/1)	0.09
North America (0/1)	0.36
Student enrollment	
Total # DP full-time students	100.89 (155.03)
Total # DP half-time students	47.58 (104.69)
Total # DP students	134.37 (176.1)
Proportion of first language students	67.77 (27.49)
Teacher composition	
Proportion of teachers teaching DP	38.66 (25.47)
Proportion of fully certified teachers	90.73 (15.44)
DP student-teacher ratio	5.85 (7.46)
School Policy	
Selectiveness of DP admission (0/1)	0.85
Use of assessment results (0/1)	
Stakes attached to formative assessment results	0.81
Instructional improvement based on formative assessment results	0.9
Stakes attached to DP exam results	0.76
Offering other program preparing students for university (0/1)	0.58
Instructional time	
Total hours of school day	7.31 (1.28)
Number of weeks of instruction per academic year	36.19 (15.26)
School Environment	
DP academic press (1-6)	4.38 (0.95)
DP student community (1-5)	3.97 (0.83)
Teacher collaboration	
DP teacher community (1-5)	3.44 (0.99)
# collaborative meetings per month	2.53 (2.25)
DP student-teacher relationship (1-4)	3.59 (0.63)
Student absenteeism (1-4)	2.91 (0.87)
Teacher absenteeism (1-4)	3.51 (0.8)
Parent expectation (1-6)	
High academic achievement	4.29 (1.29)
Low academic stress	3.47 (1.21)
Parent involvement	
School involvement of parents (1-6)	4.63 (0.89)
Proportion of parents participating in school activities/organizations	33.61 (20.82)

Notes: For details on how variables were constructed, please see Appendix Table A-2.

Aspirations

As shown in Table 3, overall DP students had very high degree and university aspirations both at the beginning and the end of the pogramme. At the start of the programme, almost all DP students aspired to at least a bachelor's degree (97%) and most students (approximately 80%) aspired to at least a master's degree; moreover, over 40% of students aspired to a doctoral degree. By the end of the DP the degree aspirations continued to be high, with 98% of students aspiring to at least a bachelor's degree, 81% aspiring to at least a master's degree and 38% aspiring to a doctoral or professional degree. Almost three-quarters aspired to attend a very good or top-level university at the start of the programme. By the end of the DP, these aspirations decreased to approximately 61%.

Table 3: Distribution of Aspirations, by Survey Wave

		Wave 1 (Beginning of DP)		Wave 2 (End of DP)	
		N	%	N	%
Degree Aspiration	Aspired to Other Degree	403	57.7	434	62.1
	High school	12	1.7	12	1.7
	Bachelor's	121	17.3	121	17.3
	Master's	262	37.5	298	42.6
	Other	8	1.1	3	0.4
	Aspired to Doctoral Degree	296	42.4	265	37.9
University Aspiration	Aspired to Other Institution	185	26.5	271	38.8
	Aspired to Very Good or Top-Level University	514	73.5	428	61.2

Notes: "Aspired to other degree" includes "high school," "bachelor's degree," "master's degree," and "other." "Aspired to doctoral degree" includes "doctoral or professional degree such as law or medicine." "Aspired to other institution" includes "I am not planning to attend any university," "average university," and "good university." "Aspired to very good or top-level university" includes "very good university" and "top-level university (e.g., Oxford, Harvard)."

Research Question 1. What are the patterns of changes in DP students' educational and occupational aspirations over the course of the programme? How are students distributed over different patterns?

Given the results presented in Table 3, we know that aspirations changed for some students. To further examine students' pre-post DP changes in aspirations, we grouped the change pattern into three categories. Table 4 presents the distribution of students over the three categories for each of the two aspiration outcomes. Degree aspirations decreased from wave

1 to wave 2 for approximately 19% of students and increased for 16.0%. The majority of students' degree aspirations remained unchanged. In regard to university aspirations, over a third of students reduced their aspirations, just over half of the respondent's aspirations remained constant, and 11% increased their aspirations. Appendix Table A-2 presents the subsample characteristics within each change category.

Table 4: Distribution of Aspiration Changes

	Decreased		Unchanged		Increased	
Aspiration	n	%	n	%	n	%
Degree	130	18.6	457	65.4	112	16.0
University	251	35.9	371	53.1	77	11.0

Research Question 2. How do aspirations change over time and vary across individuals and/or schools?

Change over time

Related to degree aspirations, analysis of equation 1 did not reveal any significant change in degree aspirations over time (Table 5). The odds of aspiring to a doctoral degree at the end of the DP was .8 times of the odds at the beginning of the programme (coefficient=-.22, se=.12, t=-1.85, p=.07, odds ratio=.80), but the decrease is not statistically significant at the $p < .05$ level.

Related to university aspirations, we found a significant decrease in aspirations from the pre-DP to the post-DP survey. The odds of aspiring to a very good or top-level university at the end of the DP were about half of the odds prior to the DP (coefficient=-.62, se=.12, t=-5.11, $p<.001$, odds ratio=.54), meaning that the odds of aspiring to a very good or top-level university decreased by 46% from the beginning to the end of the DP.

Student- and school-level variation

To assess the variation in students' aspirations, we examined intraclass correlation (ICC), that is, the proportion of variance explained at the school-level in the corresponding outcome. ICC is 19% (0.33/(1.44+0.33)) for degree aspirations and 26% (0.30/(0.30+0.84)) for university aspirations, suggesting most of the variation in the aspirations was at the student, or repeated, levels as opposed to the school-level.

Table 5: Results of Change in Aspirations from Wave 1 to Wave 2

	Degree Aspiration				University Aspiration			
Fixed Effect	***coeff***	***se***	***t***	***odds ratio***	***coeff***	***se***	***t***	***odds ratio***
Intercept	-0.36	0.12	-2.95**	--	1.06	0.12	8.89***	--
Post-DP (0/1)	-0.22	0.12	-1.85	.80	-0.62	0.12	-5.11***	.54
Random Effect	Variance				Variance			
Student-level	1.44***				0.84***			
School-level	0.33***				0.30***			

Notes: * p<.05, **p<.01, ***p<.001

Research Question 3. How do student-level characteristics predict initial educational aspirations and the changes in educational aspirations?

Predictors of pre-programme aspirations

We first examined student-level predictors of aspirations at the beginning of the program. Related to degree aspirations, the likelihood of aspiring to a doctoral degree prior to participation in the DP was positively associated with the following characteristics:

- Parent expectations for academic performance (coefficient=.29, se=.13, t=2.30, p<.05, odds ratio=1.33). With a 1 unit higher rating of parents' expectation for academic performance, students had 33% larger odds of aspiring to a doctoral degree.
- Self-perceived academic abilities (coefficient=.29, se=.10, t=3.00, p<.01, odds ratio=1.34). With a 1 unit higher rating of self-perceived academic abilities, students had 34% larger odds of aspiring to a doctoral degree.

For university aspirations, the likelihood of aspiring to a very good or top-level university prior to the DP was positively associated with the following characteristics:

- Father's education level (coefficient=.47, se=.18, t=2.60, p<.05, odds ratio=1.61). Compared to those whose father had lower than a bachelor's degree, students whose father had earned a bachelor 's degree or above had 61% larger odds of aspiring to a very good or top-level university.
- Parent expectations for school enjoyment (coefficient=.20, se=.08, t=2.50, p<.05, odds ratio=1.22). With a 1 unit higher rating of parents' expectation for school enjoyment, students had 22% larger odds of aspiring to a very good or top-level university.

- Parent expectations for academic performance (coefficient=.26, se=.12, t=2.08, p<.05, odds ratio=1.29). With a 1 unit higher rating of parents' expectation for academic performance, students had 29% larger odds of aspiring to a very good or top-level university.
- Average grade before DP (coefficient=.27, se=.09, t=2.97, p<.01, odds ratio=1.31). With a 1 unit higher average grade before DP, students had 31% larger odds of aspiring to a very good or top-level university.
- Self-perceived academic abilities (coefficient=.38, se=.09, t=4.14, p<.001, odds ratio=1.46). With a 1 unit higher rating of self-perceived academic abilities, students had 46% larger odds of aspiring to a very good or top-level university.
- Language proficiency (coefficient=.21, se=.09, t=2.38, p<.05, odds ratio=1.23). With a 1 unit higher rating of their language proficiency, students had 23% larger odds of aspiring to a very good or top-level university.

See Table 6 for the full results.

Predictors of pre-post aspiration change

We did not find any student-level variables that significantly predicted pre-post programme change in degree aspirations. However, for university aspirations, we identified parent expectations for academic performance as a significant predictor. Higher parent expectations for academic performance are associated with a smaller pre-post increase in the likelihood of aspiring to a very good or top-level university (coefficient=-.42, se=.15, t=-2.70, p<.01, odds ratio=.66). Results are given in Table 6.

Table 6: Results of Student-Level Predictors (Outcome 1: Pre-DP Aspiration; Outcome 2: Change in Aspirations)

	Degree Aspiration				University Aspiration			
Fixed Effect	*coeff*	*se*	*t*	*odds ratio*	*coeff*	*se*	*t*	*odds ratio*
Intercept	-0.37	0.12	-3.12**	--	1.17	0.13	9.03***	--
Post-DP (0/1)	-0.23	0.12	-1.90	(0.62, 1.01)	-0.69	0.13	-5.40***	(0.39, 0.64)
Personal Background								
Mother education-Bachelor's or above degree (0/1)	0.33	0.19	1.69	(0.95, 2.02)	0.09	0.18	0.50	(0.77, 1.55)
Father education-Bachelor's or above degree (0/1)	0.12	0.20	0.60	(0.76, 1.67)	0.47	0.18	2.60**	(1.12, 2.3)
Parent expectation for school enjoyment (1-6)	-0.01	0.09	-0.11	(0.83, 1.18)	0.20	0.08	2.50*	(1.04, 1.43)
Parent expectation for academic performance (1-6)	0.29	0.13	2.30*	(1.04, 1.71)	0.26	0.12	2.08*	(1.02, 1.64)
Academic Perception								
Average grade before DP (1-5)	0.18	0.10	1.80	(0.98, 1.46)	0.27	0.09	2.97**	(1.1, 1.57)
Academic abilities before DP (1-5)	0.29	0.10	3.00**	(1.11, 1.63)	0.38	0.09	4.14***	(1.22, 1.75)
Language proficiency (1-5)	0.06	0.10	0.59	(0.88, 1.27)	0.21	0.09	2.38*	(1.04, 1.46)
Change in Aspirations								
Post*Personal Background								
Parent expectation for academic performance (1-6)	0.06	0.16	0.36	(0.78, 1.43)	-0.42	0.15	-2.70**	(0.49, 0.89)
Random Effect	Variance				Variance			
Student-level	1.44***				0.69***			
School-level	0.25***				0.41***			

Notes: * p<.05, **p<.01, ***p<.001. Post*Personal Background examines the interaction effect between time and personal background predictors. It suggests the potential effects of selected predictors on the pre-post change in the corresponding outcome.

Research Question 4. How do school-level characteristics predict initial educational aspirations and the changes in educational aspirations?

Predictors of pre-programme aspiration

Related to degree aspirations, the likelihood of aspiring to a doctoral degree prior to participation in the DP was positively associated with the following school-level characteristics:

- State school (coefficient=.38, se=.18, t=2.15, p<.05, odds ratio=1.46). Compared to students from other types of schools, students enrolled in state schools had 46% larger odds of aspiring to a doctoral degree.
- Proportion of first language students (coefficient=.01, se=.00, t=3.65, p<.001, odds ratio=1.01). With 1 percent higher in the proportion of first language students in schools, students had 1% larger odds of aspiring to a doctoral degree.
- Selectiveness of DP admission (coefficient=.49, se=.21, t=2.33, p<.05, odds ratio=1.62). Compared to students whose schools were not selective in DP admission, those attending selective schools had 62% larger odds of aspirating to a doctoral degree.
- Stakes attached to DP exam results (coefficient=.53, se=.20, t=2.58, p<.05, odds ratio=1.70). Compared to students from schools with minimum stakes attached to DP exam results, students whose schools used the exam results for principal or teacher evaluation or for decisions about instructional resource allocation had 70% larger odds of aspiring to a doctoral degree.

Aspiring to a doctoral degree prior to DP participation was found to be negatively associated with total hours of school days (coefficient=-.14, se=.05, t=-2.79, p<.01, odds ratio=.87). With one more hour per school day, students had 13% smaller odds of aspiring to a doctoral degree.

For university aspirations, we found that a student who aspired to a very good or top-level university prior to the DP was positively associated with the following:

- Proportion of teachers teaching DP in schools (coefficient=.01, se=.00, t=2.34, p<.05, odds ratio=1.01). With 1 percent higher in the proportion of teachers teaching DP in schools, students had 1% larger odds of aspiring to a very good or top-level university.

Aspiring to a very good or top-level university was negatively associated with attending a state school (coefficient=-.43, se=.20, t=-2.18, p<.05, odds ratio=.65). Compared to students from other types of schools, students enrolled in state schools had 35% smaller odds of aspiring to a very good or top-level university.

See Table 7 for the full results.

Predictors of pre-post aspiration change

We identified one statistically significant school-level predictors of pre-post aspiration change for each aspiration measure. Both of the variables were positively associated with change in aspirations.

- School involvement of parents (coefficient=.19, se=.09, t=2.04, p<.05, odds ratio=1.21). With 1 unit higher rating on the involvement of DP students' parents in schools, students had 21% larger odds of aspiring to a doctoral degree.
- DP student-teacher relationship (coefficient=.29, se=.14, t=2.04, p<.05, odds ratio=1.33). With a 1 unit higher rating of DP student-teacher relationship, students had 33% larger odds of aspiring to a very good or top-level university.

Results are given in Table 7.

Table 7: Results of School-level Predictors (Outcome 1: Pre-DP Aspiration; Outcome 2: Change in Aspirations)

	Degree Aspiration				University Aspiration			
Fixed Effect	*coeff*	*se*	*t*	*odds ratio*	*coeff*	*se*	*t*	*odds ratio*
Intercept	-0.35	0.11	-3.32**	--	1.08	0.12	9.31***	--
Post-DP (0/1)	-0.23	0.12	-1.87	(0.63, 1.01)	-0.63	0.12	-5.16***	(0.42, 0.68)
School Demographic								
State school (0/1)	0.38	0.18	2.15*	(1.03, 2.07)	-0.43	0.20	-2.18*	(0.44, 0.96)
Proportion of teachers teaching DP	0.00	0.00	-0.33	(0.99, 1.01)	0.01	0.00	2.34*	(1, 1.02)
Proportion of first language students	0.01	0.00	3.65***	(1.01, 1.02)	0.01	0.00	1.59	(1, 1.01)
School Policy								
Selectiveness of DP admission (0/1)	0.49	0.21	2.33*	(1.08, 2.44)	0.15	0.24	0.65	(0.73, 1.86)
Stakes attached to DP exam results	0.53	0.20	2.58*	(1.13, 2.53)	0.40	0.22	1.81	(0.97, 2.31)
Total hours of school day	-0.14	0.05	-2.79**	(0.79, 0.96)	0.01	0.05	0.24	(0.91, 1.12)
Change in Aspirations								
Post*School Environment								
DP student-teacher relationship (1-4)	0.03	0.13	0.26	(0.81, 1.33)	0.29	0.14	2.04*	(1.01, 1.76)
School involvement of parents (1-6)	0.19	0.09	2.04*	(1.01, 1.46)	0.01	0.10	0.08	(0.83, 1.23)
Random Effect	Variance				Variance			
Student-level	1.59***				0.90***			
School-level	0.05				0.21**			

Notes: * p<.05, **p<.01, ***p<.001. Post*School Environment examines the interaction effect between time and personal background predictors. It suggests the potential effects of selected predictors on the pre-post change in the corresponding outcome.

Research Question 5. How do student- and school-level characteristics simultaneously predict initial educational aspirations and the changes in educational aspirations?

Predictors of pre-programme aspirations

When examining student and school predictors simultaneously, we found that the likelihood of aspiring to a doctoral degree prior to the DP was positively associated with the following student-level characteristics:

- Parent expectations for academic performance (coefficient=.29, se=.13, t=2.26, p<.05, odds ratio=1.33). With a 1 unit higher rating of parents' expectation for academic performance, students had 33% larger odds of aspiring to a doctoral degree.
- Self-perceived academic abilities (coefficient=.29, se=.10, t=2.94, p<.01, odds ratio=1.34). With a 1 unit higher rating of self-perceived academic abilities, students had 34% larger odds of aspiring to a doctoral degree.

At the school-level, the likelihood of aspiring to a doctoral degree was positively associated with the proportion of first language students (coefficient=.01, se=.00, t=2.02, p<.05, odds ratio=1.01). With 1 percent higher in the proportion of first language students in schools, students had 1% larger odds of aspiring to a doctoral degree. It was negatively associated with total hours of school days (coefficient=-.12, se=.05, t=-2.21, p<.05, odds ratio=.89). With one more hour per school day, students had 11% smaller odds of aspiring to a doctoral degree.

For university aspirations, the likelihood of aspiring to a very good or top-level university prior to the DP was positively associated with the following student-level characteristics:

- Father's education level (coefficient=.54, se=.17, t=3.22, p<.05, odds ratio=1.72). Compared to those whose father had lower than a bachelor's degree, students whose father had earned a bachelor's degree or above had 72% larger odds of aspiring to a very good or top-level university.
- Parent expectations for school enjoyment (coefficient=.20, se=.08, t=2.49, p<.05, odds ratio=1.22). With a 1 unit higher rating of parents' expectation for school enjoyment, students had 22% larger odds of aspiring to a very good or top-level university.
- Average grade before DP (coefficient=.36, se=.09, t=3.84, p<.001, odds ratio=1.43). With a 1 unit higher average grade before DP, students had 43% larger odds of aspiring to a very good or top-level university.

- Self-perceived academic abilities (coefficient=.39, se=.09, t=4.18, p<.001, odds ratio=1.47). With a 1 unit higher rating of self-perceived academic abilities, students had 47% larger odds of aspiring to a very good or top-level university.
- Language proficiency (coefficient=.23, se=.09, t=2.64, p<.01, odds ratio=1.26). With a 1 unit higher rating of their language proficiency, students had 26% larger odds of aspiring to a very good or top-level university.

At the school-level, the likelihood of aspiring to a very good or top-level university was positively associated with the following:

- Proportion of teachers teaching DP in schools (coefficient=.01, se=.00, t=2.94, p<.01, odds ratio=1.01). With 1 percent higher in the proportion of teachers teaching DP in schools, students had 1% larger odds of aspiring to a very good or top-level university.
- Total hours of the school day (coefficient=.12, se=.05, t=2.38, p<.05, odds ratio=1.13). With a 1 higher in the total hours of the school day, students had 13% larger odds of aspiring to a very good or top-level university.

Aspiring to a very good or top-level university was negatively associated with a state school (coefficient=-.60, se=.19, t=-3.07, p<.01, odds ratio=.55). Compared to students from other types of schools, students enrolled in state schools had 45% smaller odds of aspiring to a very good or top-level university.

Results are given in Table 8.

Predictors of pre-post aspiration change

No predictors were found to statistically predict pre-post change in degree aspiration. However, for university aspirations, we identified parent expectations for academic performance as a significant predictor. Higher parent expectations for academic performance are associated with a smaller pre-post increase in the likelihood of aspiring to a very good or top-level university (coefficient=-.43, se=.16, t=-2.73, p<.01, odds ratio=.65). A 1 unit higher in parents' expectation for academic performance at the beginning of the program would lead to 35% less improvement in students' odds of aspiring to a very good or top-level university.

See Table 8 for full results.

Table 8: Results of Student- and School-level Predictors (Outcome 1: Pre-DP Aspiration; Outcome 2: Change in Aspirations)

	Degree Aspiration				University Aspiration			
Fixed Effect	*coeff*	*se*	*t*	*odds ratio*	*coeff*	*se*	*t*	*odds ratio*
Intercept	-0.38	0.11	-3.39**	--	1.20	0.12	10.06***	--
Post-DP (0/1)	-0.23	0.12	-1.91	(0.62, 1.01)	-0.70	0.13	-5.44***	(0.38, 0.64)
Personal Background								
Father education-Bachelor's or above degree (0/1)	0.29	0.19	1.53	(0.92, 1.92)	0.54	0.17	3.22**	(1.23, 2.38)
Parent expectation for school enjoyment (1-6)	-0.01	0.09	-0.14	(0.83, 1.17)	0.20	0.08	2.49*	(1.04, 1.43)
Parent expectation for academic performance (1-6)	0.29	0.13	2.26*	(1.04, 1.72)	0.23	0.12	1.83	(0.98, 1.61)
Academic Perception								
Average grade before DP (1-5)	0.14	0.10	1.41	(0.95, 1.41)	0.36	0.09	3.84***	(1.19, 1.72)
Academic abilities before DP (1-5)	0.29	0.10	2.94**	(1.1, 1.62)	0.39	0.09	4.18***	(1.23, 1.76)
Language proficiency (1-5)	0.02	0.10	0.16	(0.84, 1.23)	0.23	0.09	2.64**	(1.06, 1.5)
School Demographic								
State school (0/1)	0.39	0.20	1.98	(1, 2.18)	-0.60	0.19	-3.07**	(0.38, 0.81)
Proportion of teachers teaching DP	0.00	0.00	0.12	(0.99, 1.01)	0.01	0.00	2.94**	(1, 1.02)
Proportion of first language students	0.01	0.00	2.02*	(1, 1.01)	0.00	0.00	-0.03	(0.99, 1.01)
School Policy								
Total hours of school day	-0.12	0.05	-2.21*	(0.8, 0.99)	0.12	0.05	2.38*	(1.02, 1.25)
Change in Aspirations								
Post*Personal Background								
Parent expectation for academic performance (1-6)	0.06	0.16	0.37	(0.78, 1.44)	-0.43	0.16	-2.73**	(0.48, 0.89)
Random Effect	Variance				Variance			
Student-level	1.50***				0.75***			
School-level	0.16*				0.19**			

Notes: * p<.05, **p<.01, ***p<.001. Post*Personal background examines the interaction effect between time and personal background predictors. It suggests the potential effects of selected predictors on the pre-post change in the corresponding outcome.

Research Question 6. What are the student- and school-level predictors of initial educational aspirations and changes in educational aspirations by geographic regions?

The sampled 90 schools were from 32 countries with the majority concentrated in the United States. To allow for comparison, we grouped the schools into two categories—those in North America and those in all other regions—and examined within each group the predictive power of the student- and school-level predictors identified from Research Question 5. Due to the limited number of schools in each subgroup as well as how we grouped schools, we consider this analysis to be exploratory, thus results should be interpreted with caution. Table 9 presents the results from the subgroup analysis.

North American schools

Within North American schools, the likelihood of aspiring to a doctoral degree prior to participation in the DP was negatively associated with total hours of school days (coefficient=-.25, se=.11, t=-2.19, p<.05, odds ratio=.78).

The likelihood of aspiring to a very good or top-level university at the beginning of the DP was positively associated with parent expectations for school enjoyment (coefficient=.31, se=.12, t=2.52, p<.05, odds ratio=1.37), average grade before DP (coefficient=.32, se=.14, t=2.24, p<.05, odds ratio=1.38), self-perceived academic abilities (coefficient=.38, se=.15, t=2.55, p<.05, odds ratio=1.46), and language proficiency (coefficient=.35, se=.15, t=2.26, p<.05, odds ratio=1.41).

No predictor was found to significantly predict the pre-post change in degree or university aspirations.

Non-north American schools

Within schools outside of North America, the likelihood of aspiring to a doctoral degree prior to the programme was positively associated with parent expectations for academic performance (coefficient=.32, se=.16, t=2.04, p<.05, odds ratio=1.37), self-perceived academic abilities (coefficient=.35, se=.13, t=2.80, p<.01, odds ratio=1.42), state school (coefficient=.64, se=.28, t=-2.31, p<.05, odds ratio=1.90), and proportion of first language students (coefficient=.01, se=.00, t=2.06, p<.05, odds ratio=1.01).

The likelihood of aspiring to a very good or top-level university at the beginning of the DP was positively associated with father's education level (coefficient=.57, se=.21, t=2.67, p<.01, odds ratio=1.76), average grade before DP (coefficient=.41, se=.13, t=3.27, p<.01, odds ratio=1.51), self-perceived academic abilities (coefficient=.39, se=.12, t=3.26, p<.01, odds ratio=1.48), and proportion of teachers teaching DP in schools (coefficient=.02,

se=.00, t=3.32, p<.01, odds ratio=1.02). It was negatively associated with state school (coefficient=-.83, se=.27, t=-3.06, p<.01, odds ratio=.44).

We did not find any predictor that significantly predicted pre-post programme change in degree aspirations. However, for university aspirations, higher parent expectations for academic performance is associated with smaller pre-post changes in the likelihood of aspiring to a very good or top-level university (coefficient=-.39, se=.19, t=-2.05, p<.05, odds ratio=.68).

Table 9: Results of Student- and School-level Predictors by Country Location (Outcome 1: Pre-DP Aspiration; Outcome 2: Change in Aspirations)

	North America							
	Degree Aspiration				University Aspiration			
Fixed Effect	***coeff***	***Se***	***t***	***odds ratio***	***coeff***	***se***	***t***	***odds ratio***
Intercept	-1.01	0.35	-2.93**	--	0.57	0.31	1.85	--
Post-DP (0/1)	-0.05	0.21	-0.24	(0.62, 1.44)	-0.67	0.22	-3.1**	(0.33, 0.78)
Personal Background								
Father education-Bachelor's or above degree (0/1)	0.21	0.33	0.64	(0.64, 2.38)	0.33	0.29	1.13	(0.78, 2.46)
Parent expectation for school enjoyment (1-6)	0.06	0.14	0.39	(0.8, 1.4)	0.31	0.12	2.52*	(1.07, 1.74)
Parent expectation for academic performance (1-6)	0.39	0.25	1.56	(0.9, 2.44)	0.28	0.23	1.23	(0.85, 2.05)
Academic Perception								
Average grade before DP (1-5)	0.21	0.17	1.24	(0.89, 1.71)	0.32	0.14	2.24*	(1.04, 1.83)
Academic abilities before DP (1-5)	0.24	0.17	1.45	(0.92, 1.77)	0.38	0.15	2.55*	(1.09, 1.95)
Language proficiency (1-5)	0.03	0.18	0.19	(0.73, 1.46)	0.35	0.15	2.26*	(1.05, 1.91)
School Demographic								
State school (0/1)	0.78	0.42	1.87	(0.96, 4.97)	0.09	0.39	0.23	(0.51, 2.34)
Proportion of teachers teaching DP	0.00	0.01	-0.01	(0.97, 1.03)	-0.02	0.01	-1.93	(0.95, 1)
Proportion of first language students	0.02	0.01	1.66	(1, 1.04)	0.00	0.01	0.44	(0.99, 1.02)
School Policy								
Total hours of school day	-0.25	0.11	-2.19*	(0.62, 0.97)	0.09	0.10	0.95	(0.91, 1.33)
Change in Aspirations								
Post*Personal Background								
Parent expectation for academic performance (1-6)	-0.21	0.31	-0.69	(0.44, 1.47)	-0.54	0.29	-1.87	(0.33, 1.03)
Random Effect								
Student-level	1.65***				0.69**			
School-level	0.00				0.03			

	Non-North America							
	Degree Aspiration				University Aspiration			
Fixed Effect	***coeff***	***se***	***t***	***odds ratio***	***coeff***	***se***	***t***	***odds ratio***
Intercept	-0.11	0.16	-0.67	--	1.13	0.17	6.69	--
Post-DP (0/1)	-0.32	0.15	-2.06*	(0.54, 0.98)	-0.73	0.17	-4.4	(0.35, 0.67)
Personal Background								
Father education-Bachelor's or above degree (0/1)	0.34	0.23	1.44	(0.89, 2.21)	0.57	0.21	2.67**	(1.16, 2.68)
Parent expectation for school enjoyment (1-6)	-0.12	0.12	-0.98	(0.71, 1.12)	0.14	0.11	1.28	(0.93, 1.44)
Parent expectation for academic performance (1-6)	0.32	0.16	2.04*	(1.01, 1.86)	0.23	0.16	1.47	(0.93, 1.72)
Academic Perception								
Average grade before DP (1-5)	0.09	0.13	0.66	(0.84, 1.41)	0.41	0.13	3.27**	(1.18, 1.93)
Academic abilities before DP (1-5)	0.35	0.13	2.80**	(1.11, 1.81)	0.39	0.12	3.26**	(1.17, 1.88)
Language proficiency (1-5)	0.03	0.12	0.25	(0.81, 1.31)	0.22	0.11	1.95	(1, 1.56)
School Demographic								
State school (0/1)	0.64	0.28	2.31*	(1.1, 3.29)	-0.83	0.27	-3.06**	(0.26, 0.74)
Proportion of teachers teaching DP	0.00	0.00	-0.92	(0.99, 1)	0.02	0.00	3.32**	(1.01, 1.03)
Proportion of first language students	0.01	0.00	2.06*	(1, 1.02)	0.00	0.00	-0.33	(0.99, 1.01)
School Policy								
Total hours of school day	-0.08	0.06	-1.26	(0.82, 1.05)	0.12	0.06	1.94	(1, 1.28)
Change in Aspirations								
Post*Personal Background								
Parent expectation for academic performance (1-6)	0.14	0.19	0.76	(0.8, 1.66)	-0.39	0.19	-2.05*	(0.47, 0.98)
Random Effect	Variance				Variance			
Student-level	1.57***				0.91***			
School-level	0.2*				0.23*			

Notes: * p<.05, **p<.01, ***p<.001. Post*Personal background examines the interaction effect between time and personal background predictors. It suggests the potential effects of selected predictors on the pre-post change in the corresponding outcome.

Discussion

We summarize the results in Table 10 below. Educational aspirations, whether operationalized as the aspiration to earn a certain degree or attend a specific type of university, are multifaceted and ever changing. For our sample of approximately 700 DP students in over 30 countries, we found that both degree and university aspirations are consistent with recent research indicating that student's aspirations are not fixed and are constantly changing as students gain new information and experiences (DesJardins et al., 2019). Further, we found that both student- and school-level variables influence aspirations (Avery, 2010; Ceja, 2006). Given these results, we would caution teachers, administrators, and parents to not automatically assume that a "decline" in aspirations is a negative outcome. Rather, students are still developing and continuing to integrate their abilities and skills into a "realistic strategy" that aligns their educational expectations with their career interests (Schneider, Kim, & Klager, 2017).

Aspirations are heavily influenced by the traits that students bring into the DP. Consistent with the prior research of Chenoweth and Galliher (2004), we identified the student-level factors that positively predicted pre-DP degree aspirations to include preexisting academic ability and their parents' expectation of their academic performance. These two student-level variables were also identified as predictors of initial university aspirations, in addition to father's level of education, parental expectation for school enjoyment, average grades before participation in the DP, and language proficiency. It is clear from the pattern of significant variables that DP students' degree and university aspirations at the start of the programme are high and are heavily influenced by student-level factors related to academics and family background. This is consistent with the research of Chenoweth and Galliher (2004) who found that a student's preexisting factors—especially those related to SES and familial background—are important predictors of educational aspirations.

Our results also indicate that school-level characteristics are associated with student's initial aspirations as measured at the start of the DP. The predictors with the largest magnitude of effect on degree aspirations included if there were stakes attached to the DP exam results and selectiveness of DP admissions. Thus, students who attended schools that placed more "weight" on the DP exam scores had higher initial degree aspirations. This result is consistent with the finding in Buchmann and Dalton (2002) that contextual factors such as the culture of the school may influence student's aspirations. School-level factors positively related to initial university aspirations also centered on contextual factors of the school, including DP student-teacher relationships. Previous research has indicated that teachers often supplement the role of counselor for students since they have existing relationships

and interact frequently with students (Hatch, 2013) and that is a potential mechanism through which this finding is operating.

Similar to previous research, our full model demonstrates that student-level variables affected initial aspirations – both degree and university – more than school-level variables (Grodsky & Riegle-Crumb, 2010). The traits that students bring with them to the DP – perception of academic ability, father's education level, and parental expectations – are instrumental in shaping initial aspirations. We found no statistically significant predictors at the school-level for change of aspirations over time. However, at the student-level, parental expectations for academic performance, as reported by the student, was associated with a decrease in university aspirations. Further, this same variable was the only relationship that was significant in the full model that included both student- and school-level variables.

This seemingly incongruous finding that parental expectations for academic performance is negatively associated with the change in university aspirations could be explained by the following. As detailed above, the DP attracts students with high aspirations, both for themselves and from their parents. Students who were heavily influenced by their parent's expectations could face additional pressure from their parents and report inflated university expectations in wave 1 of the survey as a result. Then, as a consequence of additional information and experiences in the DP, along with the consultation of their parents, those same students adjusted their university aspirations to bring them in alignment with either their occupational goals or abilities. Given that the DP takes place during the 11th- and 12th-grade years—when students are actively seeking out and applying to postsecondary education—students surveyed in wave 2 of spring of their 12th-grade year would have a more detailed understanding of, or even know, what level of university they could realistically attend in the fall.

Table 10: Summary Table of Main Findings

Student-level		
Aspirations	**Beginning DP**	**Change over DP**
Degree	Parent expectation for academic performance	None
	Academic ability before DP	
University	Father's education	
	Parent expectation for school enjoyment	
	Parent expectation for academic performance	Parent expectation for academic performance (-)
	Average grade before DP	
	Academic ability before DP	
	Language proficiency	
School-level		

	Beginning DP	Change over DP
Degree	State school	School involvement of parents
	Proportion of first language students	
	Selectiveness of DP admission	
	Stakes attached to DP exam results	
	Total hours of school day (-)	
University	State school (-)	DP student-teacher relationship
	Proportion of teachers teaching DP	
Combined		
	Beginning DP	**Change over DP**
Degree	Parent expectation for academic performance	None
	Academic ability before DP	
	Proportion of first language students	
	Total hours of school day (-)	
University	Father's education	Parent expectation for academic performance (-)
	Parent expectation for school enjoyment	
	Average grade before DP	
	Academic ability before DP	
	Language proficiency	
	State school (-)	
	Proportion of teachers teaching DP	
	Total hours of school day	

Notes: Effects are positive unless indicated by a (-).

Recommendations

Practice

One of our main findings was that educational aspirations can change. Once one accepts that aspirations can change, it is inevitable that some students will increase their aspirations while others will decrease. However, the finding that students who initially aspired to a doctoral degree were more likely to decrease their degree aspirations should not be viewed as simply a negative outcome. Rather, it could very well be the case that students are gaining awareness of new educational and occupational opportunities through their participation in the DP. Students then integrate this new information and adjust their occupational and educational aspirations to become better aligned, which previous research indicates is

beneficial for their longer-term educational outcomes (Schneider, Kim & Klager, 2017; Sabates, 2011). We expand further on this idea below.

Future Research

This report presents rigorous quantitative evidence related to factors that influence students' educational aspirations. Additional research is needed to more fully contextualize the results we present here. Using both quantitative and qualitative data to access student's experience *during* the DP would help shed light on *why* students alter their aspirations. As we discuss above, a decrease in aspirations could be a positive outcome of participation in the DP. Related, having data on a control group of students could also inform what role the DP plays in student's educational aspirations compared with students who experience a different high school curriculum. Given the nature of multilevel models, having increased sample sizes would also allow for the inclusion of additional variables that our sample of 700 would not support.

Related to the student self-report data on aspirations, having larger sample sizes could allow for more fine-grained categories of aspirations. Our current dichotomous variables may be oversimplifying students' reality. For university aspirations, it would be insightful to match these student data with data indicating to which universities students actually applied and were accepted. If students are "matching" to universities as one would expect, this could provide additional evidence that aspirations are aligned with reality.

Our results show that the majority of the variation in changing aspirations is due to student-level factors as opposed to school-level factors. Given this, individual schools could undertake a more detailed study of how and why *their* students' aspirations change. Focusing on the students within a given school could also allow for more detailed data on students and their experiences as provided by their teachers or parents. Larger samples with more fine-grained data could be combined with mediation analysis to investigate what types of experiences, both in and out of school, contributed to the decline in aspirations.

Limitations

This study, as do all studies, has limitations. The aspiration measures have two notable limitations. Since the measures were self-reported by students at the beginning and end of their DP, it is conceivable that students inflated their aspirations or reported the highest possible university aspirations in wave 1. This could be caused by issues of social desirability, parental pressure/expectations, or not having fully informed aspirations yet.

Second, the aspiration measures are bound by the top-level category. Given that such a large percentage of students reported wave 1 aspirations that were already at the top-level of the scale—42.4% of students reported aspiring to a doctoral degree and 73.5% reported aspiring to a very good or top-level university—there was no way for these students to increase their aspirations.

We did not have access to occupational aspiration data. This omission complicated the interpretation of the finding of declining educational aspirations as previous research indicates that educational and occupational aspirations are tightly coupled (Goyette, 2008; Staff et al., 2010), as we discussed in detail above.

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Appendix

Interpreting Odds Ratios

We report odds ratios from our models. Overall, odds ratios are interpreted as the ratio of the predicted odds of an outcome occurring for two groups of students. For example, take the case of a dichotomous predictor variable such as mother's education level (coded as 0=below a bachelor's degree; 1=bachelor's degree or above) and the outcome of increasing degree aspirations. If the odds ratio is greater than 1, it is interpreted as a positive effect on degree aspirations, and if the odds ratio is less than 1 it is interpreted as a negative effect on degree aspirations. For example, an odds ratio of .75 is interpreted as students whose mother's highest degree is below a bachelor's degree have 25% lower odds of increasing their degree aspirations compared with students whose mothers have at least a bachelor's degree.

For continuous variables, such as parent's involvement in school (coded 1 to 5 with 1=not at all involved to 5=extremely involved), the odds ratio represents the change in the predicted odds of moving an additional point on the scale. For example, an odds ratio of 1.30 is interpreted as students whose parents are "extremely" involved (5 on the scale) have 30% higher odds of increasing their degree aspirations compared with students whose parents are "quite" involved (4 on the scale).

Table A-1 provides information on the constructed variables that were used in the analysis. Variables are divided into groupings based on student level, school-level, and outcomes. Variable names (column 1), label description (column 2), and type and value labels (column 3) are provided. For variables that were constructed from the original data, we provide notes on how that was done (column 4) as well as the psychometric properties (column 5) of composite measures used the in analysis.

Table A-1: Constructed Variables

Variable Name	Variable Label	Variable Type and Value Labels	Notes on Variable Construction	Psychometric
Student-level Predictors				
female	Female	0=Male 1=Female		
age	Age by 1/2017	Numeric	((2017-birth year)*12+(1- birth month))/12	
medu	Mother education-bachelor's or above degree	0=No 1=Yes		
fedu	Father education-bachelor's or above degree	0=No 1=Yes		
lvw2prnt	Living with both mother and father	0=No 1=Yes		
pinvlv1	Parent involvement in school	1=not all involved to 5=extremely involved	mean of a80a & a80b	correlation=.69
pinvlv2	Parent involvement out of school	1=not all involved to 5=extremely involved	mean of a80c, a80d, & a80e	reliability=.86
pexp1	Parent expectation - school enjoyment	1=strongly disagree to 6=strongly agree	mean of a81a & a81c	correlation=.60
pexp2	Parent expectation - academic performance	1=strongly disagree to 6=strongly agree	mean of a81b & a81d	correlation=.61
IBexp	Prior IB experience	0=No 1=Yes		
reptgrade	Ever repeated grade	0=No 1=Yes		
A38	Before DP: average grade (mark)	1=low to 5=excellent		
A40	Before DP: academic abilities	1=below average to 5=extremely above average		
langprof	Language proficiency	1=poor to 5=native speaker	mean of a41a-- a41d	reliability=.94

Variable Name	Variable Label	Variable Type and Value Labels	Notes on Variable Construction	Psychometric
School-level Predictors				
statesch	State school	0=No 1=Yes		
bdsch	Boarding school	0=No 1=Yes		
namerica	North America	0=No 1=Yes		
DPftime	Total # DP full-time students	Numeric		
DPhtime	Total # DP half-time students	Numeric		
DPtotal	Total # DP students	Numeric	sum of DP full-time and half-time students	
DPtchp	Proportion of teachers teaching DP	Numeric		
flgstp	Proportion of first language students	Numeric	q15 converted to continuous score	
ctftchp	Proportion of fully certified teachers	Numeric	q12 converted to continous score	
DPst2tch	DP student-teacher ratio	Numeric	total# DP students/q11	
select	Selective school	0=No 1=Yes	q16a--q16e -- if any of the items was rated 3=always, then yes	
stakeftest	Use of formative assessment-stake attached	0=No 1=Yes	q50b & q50d -- if any of the items was rated 1, then yes	
instftest	Use of formative assessment-instructional improvement	0=No 1=Yes	q50c & q50e -- if any of the items was rated 1, then yes	
stakedp	Use of DP final-stakes attached	0=No 1=Yes	q51d q51e & q51f -- if any of the items was rated 1, then yes	
univprgm	Offer other program preparing students for university	0=No 1=Yes		
schhour	Total # hours of school day	Numeric	mean of q13a & q13b	
schweek	Number of weeks of instruction per academic year	Numeric		
dpapress	DP academic press	1=strongly disagree to 6=strongly agree	mean of q54a, q54b, q54c	reliability=.75
stexp	DP student community	1=none of the time 5=all the time	factor score based on q53a---q53d (q53a & q53c reverse coded)	reliability=.76

Variable Name	Variable Label	Variable Type and Value Labels	Notes on Variable Construction	Psychometric
tcexp	DP teacher community	1= none of the time 5=all the time	factor score based on q55a---q53d (q55a & q55c reverse coded)	reliability=.80
tcmeet	DP teacher - # collaborative meetings per month	Numeric	sum of q48a & q48b	
tsrelate	DP student-teacher relationship	1=to a great extent hindered to 4=not at all hindered	mean of q56c, q56d, & q56e (reverse coded)	reliability=.86
stabst	Student absenteeism	1=to a great extent hindered to 4=not at all hindered	q56a reverse coded	
tcabst	Teacher absenteeism	1=to a great extent hindered to 4=not at all hindered	q56g reverse coded	
spexp1	Parent expectation-high academic achievement	1=strongly disagree to 6=strongly agree	factor score based on q68a, q68b, q69a & q69c	reliability=.85
spexp2	Parent expectation-low academic stress	1=strongly disagree to 6=strongly agree	factor score based on q69d & q69e	correlation=.71
spsinvlv	School involvement of parents	1=strongly disagree to 6=strongly agree	factor score based on q66a-q66d	reliability=.84
sppart	Proportion of parents participating in school activities/organizations	Numeric	q67a & q67b converted to continuous score and then taken average	
Outcomes				
easpphd_pre	Degree aspiration: doctoral vs. not (pre)	0=No 1=Yes		
easpphd_pst	Degree aspiration: doctoral vs. not (post)	0=No 1=Yes		
easpchg	Degree aspiration: change	-1=decrease, 0=unchanged, 1=increase		
uaspgd_pre	University aspiration: very good+top-level vs. not (pre)	0=No 1=Yes		
uaspgd_pst	University aspiration: very good+top-level vs. not (post)	0=No 1=Yes		
uaspchg	University aspiration: change	-1=decrease, 0=unchanged, 1=increase		

Table A-2 provides, by degree and university aspiration, the number of students who decreased, held steady, or increased their aspirations. It then provides the distribution by the sample characteristics. For example, of the 130 students who decreased their degree aspiration from wave 1 to wave 2, 70% were female. At the school-level, the table can be read as follows. Fifty-five schools had at least one student whose degree aspirations decreased from wave 1 to wave 2. Of the schools who had at least one student whose degree aspirations decreased, 53% were a state school. Note that since students are nested within schools, schools can be included in more than one column. Thus, the total number of schools across the three categories of decreased, unchanged, and increased does not sum to the total number of schools (n=90).

Table A-2: Changes in Degree Aspirations and University Aspirations

	Degree Aspiration			University Aspiration		
	Decreased	Unchanged	Increased	Decreased	Unchanged	Increased
Student *n*	130	457	112	251	371	77
Personal Background						
Female (0/1)	0.7	0.69	0.63	0.67	0.7	0.66
Age (0/1)	16.98 (0.69)	17.01 (0.74)	16.9 (0.63)	16.99 (0.71)	16.99 (0.71)	17 (0.76)
Mother education-Bachelor's or above degree (0/1)	0.72	0.72	0.57	0.64	0.71	0.78
Father education-Bachelor's or above degree (0/1)	0.71	0.77	0.66	0.72	0.74	0.79
Living with both mother and father (0/1)	0.82	0.86	0.84	0.85	0.85	0.84
Parent involvement (1-5)						
In school	2.8 (1.09)	2.94 (1.04)	2.72 (0.96)	2.96 (1.02)	2.83 (1.02)	2.82 (1.15)
Out of school	2.88 (1.1)	3.12 (0.95)	2.96 (1.06)	2.99 (1.01)	3.1 (0.99)	2.97 (1.06)
Parent expectation (1-6)						
School enjoyment	5.07 (1)	5.21 (0.89)	5.12 (0.94)	5.15 (0.93)	5.21 (0.88)	5.01 (1.03)
Academic performance	5.16 (0.88)	5.25 (0.79)	5.24 (0.82)	5.3 (0.82)	5.26 (0.75)	4.87 (0.96)
Academic Background						
Prior IB experience (0/1)	0.51	0.47	0.39	0.41	0.49	0.47
Ever repeated grade (0/1)	0.02	0.04	0.06	0.04	0.05	0.03
Academic Perception						
Average grade before DP (1-5)	3.9 (1.06)	4.16 (0.94)	4.02 (0.87)	4.12 (0.97)	4.1 (0.94)	3.9 (1)

	Degree Aspiration			University Aspiration		
	Decreased	Unchanged	Increased	Decreased	Unchanged	Increased
Academic abilities before DP (1-5)	3.43 (1)	3.57 (0.97)	3.44 (0.84)	3.55 (1.01)	3.55 (0.94)	3.27 (0.82)
Language proficiency (1-5)	3.9 (1.01)	4.07 (0.91)	4.06 (0.92)	4.03 (0.94)	4.07 (0.92)	3.9 (0.98)
School *n*	55	83	57	76	78	42
School Demographic						
State school (0/1)	0.53	0.54	0.51	0.55	0.51	0.57
Boarding school (0/1)	0.09	0.1	0.14	0.11	0.1	0.1
North America (0/1)	0.35	0.36	0.37	0.37	0.36	0.36
Student enrollment						
Total # DP full-time students	104.81 (95.96)	106.17 (161.97)	102.39 (95.72)	107.25 (168.77)	112.24 (165.68)	103.81 (79.67)
Total # DP half-time students	26.52 (56.99)	35.13 (90.4)	32.99 (101.55)	36.11 (92.83)	36.15 (92.64)	25.31 (60.79)
Total # DP students	131.33 (114.77)	141.3 (182.92)	135.38 (142.49)	143.37 (190.52)	148.4 (186.6)	129.11 (100.59)
Teacher composition						
Proportion of teachers teaching DP	41.66 (23.83)	38.11 (24.05)	41.28 (25.77)	38.52 (23.67)	40.97 (24.78)	40.47 (22.7)
Proportion of first language students	66.77 (27.43)	68.74 (27.33)	72.01 (25.9)	67.98 (26.53)	69.79 (27.36)	67.69 (27.23)
Proportion of fully certified teachers	90.56 (14.79)	91.35 (14.9)	89.38 (17.57)	91.63 (12.77)	90.77 (15.42)	88.74 (18.98)
DP student-teacher ratio	4.9 (3.78)	5.6 (5.4)	6.09 (7.67)	5.6 (5.56)	6.34 (7.66)	5.49 (3.75)
School Policy						
Selectiveness of DP admission (0/1)	0.8	0.83	0.81	0.83	0.81	0.76
Use of assessment results (0/1)						
Stakes attached to formative assessment results	0.82	0.78	0.79	0.79	0.79	0.86
Instructional improvement based on formative assessment results	0.89	0.89	0.91	0.88	0.88	0.9
Stakes attached to DP exam results	0.75	0.71	0.7	0.71	0.74	0.79
Offering other program preparing students for university (0/1)	0.58	0.59	0.49	0.57	0.56	0.6
Instructional time						

	Degree Aspiration			University Aspiration		
	Decreased	Unchanged	Increased	Decreased	Unchanged	Increased
Total hours of school day	7.83 (1.94)	7.35 (1.97)	7.53 (2.09)	7.43 (2.02)	7.55 (1.97)	7.36 (1.9)
Number of weeks of instruction per academic year	34.86 (11.75)	36.38 (13.17)	36.04 (22.47)	35.25 (14.19)	37.39 (19.45)	35.33 (12.66)
School Environment						
DP academic press (1-6)	4.33 (1.07)	4.4 (1.05)	4.34 (1.07)	4.4 (1.05)	4.42 (1.04)	4.5 (1.04)
DP student community (1-5)	4.03 (0.84)	4.04 (0.83)	4.11 (0.72)	4.06 (0.86)	4.02 (0.79)	4.22 (0.55)
Teacher collaboration						
DP teacher community (1-5)	3.54 (1.11)	3.38 (1.02)	3.46 (1.11)	3.44 (1.06)	3.4 (1.04)	3.58 (0.99)
# collaborative meetings per month	2.82 (2.33)	2.56 (2.24)	2.71 (2.23)	2.45 (2.11)	2.69 (2.27)	2.74 (2.21)
DP student-teacher relationship (1-4)	3.51 (0.71)	3.5 (0.7)	3.51 (0.73)	3.49 (0.7)	3.55 (0.65)	3.45 (0.77)
Student absenteeism (1-4)	2.83 (0.88)	2.95 (0.86)	2.94 (0.87)	2.87 (0.91)	2.96 (0.8)	2.77 (0.92)
Teacher absenteeism (1-4)	3.5 (0.77)	3.41 (0.84)	3.36 (0.81)	3.42 (0.85)	3.44 (0.75)	3.34 (0.93)
Parent expectation (1-6)						
High academic achievement	4.36 (1.25)	4.27 (1.34)	4.25 (1.37)	4.22 (1.36)	4.29 (1.34)	4.24 (1.34)
Low academic stress	3.29 (1.28)	3.41 (1.27)	3.22 (1.19)	3.42 (1.27)	3.37 (1.24)	3.3 (1.14)
Parent involvement						
School involvement of parents (1-6)	4.48 (0.99)	4.55 (1)	4.47 (0.96)	4.55 (1.01)	4.47 (0.94)	4.62 (0.91)
Proportion of parents participating in school activities/organizations	36.78 (21.82)	34.53 (23.46)	34.37 (21.48)	33.59 (22.53)	35.26 (22.43)	36.64 (23.17)