High School Science and Mathematics Course Enrollment and Performance of Students who Attended the International Baccalaureate Middle Years Programme

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Executive Summary

A study of 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 three-phase study is to examine the influence of MYP on later high school performance and course enrollment, as well as to gain a more thorough understanding of the MYP experience from both student and teacher perspectives. This report is focused on phase 1 of the study: an analysis of the high school mathematics and science course-taking and performance of students previously enrolled in the five district MYP middle schools and five non-MYP middle schools.

Summary of Methodology

Grade 9 and Grade 10 science and mathematics course enrollment and performance were examined for two groups of students: students who attended an MYP middle school in Grade 8 during the 2009–2010 school year (N = 1,317), and students who attended a demographically similar non-MYP middle school in Grade 8 during the same school year (N = 1,266). Biology and Algebra 1 state-mandated test scores also were examined in relation to previous MYP enrollment. The study was conducted using two levels of control to reduce the selection bias: 1) by design, in the selection of demographically similar comparison schools; and 2) by statistical procedures, controlling for student background characteristics.

Key Findings

Findings for each of the research questions follow.

1. **Was previous enrollment in MYP related to enrollment in advanced level (honors or Advanced Placement [AP]) science or mathematics courses in Grades 9 and 10?** In Grade 9 and Grade 10 science and mathematics courses, students who attended an MYP school were significantly more likely to be enrolled in an advanced-level course than students who attended a non-MYP school. The effect was strongest for enrollment in Grade 9 advanced-level courses. In mathematics, the effect size was small, but of practical significance (d = .20). The effect size for Grade 9 science approached significance (d = .19).

2. **Was previous enrollment in MYP related to performance in science or mathematics courses in Grades 9 and 10?** In Grade 9 science and mathematics courses, significantly lower percentages of students who previously attended MYP schools earned a C or higher, compared with students who previously attended non-MYP schools. The effect size for Grade 10 science was small but of practical significance (d = -.21) and the effect size for Grade 9 mathematics approached significance (d = -.18). Effect sizes for Grade 9 science and Grade 10 mathematics were negligible (Grade 9 science: d = -.10; Grade 10 mathematics: d = -.06).

3. **Was previous enrollment in MYP related to performance on Biology and Algebra state-mandated exams?** Students who previously attended MYP schools were significantly more likely to achieve a passing score on the Biology exam, but the effect size was not large enough to be of practical educational significance (d = .16). In addition, no statistically significant differences between MYP and non-MYP students were found in their mean Biology or Algebra 1 scale scores.

Conclusion

This study found some evidence that students who attended an MYP school were more likely to enroll in advanced-level science and mathematics courses in high school than their peers who attended a non-MYP school. Enrollment in Grade 9 advanced-level science and mathematics courses had the strongest association with previous MYP enrollment. This finding is in line with the better performance of MYP students compared with non-MYP students on Grade 8 mathematics MSA tests (Wade, 2011). In addition, in survey responses, MYP students named the rigor and challenge of MYP courses as one of the top three benefits of being an MYP student (Wade & Wolanin, 2013). The findings suggest that the opportunity to tackle a high level of academic work through the MYP has an impact on students' course selections in high school.

There were few differences between MYP students and their non-MYP peers with respect to course grades in science and mathematics, or performance on Biology and Algebra 1 state-mandated tests. It is possible that these measures in the context of this follow-up study were not sensitive enough to detect the effects of previous enrollment in MYP.

High School Science and Mathematics Course Enrollment and Performance of Students who Attended the International Baccalaureate Middle Years Programme

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Background

The International Baccalaureate (IB) offers four programs of international education to over 1,080,000 students, aged 3 to 19 years, in 145 countries. The IB Primary Years Programme (PYP), Middle Years Programme (MYP), Diploma Programme (DP), and the IB Career-related Certificate (IBCC) offer challenging curricula with rigorous assessment; each program encourages students to become lifelong learners and active citizens with a global perspective. The MYP "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" (http://www.ibo.org/mission/). Five middle schools in the district have implemented MYP, and all use a whole-school model; that is, all teachers and students in the school participate in the program.

The broad objective of this study was to examine the influence of MYP on later high school performance and course enrollment, as well as to gain a more thorough understanding of the MYP experience from both student and teacher perspectives. The study was conducted in three phases: 1) an analysis of the effect of previous enrollment in MYP on high school course-taking and performance; 2) a comparison of the perceptions of students previously enrolled in MYP with students previously enrolled in non-MYP middle schools with regard to their middle school experiences, their plans for IB, student service learning and volunteer experiences, and global mindedness; and 3) an examination of the perceptions of MYP teachers about the program and MYP professional development.

This report addresses phase 1 of the study: An analysis of the high school science and mathematics course-taking and performance of students previously enrolled in the five district MYP middle schools and five non-MYP middle schools. A previous study of the MYP in the district (Wade, 2011) found small to medium effect sizes in favor of MYP in the science and mathematics performance of MYP and non-MYP middle school students. The aim of the current study was to extend and substantiate those findings by following the progress of these students into high school.

The study was conducted by evaluation personnel in the district; it was requested by the district office overseeing the program, in collaboration with the IB. Funding for the study was provided by the IB.

Literature Review

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 (Tan & Bibby, 2010, 2010; Kiplinger, 2005a, 2005b; Tan and Bibby, 2012; Wade, 2011). In general, when effects were found, they more often favored MYP, but regional differences and issues of research design have been noted. 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.

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. This problem was highlighted by Kiplinger (2005a; 2005b) and discussed in an IB publication (IB, 2008). Studies of effects associated with IB programs must contend with the fact that IB students, particularly at the high school level, are often high-performing students who have opted to take the most demanding courses. 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 whole-school model of the MYP in five district middle schools provided a study sample not confounded by student self-selection factors. A previous study of MYP in the same district (Wade, 2011), compared the engagement and performance of students enrolled in the five MYP middle schools with that of students in five demographically similar middle schools without MYP. In the district that conducted the study, MYP students attend their neighborhood public school, where all students and teachers participate in the MYP. Thus, although at the *school* level some selection factors may be at play (i.e., the schools that students attended were not randomly assigned to MYP or non-MYP); the students within schools did not elect whether or not to be in MYP, as has been the case in some earlier studies. The current study builds on the earlier study and its use of the whole-school model for MYP by following the academic progress of students who were enrolled in the two study samples—students from MYP middle schools and students from demographically similar non-MYP comparison schools.

Scope of the Study

This study compared the Grade 9 and Grade 10 science and mathematics course enrollment and performance of students who previously attended five MYP middle schools with that of students who attended five demographically similar non-MYP middle schools. The questions guiding the study included:

1. Was previous enrollment in MYP related to enrollment in advanced level (honors or AP) science or mathematics courses in Grades 9 and 10?
2. Was previous enrollment in MYP related to performance in science or mathematics courses in Grades 9 and 10?

3. Was previous enrollment in MYP related to performance on Biology and Algebra state-mandated exams?

Methodology

Course enrollment and student performance were examined for two groups of students: students who attended an MYP middle school in Grade 8 during the 2009–2010 school year, and students who attended a demographically similar non-MYP middle school in Grade 8 during the same school year. The study was conducted using two levels of control to reduce the selection bias: 1) by design, in the selection of demographically similar comparison schools; and 2) by statistical procedures, controlling for student background characteristics.

Sample of Schools

The sample of schools used in this study was the same sample used in the previous study (Wade, 2011) which compared the performance and school engagement of students in MYP schools with students in non-MYP schools. That is, all five MYP schools were included in the study, and five comparison schools were selected from among the 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. Schools with special programs requiring student applications for selection were not included among the comparison group of schools.

Sample of Students

The sample of students for this study was drawn from the previous study sample (Wade, 2011). Two groups of students comprised the study sample: students who attended an MYP in Grade 8 during the 2009–2010 school year (N = 1,317); and students who attended a demographically similar non-MYP middle school in Grade 8 during the same school year (N = 1,266). Course enrollment and performance measures were examined for these two groups of students at two points: in Grade 9 (one year out of middle school) and in Grade 10 (two years out of middle school).

For this study, students were categorized according to their (previous) Grade 8 middle school enrollment (MYP middle school or non-MYP middle school). Their current high school of enrollment was not considered in the analyses.

Measures of Course Enrollment and Student Performance

Course enrollment and student performance data were obtained from district student records. Science and mathematics course enrollment and course grades were examined, as well as Biology and Algebra 1 state exam scores.

Enrollment in advanced-level science and mathematics courses in Grade 9 and in Grade 10 was examined for the two groups of students. Courses were counted as advanced if they were designated "Honors," "AP," or "pre-IB." In addition, mathematics courses that were more than one year beyond the typical "pathway" in this school district were counted as advanced courses: in Grade 9, Algebra 2, Pre-calculus, Calculus, and Statistics were counted as advanced courses (in addition to Honors, AP, and pre-IB courses); in Grade 10, Pre-calculus, Calculus, and Statistics were counted as advanced courses.

Scores and passing rates on the state-mandated Biology and Algebra exams were used as additional measures of performance in science and mathematics. All high school students in this state are required to take and pass exams in algebra, biology, government, and English. The exams measure students' content knowledge in the respective subject areas, and are aligned with the state's High School Core Learning Goals. Analyses of state-mandated test performance included data for students who had taken the exams as of the end of Grade 10 (2011–2012 school year).

Student Demographic Information

Race/ethnicity, gender, previous and current school, and receipt of services (FARMS, ESOL, and special education) data were obtained from the district student records. The demographic data were used as control variables in analyses of the effect of MYP on high school course enrollment, course performance, and state-mandated test scores.

Procedures for Analysis

Data analytic procedures varied with the format of the data (e.g., binary or continuous outcome variable). In all analyses of student performance and course enrollment, differences in student characteristics were controlled using propensity scores based on race/ethnicity; receipt of FARMS, special education, and ESOL services; and gender. The propensity scores were converted to quintiles and used as covariates in the analytic models (Rosenbaum & Rubin, 1983, 1984, 1985). Additional covariates were used in some analyses, as described below. The following analytic procedures were used in this study:

- Logistic regression was used for the first evaluation question, examining whether previous attendance at an MYP school had an effect on enrollment in advanced-level science and mathematics courses during Grades 9 and 10. Differences in demographic characteristics were controlled, as described above, using propensity score quintiles.
- Logistic regression was used for the second evaluation question, examining whether MYP had an effect on earning a C or higher in Grades 9 and 10 science and mathematics courses. Differences in demographic characteristics were controlled, as described above, using propensity score quintiles. In addition, students' enrollment in an advanced-level science or mathematics course was used as a covariate.
- Analysis of Covariance (ANCOVA) and logistic regression were used to address the third evaluation question. ANCOVA was used to examine whether previous attendance at an MYP school had an effect on students' scale scores on the Algebra 1 and Biology state-mandated tests. Logistic regression was used to test whether MYP was related to achieving a passing score on the Algebra 1 or Biology state test. Differences in

demographic characteristics were controlled, as described above, using propensity score quintiles.

Both statistical significance tests and measurement of effect size (Cohen's *d*) were used in the study. 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). Appendix A describes the computation of effect sizes associated with the analytic procedures used in this evaluation.

Results

Characteristics of the Student Sample

Characteristics of two groups of students—those who were enrolled in Grade 8 in 2009–2010 in an MYP school, and those who were enrolled in Grade 8 in 2009–2010 in a non-MYP school—were examined. Table 1 shows the demographic characteristics of the two groups of students in 2010–2011, during Grade 9.

Table 1
Demographic Characteristics of 2010–2011 Grade 9 Students
Who Attended 2009–2010 Grade 8 in an MYP School or a non-MYP School

		Grade 8 Enrollment in 2009–2010	
		MYP School (*N* = 1,317)	non-MYP School (*N* = 1,266)
Demographic Characteristics		*%*	*%*
Gender	Male	51.9	53.2
	Female	48.1	46.8
Race/Ethnicity	American Indian or Alaskan Native	0.3	0.0
	Asian	11.8	19.8
	Black or African American	23.9	17.3
	Hispanic/Latino	32.8	29.6
	Native Hawaiian or Other Pacific Islander	0.2	0.0
	White	26.7	29.5
	Two or More Races	4.3	3.7
FARMS (current or previous)	FARMS	51.6	44.2
ESOL (current)	ESOL enrollment, any level	6.8	4.9
Special education (current)	Special education services, any level	10.2	11.1

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

Since the non-MYP schools were chosen to be demographically similar to the five MYP schools, the samples were similar overall. The percentage of Black or African American students in the MYP group was somewhat higher than that of the non-MYP group (24% vs. 17%), the percentage of Asian students was somewhat lower in the MYP group than in the non-MYP group (12% vs. 20%) and the percentage of students who currently or previously had been enrolled in

FARMS was 52% among the MYP group and 44% among the non-MYP group. Other differences in the demographic makeup of the two groups were less than five percentage points.

Research Question 1: Was previous enrollment in MYP related to enrollment in advanced level (honors or AP) science or mathematics courses in Grades 9 and 10?

Table 2 shows the percentage of students in each group who were enrolled in advanced-level science and mathematics courses during Grade 9 and Grade 10. Higher percentages of students who previously attended MYP schools were enrolled in advanced-level science and mathematics courses compared with students who attended non-MYP schools, particularly in Grade 9 courses.

Table 2
2010–2011 and 2011–2012 Enrollment in Advanced-Level Science and Mathematics Courses: Students from MYP Schools and non-MYP Schools

	Students previously enrolled in MYP Schools (2009–2010)		Students previously enrolled in non-MYP Schools (2009–2010)	
Course and Grade Level	*Group N*	*%*	*Group N*	*%*
Enrolled in advanced-level **science course** in Grade 9, 2010–2011	1,282	69.5	1,234	63.9
Enrolled in advanced-level **science course** in Grade 10, 2011–2012	1,025	62.0	1,109	61.0
Enrolled in advanced-level **mathematics course** in Grade 9, 2010-2011	1,310	52.0	1,241	47.1
Enrolled in advanced-level **mathematics course** in Grade 10, 2011-2012	1,050	46.1	1,090	44.7

Note. *Group N*s represent all students in study sample group (MYP or non-MYP) who had record of a course in the subject area during the specified year.

The effect of previous enrollment in an MYP school on enrollment in advanced-level courses in high school was tested using logistic regression analyses, controlling for demographic characteristics (using a propensity score quintile). As shown in Table 2a, in both science and mathematics courses in Grade 9 and Grade 10, previous MYP enrollment had a statistically significant effect; students who attended an MYP school were significantly more likely to be enrolled in an advanced-level course than students who attended a non-MYP school. The effects were strongest for enrollment in advanced-level courses in Grade 9. In Grade 9 mathematics, the Odds Ratio was 1.43, indicating a small effect (d = .20), but one of practical significance. The effect size for Grade 9 science was similar, and was very close to the threshold for practical significance in education (OR = 1.42, d = .19).

Table 2a
Odds Ratios for Enrollment in Advanced-Level Courses in Mathematics and Science, Effect of Grade 8 Enrollment in MYP

Course	*N*	Odds Ratio	*p* value	Effect size (*d*)
Enrolled in advanced-level **science course** in Grade 9				
MYP students	1,282	1.42	.00	.19
Non-MYP students	1,234			
Enrolled in advanced-level **science course** in Grade 10				
MYP students	1,025	1.21	.04	.10
Non-MYP students	1,109			
Enrolled in advanced-level **mathematics course** in Grade 9				
MYP students	1,310	1.43	.00	.20
Non-MYP students	1,241			
Enrolled in advanced-level **mathematics course** in Grade 10				
MYP students	1,050	1.21	.04	.10
Non-MYP students	1,090			

Research Question 2: Was previous enrollment in MYP related to performance in science or mathematics courses in Grades 9 and 10?

Course grades in science and mathematics were examined for students in the MYP and non-MYP groups. Lower percentages of students who previously attended MYP schools had course grades of a C or higher in Grade 9 and Grade 10 science and mathematics courses, compared with students who attended non-MYP schools. Table 3 shows the percentage of students in each group with a grade C or higher in each of the science and mathematics courses. Grades for *all* science and mathematics courses are included in the table, regardless of type or level.

Table 3
2010–2011 and 2011–2012 Percentage of Students Earning a Grade of C or Higher in Science and Mathematics Courses:
Students From MYP Schools and non-MYP Schools

	Students previously enrolled in MYP Schools (2009–2010)		Students previously enrolled in non-MYP Schools (2009–2010)	
	Group N	%	*Group N*	%
Science grade of C or higher in Grade 9, 2010–2011	1,276	73.6	1,231	77.3
Science grade of C or higher in Grade 10, 2011–2012	1,007	78.0	1,106	84.3
Mathematics grade of C or higher in Grade 9, 2010–2011	1,303	71.0	1,241	77.0
Mathematics grade of C or higher in Grade 10, 2011–2012	1,021	73.8	1,079	76.8

Note. *Group N*s represent all students in study sample group (MYP or non-MYP) who had record of a course grade in the subject area during the specified year.

Logistic regression analyses were used to test whether previous MYP enrollment was related to a grade of C or higher in Grade 9 and Grade 10 science and mathematics.[1] Demographic characteristics, as well as current enrollment in an advanced-level course, were controlled in the analyses. Significantly higher percentages of students who previously attended non-MYP schools earned a C or higher in Grade 10 science and in Grade 9 mathematics courses. The effect size for Grade 10 science was small but of practical significance (d = -.21), and the effect size for Grade 9 mathematics approached practical significance (d = -.18). Effect sizes for Grade 9 science and Grade 10 mathematics were negligible (Grade 9 science: d = -.10; Grade 10 mathematics: d = -.06).

Table 3a
Odds Ratios for Earning a Course Grade of C or Higher,
Effect of Previous Enrollment in MYP

Course	*N*	Odds Ratio	*p* value	Effect size (*d*)
Science grade of C or higher in Grade 9				
MYP students	1,276	.83	.06	-.10
Non-MYP students	1,231			
Science grade of C or higher in Grade 10				
MYP students	1,007	.69	.00	-.21
Non-MYP students	1,106			
Mathematics grade of C or higher in Grade 9				
MYP students	1,303	.72	.00	-.18
Non-MYP students	1,241			
Mathematics grade of C or higher in Grade 10				
MYP students	1,021	.89	.28	-.06
Non-MYP students	1,079			

Research Question 3: Was previous enrollment in MYP related to performance on Biology and Algebra 1 state-mandated exams?

Performance on the Biology and Algebra 1 state exams were examined with scale scores and passing rates. Table 4 summarizes the mean scale scores for students who attended MYP schools and students who attended non-MYP schools, adjusted for demographic characteristics. ANCOVA revealed no statistically significant differences between MYP and non-MYP students in their mean Biology scale scores or their mean Algebra 1 scale scores.

[1] Course grades were categorized into "C or higher" and "D or E (failing)" because the district uses these categories in systemwide analyses. Additional analyses were conducted using course grades of B and higher, with similar results.

Table 4
Adjusted Mean Scale Scores on Algebra 1 and Biology State-mandated Exams Through Grade 10: Students from MYP Schools and non-MYP Schools

	Grade 8 Enrollment in 2009–2010							
	IB MYP Schools		Non-MYP Schools		MYP effect			
	N	*Adjusted* $\bar{X}$	*N*	*Adjusted* $\bar{X}$	Mean difference	Std. error	*p*	ES (*d*)
Biology Score	983	440.6	1,053	439.9	0.7	1.04	.65	.02
Algebra 1 Score	1,215	441.4	1,207	440.2	1.2	.85	.33	.04

Table 5 shows the percentage of students in each of the two groups who earned passing scores on the Biology and Algebra 1 state-mandated exams.

Table 5
Percentage of Students Earning a Passing Score on Algebra 1 and Biology State-mandated Exams Through Grade 10: Students From MYP Schools and non-MYP Schools

	Grade 8 Enrollment in 2009–2010			
	MYP Schools		non-MYP Schools	
	Group N	%	*Group N*	%
Earned Passing Score on Biology Exam	983	90.5	1,053	89.1
Earned Passing Score on Algebra 1 Exam	1,215	87.0	1,207	87.6

Logistic regression analyses were used to test whether previous MYP enrollment was related to earning a passing score on the Biology and Algebra exams (Table 5a). Demographic characteristics (using propensity score quintiles) were controlled. Analysis of Biology exam pass results revealed an Odds Ratio of 1.35 (p = .05), indicating the MYP students were more likely to pass, but the effect size was smaller than the traditional threshold for practical educational significance (d = .17). MYP enrollment had no effect on a students' likelihood of passing the Algebra exam (OR = 1.09, p = .49)

Table 5a
Odds Ratios for Passing Algebra and Biology State-mandated Exam, Effect of Previous Enrollment in MYP

State-mandated exam	*N*	Odds Ratio	*p* value	Effect size (*d*)
Biology				
MYP students	983	1.35	.05	.17
Non-MYP students	1,053			
Algebra				
MYP students	1,215	1.09	.49	.05
Non-MYP students	1,207			

Conclusion

This study followed the progress of MYP and non-MYP students into high school in an effort to examine whether high school course enrollment and performance in mathematics and science were related to previous MYP enrollment. There was some evidence that students who attended an MYP school were more likely to be enrolled in advanced-level mathematics and science courses in Grades 9 and 10; the strongest effects of MYP were in Grade 9 course enrollment. This finding is in line with the better performance of MYP students compared with non-MYP students on Grade 8 mathematics and science MSA tests reported in an earlier study (Wade, 2011). In addition, in survey responses, MYP students named the rigor and challenge of MYP courses as one of the top three benefits of being an MYP student (Wade and Wolanin, 2013). It may be that the opportunity to tackle a high level of academic work in MYP has an impact on students' course selections in high school.

However, students who attended MYP schools were slightly less likely than their non-MYP counterparts to earn a grade of C or better in Grade 10 science, after controlling for demographic variables and current enrollment in an advanced level course. Other differences between MYP students and non-MYP students were not statistically or practically significant. The current study does not provide insight into why no positive effects were found for MYP on course grades. Since the scale for course grades is only five points with a restricted range, it is possible that grades were not a sensitive measure for testing the effect of a program that the student was enrolled in one or two years earlier.

Finally, students who had attended MYP schools were more likely to pass their Biology state-mandated exam than non-MYP students, but the difference was too small to be of practical significance to educators. Passing rates on the Algebra 1 exam and scale scores on both exams were statistically similar for the two groups of students. Given that almost all students pass the state-mandated exams, it becomes difficult to detect a relationship with MYP. In addition, students have little or no incentive to achieve more than a passing score, so the scale scores may not display the same range as other tests on which a student may realize some benefit by achieving the highest score possible (e.g., SAT).

Limitations

Students in this study were categorized according to their (previous) Grade 8 middle school enrollment (MYP middle school or non-MYP middle school). Their current high school of enrollment was not considered in the analyses. It should be noted, however, that 6 of the 25 high schools attended by students in the study have MYP or pre-IB programs for students in Grades 9 and 10, and students from both MYP and non-MYP middle schools may participate in the Grades 9 and 10 MYPs in these high schools. Thus, in the current study, some students in the non-MYP group (based on enrollment in a non-MYP middle school) may have participated in an MYP or pre-IB program in Grade 9 or Grade 10.

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Appendix A

Calculation of Effect Sizes

Effect sizes for comparing groups on continuous outcome measures (e.g., means). 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.

Cohen (1988) provides these guidelines for interpretation: $d = .20$ is considered a small effect; $d = .50$ is considered a medium effect; $d = .80$ is considered a large effect.

Effect sizes for comparing groups on categorical outcome measures (e.g., proficient/not proficient; agree/disagree). 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:

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