A Comparison of MYP and Non-MYP Students' Participation and Performance in High School

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Table of Contents

List of Tables

List of Appendix Tables

List of Figures

Executive Summary

A study of students who were previously enrolled in the International Baccalaureate (IB) Middle Years Programme (MYP) was conducted in a large, socioeconomically diverse district of rural, urban, and suburban communities. The study was requested by the school district office overseeing the program, in collaboration with the IB. Funding for the study was provided by the IB.

The broad objective of this study was to examine the influence of MYP on students' high school course and program enrollment. The research questions guiding the study were:
1. Was previous enrollment in MYP related to participation and performance on AP and IB exams?
2. Was previous enrollment in MYP related to SAT or ACT scores?
3. Was previous enrollment in MYP related to IB course-taking and exam performance, and enrollment, persistence, and performance in IB Diploma Programme (DP)?

Summary of Methodology

The study compared outcomes of high school students who attended an MYP school with those of students who attended a non-MYP school. Two different samples were used to address the research questions.

The first two research questions examined AP and IB exam participation and performance, and SAT and ACT performance of MYP and non-MYP students. The groups were drawn from an earlier study sample (Wade, 2011) and matched on demographic characteristics. Analyses compared outcomes for students who attended an MYP middle school in Grade 8 during the 2009–2010 school year ($N = 885$), and students who attended a demographically similar non-MYP middle school in Grade 8 during the same school year ($N = 885$).

The third research question examined IB course-taking and enrollment, persistence, and performance in the IB Diploma Programme (DP). Analyses compared outcomes of two groups of students—MYP and non-MYP—from three high schools. The three high schools were selected for the study because they met two criteria: 1) offered an IB Diploma Programme; 2) enrolled students from both MYP and non-MYP middle schools. Analytic groups were made up of 266 students who formerly attended an MYP school and 266 students who formerly attended a non-MYP school. The two groups of students were identified using propensity scores to match them on demographic characteristics.

Key Findings

A summary of findings for each of the research questions follow.

1. **Was previous enrollment in MYP related to participation and performance on AP and IB exams?** Higher percentages of students who previously attended MYP middle schools participated in AP and IB exams compared with students who attended non-MYP middle schools. Further, higher percentages of students who previously attended MYP schools achieved at least one college-ready score on AP or IB exams compared with students who attended non-MYP schools. Effect sizes for these two measures reached the level of practical significance established for this study ($d > .15$).

   Among the students who took at least one AP or IB exam, MYP students took significantly more exams and also earned more college-ready scores on AP/IB tests than their non-MYP counterparts. The effect size for the difference in number of AP/IB tests taken was of practical significance; among students who took at least one AP/IB test, the students who had previously attended MYP schools took, on average, one more AP/IB test than the non-MYP students. The effect size for the difference in the number of college-ready scores also reached the threshold for practical significance, as established for this study.

2. **Was previous enrollment in MYP related to SAT or ACT scores?** Previous enrollment in MYP was not related to taking the SAT or ACT—similar percentages of MYP students and non-MYP students took the SAT or ACT. Enrollment in MYP also was not related to meeting the district target of 1650 for the SAT or 24 for the ACT. Scores on SAT were not significantly different for students previously enrolled in MYP schools and those from non-MYP schools.

3. **Was previous enrollment in MYP related to IB course-taking and exam performance, and enrollment, persistence, and performance in IB DP?** Among students who took at least one IB course, students from the MYP and non-MYP groups took, on average, a similar number of IB courses. Among students who took at least one IB exam, students who previously attended an MYP school earned more scores of 4 or higher, compared with their non-MYP counterparts. The effect size ($d = .50$) indicated that MYP enrollment had a moderate size practically significant effect on this measure of IB performance; on average students who previously were enrolled in MYP earned one more score of 4 or higher on than did non-MYP students.

   Among students in these analytic subgroups, similar numbers of students took the *Theory of Knowledge* course in Grade 11, which marks enrollment in the DP program. Further, the percentage of students who pursued an IB diploma, and the percentage of students who earned a diploma were not significantly different for students who had attended MYP and students who had attended a non-MYP school, although the numbers of students at each level of participation were small.

Conclusion

The study provides some evidence that MYP participation is positively related to greater success on AP and IB exams. Previous work has reported that students view the rigor of MYP as a benefit of MYP (Wade and Wolanin, 2013) and that an MYP background prepares students for DP by providing them with an understanding of criterion-based assessment and by developing their organizational skills and inquiry skills (Walker, Bryant, and Lee, 2014). This study suggests that students may have gained skills in MYP that prepared them for success in advanced courses such as AP and IB. Further study, with larger numbers of students, is needed to explore the relationship between MYP and the participation in the IB diploma program.

A Comparison of MYP and NON-MYP Students' IB Participation and Performance in High School

Background

A study of the high school achievement of students who attended International Baccalaureate (IB) Middle Years Programme (MYP) was conducted in a large, socioeconomically diverse district of rural, urban, and suburban communities. The study was requested by the school district office overseeing the program in collaboration with the IB. Funding for the study was provided by the IB.

Program Description

Founded in 1968, the International Baccalaureate (IB) currently works with more than 4,000 schools in 145 countries to develop and offer four programs to over 1,080,000 students aged 3 to 19 years (IB, 2015a). The IB Primary Years Programme (PYP), Middle Years Programme (MYP), Diploma Programme (DP), and the IB Career Programme (IBCP) offer challenging curricula with rigorous assessment; each program encourages students to become lifelong learners and active citizens with a global perspective.

In the school district conducting the study, 22 IB programs have been authorized and established: one PYP, seven MYPs in middle schools, eight DPs and two IBCPs in high schools. Four of the high schools with DPs also have the MYP for students in Grades 9 and 10. All PYPs and MYPs in the district employ a whole-school model.

The MYP, for students aged 11 to 16, provides "a framework of academic challenge that encourages students to embrace and understand the connections between traditional subjects and the real world, and become critical and reflective thinkers" (IB, 2015b). The MYP provides a coherent and comprehensive curriculum that merges a framework of academic challenges and life skills with the district's instructional guides. The program is intended to promote the education of the whole person, emphasizing the importance of a broad and balanced education. Teachers focus on the inclusion of skills and processes built around a framework of concepts; the aim is to teach not only content knowledge but also to help students develop a genuine understanding of the underlying principles in each discipline and apply these in a new context in preparation for further learning.

Literature Review

The dual focus of the study—examining the high school achievement of former MYP students as well as their choice to enroll in IB courses and DP—suggests two threads of the literature. The first, academic achievement of MYP students, has received relatively little study (Hallinger, Lee, and Walker, 2011). In an examination of the IB MYP after 30 years of operation, Bunnell (2011) noted that the MYP has been the focus of little research, particularly when compared with the DP.

A few studies have examined the academic achievement of MYP students in comparison with non-MYP students (Australian Council for Educational Research, 2010; Kiplinger, 2005a, 2005b; Tan and Bibby, 2011; Wade, 2011). In general, when effects were found, they more often favored MYP, but regional differences and issues of research design have been noted. It also has been noted that assessing the impact of IB program participation on student achievement is often complicated by issues of selection, since many IB students, particularly in the IB DP, are high-achieving even before they participate in IB (Kiplinger, 2005a; 2005b; IB, 2008). Although the philosophy of the IB program extends beyond academics, it is difficult to measure the impact of IB, academic or otherwise, because of self-selection in most IB programs (IB, 2008).

The second outcome examined in the study was enrollment in IB courses and participation and success in the DP. MYP is often viewed as supporting the preparation of students for the DP (Walker, Bryant, and Lee, 2014; Sperandio, 2010) and the three IB programs are frequently referred to as the "IB continuum" (Hallinger, Lee, and Walker, 2011). Although the MYP was designed and developed separately and 25 years after the DP, and it evolved organically, without a direct link to the DP (Hallinger, Lee, and Walker, 2011), the programs are based on the same values. MYP and the DP share an emphasis on interdisciplinary learning, which is particularly evident in the *Theory of Knowledge* course in the DP (Marshman, 2010).

A few studies have examined the relationship between MYP enrollment and success in DP. Gordon and Bergeron (2015) recently reported findings that suggest students who perform better in MYP tend to perform better on DP exams. Using multilevel modeling, the authors found that school-level MYP performance moderates the MYP-DP relationship, such that as MYP scores increase, students in higher performing schools tend to perform better on their DP exams than students in lower performing schools, even if they have the same MYP score.

Sachdev (2011) also explored the relationship between MYP and DP, using qualitative and quantitative data. Feedback from students and teachers indicated that MYP prepares students for the internal (coursework) and external (examination) assessment components of the DP. Sachdev also reported a positive correlation between students' MYP grades and DP total score. Reimers (2004) examined the impact of MYP on IB DP scores, with mixed results. Caffyn and Cambridge (2005), however, published a critique questioning the design and analyses of Reimers' study, and concluding that the findings were not valid.

Scope of the Study

This study focused on the long-term impact of the IB Middle Years Programme by examining the relationship between enrollment in the IB Middle Years Programme and later high school academic outcomes. The study examined 2013–2014 data for students who were in Grade 8 during the 2009–2010 school year. Outcomes were compared for students who attended an MYP school and students who attended a non-MYP school.

The questions guiding the study were:

1. Was previous enrollment in MYP related to participation and performance on Advanced Placement (AP) and IB exams?

2. Was previous enrollment in MYP related to performance on SAT and ACT tests?
3. Was previous enrollment in MYP related to IB course-taking and exam performance, and enrollment, persistence, and performance in IB DP?

Methodology

Sample of Students and Procedures for Analyses for Questions 1 and 2

Student sample. The sample of students used to address the first two study questions—AP and IB course enrollment and SAT/ACT scores—was drawn from the study sample used in two earlier studies (Wade, 2011; Wade and Wolanin, 2013). The original sample included students in five MYP schools and five comparison schools. Comparison schools were selected from among non-MYP schools in the district based on their similarity on a composite of demographic variables: percentage of students receiving English for Speakers of Other Languages (ESOL), Free and Reduced-price Meals System (FARMS), and special education services; percentage of students identified as Asian American, African American, Hispanic, or White; and number of students in the school. The demographic characteristics of the two sets of schools at the time of the initial study is shown in Appendix A, Table A-1. The MYP and comparison schools were located in a large, diverse district of rural, urban, and suburban communities on the east coast.

Records from 2013–2014 were used to identify students who were enrolled in high school in the district four years later. Four of the 24 high schools currently attended by the students in the study have an MYP in which all Grade 9 and Grade 10 students participate. In order to avoid contaminating the non-MYP group with a "dose" of the MYP program in high school, the students who attended a non-MYP school and subsequently attended a high school with MYP for Grade 9 and Grade 10 (108 students) were removed from the sample. The resulting sample of students enrolled during 2013–2014 included 1,206 students who attended an MYP school in Grade 8 and 1,103 students who attended a non-MYP school in Grade 8 (see Appendix A, Table A-2).

An examination of the demographic characteristics of students in the two groups revealed several statistically significant differences. To reduce the possible impact of demographic differences between the two groups, analytic subsamples were identified using propensity score matching, resulting in a study sample of 885 former MYP students and 885 former non-MYP students.

Propensity score matching is a method of identifying two groups of subjects who would have similar chances (based on selected variables) of being in the "treatment" group (Rosenbaum & Rubin, 1984; 1985; Stuart, 2010). In this study the "treatment group" refers to enrollment in an MYP middle school. Statistical Package for the Social Sciences (SPSS) R-Plugin was used to compute the propensity scores. Nearest neighbor matching with no replacement was used to identify the two groups for this study. Propensity scores were computed using race/ethnicity, gender, and current receipt of FARMS, ESOL, and special education services. Descriptive statistics and distributions of propensity scores for the MYP and non-MYP groups are shown in Table A-3 and Figure A-1 in Appendix A.

Table 1 shows the demographic characteristics of the two analytic subgroups of students (after matching) in 2013–2014. About one third of each group was Hispanic/Latino and about one third was White. About half of each group currently or previously received FARMS, and only one percent currently received ESOL services. About 10 percent currently received special education services. Chi-square tests were conducted to test for differences in the demographic characteristics of the two groups; there were no significant differences by gender, race/ethnicity, or receipt of FARMS, ESOL, or special education services.

Table 1
2013–2014 Demographic Characteristics of Matched Subgroups of Students
Who Attended Grade 8 in an MYP School or a non-MYP School

		Previously Attended MYP School ($N = 885$)	Previously Attended Non-MYP School ($N = 885$)
		%	*%*
Gender	Male	52.2	52.2
	Female	47.8	47.8
Race/Ethnicity	American Indian or Alaskan Native	0.0	0.0
	Asian	12.8	12.9
	Black or African American	17.6	17.2
	Hispanic/Latino	32.3	32.8
	White	33.7	33.6
	Two or More Races	3.6	3.6
FARMS (current or previous)	FARMS	48.7	48.6
ESOL (current)	ESOL enrollment, any level	1.2	1.0
Special education (current)	Special education services, any level	9.7	9.6

Note. FARMS = Free and Reduced-price Meals System; ESOL = English for Speakers of Other Languages.

Procedures for analyses. In analyses addressing the first two research questions, comparisons of the two groups were statistically controlled using the following covariates: race/ethnicity; current receipt of special education or ESOL services; current or previous receipt of FARMS; and gender. The following analytic procedures were used in this study:
- Logistic regression was used to examine whether previous attendance at an MYP school had an effect on AP/IB test participation and achieving a college-ready AP/IB score. Differences in demographic characteristics were controlled as described above.
- Analysis of Covariance (ANCOVA) was used to examine whether previous attendance at an MYP school had an effect on the number of AP/IB exams taken, and on SAT scores and ACT scores. Differences in demographic characteristics were controlled as described above.

Both statistical significance tests and effect sizes (Cohen's *d*) were used in the analyses for Questions 1 and 2. Cohen's *d* was included to provide context across the findings, and to judge whether the observed relationships were large enough to be of practical significance to educators (American Psychological Association, 2010).

In this study, an effect size of .15 was considered an appropriate threshold for practical significance. While Cohen (1988) defines a small effect size of $d = .20$ and a large effect size as $d = .80$, he also points out that the relatively small effects of around $d = .20$ are most representative of fields that are closely aligned with education, such as social and clinical psychology. Similarly, Lipsey and Wilson's (1993) compendium of meta-analyses concluded that psychological, educational, and behavioral treatment effects of modest values of $d = .10$ to $d = .20$ should not be interpreted as trivial. Lipsey et al. (2012) compiled 829 reported effect sizes for achievement outcomes drawn from 124 studies and categorized them by type of intervention. The mean effect size for "Curriculum or broad instruction program" was $d = .13$ ($N = 227$ effect sizes), and the mean effect size for "Whole school program" was $d = .11$ ($N = 32$ effect sizes).

Appendix B describes the computation of effect sizes associated with the analytic procedures used in this evaluation.

Sample of Students and Procedures for Analyses for Question 3

Student sample. The sample of students used to address the third study question—IB course-taking and enrollment in the IB DP—was made up of two groups of students in three high schools with IB DP. The three high schools were selected because each offers an IB program for interested and qualified students attending the school, and each of the high schools receives students from both MYP and non-MYP middle schools. Thus, the design allowed analysis of participation in IB by students from both MYP and non-MYP backgrounds, where both groups have access to IB in their local high school.

To create two analytic groups, Grade 12 students in the three high schools were categorized as previously attending an MYP school or a non-MYP school during Grade 8 (only students who were in the district in Grade 8 were categorized). The initial categorization resulted in 273 students who had attended an MYP middle school and 604 students who had attended a non-MYP middle school. In order to control for selection bias, propensity score matching was conducted to select a sample from the non-MYP students that would be similar to the MYP students demographically; propensity scores were computed based on race/ethnicity, gender, and receipt of ESOL, special education, and FARMS services. SPSS R-Plugin, with nearest neighbor matching without replacement, was used to conduct the analysis. The demographic characteristics of students in the two matched analytic groups are shown in Table 2. Chi-square tests were conducted to test for differences in the demographic characteristics of the two study groups; there were no significant differences by gender, race/ethnicity, or receipt of FARMS, ESOL, or special education services.

Table 2 shows the resulting samples of former MYP ($N = 266$) and former non-MYP ($N = 266$) students. About a third of each sample was Hispanic/Latino and about a third was Black or African American. About two thirds of each group currently or previously received FARMS, and 2% currently were enrolled in ESOL classes. About 13% to 14% currently received special education services. For context, the demographic characteristics of all Grade 12 students in the study schools also are shown in Table 2. The students in the two analytic groups were demographically similar to the school populations of Grade 12 students overall, with percentages not differing more than four percentage points.

Table 2
2013–2014 Demographic Characteristics of Matched Subgroups of
Grade 12 Students Who Attended Grade 8 in an MYP School or non-MYP School,
And All Grade 12 Students in the Study Schools

2013–2014 Demographic Characteristics		Students Previously Enrolled in MYP ($N = 266$)	Students Previously Enrolled in Non-MYP ($N = 266$)	Grade 12 Students in Study Schools ($N = 1,333$)
		%	%	%
Gender	Male	47.7	48.5	51.9
	Female	52.3	51.5	48.1
Race/ Ethnicity	Amer.Indian/Alaska Native	0.4	0.0	0.2
	Asian	12.0	9.8	11.3
	Black/African Amer.	33.1	38.7	35.8
	Hispanic/Latino	38.3	35.7	38.5
	White	14.7	12.8	12.1
	Two or More Races	1.5	3.0	2.3
FARMS	Current or previous	67.3	69.2	68.3
ESOL	Current, any level	1.5	1.5	3.8
Spec. Educ.	Current, any level	12.8	14.3	14.3

Note. FARMS = Free and Reduced-price Meals System; ESOL = English for Speakers of Other Languages.

Procedures for Analyses. In all analyses addressing Question 3, differences in demographic characteristics were further controlled by including the following covariates: race/ethnicity; current receipt of special education or ESOL services; current or previous receipt of FARMS; and gender. In addition, since one of the three high schools has an MYP in which all Grade 9 and Grade 10 students participate, enrollment at that high school (with MYP) was included in the analyses to control for the potential effect of MYP in Grades 9 and 10 in high school. The following analytic procedures were used in this study:

- Logistic regression was used to examine whether previous attendance at an MYP school had an effect on IB course-taking, IB test participation and performance, enrollment in the DP, and earning an IB diploma. Differences in demographic characteristics, as well as MYP in high school, were controlled as described above.

- Analysis of Covariance (ANCOVA) was used to examine whether previous attendance at an MYP school had an effect on the number of IB courses taken, number of IB exams taken, and the number of college-ready scores earned on IB exams. Differences in demographic characteristics, as well as MYP in high school, were controlled as described above.

As described above in reference to analyses for Questions 1 and 2, both statistical significance tests and effect sizes were used in the analyses for Question 3.

Measures of Course Enrollment and Student Performance

Course enrollment and student performance data were obtained from the school district student records. AP exam participation and AP exam scores, as well as SAT participation and scores were obtained from district files that were constructed from data received from College Board. IB exam participation and IB exam scores were obtained from district files that were constructed from data provided by IB. ACT participation and scores were obtained from district files constructed from data provided by ACT.

The school district conducting the study has established a milestone of 1650 on the SAT or 24 on the ACT as an indicator of college and career readiness (MCPS, 2013). The College Board (2015) designates a score of 3, 4, or 5 on an AP test as an indication that the student has proven to be capable of doing the work of an introductory-level course in a particular subject at college, and some colleges award credit for an AP score of 3 or above. On IB exams, some colleges award college credit to students earning a 4 or above (college practices vary considerably: see IB, 2015c). In the current study, both the district milestone for SAT or ACT, as well as students' scores on the tests, were analyzed.

Student Demographic Information

Race/ethnicity, gender, previous and current school, and receipt of services (FARMS, ESOL, and special education) data were obtained from student records. The demographic data were used to generate propensity scores for selecting a comparison group, and as control variables in analyses of the effect of MYP on AP and IB test participation and performance, IB course enrollment, and SAT/ACT scores.

Strengths and Limitations of the Study

The study was conducted using multiple procedures to reduce the sample selection bias: 1) by design, in the selection of demographically similar comparison schools for samples used in questions 1 and 2; 2) by matching samples using statistical techniques; and 3) by statistical procedures, controlling for student background characteristics.

The numbers of students who participated in the IB DP (Question 3) were fairly small, so findings must be viewed cautiously. Analyses were based on a subset of students enrolled in the three high schools. In order to conduct the most balanced comparisons, matched samples of MYP and non-MYP students were selected, so the numbers of exams and diplomas for the two groups in this study reflect only a subset of students. However, the percentages of students in the analytic sample who were IB DP candidates, and who earned an IB diploma, were similar to those in the school population.

Results

Research Question 1: Was previous enrollment in MYP related to participation and performance on AP and IB exams?

AP and IB Exam Participation and Performance

Table 3 shows the percentage of students in each group who took at least one AP or IB test during high school, and who earned at least one AP or IB score at a "college-ready" level (3, 4, or 5 on an AP test, and 4, 5, 6, or 7 on an IB test).

Table 3
Percentages of Students with AP or IB Exam Participation and AP or IB College-Ready Scores:
Students from MYP Schools and Non-MYP Schools

	Students previously enrolled in MYP Schools ($N = 885$)		Students previously enrolled in non-MYP Schools ($N = 885$)	
	n	*%*	*n*	*%*
Took at least one AP or IB test	597	67.5	556	62.8
Scored college-ready on AP (3 or higher) or IB (4 or higher) on at least one test	485	54.8	435	49.2

The effect of previous enrollment in an MYP school on AP or IB exam participation and performance in high school was tested using logistic regression analyses, controlling for demographic characteristics. Previous enrollment in MYP was significantly related to taking at least one AP or IB test ($p = .02$) and to achievement of at least one college-ready score on an AP or IB test ($p = .01$). Effect sizes indicated practical significance of the findings; the MYP students were about a third more likely to take an AP or IB test and to achieve at least one college-ready score ($d = .16$, $d = .18$). Full results of the regression models are shown in Appendix C, Table C-1.

Table 3a
Odds Ratios for Enrollment and Performance in AP and IB Courses,
Effect of Previous Enrollment in MYP

Course	*N*	Odds Ratio	*p* value	Effect size (*d*)
Took at least one AP or IB test				
Students previously enrolled in MYP schools	885	1.34	.02	.16
Students previously enrolled in non-MYP schools	885			
Achieved at least one college-ready score on AP or IB				
Students previously enrolled in MYP schools	885	1.39	.01	.18
Students previously enrolled in non-MYP schools	885			

Among students who took at least one AP or IB test, the adjusted mean number of AP or IB tests taken and the adjusted mean number of AP or IB tests receiving college-ready scores (3 or higher on AP; 4 or higher on IB) were examined for the two groups. Table 4 shows the adjusted mean number of tests for each group.

Analysis of covariance (ANCOVA), with demographic characteristics controlled revealed that among test-takers, students who previously attended MYP schools took more AP/IB tests ($F = 46.4$, $p < .001$, $d = .37$), and also earned more college-ready scores on AP/IB tests than their non-MYP counterparts ($F = 16.2$, $p < .001$, $d = .21$). The effect sizes for the differences in the number of AP/IB tests taken, as well as in the number of tests achieving college-ready scores, were of practical significance; the students who had previously attended MYP schools took, on average, one more AP/IB test than the non-MYP students, and the MYP students had an adjusted mean number of college-ready scores that was .79 higher than that of the non-MYP students.

Table 4
Adjusted Mean Number of AP/IB Tests Taken and Adjusted Mean Number of College-Ready
Scores: Students from MYP Schools and non-MYP Schools Who Took at Least One AP or IB Test

	Students previously enrolled in MYP schools		Students previously enrolled in non-MYP schools		MYP effect			
	N	*Adjusted* $\bar{X}$	N	*Adjusted* $\bar{X}$	Mean difference	Std. error	p	ES (d)
Number of AP/IB tests taken[a]	597	5.77	556	4.50	1.27	.13	.00	.37
Number of college-ready scores on AP/IB tests earned[b]	597	4.23	556	3.44	.79	.14	.01	.21

Note. Means were adjusted using the following covariates: race/ethnicity, gender, ESOL, FARMS, and special education.
[a] Includes only students who took at least one AP or IB test. Levene's test of equality of variances, $p < .01$.
[b] Includes only students who took at least one AP or IB test. Levene's test of equality of variances, $p < .01$.

Research Question 2: Was previous enrollment in MYP related to performance on SAT and ACT tests?

Nearly three quarters of the students in each of the groups—MYP and non-MYP—took the SAT or ACT during high school (see Table 5). More than a third of the students from each of the groups (40% of the students who attended MYP schools and 38% of the non-MYP students) met the district SAT/ACT milestone of 1650 on the SAT or 24 on the ACT.

Table 5
Percentage of Students Taking SAT or ACT and Percent of Students Meeting District Milestone:
Students from MYP Schools and Non-MYP Schools

	Students previously enrolled in MYP Schools ($N = 885$)		Students previously enrolled in non-MYP Schools ($N = 885$)	
	n	%	*n*	%
Took SAT or ACT	648	73.2	621	70.2
Scored at or above district milestone of 1650 on SAT or 24 on ACT	350	39.5	337	38.1

Logistic regression analyses were used to test whether previous MYP enrollment was related to taking the SAT or ACT, and to scoring at or above the district target of 1650 on the SAT or 24 on the ACT. For these analyses, students who met the criterion (i.e., took the SAT or ACT; scored at the district milestone) were coded 1; students who did not meet the criterion were coded 0. Demographic characteristics were included in the analysis as covariates. The percentages of students in the two groups who took the SAT or ACT, and the percentages of students in the two groups scoring at or above the district SAT/ACT target, were not significantly different (although the difference in percentages taking the SAT or ACT approached significance, $p = .06$) (Table 5a). Full results of the logistic regression analyses are presented in Appendix C, Table C-2). Effect sizes did not reach the threshold for practical significance.

Table 5a
Odds Ratios for Taking SAT or ACT and for Scoring at District Target,
Effect of Previous Enrollment in MYP

	N	Odds Ratio	*p* value	Effect size (*d*)
Took SAT or ACT				
Students previously enrolled in MYP schools	885			
Students previously enrolled in non-MYP schools	885	1.28	.06	.14
Scored at or above district target of 1650 on SAT or 24 on ACT				
Students previously enrolled in MYP schools	885			
Students previously enrolled in non-MYP schools	885	1.12	.38	.06

Scores for SAT and ACT were compared for students previously enrolled in MYP schools and students previously enrolled in non-MYP schools. The adjusted mean scores for SAT (3 subtests), and for ACT composite score are shown in Table 5b for the two groups.

Table 5b
Adjusted Mean Scores on SAT and Adjusted Mean Scores on ACT:
Students from MYP Schools and non-MYP Schools

	Students previously enrolled in MYP schools		Students previously enrolled in non-MYP schools		MYP effect			
	N	Adjusted $\bar{X}$	N	Adjusted $\bar{X}$	Mean difference	Std. error	p	ES (d)
Mean SAT[a]	583	1663	548	1668	-5	10.6	.73	-.02
Mean ACT[b]	237	24.2	263	24.8	-0.6	.33	.10	-.11

Note. Means were adjusted with the following covariates: race/ethnicity, gender, ESOL, FARMS, and special education.
[a] SAT is high administration on record, three subtests. Levene's test of equality of variances, $p = .818$.
[b] ACT is high administration on record, composite score. Levene's test of equality of variances, $p = .350$.

The mean adjusted SAT scores and the mean adjusted ACT scores were not significantly different between the students who were previously enrolled in MYP schools and the students who were previously in non-MYP schools ($p > .05$).

Research Question 3: Was previous enrollment in MYP related to IB course-taking and exam performance, and enrollment, persistence, and performance in IB DP?

In each of the three high schools in the study, students may take IB courses and may sit for IB exams without enrolling in the full Diploma Programme. Table 6 shows the percentage of students in each group who were enrolled in at least one IB course during high school, as well as percentages of students who took at least one IB exam, and who earned at least one IB score at a college-ready level (4 or higher).

Table 6
Percentages of Students with IB Course Enrollment, Exam Participation, and College-Ready Scores:
Analytic Subgroups of Students from MYP Schools and Non-MYP Schools

	Students previously enrolled in MYP schools ($N = 266$)		Students previously enrolled in non-MYP schools ($N = 266$)	
	n	%	n	%
Took at least one IB course during high school	90	33.8	89	33.5
Took at least one IB exam	39	14.7	53	19.9
Scored college-ready on at least one IB exam (4 or higher)	34	12.8	41	15.4

One third of the students in each subgroup (i.e., former MYP students and their non-MYP counterparts) took at least one IB course during high school; between 15% and 20% of students took at least one IB exam and 13% to 15% scored at least one college-ready score. The effect of previous enrollment in MYP on IB course-taking, IB exam participation, and IB exam performance was tested using logistic regression analyses, controlling for demographic characteristics and MYP in high school. Students who met the criterion (i.e., took at least one IB course; took at least one

IB exam; scored 4 or higher on at least one IB exam) were coded 1; students who did not meet the criterion were coded 0. As shown in Table 6a, previous MYP enrollment was not significantly related to taking an IB course, taking an IB exam, or to IB exam performance. The effect size for "Took at least one IB exam" was large enough to meet the threshold for practical significance in favor of students previously enrolled in non-MYP schools, but the 95% confidence interval for the odds ratio indicated that the result would not be considered reliable (95% C.I.: .41, 1.08). Full results of the logistic regression analyses are presented in Appendix C, Table C-3.

Table 6a
Odds Ratios for Taking IB Course, Taking IB Exam, and Scoring at College-Ready Level,
Effect of Previous Enrollment in MYP

	N	Odds Ratio	p value	Effect size (d)
Took at least one IB course during high school				
Students previously enrolled in MYP schools	266	1.02	.91	.01
Students previously enrolled in non-MYP schools	266			
Took at least one IB exam				
Students previously enrolled in MYP schools	266	.66	.10	-.23
Students previously enrolled in non-MYP schools	266			
Scored college-ready level on at least one IB exam				
Students previously enrolled in MYP schools	266	.84	.53	-.09
Students previously enrolled in non-MYP schools	266			

For students who took at least one IB course or one IB exam, Table 7 shows: the adjusted mean number of IB courses taken; the adjusted mean number of IB exams taken; and the adjusted mean number of IB exams earning a score of 4 or above. The mean number of courses are reported only for students taking at least one IB course, and the mean number of exams and exams earning a score of 4 or higher are reported only for students taking at least one IB exam.

Table 7
Adjusted Mean Number of IB Courses Taken, Exams Taken, and Exams Earning 4 or Above:
Analytic Subgroups of Students from MYP Schools and non-MYP Schools

	Students previously enrolled in MYP schools		Students previously enrolled in non-MYP schools		MYP effect			
	N	Adjusted $\bar{X}$	N	Adjusted $\bar{X}$	Mean difference	Std. error	p	ES (d)
Number of IB courses taken[a]	90	3.90	89	3.84	0.06	.41	.93	.01
Number of IB exams taken[b]	39	3.88	53	3.07	0.81	.30	.09	.35
Number of college-ready scores on IB exams earned[c]	39	3.03	53	2.05	0.98	.26	.02	.50

Note. Means were adjusted using the following covariates: race/ethnicity, gender, ESOL, FARMS, and special education.
[a] Includes only students who took at least one IB course. Levene's test of equality of variances, $p = .478$.
[b] Includes only students who took at least one IB exam. Levene's test of equality of variances, $p = .062$.
[c] Includes only students who took at least one IB exam. Levene's test of equality of variances, $p = .049$.

Among students who took at least one IB course, students from the MYP and non-MYP groups took, on average, a similar number of IB courses (MYP = 3.9; non-MYP = 3.8); ANCOVA revealed no significant difference between the two groups ($p = .93$). Among students who took at least one IB exam, the difference in the number of exams taken by MYP and non-MYP students was not statistically significant ($F = 3.02$, $p = .09$); a practically significant effect size (Cohen's $d = .35$) was observed, but the 95% confidence interval indicated the result would not be considered reliable (95% C.I.: -.06, .77). However, the number of college-ready scores was significantly higher among MYP students than among non-MYP students ($F = 5.81$, $p = .02$), with a practically significant effect size (Cohen's $d = .50$). Students who had previously attended MYP schools earned, on average, one more IB test score of 4 or higher than students who attended non-MYP schools.

IB Diploma Programme Participation, Persistence, and Performance

DP Participation. Students who enter the IB Diploma Programme are required to take the *Theory of Knowledge* course during Grade 11, so for this study, enrollment in this course was used to mark entry into the DP. Among students in the two analytic subgroups, 23 (8.5%) students who previously attended an MYP school and 21 (7.9%) students who previously attended a non-MYP school were enrolled in *Theory of Knowledge* course in Grade 11.

DP Persistence. In these analytic subgroups, most of those students who took the *Theory of Knowledge* course in Grade 11 continued IB DP participation in Grade 12 and took exams as a DP candidate (21 of 23 or 91% of the MYP students and 18 of 21 or 86% of the non-MYP students).

DP Performance: Diploma Achievement. Finally, in these analytic subgroups, 12 of the MYP students (4% of the total) and 6 of the non-MYP students (2% of the total) successfully met the requirements for an IB Diploma.[1] Table 8 shows the percentages in the analytic subgroups who achieved each of these stages of IB participation.

Table 8
Percentage of Students Enrolled in *Theory of Knowledge* Course in Grade 11,
Tested for IB Diploma and Earned IB Diploma:
Analytic Subgroups of Students from MYP Schools and Non-MYP Schools

	Students previously enrolled in MYP Schools ($N = 266$)		Students previously enrolled in non-MYP Schools ($N = 266$)	
	n	%	*n*	%
Took *Theory of Knowledge* Course	22	8.3	21	7.9
Tested as a DP candidate	20	7.5	18	6.8
Earned IB Diploma	11	4.1	6	2.3

[1]It should be remembered that the numbers of course enrollments, exams, and diplomas are based on a subset of students in the three schools. Thus, numbers of exams and diplomas do not reflect numbers achieved by all students in the schools, although percentages within the analytic sample and within the school population are similar. Among all Grade 12 students in the three high schools, 78 were candidates for a diploma (7%) and 38 earned an IB diploma (3%).

Table 8a shows the results of logistic regression analyses that were used to test the effect of MYP on students' participation, persistence, and performance in the IB DP. In these analytic subgroups the numbers of students meeting each level of participation were small, and statistical tests yielded results that were not statistically significant. The effect size for earning an IB diploma ($d = .38$) indicated practical significance for the effect of previous MYP enrollment but the 95% confidence interval of the odds ratio indicated instability (95% C.I. = .70, 5.76).

Table 8a
Odds Ratios for Enrollment in *Theory of Knowledge* Course in Grade 11,
Testing for IB Diploma and Earning IB Diploma:
Effect of Previous Enrollment in MYP

	N	Odds Ratio	*p* value	Effect size (*d*)
Took *Theory of Knowledge* Course				
Students previously enrolled in MYP schools	266	1.11	.77	.06
Students previously enrolled in non-MYP schools	266			
Tested as a DP candidate				
Students previously enrolled in MYP schools	266	1.21	.60	.10
Students previously enrolled in non-MYP schools	266			
Earned IB Diploma				
Students previously enrolled in MYP schools	266	2.00	.20	.38
Students previously enrolled in non-MYP schools	266			

Conclusion

The study used two different samples to examine the effect of previous MYP enrollment on high school course-taking and performance: 1) a follow-up sample of students who attended either an MYP middle school or a non-MYP middle school and currently were attending a high school in the district; and 2) a sample of students in three district high schools that have local IB DP programs and that receive students from both MYP and non-MYP schools. In both of the samples used for this study, students with previous MYP enrollment participated in more AP or IB exams, and scored at college-ready levels on more AP or IB exams.

Performance on the SAT and ACT did not appear to be related to previous MYP enrollment. The lack of a positive effect for MYP on SAT and ACT may suggest that an MYP background does not influence performance on these standardized tests, or it may be the result of the district's efforts to prepare *all* students for success on these indicators of college readiness.

Finally, measures of IB Diploma Programme participation were not significantly related to previous attendance at an MYP school, but the numbers of students in these analytic samples were relatively small. Further study, with larger numbers of students, is needed to explore the relationship between enrollment in MYP and participation, persistence, and performance in the IB Diploma Programmme.

The study provides some evidence that MYP participation is positively related to greater success on AP and IB exams. Previous work has reported that students view the rigor of MYP as a benefit

of MYP (Wade and Wolanin, 2013) and that an MYP background prepares students for DP by providing them with an understanding of criterion-based assessment and by developing their organizational skills and inquiry skills (Walker, Bryant, and Lee, 2014). This study suggests that students may have gained skills in MYP that prepared them for success in advanced courses such as AP and IB.

Acknowledgements

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Appendix A

Table A-1
Demographic Characteristics of Students in MYP Schools and Comparison Schools, 2009–2010

		Students in MYP Schools (5 middle schools) ($N = 4,201$)	Students in Comparison Schools (5 middle schools) ($N = 3,847$)
		%	%
Gender	Male	51.1	52.4
	Female	48.9	47.6
Race/Ethnicity	American Indian or Alaskan Native	0.3	0.2
	Asian	12.5	20.1
	Black or African American	25.7	20.6
	Hispanic/Latino	29.5	26.0
	White	26.9	30.1
FARMS (current)	FARMS	37.2	34.9
ESOL (current)	ESOL enrollment, any level	6.8	5.9
Special education (current)	Special education services, any level	11.9	11.1

Note. FARMS = Free and Reduced-price Meals System; ESOL = English for Speakers of Other Languages.

Table A-2

2013–2014 Demographic Characteristics of Subgroups of Students

Who Attended Grade 8 in an MYP School or a non-MYP School

		Previously Attended MYP School (*N* = 1,206)	Previously Attended Non-MYP School (*N* = 1,103)
		%	%
Gender	Male	52.0	53.1
	Female	48.0	46.9
Race/Ethnicity	American Indian or Alaskan Native	0.3	0.0
	Asian	12.0	20.9
	Black or African American	24.0	14.9
	Hispanic/Latino	32.4	28.6
	Native Hawaiian or Other Pacific Islander	0.2	0.0
	White	26.9	31.6
	Two or More Races	4.1	4.0
FARMS (current or previous)	FARMS	54.3	44.0
ESOL (current)	ESOL enrollment, any level	1.5	1.2
Special education (current)	Special education services, any level	10.3	9.9

Note. FARMS = Free and Reduced-price Meals System; ESOL = English for Speakers of Other Languages.

Table A-3
Descriptive Statistics for Propensity Scores of Two Analytic Groups

	Students previously enrolled in MYP schools (N = 885)				Students previously enrolled in non-MYP schools (N = 885)			
	Mean	S.D.	Min.	Max.	Mean	S.D.	Min.	Max
Propensity score	.4997	.0408	.42	.59	.4997	.0408	.42	.59
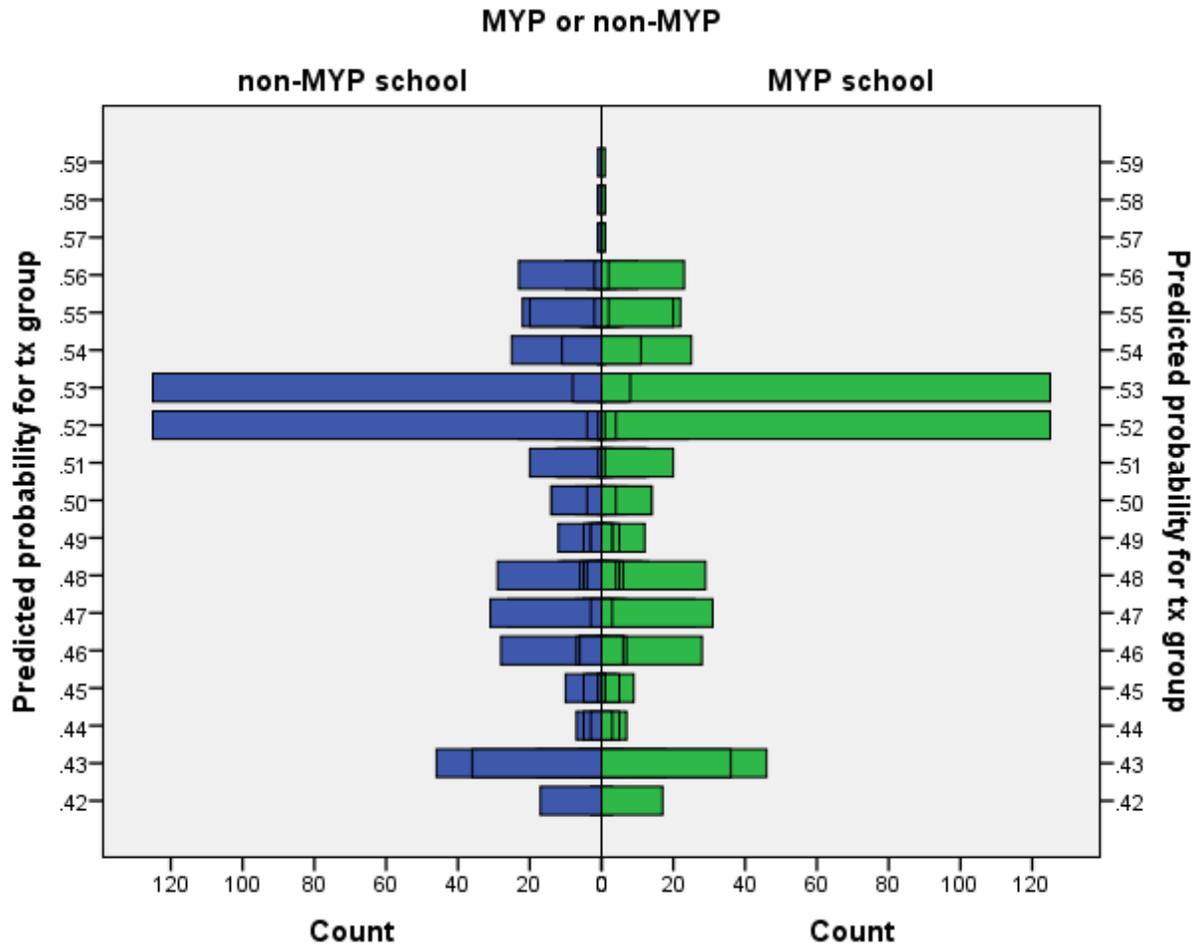
Figure A-1. Frequency of propensity scores in samples of students previously enrolled in MYP school (N = 885) and previously enrolled in non-MYP school (N = 885).

Appendix B

Calculation of Effect Sizes

Effect sizes for comparing groups on continuous outcome measures (e.g., mean number of IB courses taken). Effect sizes were estimated for differences between means with the standardized mean difference statistic, or Cohen's *d* (Cohen, 1988). The formula for Cohen's *d* is:

$$\frac{\text{mean}_{\text{treatment}} - \text{mean}_{\text{comparison}}}{\text{pooled standard deviation of outcome measure}}$$

> In this study, the treatment group is students who attended MYP schools and the comparison group is students who attended non-MYP schools.

Effect sizes for comparing groups on categorical outcome measures (e.g., earned an IB Diploma). For categorical outcomes the logistic regression analytic procedure was used to compute an odds ratio. Kline (2004) provides a formula for converting an odds ratio to an effect size expressed as *d*. That formula is:

$$\frac{\text{logit } d = \ln(OR)}{pi/\sqrt{3}}$$

Appendix C

Table C-1
Results of Logistic Regression Models Testing
Enrollment and Performance in AP and IB Courses:
Effect of Previous Enrollment in MYP

Model	B	S.E.B	Wald	Sig.	O.R.	*d*
Took at least one AP or IB test						
Gender (female)	.705	.121	33.97	.000	2.02	
Special Ed (current)	-1.807	.217	69.16	.000	.16	
FARMS (current or prior)	-1.221	.154	62.95	.000	.30	
ESOL (current)	-.431	.173	6.23	.013	.65	
Asian	.463	.242	3.66	.056	1.59	
African American	-1.478	.196	56.80	.000	.23	
Hispanic	-.814	.189	18.47	.000	.44	
More than one race/ethnicity	.258	.428	.363	.547	1.29	
Previous MYP enrollment	.296	.119	6.16	.013	1.34	.16
Constant	1.633	.145	126.41			
Scored college-ready on at least one AP or IB test						
Gender (female)	.477	.115	17.152	.000	1.61	
Special Ed (current)	-2.286	.281	66.01	.000	.10	
FARMS (current or prior)	-1.391	.146	91.356	.000	.25	
ESOL (current)	-.236	.177	1.767	.184	.79	
Asian	.173	.200	.747	.387	1.19	
African American	-1.819	.193	88.784	.000	.16	
Hispanic	-.555	.173	10.338	.001	.57	
More than one race/ethnicity	.307	.354	.754	.385	1.36	
Previous MYP enrollment	.333	.114	8.445	.004	1.40	.18
Constant	1.027	.127	65.121			

Note. Contrast group for race/ethnicity variables was white. For the model testing "Took at least one AP or IB test," the overall model $\chi^2(9, N = 1,770) = 544.664$, $p = .000$; overall prediction success was 74.9%. For the model testing "Scored college-ready on at least one AP or IB test," the overall model $\chi^2(9, N = 1,770) = 593.67$, $p = .000$; overall prediction success was 74.7%.

Table C-2
Results of Logistic Regression Models Testing
Taking the SAT or ACT and Achieving District Milestone:
Effect of Previous Enrollment in MYP

Model	B	S.E.B	Wald	Sig.	O.R.	d
Took the SAT or ACT						
Gender (female)	.744	.132	31.98	.000	2.10	
Special Ed (current)	-1.642	.206	63.28	.000	.19	
FARMS (current or prior)	-1.665	.180	85.73	.000	.19	
ESOL (current)	-.686	.178	14.78	.000	.50	
Asian	1.02	.293	12.07	.001	2.77	
African American	-.344	.229	2.25	.133	.709	
Hispanic	-.906	.211	18.468	.000	.40	
More than one race/ethnicity	1.101	.662	2.76	.096	3.01	
Previous MYP enrollment	.245	.129	3.63	.06	1.28	.14
Constant	2.114	.167	161.18			
Scored at district milestone on SAT or ACT						
Gender (female)	.167	.130	1.66	.198	1.18	
Special Ed (current)	-2.189	.352	38.66	.000	.11	
FARMS (current or prior)	-1.807	.161	126.30	.000	.16	
ESOL (current)	-.955	.266	12.85	.000	.38	
Asian	.184	.203	.820	.365	1.20	
African American	-2.264	.224	101.825	.000	.10	
Hispanic	-1.685	.187	81.229	.000	.185	
More than one race/ethnicity	-.337	.295	1.310	.252	.714	
Previous MYP enrollment	.114	.129	.780	.377	1.12	.06
Constant	1.099	.134	67.013			

Note. Contrast group for race/ethnicity variables was white. For the model testing "Took SAT or ACT," the overall model $\chi^2(9, N = 1,770) = 585.83$ $p = .000$; overall prediction success was 81.0%. For the model testing "Scored at district milestone on SAT or ACT," the overall model $\chi^2(9, N = 1,770) = 856.58$, $p = .000$; overall prediction success was 81.3%.

Table C-3
Results of Logistic Regression Models Testing
Taking IB Course, Taking IB Exam, and Scoring at College-Ready Level:
Effect of Previous Enrollment in MYP

Model	B	S.E.B	Wald	Sig.	O.R.	d
Took at least one IB course						
Gender (female)	.595	.201	8.75	.003	1.81	
Special Ed (current)	-.733	.259	8.02	.005	.48	
FARMS (current or prior)	-.624	.240	6.79	.009	.54	
ESOL (current)	-.373	.317	1.39	.239	.69	
Asian	-.276	.406	.46	.496	.76	
African American	-.913	.321	8.08	.004	.40	
Hispanic	-.929	.337	7.62	.006	.40	
More than one race/ethnicity	.565	.677	.70	.404	1.76	
Attended high school MYP	-.281	.214	1.72	.190	.76	
Previous MYP enrollment	.023	.199	.01	.909	1.02	.01
Constant	.360	.301	1.43			
Took at least one IB exam						
Gender (female)	.762	.257	8.78	.003	2.14	
Special Ed (current)	-1.007	.381	6.99	.008	.37	
FARMS (current or prior)	-.750	.293	6.55	.011	.47	
ESOL (current)	-.074	.406	.03	.856	.93	
Asian	.091	.455	.04	.842	1.10	
African American	-.476	.364	1.70	.192	.62	
Hispanic	-1.153	.416	7.68	.006	.32	
More than one race/ethnicity	.225	.696	.11	.746	1.25	
Attended high school MYP	.038	.260	.02	.884	1.04	
Previous MYP enrollment	-.414	.250	2.75	.097	.66	-.23
Constant	-.693	.345	4.037			
Scored college-ready on at least one IB exam						
Gender (female)	.786	.286	7.53	.006	2.19	
Special Ed (current)	-2.045	.610	11.24	.001	.13	
FARMS (current or prior)	-.904	.323	7.83	.005	.41	
ESOL (current)	-.138	.469	.09	.769	.87	
Asian	-.078	.494	.03	.874	.93	
African American	-.498	.390	1.63	.202	.61	
Hispanic	-1.243	.453	7.53	.006	2.29	
More than one race/ethnicity	.432	.711	.370	.543	1.54	
Attended high school MYP	-.272	.291	.874	.350	.76	
Previous MYP enrollment	-.171	.274	.389	.533	.84	-.09
Constant	-.760	.372	4.18			

Note. Contrast group for race/ethnicity variables was white. For the model testing "Took at least one IB course," the overall model $\chi^2(10, N = 532) = 62.99$, $p = .000$; overall prediction success was 71.6%. For the model testing "Took at least one IB exam," the overall model $\chi^2(10, N = 532) = 55.96$, $p = .000$; overall prediction success was 83.6%. For the model testing "Scored college-ready on at least one IB exam," the overall model $\chi^2(10, N = 532) = 66.92$, $p = .000$; overall prediction success was 87.0%.

Table C-4
Results of Logistic Regression Models Testing
Enrollment in Theory of Knowledge Course in Grade 11,
Testing for IB Diploma and Earning IB Diploma:
Effect of Previous Enrollment in MYP

Model	B	S.E.B	Wald	Sig.	O.R.	d
Enrolled in Theory of Knowledge Course in Grade 11						
Gender (female)	.241	.339	.51	.476	1.27	
Special Ed (current)	-1.014	.547	3.44	.064	.36	
FARMS (current or prior)	-.862	.383	5.06	.024	.42	
ESOL (current)	-.108	.590	.03	.855	.90	
Asian	.281	.665	.18	.673	1.32	
African American	.520	.506	1.06	.304	1.68	
Hispanic	-.442	.608	.53	.468	.64	
More than one race/ethnicity	1.785	.772	5.35	.021	5.96	
Attended high school MYP	.214	.345	.38	.535	1.24	
Previous MYP enrollment	.100	.336	.09	.766	1.11	.06
Constant	-2.23	.504	19.57			
Tested for IB Diploma						
Gender (female)	-.025	.357	.01	.945	.98	
Special Ed (current)	-1.245	.623	4.00	.046	.29	
FARMS (current or prior)	-.960	.398	5.82	.016	.38	
ESOL (current)	-.757	.780	.94	.332	.47	
Asian	.643	.683	.89	.347	1.90	
African American	.628	.536	1.37	.241	1.87	
Hispanic	-.310	.648	.23	.632	.73	
More than one race/ethnicity	1.945	.793	6.02	.014	7.00	
Attended high school MYP	.049	.370	.02	.895	1.05	
Previous MYP enrollment	.188	.358	.27	.601	1.21	.10
Constant	2.213	2.532	17.31			
Earned IB Diploma						
Gender (female)	-.328	.526	.39	.534	.72	
Special Ed (current)	-.740	.783	.89	.344	.48	
FARMS (current or prior)	-1.305	.648	4.06	.044	.27	
ESOL (current)	-.084	1.144	.01	.941	.92	
Asian	-.128	.932	.02	.891	.88	
African American	-.233	.677	.12	.731	.79	
Hispanic	-1.087	.925	1.38	.240	.34	
More than one race/ethnicity	1.321	.982	1.81	.179	3.75	
Attended high school MYP	.124	.534	.05	.816	1.13	
Previous MYP enrollment	.694	.539	1.66	.198	2.00	.38
Constant	-2.639	.681	15.03			

Note. Contrast group for race/ethnicity variables was white. For the model testing "Enrolled in TOK course," the overall model $\chi^2(10, N = 532) = 26.63$, $p = .003$; overall prediction success was 91.9%. For the model testing "Tested for IB Diploma," the overall model $\chi^2(10, N = 532) = 29.80$, $p = .001$; overall prediction success was 92.8%. For the model testing "Earned IB Diploma," the overall model $\chi^2(10, N = 532) = 19.26$, $p = .037$; overall prediction success was 96.8%.