Postsecondary Outcomes of IB Diploma Programme Graduates in the U.S.

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Executive Summary

The International Baccalaureate's (IB's) 2-year Diploma Programme (DP) includes courses in six subject groups that emphasize interdisciplinary understanding and critical thinking skills. IB commissioned SRI Education to draw on multiple extant data sets to examine and summarize postsecondary outcomes of IB DP graduates in the United States.

- Our analyses indicate that DP graduates experience more positive postsecondary outcomes than the average American high school graduate.
  - In 2013, 82.2 percent of DP graduates enrolled in postsecondary institutions, as compared to 66 percent of all high school graduates. The vast majority of DP graduates enrolled in 4-year institutions (74.7 percent), as compared to 40 percent of all high school graduates.
  - Of the 2013 DP graduates who enrolled in 4-year postsecondary institutions, 88.1 percent were still enrolled in the fall of their second year. As a comparison, 80 percent of all students who enrolled in 4-year institutions in 2013 returned the following fall.
  - Of the 2013 DP graduates who enrolled in 4-year postsecondary institutions, 61.6 percent graduated after 4 years, as compared to 41.1 percent of all students in the United States.
- Additionally, diploma candidates experienced more positive postsecondary outcomes than course students, and diploma candidates who ultimately received an IB diploma experienced more positive postsecondary outcomes than diploma candidates who did not receive a diploma. Specifically, our analysis showed that:
  - 81.9 percent of diploma candidates enrolled directly in a 4-year institution, as compared to 67.6 percent of course students, and 84.5 percent of diploma candidates who received their diploma enrolled in 4-year institutions, as compared to 76.4 percent of diploma candidates who did not receive a diploma.
  - 90.4 percent of diploma candidates persisted into their second year of college, as compared to 85.4 percent of course students, and 92.9 percent of diploma candidates who received their diploma persisted into their second year of college, as compared to 84.9 percent of diploma candidates who did not receive a diploma. The differences are slightly greater when we examine students' persistence into their third year of college. The 2-year persistence rate for diploma candidates was 84.8 percent, as compared to 77.5 percent for course students, and 88.7 percent for diploma candidates who received a diploma, as compared to 75.9 percent of those who did not receive a diploma.

  - 66.5 percent of diploma candidates earned a bachelor's degree in 4 years, as compared to 55.8 percent of course students. The difference between the 4-year graduation rate for diploma candidates who received a diploma and diploma candidates who did not receive a diploma was even greater (74.4 percent vs. 48.3 percent).

- For all categories of DP graduates, students who enrolled in *more selective* postsecondary institutions experienced more positive outcomes than those who attended *selective* or *inclusive* institutions. Notably, we found that:
  - 91.4 percent of DP graduates who enrolled in *more selective* 4-year institutions persisted into their second year of college and 86.9 percent persisted into their third year of college, whereas 83.8 percent of DP graduates enrolled in *selective* institutions persisted into their second year of college and 74.9 percent persisted into their third year of college. Among DP graduates enrolled in *inclusive* institutions, 78.6 percent persisted into their second year of college and 66.2 percent persisted into their third year of college.
  - 70.1 percent of DP graduates who enrolled in *more selective* 4-year institutions graduated after 4 years, as compared to 48.8 percent of DP graduates enrolled in *selective* institutions and 37.8 percent of DP graduates enrolled in *inclusive* institutions.

- For students attending *more selective* and *selective* postsecondary destinations, the most popular destinations were large public universities, especially those in Florida. The most common majors for DP graduates who earned a 4-year degree ranged from biology to liberal arts to engineering and business.
  - The five most popular *more selective* postsecondary institutions for 2013 DP graduates include the University of Florida, Florida State University, Virginia Polytech and State University, University of Colorado Boulder, and University of Virginia. The most popular *selective* postsecondary institutions include University of Central Florida, University of South Florida, Virginia Commonwealth University, Oregon State University, and University of Arizona.
  - The most common majors for 2013 DP graduates who earned a 4-year degree include Biological and Biomedical Sciences; Liberal Arts and Sciences, General Studies and Humanities; Engineering; Business, Management, Marketing, and Related Support; and Health Professions and Related Clinical Sciences.

- By summarizing the relationship between school- and student-level predictors, this report demonstrates that many of the national trends, such as lower college enrollment and graduation rates for low-income and underrepresented minority students, persisted among

DP graduates. This analysis also showed that indicators of intensive IB participation and performance were associated with postsecondary education success.

- For course students, IB participation and performance were positively associated with postsecondary outcomes. The more IB assessments taken by a student, the greater their odds of enrolling in college and graduating (odds ratio of 1.32). Performance on these assessments was even more predictive of college success. Average assessment score had the strongest positive relationship of any of the variables we considered with college persistence (odds ratio of 1.35) and with graduation (odds ratio of 1.56).
- For diploma candidates, total points earned toward the diploma was positively associated with college enrollment, persistence, and graduation. Further, our analysis suggests that the bonus points students can earn from the Theory of Knowledge course and extended essay, which are part of the total points students can earn toward the diploma, were particularly effective at identifying students who were likely to succeed in college by earning a degree in 4 years. The strength of the relationship between bonus points, which depend on strong writing and self-management skills, and college success is consistent with research that highlights the importance of both writing and interpersonal skills to academic success (Belfield et al., 2015; Conley, 2010; Farrington et al., 2012; Geiser & Studley, 2004).

Introduction

The International Baccalaureate (IB) is a nonprofit educational organization with a 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's 2-year Diploma Programme (DP), first established in 1968, is currently offered to students ages 16 through 19 in almost 3,300 schools in 153 countries (IB, 2019). The DP curriculum includes courses in six subject groups that emphasize interdisciplinary understanding and critical thinking skills. To earn an IB diploma, students must complete requirements across the subject groups in addition to a Theory of Knowledge course, an extended essay, and a project that integrates creativity, activity, and service.

IB commissioned SRI Education, a division of SRI International, to examine and summarize postsecondary outcomes of IB Diploma Programme students in the United States. More specifically, this report addresses the following research questions:

(1) What are the postsecondary enrollment rates of DP graduates in comparison with national benchmarks? What are the enrollment rates at 4-year institutions by selectivity index?

(2) What are DP graduates' 1- and 2-year postsecondary persistence rates in comparison with national benchmarks? What are the persistence rates at 4-year institutions by selectivity index?

(3) What are DP graduates' postsecondary graduation rates in comparison with national benchmarks? What are the graduation rates at 4-year institutions by selectivity index?

(4) What are the most popular postsecondary destinations by institutional selectivity?

(5) Which majors do DP graduates pursue at 4-year postsecondary institutions?

(6) What factors predict postsecondary enrollment, persistence, and graduation for DP graduates? Do DP graduates' enrollment, persistence, and graduation vary based on student characteristics and high school characteristics? What is the relationship between participation and performance in the Diploma Programme and postsecondary outcomes?

Literature Review

Participation and success in postsecondary education are associated with a wide variety of positive outcomes in the United States today. College graduates are more likely to be employed

and enjoy higher median earnings than individuals with a high school degree only. In 2015, the median earnings of bachelor's degree recipients were $24,600 (67 percent) higher than those of high school graduates, and the unemployment rate for college graduates was about half of that for high school graduates (Ma, Pender, & Welch, 2016). Higher levels of educational attainment are also associated with positive health outcomes, increased civic engagement, and decreased reliance on public assistance (Ma et al. 2016).

Despite this evidence, the immediate college enrollment rate, or the percentage of high school graduates[1] who enroll in 2- or 4-year colleges in the fall immediately following high school, has not increased significantly since 2010 (McFarland et al., 2018). Seventy percent of students who completed high school in 2016 were enrolled in college by October of that year (McFarland et al., 2018). Six-year college completion rates have increased slightly from 58 percent to 60 percent between 2010 and 2016 (Aud et al., 2012; McFarland et al., 2018).

Previous research has found that, descriptively, DP participants enroll, persist, and graduate from college at higher rates than students who did not participate in the IB programme, though these studies do not assess the relatively high academic achievement and motivation of students attracted to the Diploma Programme relative to their peers (Bergeron, 2015; Caspary, 2011). Two studies used quasi-experimental methods to control for some of those observable differences between DP and non-DP students and found similar benefits (Coca et al., 2012; Saavedra, 2011). Coca et al. (2012) found that DP students in Chicago were more likely than students in a matched comparison group to enroll in a 4-year college, enroll in a more selective college, and persist for 2 years at a 4-year college once enrolled. Saavedra (2011) also examined outcomes for DP students in Chicago and found that enrollment in the full IB Diploma Programme increased students' probability of enrolling in college by 38 percent. In addition to these critical postsecondary outcomes, Inkelas and colleagues (2012) found that former DP students were well prepared to participate in undergraduate research experiences, possibly due to completion of the IB extended essay requirement in high school. Other research also suggests that students who participated in the IB programme in high school reported feeling well prepared for the academic demands of postsecondary education (Coca et al., 2012; Conley et al., 2014). However, students who chose to participate in the Diploma Programme may differ from non-DP students on a range of observable and unobservable characteristics; although the two quasi-experimental studies described above controlled for the available observable characteristics of DP and non-DP students, unobserved differences between these groups may bias the findings. None of these descriptive, quasi-experimental, or qualitative studies can conclude definitively that the Diploma Programme had a causal impact on postsecondary outcomes.

[1] The Current Population Survey, which collects this data, defines high school graduates as those who have received a high school diploma or the equivalent (e.g., GED).

Methodology

This study draws on multiple extant data sources to examine the postsecondary enrollment, persistence, and graduation rates of DP students, and uses both descriptive statistics and multilevel modeling.

Data Sources

This study combines data from a variety of sources, including from the IB Information System (IBIS), the National Student Clearinghouse (NSC), the Carnegie Classifications of Institutions of Higher Education (CCIHE), the Integrated Postsecondary Education Data System (IPEDS), and the Common Core of Data (CCD) to examine postsecondary outcomes of the 2013 cohort of DP graduates in the United States. Specific data elements from each of these sources were used (Exhibit 1).

Exhibit 1. Data Sources

Data Source	Year	Data Element
International Baccalaureate Information System (IBIS)	2013	Results on IB assessments, programme type (e.g., full diploma, course students)
National Student Clearinghouse (NSC)	2013–17	Enrollment dates, status (full/half-time), degree earned, institution-level (2-/4-year)
Integrated Postsecondary Education Data System (IPEDS)	2011 cohort	4-year graduation rates for U.S. postsecondary institutions
Carnegie Classification of Institutions of Higher Education (CCIHE)	2015 classifications based on data from 2013 and 2014	Institutional selectivity
Common Core of Data (CCD)	2012–13	Characteristics of U.S. public high schools

International Baccalaureate Information System (IBIS)

The International Baccalaureate collects data on students who register for IB assessments. Students who are enrolled in the full IB Diploma Programme for their last 2 years of high school are considered diploma candidates, whereas students who take at least one IB exam in their junior or senior year of high school without the intention of completing the IB diploma are classified as IB course students. To be awarded the IB diploma, students must fulfill a variety of requirements, including taking at least six IB assessments in different subject areas (scored 1 to 7) and earning a total of 24 points toward the diploma, through their scores on these assessments and fulfilling the other diploma requirements. In 2013, 79 percent of diploma

candidates worldwide earned the IB diploma (IB, 2013). In this study, both diploma candidates and course students are considered DP graduates.

National Student Clearinghouse (NSC)

The NSC provides a central repository of enrollment and degree information for more than 3,600 participating postsecondary institutions. Using these data, the NSC offers a variety of services, including fulfilling postsecondary transcript requests and verifying student enrollment and degree completion. The NSC also offers Student Tracker, the service that we drew on for this analysis, to track enrollments across multiple institutions.

We used these data to examine the following postsecondary outcomes: immediate enrollment, 1-year and 2-year persistence, and 4-year graduation. These outcomes are operationalized and defined in Exhibit 2.

Exhibit 2. Definitions of Postsecondary Outcomes for Diploma Programme Graduates

	Definition
Immediate enrollment	Enrollment at an NSC-participating college or university immediately after high school graduation (between August 2013 and January 31, 2014).
1-year persistence	Enrollment at the same 4-year college or university in the fall after immediate enrollment (persisting into second year of college). In addressing research question 6 only, this definition is broadened to include persistence at any 4-year institution given an immediate 4-year enrollment after high school.
2-year persistence	Enrollment at the same 4-year college or university in the fall 2 years after immediate enrollment (persisting into third year of college).
4-year graduation	Graduation by the end of August 4 years after immediate enrollment at a 4-year college or university.

Integrated Postsecondary Education Data System (IPEDS)

The IPEDS includes aggregate-level data from over 7,500 postsecondary institutions that participate in any federal financial aid program authorized by Title IV of the Higher Education Act of 1965. These data are collected by the National Center for Education Statistics (NCES) via a series of interrelated surveys throughout the year. In this study, we accessed graduation rates for the 2011 cohort, which is the most recent cohort with these data available in IPEDS, to contextualize the postsecondary outcomes for the 2013 DP graduates.

Carnegie Classification of Institutions of Higher Education (CCIHE)

The CCIHE, originally developed by the Carnegie Commission on Higher Education, is currently published by the Center for Postsecondary Research at Indiana University. The framework is based on data from IPEDS and the National Science Foundation (NSF) and classifies 4-year

institutions as *more selective*, *selective*, or *inclusive*, based on full-time enrollment and college admissions test scores (Exhibit 3).

Exhibit 3. Categorization of 4-year Institutions with Predominantly Full-Time Enrollments

	Full-time 4-year institutions[a]
More selective	• At least 80 percent of undergraduates enrolled full time • College admission test scores (SAT I or ACT composite) for incoming freshmen in the top fifth of bachelor's degree-granting institutions
Selective	• At least 60 percent of undergraduates enrolled full time • College admission test scores (SAT I or ACT composite) for incoming freshmen in the middle two fifths of bachelor's degree-granting institutions
Inclusive	• At least 60 percent of undergraduates enrolled full time • College admission test score data not submitted, or in the bottom two fifths of bachelor's degree-granting institutions

[a] The Carnegie Classification's selectivity categorizations are based on the 25th percentile test score for each institution's incoming freshman class.

The 2015 Carnegie Classifications are based on data from 2013 and 2014, and include all institutions that conferred at least one academic degree in the 2013–14 academic year. In 2015, the Carnegie Classifications included 2,327 full-time 4-year institutions. Eighteen percent of those institutions (422) were considered *more selective*, 27 percent (624 institutions) were considered *selective*, and 55 percent (1,281 institutions) were considered *inclusive*.

Common Core of Data (CCD)

The CCD is another set of data collected by NCES, which describes public elementary and secondary schools and school districts across the United States. The CCD includes data on student enrollment, overall and by grade level, race and ethnicity, and poverty, as well as financial data on revenues and expenditures. In this study, we use school-level demographic data from the 2012–13 CCD, the cohort of DP graduates' final year of high school.

Analysis Methods

We addressed research questions 1 through 5 using univariate and bivariate descriptive statistics. These analyses were performed using SAS version 9.4. In creating a student level DP student file from the IBIS data, we dropped all invalid assessment records, including withdrawals. Students were classified as diploma candidates or course students based on their 2013 category status. Students who took an IB course in 2012 only (as an 11th grader) were classified as course students. We excluded from this analysis data corresponding to approximately 5,000 DP graduates with a foreign or joint foreign and U.S. nationality.

Preliminary analysis indicated that these students had lower postsecondary enrollment rates than domestic students, possibly because they were more likely to attend a postsecondary institution outside of the United States. Because of the likelihood that outcome data were disproportionately missing for these students, this analysis focuses on domestic students only. Further, course student and diploma candidates have slightly different demographic characteristics, very different IB assessment taking patterns, and may also differ on level of prior achievement; thus, all summary statistics are provided for DP students overall and separately for course students and diploma candidates.

To address research question 6, we used multilevel generalized linear models to examine the relationship between student and school characteristics and postsecondary outcomes for DP students, as well as between DP participation and performance and these postsecondary outcomes. The SAS PROC GLIMMIX command was used for all models, with students nested in schools (school code as the level-2 class variable). See the appendix for more detail.

All outcomes are binary, and the appendix contains the untransformed logit results (Exhibits A-3a through A-20a) and the odds ratios (Exhibits A-3b through A-20b). For ease of interpretation, the body of the report presents odds ratios, or the predicted change in odds for each predictor variable.

The standard $p < 0.05$ threshold to determine statistical significance is used to identify relationships to highlight in the body of the report. Because of the strong correlation among many of the predictors, these were added first at the school level, and then at the student level, and in some cases one at a time to isolate their relationship with the outcome.

Findings

We found that 37,348 students graduated from high school in 2013 having participated in the IB Diploma Programme, representing an even split between course students and diploma candidates (Exhibit 4).[2] These DP graduates were disproportionately female (59 percent) and most attended public schools (93 percent). Our analysis showed 58 percent of those DP graduates were White and non-Hispanic, 14 percent were Hispanic, 13 percent were Asian or Pacific Islander, 11 percent were Black and non-Hispanic, 4 percent identified as some other race, and 1 percent were American Indian or Alaska Native. Few 2013 DP graduates were eligible for free or reduced-price meals (22 percent) or demonstrated limited proficiency in English (< 1 percent). As a comparison, 91 percent of all U.S. high school graduates in 2013 attended public schools, and about 50 percent of those public high school graduates were female. About 57 percent of 2013 U.S. public high school graduates were White and non-Hispanic, 20 percent were Hispanic, 15 percent were Black and non-Hispanic, 6 percent were

[2] Excludes students with foreign or joint foreign and U.S. nationality.

Asian/Pacific Islander, and 1 percent were American Indian or Alaska Native (Snyder, de Brey, & Dillow, 2016). DP students were more likely to be Asian/Pacific Islander and less likely to be Black or Hispanic than the national population of public high school graduates.

Black and Hispanic students were further underrepresented among DP graduates who ultimately earned the IB diploma, and low-income students earned the diploma at disproportionately low rates as well. Six percent of DP graduates who received the IB diploma were Black, 10 percent were Hispanic, and 13 percent were eligible for free or reduced-price meals. Exhibit 4 presents this descriptive information about the 2013 IB cohort of DP graduates used in the analysis.

Exhibit 4. Characteristics of 2013 U.S. Diploma Programme Graduates

				Diploma Candidates	
	All DP Graduates (Diploma and Course Students)	Course Students	Diploma Candidates	Diploma Received	Diploma Not Received
N (public and private schools)	37,348	18,688	18,660	12,617	6,043
Gender					
Female	59.3%	59.0%	59.7%	60.7%	57.6%
Male	40.7%	41.0%	40.3%	39.3%	42.4%
School type					
Private	7.0%	7.4%	6.7%	7.6%	4.8%
Public	93.0%	92.6%	93.3%	92.4%	95.2%
N (public schools only)	34,722	17,303	17,419	11,664	5,755
Race/ethnicity					
American Indian/Alaska Native	0.5%	0.7%	0.3%	0.3%	0.3%
Asian/Pacific Islander	12.5%	9.7%	15.3%	16.7%	12.5%
Black, non-Hispanic	11.3%	11.1%	11.4%	5.9%	22.5%
Hispanic	13.8%	14.8%	12.8%	9.9%	18.6%
White, non-Hispanic	58.0%	59.7%	56.3%	63.2%	42.3%
Other	3.9%	3.8%	3.9%	4.0%	3.7%
Free or reduced-price meals					
Eligible	21.9%	23.6%	20.2%	13.1%	34.7%
Not eligible	78.1%	76.4%	79.8%	86.9%	65.3%
English proficiency					
Proficient	99.7%	99.6%	99.8%	99.9%	99.7%
Limited proficiency	0.3%	0.4%	0.2%	0.1%	0.3%

Note: Data on ethnicity, income status, and English proficiency are available for public school students only.

Postsecondary Enrollment, Persistence, and Graduation Rates of DP Graduates

This section discusses the postsecondary outcomes of DP graduates, including immediate college enrollment rates, 1- and 2-year persistence rates, and 4-year graduation rates (Exhibits 5 through 7). We present findings for all DP graduates combined, then separately for course students and diploma candidates, and then separately for diploma candidates who ultimately received an IB diploma and those who did not receive an IB diploma. These outcomes are also presented separately for DP graduates enrolled in *more selective*, *selective*, and *inclusive* institutions, based on the Carnegie Classification of Institutions of Higher Education.

Immediate Enrollment

Over 82 percent of DP graduates in the United States enrolled in college immediately after graduating from high school, the vast majority of whom enrolled in 4-year institutions (Exhibit 5). Nearly 75 percent of DP graduates enrolled in 4-year institutions and 7 percent enrolled in 2-year institutions. As a comparison, 66 percent of all 2013 U.S. high school graduates enrolled immediately in colleges or universities; about 40 percent enrolled in 4-year institutions and 26 percent enrolled in 2-year institutions (Bureau of Labor Statistics, 2014).

A greater percentage of DP graduates in all categories—course students, diploma candidates, diploma candidates who received an IB diploma, and those who did not receive the diploma—enrolled in *more selective* institutions than in *selective* or *inclusive* institutions. However, immediate college enrollment rates at *more selective* 4-year institutions were higher for diploma candidates (70.2 percent) than for course students (57 percent), and higher for diploma candidates who received an IB diploma (78 percent) than for those who did not receive the diploma (52.2 percent). In contrast, immediate college enrollment rates at *selective* and *inclusive* 4-year institutions were higher for course students (32.2 percent and 8 percent, respectively) than for diploma candidates (23.3 percent and 3.4 percent), and higher for diploma candidates who did not receive the IB diploma (35.4 percent and 7.6 percent) than for those who did (18 percent and 1.6 percent).

Exhibit 5. Immediate College Enrollment Rates of 2013 U.S. Diploma Programme Graduates Enrolled in U.S. Postsecondary Institutions

	All DP Graduates (Diploma and Course Students)	Course Students	Diploma Candidates	Diploma Candidates	
				Diploma Received	Diploma Not Received
N (Overall)	37,348	18,688	18,660	12,617	6,043
Immediate college enrollment (2- or 4-year institution)	82.2%	79.7%	84.6%	85.6%	82.6%
Immediate 2-year enrollment	7.4%	12.1%	2.7%	1.1%	6.1%
Immediate 4-year enrollment	74.7%	67.6%	81.9%	84.5%	76.4%
No immediate U.S. college enrollment	17.8%	20.3%	15.4%	14.4%	17.4%
N (Immediate 4-year enrollment)	27,915	12,639	15,276	10,658	4,618
More selective	64.2%	57.0%	70.2%	78.0%	52.2%
Selective	27.4%	32.3%	23.3%	18.0%	35.4%
Inclusive	5.5%	8.1%	3.4%	1.6%	7.6%
Missing selectivity	2.9%	2.6%	3.1%	2.4%	4.8%

Persistence

Eighty-eight percent of DP graduates who enrolled in a 4-year postsecondary institution immediately after graduating high school were enrolled in the same institution the following fall (Exhibit 6). As a comparison, 80 percent of all U.S. students who enrolled in 4-year institutions in 2013 returned the following fall (Kena et al., 2016).

Persistence rates at *more selective* institutions were higher than persistence rates at *selective* or *inclusive* institutions for all categories of DP graduates. At *more selective*, *selective*, and *inclusive* institutions, persistence rates for diploma candidates were higher than persistence rates for course students, and persistence rates for diploma candidates who received an IB diploma were higher than persistence rates for diploma candidates who did not ultimately receive a diploma.

Exhibit 6. One- and 2-Year Persistence Rates of 2013 Diploma Programme Graduates Enrolled in U.S. 4-Year Postsecondary Institutions

				Diploma Candidates	
	All DP Graduates (Diploma and Course Students)	Course Students	Diploma Candidates	Diploma Received	Diploma Not Received
N (Immediate 4-year enrollment)	27,915	12,639	15,276	10,658	4,618
N (Immediate 4-year more selective enrollment)	17,918	7,199	10,719	8,308	2,411
N (Immediate 4-year selective enrollment)	7,644	4,085	3,559	1,923	1,636
N (Immediate 4-year inclusive enrollment)	1,549	1,030	519	170	349
1-year persistence rate	88.1%	85.4%	90.4%	92.9%	84.9%
More selective	91.4%	89.5%	92.8%	94.1%	88.2%
Selective	83.8%	81.4%	86.7%	90.6%	82.1%
Inclusive	78.6%	77.3%	81.1%	84.7%	79.4%
2-year persistence rate	81.5%	77.5%	84.5%	88.7%	75.9%
More selective	86.9%	84.1%	88.9%	90.9%	81.8%
Selective	74.9%	71.2%	79.2%	85.2%	72.2%
Inclusive	66.2%	64.9%	69.0%	73.5%	66.8%

Graduation

Sixty-two percent of 2013 DP graduates who enrolled in 4-year institutions immediately after high school graduated after 4 years (Exhibit 7). As a comparison, 41.1 percent of all students who began seeking a bachelor's degree at a 4-year institution in 2011 graduated after 4 years (IPEDS, 2017).

Four-year graduation rates at *more selective* institutions were higher than graduation rates at *selective* or *inclusive* institutions for all categories of DP graduates. At *more selective*, *selective*, and *inclusive* institutions, graduation rates for diploma candidates were higher than graduation rates for course students, and graduation rates for diploma candidates who received an IB diploma were higher than graduation rates for diploma candidates who did not ultimately receive a diploma.

Exhibit 7. Four-Year Graduation Rates of 2013 Diploma Programme Graduates Enrolled in U.S. 4-Year Postsecondary Institutions

	All DP Graduates (Diploma and Course Students)	Course Students	Diploma Candidates	Diploma Candidates	
				Diploma Received	Diploma Not Received
N (Immediate 4-year enrollment)	27,915	12,639	15,276	10,658	4,618
N (Immediate 4-year more selective enrollment)	17,918	7,199	10,719	8,308	2,411
N (Immediate 4-year selective enrollment)	7,644	4,085	3,559	1,923	1,636
N (Immediate 4-year inclusive enrollment)	1,549	1,030	519	170	349
4-year graduation rate	61.6%	55.8%	66.5%	74.4%	48.3%
More selective	70.1%	65.8%	73.0%	77.6%	57.0%
Selective	48.8%	44.9%	53.4%	63.9%	41.1%
Inclusive	37.8%	35.0%	43.4%	59.4%	35.5%

Most Popular Postsecondary Destinations and Courses of Study for DP Graduates

This section discusses the most popular *more selective* and *selective* postsecondary destinations for 2013 DP graduates (Exhibits 8 and 9). We also present the 4-year graduation rates of DP graduates at those institutions and the overall institutional graduation rates from IPEDS. At the vast majority of these institutions, the 4-year graduation rate of DP graduates was higher than the 4-year graduation rate for the institution as a whole.

Many of the most popular postsecondary destinations were located in Florida and Virginia. Four of the top five *more selective* institutions, and three of the top five *selective* institutions were located in one of those two states. The most popular postsecondary destinations also tended to be large public universities, possibly because they had larger overall student enrollments, so they may have been more likely to enroll DP graduates as well.

The most common *more selective* 4-year institution for 2013 DP graduates was the University of Florida (Exhibit 8). Of the 2013 DP graduates, 900 or 3.2 percent who enrolled in a 4-year institution attended the University of Florida. The 4-year graduation rate for those DP graduates was 67.4 percent, as compared to 68.0 percent for the institution as a whole.

The most common *selective* 4-year institution for 2013 DP graduates was the University of Central Florida (Exhibit 9). Of the 2013 DP graduates, 316 or 1.1 percent who enrolled in a 4-year institution attended the University of Central Florida. The 4-year graduation rates for those DP graduates was 40.5 percent, as compared to 40.3 percent for the institution as a whole.

Exhibit 8. More Selective 4-Year Postsecondary Institutions Enrolling the Highest Number of 2013 U.S. Diploma Programme Graduates

		DP Graduates		4-Year Graduation Rate	
Rank	School	Number	Percent[a]	DP Graduates	Institution[b]
1	University of Florida	900	3.2%	67.4%	68.0%
2	Florida State University	468	1.7%	74.8%	62.6%
3	Virginia Polytech and State University	320	1.1%	68.1%	63.4%
4	University of Colorado Boulder	287	1.0%	58.9%	45.3%
5	University of Virginia	287	1.0%	89.9%	88.3%
6	University of Washington, Seattle	275	1.0%	73.5%	65.0%
7	University of Michigan	263	0.9%	84.8%	77.1%
8	James Madison University	248	0.9%	67.7%	57.7%
9	George Mason University	244	0.9%	42.6%	48.9%
10	University of Minnesota, Twin Cities	237	0.8%	65.4%	63.6%
11	Arizona State University	231	0.8%	59.7%	45.5%
12	The Ohio State University	224	0.8%	60.7%	58.6%
13	University of South Carolina	221	0.8%	65.6%	58.1%
14	University of California, Los Angeles	214	0.8%	71.0%	74.8%
15	University of Oregon	212	0.8%	67.0%	51.8%
16	University of North Carolina - Chapel Hill	208	0.7%	86.5%	84.0%
17	University of Texas at Austin	204	0.7%	59.8%	57.8%
18	University of Georgia	203	0.7%	66.0%	61.5%
19	University of Maryland, College Park	200	0.7%	70.5%	66.9%
20	University of Wisconsin, Madison	197	0.7%	60.9%	60.3%
21	University of California, Berkeley	189	0.7%	87.3%	75.8%
22	University of California, San Diego	170	0.6%	58.2%	55.1%
23	University of California, Davis	168	0.6%	59.5%	57.9%
24	Michigan State University	167	0.6%	68.9%	51.7%
25	Texas A & M University	161	0.6%	59.0%	54.0%

[a] Percent of DP graduates who enrolled in a 4-year college or university immediately after high school (*N* = 27,915).
[b] National Center for Education Statistics Integrated Postsecondary Data System, 2011 cohort.

Exhibit 9. Selective 4-Year Postsecondary Institutions Enrolling the Highest Number of 2013 U.S. Diploma Programme Graduates

		DP Graduates		4-Year Graduation Rate	
Rank	School	Number	Percent[a]	DP Graduates	Institution[b]
1	University of Central Florida	316	1.1%	40.5%	40.3%
2	University of South Florida	304	1.1%	60.2%	51.3%
3	Virginia Commonwealth University	275	1.0%	52.7%	39.5%
4	Oregon State University	205	0.7%	37.6%	33.3%
5	University of Arizona	142	0.5%	53.5%	45.1%
6	Florida International University	100	0.4%	44.0%	26.7%
7	University of North Texas	95	0.3%	43.2%	29.0%
8	University of Wisconsin, Milwaukee	94	0.3%	18.1%	14.8%
9	Old Dominion University	93	0.3%	28.0%	27.3%
10	California State University, Fullerton	85	0.3%	29.4%	21.9%
11	University of Utah	78	0.3%	46.2%	31.1%
12	Georgia State University	75	0.3%	40.0%	23.5%
13	Grand Valley State University	75	0.3%	42.7%	35.7%
14	Washington State University	73	0.3%	46.6%	38.0%
15	University of Houston	72	0.3%	37.5%	25.2%
16	Missouri State University	69	0.2%	43.5%	31.4%
17	East Carolina University	67	0.2%	46.3%	36.7%
18	University of Colorado Denver	63	0.2%	23.8%	23.1%
19	Howard University	62	0.2%	67.7%	43.4%
20	California State University, Long Beach	61	0.2%	26.2%	16.1%
21	San Jose State University	61	0.2%	9.8%	10.1%
22	Florida Atlantic University	61	0.2%	41.0%	23.9%
23	Northern Arizona University	60	0.2%	60.0%	40.3%
24	University of Hawaii at Manoa	60	0.2%	36.7%	27.9%
25	Ohio University	59	0.2%	44.1%	44.4%

[a] Percent of DP graduates who enrolled in a 4-year college or university immediately after high school (*N* = 27,915).
[b] National Center for Education Statistics Integrated Postsecondary Data System, 2011 cohort.

Exhibit 10 presents the most common majors pursued by DP graduates who graduated from 4-year institutions. Over 13 percent of 2013 DP graduates who graduated from a 4-year institution earned a degree in biological and biomedical sciences; 11.8 percent earned a degree in liberal arts and sciences, general studies and humanities, and 11 percent earned a degree in engineering.

Exhibit 10. Most Frequent Majors of 2013 U.S. Diploma Programme Graduates Earning 4-Year Postsecondary Degrees

		DP Graduates	
Rank	Major	Number	Percent[a]
1	Biological and Biomedical Sciences	2,070	13.2%
2	Liberal Arts and Sciences, General Studies and Humanities	1,847	11.8%
3	Engineering	1,726	11.0%
4	Business, Management, Marketing, and Related Support	1,502	9.6%
5	Health Professions and Related Clinical Sciences	942	6.0%
6	Social Sciences	828	5.3%
7	Visual and Performing Arts	820	5.2%
8	Multi/Interdisciplinary Studies	618	3.9%
9	Psychology	616	3.9%
10	Physical Sciences	392	2.5%
11	Computer and Information Sciences and Support Services	361	2.3%
12	Education	347	2.2%
13	Not Declared	332	2.1%
14	English Language and Literature/Letters	232	1.5%
15	Parks, Recreation, Leisure and Fitness Studies	225	1.4%
16	Unknown	224	1.4%
17	Mathematics and Statistics	143	0.9%
18	Security and Protective Services	130	0.8%
19	History	109	0.7%
20	Foreign Languages, Literatures, and Linguistics	101	0.6%
21	Family and Consumer Sciences/Human Sciences	71	0.5%
22	Public Administration and Social Service Professions	68	0.4%
23	Engineering Technologies/Technicians	59	0.4%
24	Philosophy and Religious Studies	39	0.2%
25	Legal Professions and Studies	19	0.1%

[a] Percent of DP graduates who enrolled in a 4-year college or university immediately after high school and graduated within four years (*N* = 15,715).

Predictors of Postsecondary Outcomes for DP Graduates

This section examines the factors that predict postsecondary enrollment, persistence, and graduation among the sample of 2013 domestic DP graduates. In this section, we broaden the definition of persistence and graduation to include any 4-year institution, not just the one where a student enrolled immediately after high school. Because of the different assessment-taking patterns of diploma candidates and course students, we present analyses separately for these two student groups. School-level compositional variables and all student demographics other than gender were available for DP graduates from U.S. public schools only. As a result, we limit the analytic sample for these analyses to domestic DP graduates from U.S. public schools. Ninety-three percent of all the DP graduates in 2013 attended public schools.

General Analytic Approach

For each group of DP graduates, we first examine postsecondary outcomes using bivariate descriptives, presenting 4-year college enrollment, persistence, and degree attainment by gender, income status, and ethnicity (Exhibits 11 and 13). We then provide the results of the multivariate analysis to examine the relationship between school- and student-level predictors, including IB performance, and these postsecondary outcomes. These analyses enable us to examine, as an example, the relationship between IB performance and college persistence after controlling for the limited demographic indicators available in the data. For more information about the hierarchical generalized linear models used, please see the appendix. The initial analytic sample for all analyses in this prediction section, including the descriptive tables, consists of all U.S. domestic public school students who have non-missing values for all school-and student-level predictors used in the models: 16,967 course students, and 17,094 diploma candidates.

We provide odds ratios for statistically significant estimates from key models in summary tables below (Exhibits 12 and 14). Full results for all models are in the appendix (Exhibit A-3 through A-20). A number of the predictors we examined were highly correlated, with Pearson's correlation of 0.50 or higher. For example, the two school compositional variables, percent eligible for free or reduced-price meals

Interpreting Odds Ratios

In the case of binary predictor variables, odds ratios represent the predicted odds of an outcome occurring for students with a value of 1 compared to those coded 0. For example, we can model the predicted odds of enrolling in college for male students (gender=1) compared with female students (gender=0). If this ratio is greater than 1, the odds of college enrollment are higher for men than women; if this ratio is less than 1, men have lower odds of enrolling in college than women. Thus, an odds ratio greater than 1 is a positive effect, and an odds ratio less then 1 is a negative effect. An odds ratio of 0.85 on the coefficient for male, for example, represents a 15 percent reduction in the predicted odds of enrolling in college for men compared with women. For a continuous variable, such as total points, the odds ratio represents the ratio of the predicted odds for earning an additional point, for example, the predicted odds of college enrollment for a diploma candidate who earned 25 points compared with one who earned 24 points.

and percent underrepresented minority students, have a correlation of 0.75 (course students) and 0.78 (diploma candidates). To avoid multicollinearity that renders the regression coefficients uninterpretable, these tables show the odds ratios for these correlated predictor variables entered in separate models.

- In summarizing the relationship between school composition variables and the postsecondary outcomes, we report on the results of two separate models, one with percent free or reduced-price meals and no other predictors, and the other with percent underrepresented minorities and no other predictors.
- In summarizing the relationship between student demographics and postsecondary outcomes, we report odds ratios from models with all demographic variables: gender, eligibility for free or reduced-price meals, and ethnicity, and no other school- or student-level predictors.
- In summarizing the relationship between IB performance and postsecondary outcomes, we report on the results of models that include all the student-level demographics in addition to IB participation and performance indicators, and no school-level predictors.

Because our sample is limited to students who took IB assessments, all findings are based on variability in performance among DP graduates; we cannot make any statements about DP graduates' postsecondary outcomes relative to those of students who did not take IB assessments. Further, we cannot disentangle whether the associations between DP participation and performance indicators and postsecondary outcomes were due to DP participation or to preexisting differences in the academic preparation of students who elected for more intensive DP participation or performed well on IB assessments. Given the results, however, we can conclude that strong DP performance was predictive of future postsecondary success.

Descriptive Analyses for Course Students

Without controlling for any other school or student characteristics, we find differences in postsecondary outcomes for course students based on gender, eligibility for free or reduced-price meals, and race/ethnicity (Exhibit 11). A greater percentage of female course students than male course students enrolled in a 4-year postsecondary institution after graduating from high school (67.7 percent vs. 64.8 percent). Of those students who enrolled immediately after high school, female students were also more likely to persist and graduate after 4 years. Additionally, course students who were eligible for free or reduced-price meals enrolled, persisted, and graduated from a 4-year institution at lower rates than course students who were not eligible for free or reduced-price meals, and White students enrolled, persisted, and

graduated from 4-year colleges or universities at higher rates than Asian/Pacific Islander, Black, or Hispanic students. These differences largely mirror national trends (McFarland et al., 2018).[3]

Exhibit 11. Descriptive Postsecondary Outcomes for Course Student Analytic Sample

	N (Full Sample)	Immediate 4-Year Enrollment[a]	*N (Immediate 4-Year Enrollment)*	1-Year Persistence[b]	4-Year Graduation[c]
Total	16,967	66.5%	11,278	84.9%	52.2%
Gender					
Female	9,894	67.7%	6,698	85.2%	56.8%
Male	7,073	64.8%	4,580	84.3%	45.4%
Free or reduced-price meals					
Eligible	3,948	55.0%	2,172	80.0%	33.5%
Not eligible	13,019	69.9%	9,106	86.0%	56.6%
Race/ethnicity					
Asian/Pacific Islander	1,669	61.4%	1,025	85.7%	48.0%
Black, non-Hispanic	1,886	68.2%	1,287	80.7%	35.7%
Hispanic	2,556	49.4%	1,263	82.5%	36.0%
White, non-Hispanic	10,072	71.5%	7,199	85.8%	58.6%
Other	784	64.3%	504	85.5%	52.2%

[a] Percent of course students who enrolled in a 4-year college or university immediately after high school.
[b] Percent of course students who enrolled in a 4-year college or university immediately after high school and were enrolled at any 4-year college in fall 2014.
[c] Percent of course students who enrolled in a 4-year college or university immediately after high school and earned a degree from a 4-year institution within 4 years.

Predictive Analyses for Course Students

Results of multilevel modeling show that school compositional variables and student demographics, along with intensity of IB participation and IB performance, were related to course students' postsecondary outcomes (Exhibit 12).

School composition: Between 5 and 12 percent of the variance in postsecondary outcomes for course students was at the high school level (see intraclass correlation in appendix exhibits A-3a, A-6a, and A-9a). Together, the two school compositional variables (percent minority and percent poverty) explained 59 percent of the variance in 4-year college graduation for these

[3] The exception is for the outcomes for Asian/Pacific Islander students, who generally experience more positive postsecondary outcomes than White students (McFarland et al., 2018; Shapiro et al., 2017). We hypothesize that these findings could be the result of subgroup differences that are masked by aggregating outcomes for all Asian/Pacific Islander students (Nguyen, Nguyen, Teranishi, & Hune, 2015; Valliani & Byrd, 2015). Disadvantaged and lower-performing subgroups of Asian/Pacific Islander students may be more likely to take a few IB courses, rather than pursue the full IB diploma, resulting in lower postsecondary outcomes for this group of Asian/Pacific Islander course students and more positive outcomes for Asian/Pacific Islander diploma candidates.

students (Exhibit A-9a). Course students who attended high-poverty or high-minority schools were less likely than their peers who attended schools with lower percentages of low-income or underrepresented minority students to enroll, persist, or earn a bachelor's degree in 4 years. Specifically, for each 10 percentage point increase in the percentage of students eligible for free or reduced-price meals at a course student's high school, his or her predicted odds of college enrollment were 9 percent lower (odds ratio of 0.91). For example, the predicted odds of college attendance were 9 percent lower for a course student who attended a school where 60 percent of students are eligible for free or reduced-price meals compared with one who attended a school where 50 percent are eligible for free or reduced-price meals. These trends are consistent with the relationship between school composition and postsecondary outcomes at the national level (National Student Clearinghouse Research Center, 2018).

The odds ratio associated with these school compositional variables is lowest for the model predicting graduation, indicating that the negative association between attending a high-poverty or high-minority school and postsecondary outcomes intensified the further students progressed in college. This finding is also reflected in the national trends: the gap between the graduation rates of students who attend high-poverty or high-minority schools and those who attend low-poverty or low-minority schools is greater than the gaps in enrollment or persistence rates (National Student Clearinghouse Research Center, 2018). For example, in 2018 students from high-poverty high schools were 23 percentage points less likely to enroll in college than their peers from low-poverty schools (54 percent vs. 77 percent), but those who enrolled were 35 percentage points less likely to graduate in 6 years (20 percent vs. 55 percent).

Because we have no measure of prior achievement, we do not know the extent to which course students at high-poverty or high-minority schools entered high school and the Diploma Programme with lower levels of achievement, on average, than their peers at lower poverty or lower minority schools. Alternatively, these findings may result from differences in the high school experience at high-poverty or high-minority schools, such as a less pervasive college-going culture or less rigorous academic preparation.

Student-level demographics: A number of individual student demographic characteristics were associated with lower odds of enrolling and graduating college; males and students eligible for free or reduced-price meals had lower predicted odds of enrolling and graduating than their female or higher income peers, respectively. The predicted odds of college enrollment were 15 percent lower for male course students compared with females (odds ratio of 0.85), and the predicted odds of graduating were 44 percent lower (odds ratio of 0.56). The predicted odds of college enrollment were 32 percent lower for students eligible for free or reduced-price meals compared with their higher income peers (odds ratio of 0.68), and the predicted odds of graduating were 40 percent lower (odds ratio of 0.60). Similarly, Asian (including Pacific Islanders) and Hispanic course students had lower predicted odds of enrolling and graduating than White course students. Black students had similar predicted odds of enrolling in college as

their White peers, but lower predicted odds of persisting to a second year and graduating: the predicted odds of persisting for a Black student were 18 percent lower than their White peers (odds ratio of 0.82), and graduation odds were 47 percent lower (odds ratio of 0.53). Being eligible for free or reduced-price meals was the only other demographic predictor associated with college persistence. The predicted odds of persisting to a second year for students eligible for free or reduced-price meals were 26 percent lower than those of their higher-income peers (odds ratio of 0.74).

IB performance: We examined the relationship between a variety of performance indicators and postsecondary outcomes after adjusting for students' demographic characteristics. Exhibit 12 shows the odds ratios for the number of assessments, average score, and an indicator of whether a student had taken a higher level (HL) assessment based on models that include these three variables in addition to the student demographics variables; it shows the odds ratios for an HL English indicator, math studies indicator, another standard level (SL) math indicator, and an HL math indicator from models that adjust for number of assessments and average score in addition to the student demographic variables.[4] The number of DP assessments taken, average exam score, and taking at least one exam at the higher level were all associated with higher predicted odds of enrolling, persisting, and graduating from college for course students. For example, each additional assessment taken by a student was associated with a 32 percent increase in the odds of college enrollment (odds ratio of 1.32), a 7 percent increase in the odds of persisting to a second year (odds ratio of 1.07), and a 12 percent increase in the odds of college graduation (odds ratio of 1.12). Additionally, taking the English language and literature exam at the higher level (HL English) was associated with a 12 percent increase in the predicted odds of enrolling in college compared with course students who did not (odds ratio of 1.12). Similarly, taking an SL math assessment other than math studies was associated with 65 percent greater odds of enrolling in college compared to course students who did not, though this estimate is based on the small number of students in the sample who took SL math other than math studies (234, or 5 percent of the sample). Finally, taking HL math was associated with higher odds of persisting in college; however, less than 1 percent of the course student sample took an HL math assessment, so these estimates are based on a small number of students (fewer than 100). The predicted odds of college persistence were 10 times higher for students who took HL math than those who did not, and the predicted odds of graduation were more than double for these students. Given the small number of course students who took HL math, these large positive estimates may reflect in part the unusually strong academic preparation of students who enroll in IB math at this level.

[4] Most IB courses can be taken at either standard level (SL) or higher level (HL). IB recommends that SL courses include at least 150 hours of instruction, whereas HL courses are recommended to have at least 240 hours. Students must take at least three HL courses to earn the full IB diploma (IB, 2015).

Exhibit 12. Relationship Between School-and Student-level Predictors and Course Student Postsecondary Outcomes

	Immediate 4-Year Enrollment	1-Year Persistence	4-Year Graduation
School-level compositional variables[a]			
Eligible for free or reduced-price meals	0.91	0.92	0.81
Underrepresented minority students	0.93	0.95	0.84
Student demographics[b]			
Male	0.85	o	0.56
Free or reduced-price meals	0.68	0.74	0.60
Asian/Pacific Islander	0.77	o	0.79
Black, non-Hispanic	o	0.82	0.53
Hispanic	0.48	o	0.60
Other	0.78	o	0.78
IB performance[c]			
Number of assessments	1.32	1.07	1.12
Average score	1.23	1.35	1.56
Higher Level (HL)	1.20	o	o
HL English	1.12	0.86	o
Math studies	o	o	0.63
Other SL math	1.65	o	o
HL math	o	10.92	2.36

Note: "o" indicates the relationship is not statistically significant at the p<0.05 level.
[a] Odds ratio estimates based on models with the two school-level compositional variables entered separately and no other predictors (models 2 and 3, Exhibits A-3b, A-6b, and A-9b). The two school-level compositional variables were entered in the models as proportions. For ease of interpretation, we divide the logit by 10 to calculate the odds ratio representing a 10 percentage point change in the composition of the school.
[b] Odds ratio estimates based on models with all student-level demographic variables and no other predictors (model 4, Exhibits A-4b, A-7b, and A-10b).
[c] Odds ratio estimates based on models with all student-level demographic variables plus number of assessments taken and mean score (models 2 and 3, Exhibits A-5b, A-8b, and A-11b).

Descriptive Analyses for Diploma Candidates

Descriptively, the differences in postsecondary outcomes for diploma candidates mirror the patterns we see in outcomes for course students, with the exception of differences between persistence and graduation rates for Asian/Pacific Islander students and White students, discussed in the previous section. Female diploma candidates, diploma candidates who were not eligible for free or reduced-price meals, and White or Asian/Pacific Islander diploma candidates generally experienced more positive postsecondary outcomes than male diploma candidates, diploma candidates who were eligible for free or reduced-price meals, and Black or Hispanic diploma candidates, respectively (Exhibit 13).

Exhibit 13. Descriptive Postsecondary Outcomes for Diploma Candidate Analytic Sample

	N (Full Sample)	Immediate 4-Year Enrollment[a]	*N (Immediate 4-Year Enrollment)*	1-Year Persistence[b]	4-Year Graduation[c]
Total	17,094	82.1%	14,037	90.3%	64.0%
Gender					
Female	10,142	83.2%	8,434	90.9%	68.6%
Male	6,952	80.6%	5,603	89.4%	57.0%
Free or reduced-price meals					
Eligible	3,220	77.6%	2,498	86.3%	47.5%
Not eligible	13,874	83.2%	11,539	91.2%	67.6%
Race/ethnicity					
Asian/Pacific Islander	2,642	79.2%	2,092	92.6%	68.7%
Black, non-Hispanic	1,957	80.2%	1,569	87.6%	51.9%
Hispanic	2,211	78.1%	1,726	88.4%	50.8%
White, non-Hispanic	9,567	84.2%	8,058	90.8%	68.2%
Other	717	82.6%	635	89.7%	61.0%

[a] Percent of diploma candidates who enrolled in a 4-year college or university immediately after high school.
[b] Percent of diploma candidates who enrolled in a 4-year college or university immediately after high school and were enrolled at any 4-year college in fall 2014.
[c] Percent of diploma candidates who enrolled in a 4-year college or university immediately after high school and earned a degree from a 4-year institution within 4 years.

Predictive Analyses for Diploma Candidates

Results of multilevel modeling indicate that many of the relationships between school- and student-level predictors and postsecondary outcomes for course students hold for diploma candidates as well (Exhibit 14).

School composition: Between 6 and 9 percent of the variance in postsecondary outcomes for diploma candidates was at the high school level (see intraclass correlation in Exhibits A-12a, A-15a, and A-18a). Together, the two school compositional variables (percent minority and percent poverty) explained 43 percent of the variance in 4-year college graduation for these students (Exhibit A-18a). Diploma candidates who attended high-poverty or high-minority high schools were less likely than their peers who attended schools with lower percentages of low-income or underrepresented minority students to enroll, persist, or earn a bachelor's degree in 4 years. These trends are consistent with the relationship between school composition and postsecondary outcomes at the national level (National Student Clearinghouse Research Center, 2018).

As with course students, this negative association was stronger the further students progressed in college. Specifically, for each 10 percentage point increase in the percent of students eligible

for free or reduced-price meals at a student's high school, his or her predicted odds of college enrollment were 4 percent lower (odds ratio of 0.96), odds of persisting to a second year were 9 percent lower (odds ratio of 0.91), and odds of graduating were 15 percent lower (odds ratio of 0.85). Again, we cannot disentangle these school effects from potential differences in average baseline academic achievement for diploma candidates who attended these schools.

Student-level demographics: Male diploma candidates and diploma candidates eligible for free or reduced-price meals had lower predicted odds of enrolling, persisting, and graduating than their female or higher income peers, respectively. Compared with female diploma candidates, males diploma candidates had 17 percent lower predicted odds of college enrollment (odds ratio of 0.83), 19 percent lower predicted odds of persisting to a second year, and 45 percent lower odds of graduating college (odds ratio of 0.55). Similarly, Hispanic diploma candidates had lower predicted odds of enrolling and graduating than White diploma candidates. Asian (including Pacific Islander) diploma candidates had lower predicted odds of enrolling in college, but those who enrolled had higher predicted odds of persisting to a second year than their White peers, and similar predicted odds for earning a degree. Black diploma candidates had similar predicted odds of enrolling and persisting in college as their White peers, but 39 percent lower predicted odds of graduating (odds ratio of 0.61).

IB performance: Because the two IB performance measures are highly correlated (r=0.60) we examined separately the relationship between total points and postsecondary outcomes and then bonus points and postsecondary outcomes. Both measures were associated with higher predicted odds of enrolling, persisting, and earning a degree. For each additional point earned toward the diploma, the predicted odds of college enrollment increased 5 percent (odds ratio of 1.05), of persisting to a second year increased 9 percent, and of graduating increased 13 percent.

Exhibit 14. Relationship Between School-and Student-level Predictors and Diploma Candidate Postsecondary Outcomes

	Immediate 4-Year Enrollment	1-Year Persistence	4-Year Graduation
School-level compositional variables[a]			
Eligible for free or reduced-price meals	0.96	0.91	0.85
Underrepresented minority students	0.97	0.95	0.89
Student demographics			
Male	0.83	0.81	0.55
Free or reduced-price meals[b]	0.77	0.66	0.55
Asian/Pacific Islander	0.75	1.36	o
Black, non-Hispanic	o	o	0.61
Hispanic	0.75	o	0.65
Other	o	o	0.75
IB performance[c]			
Total points	1.05	1.09	1.13
Bonus points	1.14	1.45	1.46

Note: "o" indicates the relationship is not statistically significant at the p<0.05 level.
[a] Odds ratio estimates based on models with the two school-level compositional variables entered separately and no other predictors (models 2 and 3, Exhibits A-12b, A-15b, and A-18b). For ease of interpretation, we divide the logit by 10 to calculate the odds ratio representing a 10 percentage point change in the composition of the school.
[b] Odds ratio estimates based on model with all student-level demographic variables and no other predictors (model 4, Exhibits A-13b, A-16b, and A-19b).
[c] Odds ratio estimates based on models all student-level demographic variables and the 2 performance indicators entered separately (models 2 and 3, Exhibits A-14b, A-17b, and A-20b).

Discussion

Despite strong evidence of the benefits of postsecondary education, college enrollment rates in the United States have not increased significantly in the last 8 years, and 4-year graduation rates remain relatively low. This report finds, however, that U.S. domestic DP graduates experienced more positive postsecondary enrollment, persistence, and graduation rates than the average American high school student. Eighty-two percent of 2013 DP graduates in the United States enrolled in college immediately after graduating from high school, as compared to 66 percent of all high school graduates nationwide. Of those DP graduates who enrolled in college immediately after high school, 88 percent returned to the same institution the following year, as compared to 80 percent of all U.S. students. Three years later, 62 percent of DP graduates earned a 4-year college degree, as compared to 41 percent of all U.S. students.

Although DP graduates completed college at higher rates than U.S. high school graduates as a whole, a sizeable proportion of DP graduates, including those earning the IB diploma, did not graduate 4 years later, despite the rigor of their high school preparation. Although the 4-year

graduation rates for DP graduates were greater than the overall graduation rates at the majority of the most popular postsecondary destinations, these graduation rates are still low, at both *selective* and *more selective* institutions. Less than two-thirds of DP graduates finished college in 4 years at 12 of the top 25 most popular *more selective* institutions and at 24 of the top 25 most popular *selective* institutions. Only four of the most popular postsecondary institutions graduated more than 75 percent of their DP graduates within 4 years (University of Virginia, University of Michigan, University of North Carolina-Chapel Hill, University of California-Berkeley). These findings suggest that, even for those students who chose an IB education and experienced the rigor of IB coursework, earning a college degree in 4 years remained a challenge. This may also reflect the national trend that a substantial number of students go on to complete 4-year degrees after 6 or 8 years (Shapiro et al., 2019). Data on 6- and 8-year graduation rates were not available for the 2013 cohort examined in this report, but Shapiro et al. (2019) suggest that education researchers should use those longer time periods for graduation rate analyses to develop a more complete understanding of the trends in graduation rates.

This report also documents that DP graduates who received the IB diploma have better postsecondary outcomes—that is, they were the most likely to enroll in a 4-year college immediately after high school and graduate 4 years later—than those who did not attempt the full diploma or those who attempted but did not complete it. However, these analyses also reveal that Black, Hispanic, and low-income diploma candidates were considerably less likely to earn the IB diploma than their White, Asian, and non-low-income peers.

By summarizing the relationship between school- and student-level predictors, this report indicates that many of the national trends, such as lower college enrollment and graduation rates for low-income and underrepresented minority students, persisted among DP graduates. This analysis also shows that indicators of intensive IB participation and performance were associated with postsecondary education success.

For course students, IB participation and performance were positively associated with postsecondary outcomes; the more IB assessments taken by a student, the greater his or her odds of enrolling in college and graduating. Indeed, the number of assessments taken was the strongest predictor of college enrollment of any of the participation and performance variable we considered. As for college success defined in terms of persistence and graduation, the strongest predictors were the measures of performance on IB assessments. Specifically, average assessment score had the strongest positive relationship of any of the variables we considered with college persistence (odds ratio of 1.35) and with graduation (odds ratio of 1.56). We caution, however, that research on the predictive validity of advanced college preparatory coursework suggests that estimates of the relationship between participation and college success will be positively biased (inflated) unless this relationship is modeled considering

students' full high school coursework, and particularly their science and math enrollments (Adelman 2006; Klopfenstein & Thomas, 2009).

Participation in the Diploma Programme is fairly prescribed for diploma candidates (they must take at least six assessments). For diploma candidates, total points earned toward the diploma was positively associated with college enrollment, persistence, and graduation. Further, our analysis suggests that the bonus points students can earn from the Theory of Knowledge course and extended essay, which are part of the total points students can earn toward the diploma, were particularly effective at identifying students who were likely to succeed in college by earning a degree in 4 years. The strength of the relationship between bonus points, which depend on strong writing and self-management skills, and college success is consistent with research that highlights the importance of both writing and interpersonal skills to academic success (Belfield et al., 2015; Conley, 2010; Farrington et al., 2012; Geiser & Studley, 2004).

Conclusion

In this section, we summarize key findings, describe the limitations of this study, and offer recommendations for further research in this field.

Summary of Findings

- These analyses indicate that DP graduates in the United States experienced higher rates of postsecondary enrollment, persistence, and graduation than the average American high school graduate. Additionally, diploma candidates experienced more positive postsecondary outcomes than course students, and diploma candidates who ultimately received an IB diploma experienced more positive postsecondary outcomes than diploma candidates who did not receive a diploma.

- For all categories of DP graduates, students who enrolled in *more selective* postsecondary institutions experienced more positive outcomes than those who attended *selective* or *inclusive* institutions. For students who attended *more selective* and *selective* postsecondary destinations, the most popular destinations were large public universities, especially those in Florida. The most common majors for DP graduates who earned a 4-year degree ranged from biology to liberal arts to engineering and business.

- School compositional variables—percent underrepresented minority and percent of students eligible of free or reduced-price meals—were associated with lower levels of postsecondary success for course and diploma candidates. Students from high-minority or high-poverty schools had lower predicted odds of enrolling, persisting, and graduating college than those who came from high schools with a lower percentage of minority or low-income students, and gap widened the further students progressed in college. Between 5 and 12 percent of

the variability in postsecondary outcomes was at the school level, and these school compositional variables explained more than half the variation in college graduation for course students.

- Student demographic variables such as gender, eligibility for free or reduced-price meals, and ethnicity were also associated with postsecondary success in similar ways for course students and diploma candidates. Male students, low-income students, Hispanic, and Asian students had lower odds of college enrollment and graduation than female, higher income, and White students, respectively. Black DP students, whether or not they pursued the full diploma, had similar odds of enrolling in college as their White peers, but had lower predicted odds of graduating.

- For course students, IB participation and performance—the number of assessments and average score—were associated with greater postsecondary success: enrollment, persistence, and graduation. Taking an HL assessment was associated with increased college enrollment, as was taking HL English.

- Diploma candidates with strong IB performance, measured by either total points or bonus points, had higher predicted odd of enrolling, persisting in, and completing college than lower-performing peers.

Limitations of Research

- The report focuses on U.S. domestic DP students, and excludes all DP students in the United States with foreign or joint foreign and U.S. nationality.

- Available data did not include ethnicity, English language learner status, or any measure of socioeconomic status for DP students who attend private schools, and thus these students are excluded from the analysis examining the relationship between student and school demographics and postsecondary outcomes for DP students.

- This analysis examined postsecondary outcomes for the 2013 graduating cohort. Because of the timing, we were only able to examine 4-year graduation rates. Current research suggests that a substantial percentage of students who do not graduate within 4 years still persist and graduate after 6 or 8 years (Shapiro et al., 2019). Future research should assess these 6- and even 8-year graduation rates to better understand the postsecondary experiences of DP graduates.

- Students who chose to participate in the Diploma Programme may differ from non-DP students on a range of observable and unobservable characteristics. Thus, we cannot conclude there is a causal impact of the Diploma Programme on postsecondary outcomes based on these analyses. To the extent that IB attracts students who are more highly

motivated and/or higher achieving than average, above average outcomes may reflect these pre-existing differences.

- Estimates for IB participation indicators such as taking an SL math assessment other than math studies or taking HL math are based on small numbers of students and may be unstable or highly impacted by selection bias.

Recommendations for Further Research

- This report offers a primarily descriptive summary of postsecondary outcomes for IB students. Further qualitative research may focus on the reasons for the differences between postsecondary outcomes of DP students and the general population of U.S. high school students, between course students and diploma candidates, and between DP students who enroll in *more selective* institutions and DP students who enroll in *selective* or *inclusive* institutions.

- While this report identifies the most popular postsecondary destinations and courses of study for DP graduates, further research could explore the reasons why students choose to attend particular institutions or pursue particular courses of study, and whether those decisions are impacted by participation in the Diploma Programme.

- This analysis examined postsecondary persistence and graduation rates for DP graduates who enrolled in 4-year institutions immediately after graduating from high school. Additional research could investigate these outcomes and transfer rates for students who enroll immediately in 2-year institutions and for students who do not enroll in college directly.

- A research study with a well-constructed comparison group that is equivalent to DP graduates on student demographics and prior achievement would offer the potential for causal claims about the effectiveness of the Diploma Programme at increasing college enrollment, persistence, and graduation.

Recommendations

- Because college enrollment and persistence rates vary by school, ***district leaders*** should provide school leaders with data (e.g., from the National Student Clearinghouse) and technical assistance to understand their students' postsecondary outcomes.

- Based on results for their student population, ***school leaders*** should provide strategic college counseling services (e.g., helping students select a college from which they have a good chance of graduating within 4 to 6 years).

- With information about the root causes of students' inability to reach each postsecondary milestone (immediate enrollment, persistence, graduation), ***school leaders*** should develop targeted interventions to increase the knowledge and skills students need to succeed in college.
- The ***IB Organization*** could build the capacity of schools and districts to address student needs to succeed in college by providing support (e.g., coaching and professional development) to IB schools and district leaders.

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Appendix

This section provides additional detail about the analysis methods used to address research question 6, examining the factors that predict postsecondary enrollment, persistence, and graduation for DP graduates.

Data Elements

Exhibit A-1 defines the data elements used to in these analyses. We examine school-level composition variables from the National Center for Education Statistics Common Core of Data; student-level demographic predictors from the IBIS data; student-level IB participation and performance variables from IBIS; and postsecondary outcome variables from the NSC.

Exhibit A-1. Definitions of Predictors and Postsecondary Outcomes Used in Multilevel Models

Variable	Definition
School-level predictors	
Percent eligible for free or reduced-price meals	Percent of the students in the school who are eligible for free or reduced-price meals.
Percent underrepresented minority	Percent of students in grades 9 through 12 who are Black, Hispanic, or Native American.
Student-level demographic predictors	
Male	Coded 1 if student is male.
Free or reduced-price meals	Coded 1 if student is eligible for free or reduced-price meals.
Asian/Pacific Islander	Coded 1 if student is Asian or Pacific Islander.
Black	Coded 1 if student is Black.
Hispanic	Coded 1 if student is Hispanic.
Other race	Coded 1 if student belongs to a racial or ethnic group other than Asian/Pacific Islander, Black, Hispanic, or White.
Student-level performance indicators	
Diploma candidates	
Total points	Total points earned toward diploma including bonus points earned for extended essay and theory of knowledge, ranges from 0 to 45.
Bonus points	Number of bonus points earned for extended essay and theory of knowledge, ranges from 0 to 3.
Course students	
Number of assessments	Total number of assessments taken.
Average score	Average scores across all IB assessments taken.
HL	Equal to 1 if student took at least one HL assessment; equal to 0 if student took only SL assessments.
HL English	Equal to 1 if student took HL English assessment; equal to 0 if student did not take an HL English assessment.
Math Studies	Equal to 1 if student took a math studies assessment; equal to 0 if student did not take a math studies assessment.
Other SL math	Equal to 1 if student took an SL math assessment other than math studies; equal to 0 if student did not take an SL math assessment or took only math studies.
HL Math	Equal to 1 if students took an HL math studies other than further math; equal to 0 if student did not take an HL math assessment or took further math only.
Postsecondary outcomes	
Immediate 4-year enrollment	Enrollment at a 4-year NSC-participating college or university immediately after high school graduation (between August 1, 2013 and January 31, 2014).
1-year persistence	For students with an immediate 4-year enrollment, enrollment at any college or university the subsequent fall (August 1 through December 31, 2014).
4-year graduation	Earning a bachelor's degree or higher by the end of August 2017 after immediate 2013 enrollment at a 4-year college or university.

Sample and Descriptive Statistics

School-level predictors and all student demographics other than gender were available for DP graduates from U.S. public schools only. As a result, we limit the analytic sample for research question 6 to domestic DP graduates from U.S. public schools only. The analytic sample for course students is 16,967 for the immediate enrollment analyses and drops to 11,278 for the persistence and graduation analyses (students with an immediate enrollment in a 4-year institution only) and is 17,094 diploma candidates for the enrollment analyses, dropping to 14,037 for the persistence and graduation analyses (Exhibit A-2).

Exhibit A-2: Student-level Descriptive Statistics for Analytic Sample

	Course Students		Diploma Candidates	
	Immediate Enrollment	Persistence and Graduation	Immediate Enrollment	Persistence and Graduation
N	16,967	11,278	17,094	14,037
Gender				
Female	58.3%	59.4%	59.3%	60.1%
Male	41.7%	40.6%	40.7%	39.9%
Free or reduced-price meals				
Eligible	23.9%	20.0%	20.4%	19.3%
Not eligible	76.1%	80.0%	79.6%	80.7%
Race/ethnicity				
Asian/Pacific Islander	9.8%	9.1%	15.5%	14.9%
Black, non-Hispanic	11.1%	11.4%	11.5%	11.2%
Hispanic	15.1%	11.2%	12.9%	12.3%
White, non-Hispanic	59.4%	63.8%	56.0%	57.4%
Other	4.6%	4.5%	4.2%	4.2%

Analysis Methods

To address research question 6, we used logistic multilevel models to examine the relationship between student and school characteristics and postsecondary outcomes for DP students, as well as between DP participation and performance and these postsecondary outcomes. The SAS PROC GLIMMIX command was used for all models, with students nested in schools (school code as the level-2 class variable). Because all three postsecondary outcomes are binary, we modelled the log odds of enrolling, persisting, or completing college. Outcome *Y* for student *i* in school *j* is given as

$$Y_{ij} = \beta + (\boldsymbol{IB_{ij}} - \overline{\boldsymbol{IB}})\boldsymbol{\pi} + (\boldsymbol{X_{ij}} - \overline{\boldsymbol{X}})\boldsymbol{\zeta} + (\boldsymbol{Z_j} - \overline{\boldsymbol{Z}})\boldsymbol{\delta} + \alpha_j + \varepsilon_{ij}$$

where:

Y_{ij} = outcome *Y* for student *i* in school *j*, where Y=ln (P/(1-P) and P is the probability of Y=1

$\mathrm{IB_{ij}}$ = vector of variables representing participation and performance in the Diploma Programme. All variables are grand-mean centered.

X_{ij} = vector of demographic variables consisting of a series of indicators for student gender, ethnicity, English language proficiency, low socioeconomic status, and nationality. All variables were grand-mean centered.

Z_{ij} = vector of school-level characteristics including percent of student body that is eligible for free or reduced-price meals and percent of students who are part of an underrepresented minority group (African American, Latino, Native American/Alaskan native). All variables are grand-mean centered.

α_j= school random effect.

ε_{ij}= student random effect.

All predictors were grand-mean centered, so estimates can be converted to the predicted change in probability of an outcome for the "average" student in each sample given a one-unit change in the predictor variable. Because of the strong collinearity among many of the predictors, predictors were added first at the school level, and then at the student level, and often one at a time to isolate their relationship with the outcome.

Results for Course Students

Exhibits A-3 through A-11 present the results of the multilevel models, first for course students and then for diploma candidates. The first half of each table (marked "a") presents logit estimates for course students, with the associated standard error below each estimate in parentheses. Sample sizes at both student- and school-levels are provided in a table note, and estimates that are marked with an asterisk are statistically significant at the 0.05 level. The second half of each table (marked "b") shows the logit estimates converted to odds ratios for ease of interpretation.

Within each student group, the first table for each outcome (school compositional variables) displays the percent of the total between-school variance for each outcome that is explained by each school-compositional variable (models 2 and 3) or by both variables entered together (model 4). This table also shows the intraclass correlation, the proportion of total variance in each outcome that is between schools. Because SAS does not estimate a student-level variance component, we assume that Y is a dichotomization of a latent continuous variable (Snijders & Bosker, 1999, as cited in O'Connell et al., 2008) with a variance of 3.29 (Evan, Hastings, & Peacock, 2000, as cited in O'Connell et al., 2008).

Exhibit A-3a. Relationship Between School-level Compositional Variables and Immediate Enrollment in a 4-Year College or University for IB Course Students

	Model 1	Model 2	Model 3	Model 4
Fixed Effects[a]				
Intercept	0.73	0.74	0.75	0.75
	(0.04)	(0.03)	(0.03)	(0.03)
Proportion underrepresented minority		-0.69 *		-0.22
		(0.13)		(0.18)
Proportion free or reduced-price meals			-0.92 *	-0.73 *
			(0.14)	(0.21)
Random Effects				
School-mean variance	0.35	0.30	0.29	0.28
	(0.04)	(0.04)	(0.04)	(0.04)
Percent school-level variance explained		13.1%	17.8%	18.4%
Intraclass correlation	0.10			

Note: Models based on 16,967 students in 508 schools.
* $p < .05$
[a] Point estimates are presented in logits to allow for comparisons with standard errors below the estimates in parentheses.

Exhibit A-3b. Odds Ratio Estimates of Relationship Between School-level Compositional Variables and Immediate Enrollment in a 4-Year College or University for IB Course Students

	Model 1	Model 2	Model 3	Model 4
Percent underrepresented minority		0.50		0.80
Percent free or reduced-price meals			0.40	0.48

Table A-4a. Relationship Between Student Demographic Variables and Immediate Enrollment in a 4-Year College or University for IB Course Students

	Model 1	Model 2	Model 3	Model 4
Fixed Effects[a]				
Intercept	0.73	0.74	0.73	0.74
	(0.04)	(0.03)	(0.03)	(0.03)
Male		-0.16 *	-0.15 *	-0.16 *
		(0.03)	(0.03)	(0.03)
Low income		-0.56 *		-0.39 *
		(0.05)		(0.05)
Asian/Pacific Islander			-0.34 *	-0.26 *
			(0.06)	(0.06)
Black, non-Hispanic			-0.04	0.06
			(0.06)	(0.06)
Hispanic			-0.87 *	-0.73 *
			(0.05)	(0.06)
Other			-0.31 *	-0.25 *
			(0.09)	(0.09)

Note: Models based on 16,967 students in 508 schools.
* $p < .05$
[a] Point estimates are presented in logits to allow for comparisons with standard errors below the estimates in parentheses.

Table A-4b. Odds Ratio Estimates of Relationship Between Student Demographic Variables and Immediate Enrollment in a 4-Year College or University for IB Course Students

	Model 1	Model 2	Model 3	Model 4
Male		0.85	0.86	0.85
Low income		0.57		0.68
Asian/Pacific Islander			0.71	0.77
Black, non-Hispanic			0.96	1.06
Hispanic			0.42	0.48
Other			0.73	0.78

Table A-5a. Relationship Between Course Student Participation and Performance in the IB Diploma Programme and Immediate Enrollment in a 4-Year College or University

	Model 1	Model 2	Model 3	Model 4
Fixed Effects[a]				
Intercept	0.73	0.77	0.77	0.77
	(0.04)	(0.04)	(0.04)	(0.04)
Male		-0.12 *	-0.12 *	-0.12 *
		(0.04)	(0.04)	(0.04)
Low income		-0.35 *	-0.35 *	-0.35 *
		(0.05)	(0.05)	(0.05)
Asian/Pacific Islander		-0.26 *	-0.27 *	-0.27 *
		(0.07)	(0.07)	(0.07)
Black, non-Hispanic		0.22 *	0.22 *	0.23 *
		(0.07)	(0.07)	(0.07)
Hispanic		-0.72 *	-0.72 *	-0.72 *
		(0.06)	(0.06)	(0.06)
Other		-0.23 *	-0.23 *	-0.23 *
		(0.09)	(0.09)	(0.09)
Number of Assessments		0.28 *	0.29 *	0.28 *
		(0.02)	(0.02)	(0.02)
Average Score		0.20 *	0.21 *	0.21 *
		(0.02)	(0.02)	(0.02)
HL Assessment		0.18 *		0.18 *
		(0.05)		(0.05)
HL English Assessment			0.11 *	0.03
			(0.04)	(0.05)
Math Studies			-0.09	-0.01
			(0.09)	(0.09)
Other SL Math Indicator			0.50 *	0.58 *
			(0.15)	(0.16)
HL Math			0.50	0.40
			(0.29)	(0.29)

Note: Models based on 16,967 students in 508 schools.
* $p < .05$
[a] Point estimates are presented in logits to allow for comparisons with standard errors below the estimates in parentheses.

Table A-5b. Odds Ratio Estimates of Relationship Between Course Student Participation and Performance in the IB Diploma Programme and Immediate Enrollment in a 4-Year College or University

	Model 1	Model 2	Model 3	Model 4
Male		0.89	0.89	0.89
Low income		0.71	0.71	0.71
Asian/Pacific Islander		0.77	0.77	0.77
Black, non-Hispanic		1.25	1.25	1.26
Hispanic		0.49	0.49	0.49
Other		0.79	0.80	0.80
Number of Assessments		1.32	1.33	1.32
Average Score		1.23	1.23	1.23
HL Assessment		1.20		1.20
HL English Assessment			1.12	1.04
Math Studies			0.92	0.99
Other SL Math Indicator			1.65	1.79
HL Math			1.64	1.49

Exhibit A-6a. Relationship Between School-level Compositional Variables and Persistence at a 4-Year College or University for IB Course Students

	Model 1	Model 2	Model 3	Model 4
Fixed Effects[a]				
Intercept	1.75	1.76	1.78	1.78
	(0.04)	(0.04)	(0.04)	(0.04)
Proportion underrepresented minority		-0.47 *		0.27
		(0.14)		(0.20)
Proportion free or reduced-price meals			-0.88 *	-1.11 *
			(0.15)	(0.22)
Random Effects				
School-mean variance	0.18	0.16	0.13	0.14
	(0.04)	(0.04)	(0.03)	(0.03)
Percent school-level variance explained		14.0%	26.7%	25.6%
Intraclass correlation	0.05			

Note: Models based on 11,278 students in 485 schools.
* $p < .05$
[a] Point estimates are presented in logits to allow for comparisons with standard errors below the estimates in parentheses.

Exhibit A-6b. Odds Ratio Estimates of Relationship Between School-level Compositional Variables and Persistence at a 4-Year College or University for IB Course Students

	Model 1	Model 2	Model 3	Model 4
Percent underrepresented minority		0.62		1.31
Percent free or reduced-price meals			0.41	0.33

Table A-7a. Relationship Between Student Demographic Variables and Persistence at a 4-Year College or University for IB Course Students

	Model 1	Model 2	Model 3	Model 4
Fixed Effects[a]				
Intercept	1.75	1.76	1.76	1.76
	(0.04)	(0.04)	(0.04)	(0.04)
Male		-0.10	-0.09	-0.10
		(0.05)	(0.05)	(0.05)
Low income		-0.32 *		-0.30 *
		(0.07)		(0.08)
Asian/Pacific Islander			0.05	0.13
			(0.10)	(0.10)
Black, non-Hispanic			-0.28 *	-0.20 *
			(0.09)	(0.09)
Hispanic			-0.17	-0.04
			(0.09)	(0.10)
Other			0.03	0.09
			(0.15)	(0.15)

Note: Models based on 11,278 students in 485 schools.
* $p < .05$
[a] Point estimates are presented in logits to allow for comparisons with standard errors below the estimates in parentheses.

Table A-7b. Odds Ratio Estimates of Relationship Between Student Demographic Variables and Persistence at a 4-Year College or University for IB Course Students

	Model 1	Model 2	Model 3	Model 4
Male		0.91	0.91	0.90
Low income		0.72		0.74
Asian/Pacific Islander			1.05	1.14
Black, non-Hispanic			0.75	0.82
Hispanic			0.85	0.96
Other			1.03	1.09

Table A-8a. Relationship Between Course Student Participation and Performance in the IB Diploma Programme and Persistence at a 4-Year College or University

	Model 1	Model 2	Model 3	Model 4
Fixed Effects[a]				
Intercept	1.75	1.79	1.80	1.80
	(0.04)	(0.04)	(0.04)	(0.04)
Male		-0.05	-0.08	-0.08
		(0.06)	(0.06)	(0.06)
Low income		-0.22 *	-0.20 *	-0.20 *
		(0.08)	(0.08)	(0.08)
Asian/Pacific Islander		0.15	0.14	0.14
		(0.10)	(0.10)	(0.10)
Black, non-Hispanic		-0.03	-0.01	0.00
		(0.09)	(0.09)	(0.09)
Hispanic		-0.02	-0.02	-0.02
		(0.10)	(0.10)	(0.10)
Other		0.09	0.10	0.10
		(0.14)	(0.14)	(0.14)
Number of Assessments		0.07 *	0.10 *	0.09 *
		(0.02)	(0.02)	(0.02)
Average Score		0.30 *	0.32 *	0.32 *
		(0.03)	(0.03)	(0.03)
HL Assessment		0.04		0.14
		(0.07)		(0.08)
HL English Assessment			-0.16 *	-0.22 *
			(0.07)	(0.08)
Math Studies			-0.21	-0.15
			(0.14)	(0.14)
Other SL Math Indicator			0.45	0.52 *
			(0.24)	(0.25)
HL Math			2.39 *	2.32 *
			(0.99)	(0.99)

Note: Models based on 11,278 students in 485 schools.
* $p < .05$
[a] Point estimates are presented in logits to allow for comparisons with standard errors below the estimates in parentheses.

Table A-8b. Odds Ratio Estimates of Relationship Between Course Student Participation and Performance in the IB Diploma Programme and Persistence at a 4-Year College or University

	Model 1	Model 2	Model 3	Model 4
Male		0.95	0.93	0.93
Low income		0.80	0.82	0.82
Asian/Pacific Islander		1.16	1.15	1.16
Black, non-Hispanic		0.97	0.99	1.00
Hispanic		0.98	0.98	0.98
Other		1.10	1.11	1.11
Number of Assessments		1.07	1.10	1.10
Average Score		1.35	1.38	1.38
HL Assessment		1.04		1.15
HL English Assessment			0.86	0.81
Math Studies			0.81	0.86
Other SL Math Indicator			1.57	1.68
HL Math			10.92	10.15

Exhibit A-9a. Relationship Between School-level Compositional Variables and Graduation from a 4-Year College or University for IB Course Students

	Model 1	Model 2	Model 3	Model 4
Fixed Effects[a]				
Intercept	-0.02	0.04	0.08	0.07
	(0.04)	(0.03)	(0.03)	(0.03)
Proportion underrepresented minority		-1.72 *		-0.74 *
		(0.13)		(0.18)
Proportion free or reduced-price meals			-2.10 *	-1.46 *
			(0.14)	(0.21)
Random Effects				
School-mean variance	0.45	0.23	0.20	0.18
	(0.05)	(0.03)	(0.03)	(0.03)
Percent school-level variance explained		48.6%	54.8%	59.3%
Intraclass correlation	0.12			

Note: Models based on 11,278 students in 485 schools.
* $p < .05$
[a] Point estimates are presented in logits to allow for comparisons with standard errors below the estimates in parentheses.

Exhibit A-9b. Odds Ratio Estimates of Relationship Between School-level Compositional Variables and Graduation from a 4-Year College or University for IB Course Students

	Model 1	Model 2	Model 3	Model 4
Percent underrepresented minority		0.18		0.48
Percent free or reduced-price meals			0.12	0.23

Table A-10a. Relationship Between Student Demographic Variables and Graduation from a 4-Year College or University for IB Course Students

	Model 1	Model 2	Model 3	Model 4
Fixed Effects[a]				
Intercept	-0.02	0.00	0.00	0.02
	(0.04)	(0.04)	(0.04)	(0.03)
Male		-0.56 *	-0.56 *	-0.58 *
		(0.04)	(0.04)	(0.04)
Low income		-0.68 *		-0.51 *
		(0.06)		(0.06)
Asian/Pacific Islander			-0.34 *	-0.24 *
			(0.08)	(0.08)
Black, non-Hispanic			-0.74 *	-0.64 *
			(0.07)	(0.07)
Hispanic			-0.67 *	-0.52 *
			(0.07)	(0.08)
Other			-0.33 *	-0.25 *
			(0.11)	(0.11)

Note: Models based on 11,278 students in 485 schools.
* $p < .05$
[a] Point estimates are presented in logits to allow for comparisons with standard errors below the estimates in parentheses.

Table A-10b. Odds Ratio Estimates of Relationship Between Student Demographic Variables and Graduation from a 4-Year College or University for IB Course Students

	Model 1	Model 2	Model 3	Model 4
Male		0.57	0.57	0.56
Low income		0.51		0.60
Asian/Pacific Islander			0.71	0.79
Black, non-Hispanic			0.48	0.53
Hispanic			0.51	0.60
Other			0.72	0.78

Table A-11a. Relationship Between Course Student Participation and Performance in the IB Diploma Programme and Graduation from a 4-Year College or University

	Model 1	Model 2	Model 3	Model 4
Fixed Effects[a]				
Intercept	-0.02	0.04	0.04	0.04
	(0.04)	(0.03)	(0.03)	(0.03)
Male		-0.53 *	-0.54 *	-0.54 *
		(0.04)	(0.04)	(0.04)
Low income		-0.43 *	-0.42 *	-0.42 *
		(0.06)	(0.06)	(0.06)
Asian/Pacific Islander		-0.24 *	-0.24 *	-0.24 *
		(0.08)	(0.08)	(0.08)
Black, non-Hispanic		-0.43 *	-0.42 *	-0.42 *
		(0.07)	(0.07)	(0.07)
Hispanic		-0.52 *	-0.52 *	-0.52 *
		(0.08)	(0.08)	(0.08)
Other		-0.23 *	-0.23 *	-0.23 *
		(0.11)	(0.11)	(0.11)
Number of Assessments		0.11 *	0.12 *	0.11 *
		(0.02)	(0.02)	(0.02)
Average Score		0.44 *	0.45 *	0.45 *
		(0.02)	(0.02)	(0.02)
HL Assessment		0.09		0.06
		(0.06)		(0.06)
HL English Assessment			-0.02	-0.05
			(0.05)	(0.06)
Math Studies			-0.46 *	-0.43 *
			(0.12)	(0.12)
Other SL Math Indicator			0.33	0.36
			(0.18)	(0.18)
HL Math			0.86 *	0.83 *
			(0.32)	(0.32)

Note: Models based on 11,278 students in 485 schools.
* $p < .05$
[a] Point estimates are presented in logits to allow for comparisons with standard errors below the estimates in parentheses.

Table A-11b. Odds Ratio Estimates of Relationship Between Course Student Participation and Performance in the IB Diploma Programme and Graduation from a 4-Year College or University

	Model 1	Model 2	Model 3	Model 4
Male		0.59	0.59	0.59
Low income		0.65	0.66	0.66
Asian/Pacific Islander		0.79	0.79	0.79
Black, non-Hispanic		0.65	0.65	0.66
Hispanic		0.59	0.59	0.59
Other		0.79	0.80	0.80
Number of Assessments		1.12	1.12	1.12
Average Score		1.56	1.58	1.58
HL Assessment		1.09		1.06
HL English Assessment			0.98	0.96
Math Studies			0.63	0.65
Other SL Math Indicator			1.39	1.43
HL Math			2.36	2.29

Results for Diploma Candidates

Exhibits A-12 through A-20 present logit estimates for diploma candidates, with the associated standard error below each estimate in parentheses. Sample sizes at both student- and school-levels are provided in a table note, and estimates that are marked with an asterisk are statistically significant at the 0.05 level.

Exhibit A-12a. Relationship Between School-level Compositional Variables and Immediate Enrollment in a 4-Year College or University for IB Diploma Candidates

	Model 1	Model 2	Model 3	Model 4
Fixed Effects[a]				
Intercept	1.55	1.56	1.56	1.56
	(0.03)	(0.03)	(0.03)	(0.03)
Percent underrepresented minority		-0.36 *		-0.19
		(0.11)		(0.17)
Percent free or reduced-price meals			-0.43 *	-0.26
			(0.13)	(0.21)
Random Effects				
School-mean variance	0.22	0.21	0.21	0.21
	(0.03)	(0.03)	(0.03)	(0.03)
Percent school-level variance explained		4.7%	5.1%	5.5%
Intraclass correlation	0.06			

Note: Models based on 17,094 students in 605 schools.
* $p < .05$
[a] Point estimates are presented in logits to allow for comparisons with standard errors below the estimates in parentheses.

Exhibit A-12b. Odds Ratio Estimates of Relationship Between School-level Compositional Variables and Immediate Enrollment in a 4-Year College or University for IB Diploma Candidates

	Model 1	Model 2	Model 3	Model 4
Percent underrepresented minority		0.70		0.83
Percent free or reduced-price meals			0.65	0.78

Table A-13a. Relationship Between Student Demographic Variables and Immediate Enrollment in a 4-Year College or University for IB Diploma Candidates

	Model 1	Model 2	Model 3	Model 4
Fixed Effects[a]				
Intercept	1.55	1.57	1.56	1.57
	(0.03)	(0.03)	(0.03)	(0.03)
Male		-0.19 *	-0.18 *	-0.19 *
		(0.04)	(0.04)	(0.04)
Low income		-0.34 *		-0.26 *
		(0.05)		(0.06)
Asian/Pacific Islander			-0.32 *	-0.29 *
			(0.06)	(0.06)
Black, non-Hispanic			-0.21 *	-0.13
			(0.07)	(0.07)
Hispanic			-0.38 *	-0.29 *
			(0.07)	(0.07)
Other			-0.11	-0.08
			(0.11)	(0.11)

Note: Models based on 17,094 students in 605 schools.
* $p < .05$
[a] Point estimates are presented in logits to allow for comparisons with standard errors below the estimates in parentheses.

Table A-13b. Odds Ratio Estimates of Relationship Between Student Demographic Variables and Immediate Enrollment in a 4-Year College or University for IB Diploma Candidates

	Model 1	Model 2	Model 3	Model 4
Male		0.83	0.83	0.83
Low income		0.71		0.77
Asian/Pacific Islander			0.73	0.75
Black, non-Hispanic			0.81	0.88
Hispanic			0.68	0.75
Other			0.89	0.92

Table A-14a. Relationship Between IB Diploma Candidate Performance and Immediate Enrollment in a 4-Year College or University

	Model 1	Model 2	Model 3	Model 4
Fixed Effects[a]				
Intercept	1.55	1.60	1.57	1.60
	(0.03)	(0.03)	(0.03)	(0.03)
Male		-0.16 *	-0.17 *	-0.17 *
		(0.04)	(0.04)	(0.04)
Low income		-0.15 *	-0.23 *	-0.15 *
		(0.06)	(0.06)	(0.06)
Asian/Pacific Islander		-0.30 *	-0.29 *	-0.29 *
		(0.06)	(0.06)	(0.06)
Black, non-Hispanic		0.05	-0.09	0.06
		(0.07)	(0.07)	(0.07)
Hispanic		-0.22 *	-0.26 *	-0.22 *
		(0.07)	(0.07)	(0.07)
Other		-0.05	-0.08	-0.05
		(0.11)	(0.11)	(0.11)
Total Points		0.05 *		0.05 *
		(0.00)		(0.00)
Bonus Points			0.13 *	-0.05
			(0.03)	(0.03)

Note: Models based on 17,094 students in 605 schools.
* $p < .05$
[a] Point estimates are presented in logits to allow for comparisons with standard errors below the estimates in parentheses.

Table A-14b. Odds Ratio Estimates of Relationship Between IB Diploma Candidate Performance and Immediate Enrollment in a 4-Year College or University

	Model 1	Model 2	Model 3	Model 4
Male		0.85	0.84	0.85
Low income		0.86	0.79	0.86
Asian/Pacific Islander		0.74	0.75	0.75
Black, non-Hispanic		1.06	0.91	1.06
Hispanic		0.81	0.77	0.80
Other		0.95	0.93	0.95
Total Points		1.05		1.05
Bonus Points			1.14	0.95

Exhibit A-15a. Relationship Between School-level Compositional Variables and Persistence at a 4-Year College or University for IB Diploma Candidates

	Model 1	Model 2	Model 3	Model 4
Fixed Effects[a]				
Intercept	2.33	2.34	2.36	2.36
	(0.04)	(0.04)	(0.04)	(0.04)
Proportion underrepresented minority		-0.48 *		0.44
		(0.15)		(0.23)
Proportion free or reduced-price meals			-1.00 *	-1.39 *
			(0.17)	(0.27)
Random Effects				
School-mean variance	0.32	0.31	0.28	0.28
	(0.05)	(0.05)	(0.05)	(0.04)
Percent school-level variance explained		4.8%	13.5%	14.5%
Intraclass correlation	0.09			

Note: Models based on 14,037 students in 600 schools.
* $p < .05$
[a] Point estimates are presented in logits to allow for comparisons with standard errors below the estimates in parentheses.

Exhibit A-15b. Odds Ratio Estimates of Relationship Between School-level Compositional Variables and Persistence at a 4-Year College or University for IB Diploma Candidates

	Model 1	Model 2	Model 3	Model 4
Percent underrepresented minority		0.62		1.55
Percent free or reduced-price meals			0.37	0.25

Table A-16a. Relationship Between Student Demographic Variables and Persistence at a 4-Year College or University for IB Diploma Candidates

	Model 1	Model 2	Model 3	Model 4
Fixed Effects[a]				
Intercept	2.33	2.35	2.34	2.35
	(0.04)	(0.04)	(0.04)	(0.04)
Male		-0.20 *	-0.21 *	-0.21 *
		(0.06)	(0.06)	(0.06)
Low income		-0.45 *		-0.42 *
		(0.07)		(0.08)
Asian/Pacific Islander			0.26 *	0.31 *
			(0.10)	(0.10)
Black, non-Hispanic			-0.29 *	-0.16
			(0.09)	(0.10)
Hispanic			-0.20 *	-0.05
			(0.09)	(0.10)
Other			-0.06	-0.02
			(0.15)	(0.15)

Note: Models based on 14,037 students in 600 schools.
* $p < .05$
[a] Point estimates are presented in logits to allow for comparisons with standard errors below the estimates in parentheses.

Table A-16b. Odds Ratio Estimates of Relationship Between Student Demographic Variables and Persistence at a 4-Year College or University for IB Diploma Candidates

	Model 1	Model 2	Model 3	Model 4
Male		0.82	0.81	0.81
Low income		0.64		0.66
Asian/Pacific Islander			1.29	1.36
Black, non-Hispanic			0.75	0.85
Hispanic			0.82	0.96
Other			0.94	0.98

Table A-17a. Relationship Between IB Diploma Candidate Participation and Performance and Persistence at a 4-Year College or University

	Model 1	Model 2	Model 3	Model 4
Fixed Effects[a]				
Intercept	2.33	2.45	2.39	2.45
	(0.04)	(0.04)	(0.04)	(0.04)
Male		-0.17 *	-0.18 *	-0.17 *
		(0.06)	(0.06)	(0.06)
Low income		-0.22 *	-0.35 *	-0.22 *
		(0.08)	(0.08)	(0.08)
Asian/Pacific Islander		0.30 *	0.30 *	0.30 *
		(0.10)	(0.10)	(0.10)
Black, non-Hispanic		0.22 *	-0.05	0.22 *
		(0.10)	(0.10)	(0.10)
Hispanic		0.08	0.01	0.08
		(0.10)	(0.10)	(0.10)
Other		0.03	-0.01	0.03
		(0.15)	(0.15)	(0.15)
Total Points		0.09 *		0.09 *
		(0.01)		(0.01)
Bonus Points			0.37 *	0.05
			(0.04)	(0.05)

Note: Models based on 14,037 students in 600 schools.
* $p < .05$
[a] Point estimates are presented in logits to allow for comparisons with standard errors below the estimates in parentheses.

Table A-17b. Odds Ratio Estimates of Relationship Between IB Diploma Candidate Participation and Performance and Persistence at a 4-Year College or University

	Model 1	Model 2	Model 3	Model 4
Male		0.84	0.84	0.85
Low income		0.80	0.70	0.80
Asian/Pacific Islander		1.35	1.35	1.35
Black, non-Hispanic		1.25	0.95	1.25
Hispanic		1.08	1.01	1.09
Other		1.03	0.99	1.03
Total Points		1.09		1.09
Bonus Points			1.45	1.05

Exhibit A-18a. Relationship Between School-level Compositional Variables and Graduation from a 4-Year College or University for IB Diploma Candidates

	Model 1	Model 2	Model 3	Model 4
Fixed Effects[a]				
Intercept	0.55	0.58	0.59	0.59
	(0.03)	(0.03)	(0.03)	(0.03)
Proportion underrepresented minority		-1.11 *		-0.22
		(0.10)		(0.15)
Proportion free or reduced-price meals			-1.57 *	-1.37 *
			(0.12)	(0.18)
Random Effects				
School-mean variance	0.27	0.18	0.15	0.15
	(0.03)	(0.02)	(0.02)	
Percent school-level variance explained		32.4%	42.2%	43.0%
Intraclass correlation	0.08			

Note: Models based on 14,037 students in 600 schools.
* $p < .05$
[a] Point estimates are presented in logits to allow for comparisons with standard errors below the estimates in parentheses.

Exhibit A-18b. Odds Ratio Estimates of Relationship Between School-level Compositional Variables and Graduation from a 4-Year College or University for IB Diploma Candidates

	Model 1	Model 2	Model 3	Model 4
Percent underrepresented minority		0.33		0.81
Percent free or reduced-price meals			0.21	0.26

Table A-19a. Relationship Between Student Demographic Variables and Graduation from a 4-Year College or University for IB Diploma Candidates

	Model 1	Model 2	Model 3	Model 4
Fixed Effects[a]				
Intercept	0.55	0.58	0.57	0.59
	(0.03)	(0.03)	(0.03)	(0.03)
Male		-0.58 *	-0.59 *	-0.60 *
		(0.04)	(0.04)	(0.04)
Low income		-0.74 *		-0.60 *
		(0.05)		(0.05)
Asian/Pacific Islander			0.01	0.09
			(0.06)	(0.06)
Black, non-Hispanic			-0.66 *	-0.50 *
			(0.06)	(0.06)
Hispanic			-0.61 *	-0.43 *
			(0.06)	(0.06)
Other			-0.35 *	-0.29 *
			(0.09)	(0.09)

Note: Models based on 14,037 students in 600 schools.
* $p < .05$
[a] Point estimates are presented in logits to allow for comparisons with standard errors below the estimates in parentheses.

Table A-19b. Odds Ratio Estimates of Relationship Between Student Demographic Variables and Graduation from a 4-Year College or University for IB Diploma Candidates

	Model 1	Model 2	Model 3	Model 4
Male		0.56	0.56	0.55
Low income		0.48		0.55
Asian/Pacific Islander			1.01	1.09
Black, non-Hispanic			0.52	0.61
Hispanic			0.54	0.65
Other			0.71	0.75

Table A-20a. Relationship Between IB Diploma Candidate Participation and Performance and Graduation from a 4-Year College or University

	Model 1	Model 2	Model 3	Model 4
Fixed Effects[a]				
Intercept	0.55	0.66	0.61	0.66
	(0.03)	(0.03)	(0.03)	(0.03)
Male		-0.58 *	-0.56 *	-0.58 *
		(0.04)	(0.04)	(0.04)
Low income		-0.38 *	-0.54 *	-0.38 *
		(0.05)	(0.05)	(0.05)
Asian/Pacific Islander		0.08	0.08	0.08
		(0.06)	(0.06)	(0.06)
Black, non-Hispanic		-0.03	-0.39 *	-0.02
		(0.07)	(0.06)	(0.07)
Hispanic		-0.30 *	-0.38 *	-0.30 *
		(0.06)	(0.06)	(0.06)
Other		-0.22 *	-0.27 *	-0.22 *
		(0.10)	(0.09)	(0.10)
Total Points		0.12 *		0.13 *
		(0.00)		(0.01)
Bonus Points			0.37 *	-0.06 *
			(0.03)	(0.03)

Note: Models based on 14,037 students in 600 schools.
* $p < .05$
[a] Point estimates are presented in logits to allow for comparisons with standard errors below the estimates in parentheses.

Table A-20b. Odds Ratio Estimates of Relationship Between IB Diploma Candidate Participation and Performance and Graduation from a 4-Year College or University

	Model 1	Model 2	Model 3	Model 4
Male		0.56	0.57	0.56
Low income		0.69	0.58	0.69
Asian/Pacific Islander		1.09	1.08	1.09
Black, non-Hispanic		0.98	0.68	0.98
Hispanic		0.74	0.68	0.74
Other		0.81	0.77	0.81
Total Points		1.13		1.13
Bonus Points			1.46	0.94