

Mass Math + Science Initiative

Achieving College Success

Examining the impact of the Mass Math + Science Initiative on students' matriculation to and persistence in college

Commissioned by Mass Insight Education

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Mass Insight EDUCATION

Mass Insight Education, a 501(c)(3) non-profit organization based in Boston, MA, was founded in 1997. Its launch reflected the high priority that business, government, and education leaders placed at that time on the success of Massachusetts' nascent standards-based reform drive, set in motion by the passage of the Education Reform Act of 1993. It is the sister organization of [Mass Insight Global Partnerships](#), which has worked since 1989 to keep Massachusetts and its businesses and institutions globally competitive. Mass Insight's national work focuses on district and state strategies to turn around low performing schools.



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A note about the [College Board's Advanced Placement \(AP\) Program®](#)

The Mass Math + Science Initiative (MMSI) as a program and as evaluated in this report, is designed to increase students' participation and success in AP courses, specifically Math, Science, and English courses. All references to AP courses in this report refer to the College Board's Advanced Placement program, which enables students to pursue college-level studies while still in high school. The Advanced Placement program includes more than 30 college-level courses, each culminating in a rigorous exam; the MMSI program supports students taking and succeeding in Math, Science, and English AP courses. As documented by the College Board, AP courses provide students with the opportunity to earn college credit, advanced placement or both. Each AP course is modeled upon a comparable college course. College faculty ensure that AP courses align with college level standards by defining curricular expectations for each course and through a review of all AP teachers' syllabi.

Participation in an AP course culminates with students' taking a college-level assessment that is scored by college and university faculty and experienced AP teachers. The College Board verifies that "an AP Exam score of 5 is equivalent to a grade of A in the corresponding college course. An AP Exam score of 4 is equivalent to grades of A-, B+ and B in college, and a score of 3 is equivalent to grades of B-, C+ and C in college." Most four-year colleges and universities grant students credit based on successful AP Exam scores of 3 or greater. College Board research has substantiated that students who score a 3 or higher on AP Exams typically experience greater academic success in college and are more likely to graduate on time than otherwise comparable non-AP peers.

Adapted from the The College Board's 7th Annual AP Report to the Nation

Executive Summary

The Massachusetts Math + Science Initiative (MMSI) is a research-based replication program designed to dramatically increase students' participation and performance in Advanced Placement (AP) Math, Science, and English courses. At the heart of MMSI's theory of action is the belief that by increasing students' access to AP courses, particularly for traditionally underserved populations, those students will be more likely to attend, persist, and succeed in college. Nationally, only 25% of those students from low-income families that attend college actually succeed in graduating from college. It is crucial to identify high-leverage strategies (e.g., MMSI) that directly impact students' persistence and success in college.

As of October 2012, over 13,000 public school students from 61 MMSI partner schools have taken at least one AP class. A February 2012 *Impact Study* illustrated the impact that MMSI is having on improving students' participation and success in AP courses while in high school (Insert: Impact Study Findings). This *Achieving College Success* report, the first in a series of college success reports, provides our first detailed exploration of MMSI students as they attend and progress through college, and how exactly participation in MMSI is supporting students in achieving success in college.

Summary of Findings. Overall, MMSI students are graduating from high school and subsequently attending

Impact Study Findings: February 2012 Impact Study

- AP Participation and Success (numbers of exams scoring 3 or better) in MMSI schools has increased significantly over time, in many instances doubling or tripling the number of students taking exams.
- Urban MMSI schools with significant low-income populations of students are successfully *increasing* the number of African American and Hispanic students enrolling in AP classes while *maintaining* the percent of students scoring 3, 4, or 5 on an AP exam.
- In 2010, over 7,800 exams were taken in MMSI schools, out of total eligible student population of 18,955. In contrast, only 3,685 AP exams were taken in the comparison, non-MMSI schools, out of total eligible student population of 22,911; *412 exams were taken for every 1000 students in MMSI schools, compared to 160 exams taken for every 1000 students in non-MMSI schools.*

and persisting in college at rates that exceed national and state averages for all students and for different populations of students. A noteworthy finding is that rates of college attendance (at nearly 80%) and persistence among MMSI's low-income (91.5%), African American (89.2%), and Hispanic (79.7%) students far outpace national and state averages, suggesting that MMSI has a stronger effect on underserved populations. Additionally, the likelihood that MMSI students attend and persist in college is consistently high irrespective of the score those students receive on an AP exam, suggesting that students' access and exposure to AP courses while in high school may significantly impact college success.

Evaluation Findings



... that suggest the following Hypotheses

<ul style="list-style-type: none"> ● High school graduation rates for low-income students in MMSI schools increased by over 4%, outpacing gains made in non-MMSI comparison schools and among all low-income students in Massachusetts. 	<ul style="list-style-type: none"> ● <i>Students from low-income families in MMSI schools are more likely to graduate from high school than low-income students in non-MMSI schools.</i>
<ul style="list-style-type: none"> ● College matriculation rates for MMSI students from under-represented populations are higher than state and national averages, ranging from 12% higher for low-income students to 12% higher for Hispanic students. 	<ul style="list-style-type: none"> ● <i>Students from low-income families are significantly more likely to attend college if they complete a Math, Science, or English AP course.</i> ● <i>Taking an AP course dramatically increases a student's likelihood of attending a 4-year college directly from high school, rather than first attend a 2-year college.</i>
<ul style="list-style-type: none"> ● College persistence rates for MMSI students at 2-year schools is over 25% higher than the state average and for MMSI students at 4-year schools persistence is 10% higher than the state average. 	<ul style="list-style-type: none"> ● <i>Students from low-income families are significantly more likely to persist in college if they complete a Math, Science, or English AP course.</i> ● <i>Taking an AP exam in Math, Science, or English AP exam significantly increases the likelihood that a student will persist in and graduate from college, irrespective of the AP score attained by the student.</i>

Achieving College Success: A Nationally Significant Research Agenda

The Massachusetts Math + Science Initiative (MMSI) is designed to dramatically increase students' access to, and success in, AP Math, Science, and English course. MMSI employs a strategic set of levers (e.g., awards, networking) and supports (e.g., intensive professional development, onsite support, student study sessions) to participating schools, teachers and students. Ultimately, the full measure of the impact of MMSI rests on whether or not MMSI graduates **are better prepared for college**, experience **success in college courses**, and thus are **more likely to persist and graduate from college**. Given the STEM focus of the MMSI program, it is also important to understand the link between AP course taking patterns and enrollment in college STEM-related courses.

Mass Insight Education is committed to evaluating and researching the impact of MMSI and is embarking upon a nationally significant longitudinal research agenda that will track MMSI students from high school through college.

The *Achieving College Success* research agenda includes the following activities, which are designed to promote program improvement, integrate the MMSI work with other promising initiatives (e.g., College Success Clusters), and provide for a rigorous evaluation of impact.

Formal Evaluations of Implementation and Impact

A formal **Implementation Study** of MMSI was initiated in Spring 2012, focusing on how MMSI is being implemented in different contexts, exploring how MMSI contributes to changes in school culture and instruction beyond AP, and identifying high-leverage program components, as a means of improving program implementation. The first Implementation Study report will be published in Spring 2013 and will involve illustrative case studies of MMSI schools in Boston, Fall River, Worcester, and Methuen.

A quasi-experimental **Impact Study** was initiated in November 2011 that involves: (a) an analysis of the

direct impact of MMSI on students' participation and success on AP courses in high schools and (b) research tracking students into and through college, focusing on students' matriculation, persistence, and success in college. The February 2012 *Impact Study* and the November 2012 *Achieving College Success* report are the first in a series of impact evaluation reports, which will culminate in a Spring 2014 Final Impact Analysis.

Research Advisory Committee

A MIE Research Advisory Committee has been formed to provide expert feedback on the scope and directly of the research agenda, to review draft and final reports, and offer suggestions towards Mass Insight's broader research agenda. Current members of the Advisory Committee include: Dr. Jane Hannaway, Director of the Center for the Analysis of Longitudinal Data in Education Research (CALDER) at the American Institutes for Research; Dr. Ronald Ferguson, Senior Lecturer in Education and Public Policy at Harvard University's Kennedy School of Government; and Dr. Margaret Raymond, Director of the Center for Research on Educational Outcomes (CREDO) at Stanford University.

Tracking students through college: Partnering with Community Colleges and Institutes of Higher Education

Many students matriculate to college; however, significant portions of college attendees never graduate from college. Understanding **why** some students have success while others don't, and further exploring **how** MMSI serves as a strategy to directly increase students' likelihood of success, is at the core of MIE's Research Agenda. Exploring the "why" and "how" of college success requires close partnerships with community colleges and 4-year colleges, especially as we examine students' course taking patterns, remediation trends, and other factors related to persistence and college graduation. To facilitate data sharing, nine of Massachusetts' Community Colleges and MIE have partnered to share information and track MMSI students through college. Mass Insight is working with the University of Massachusetts to develop a similar partnership and is exploring ways to obtain access to Massachusetts' statewide longitudinal data system, which would provide the information needed for a rigorous evaluation of MMSI's impact.

Introduction

Many thousands of public high school students graduate each year not fully prepared to thrive and succeed in college. Mass Insight is striving to close achievement gaps so that the “new normal” is one in which all students are prepared to succeed in college.

Of all high school graduates first attending a 4-year college¹ in 2005, approximately 56 % graduated from college within 6 years (Knapp, et al. 2012). The college graduation rate² is considerably lower for African American and Hispanic students. According to the national 2005 cohort of students attending 4-year colleges, 37.9 % of Black students and 48 % of Hispanic students that attended college ended up graduating within 6 years (Ibid.). The actual rates of college graduation are even lower in many urban cities and for students attending 2-year colleges, although district-by-district data is difficult to come by as many districts are reticent to share such information. Boston Public Schools, as one of the few districts to have commissioned a report focusing on college success, shows an overall (2- and 4-year) college graduation rate of 28% for Black students and 24% for Hispanic students (Sum et al., 2008). Nationally, the college graduation rate for students from low-income families is 24% (PEO, 2012).

The harsh reality of our current k-16 school system is that if you are a Black or Hispanic student who happens to live in a low-income family, ***your chance of graduating from college even if you make it to college is approximately 1 in 4.*** Clearly, our public school system and its partners needs to do a better job of preparing students to succeed in college and to successfully enter the workforce. Concurrently, Institutes of Higher Education (IHEs) must do a better job of supporting students once they enter college. While college readiness is an issue that has risen in prominence and that is now at the forefront of policy decisions and actions (e.g., Race to the Top and Common Core Standards), there are significant gaps in the education literature focusing on exactly why so many low income students lack the full complement of academic and non-academic (e.g., social) skills necessary to succeed in college. Moreover, there are few studies on high school interventions specifically intended to increase college readiness and promote college success.

The purpose of this report is to briefly describe the college readiness policy landscape and to situate the Mass Math + Science Initiative (MMSI) as a regional and national intervention for closing achievement gaps and improving students’ readiness for college, especially in Science, Technology, Engineering, and Math (STEM). As part of the ongoing evaluation of MMSI, this report provides the first comprehensive picture of MMSI students attending and persisting in college. Our February 2012 impact evaluation reinforced MMSI’s proof of concept as a means of significantly increasing students’ participation and success on Advanced Placement (AP) courses and exams. This report will set the stage for establishing the proof of concept of MMSI as a strategy for dramatically increasing students’ readiness for college and potential to succeed in college.

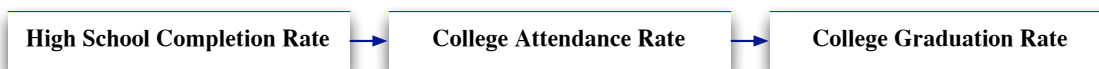
The data provided in this report is used to identify trends and to set benchmarks for MMSI students that surpass state and national rates for college persistence and graduation. Furthermore, this report contributes to the literature on college readiness and success, and in particular the focus on STEM initiatives, by examining how a scalable and STEM-focused initiative such as MMSI can directly impact students’ enrollment, persistence, and graduation from college. Specifically, we examine the relationship between students’ AP course and exam taking, including taking a course and scoring a 1 or a 2, and college persistence and success.

¹ Full-time, first-time degree/certificate-seeking undergraduate students beginning their postsecondary education in 2005.

² The college graduation rate is based on a cohort of full-time, first-time degree-seeking undergraduates and is the percent of the cohort that graduates from college within 6 years of entering college.

College Success for Economically and Ethnically Diverse Students

College success—defined as successfully graduating from a two- or four-year college—involves students moving through three steps: 1) graduating from high school; 2) attending college; and 3) persisting and graduating from college.



Over the past 40 years, *high school completion rates*³ rose dramatically for students from low income families and for African American and Hispanic students, while remaining relatively constant for all students. During this same period of time (1970 to 2010), *college attendance rates* increased for all students (from 61.3 % to 74.6 %) and even more so for students from low-income families and for African American and Hispanic students (PEO, 2012). Overall, the K-12 public school system has been successful in increasing students’ rates of high school completion and college attendance. More and greater percentages of students are attending college in 2012 than ever before, including low-income, ethnically, and racially diverse students.

The data on college graduation, however, points to a significant and ongoing obstacle to college success for all students. Since 1970, the percentage of students from mid- and higher-income families graduating from college rose considerably. During this same period of time, ***the college graduation rates for students from low-income families remained constant***, ranging from 23.4 % in 1970 to 25.9 % in 2010 (PEO, 2012; Bailey &

Table 2: Percent of students completing high school, 1970 to 2010

	1970	2010
National (All Students)	79.9%	83.4%
National (Low Income)	61.6%	72.7%
Mass (All Students)		88.6%
Mass (Low Income)		76.2%
Boston (Low Income)		67.2%

Dynarski, 2011). According to recent (October 2012) data from the National Center on Education Statistics, 38% of African Americans first attending college in 2005 graduated within 6 years, and 48% of Hispanics graduated within 6 years. District-level data from Boston presents a more realistic snapshot of college success rates in urban settings, where just 24% of African American students from non-exam schools attending college graduated within 6 years (Sum et al. 2008). Although data is not readily available for other districts in Massachusetts, we expect that similar college graduation rates persist across the state. When we look at the entire student population rather than just students attending college, the data is even more daunting. Only 9 to 10 % of students from low-income families graduate from college, a figure that has remained relatively constant over the past 40 years (PEO, 2012; Bailey & Dynarski, 2011).

Table 1. Current College Attendance and College Graduation Rates

	College Attendance	College Graduation	Year or Cohort
National data (NCES)			
All Students		56%	2005 Cohort
African American	66%	38%	
Hispanic	60%	48%	
National Data (Census)			
All Students	75%	48%	2011 Data
Low Income	64%	23%	
Massachusetts			
All Students	74%		2010 Data (ESE)
African American	71%	n/a	
Hispanic	62%		
Low Income	62%		
Boston Public Schools			
All Students	64%	36%	2000 Cohort
African American	60%	28%	
Hispanic	56%	24%	

Continued efforts to improve rates of high school completion and college attendance are clearly important. However, the analysis shared here brings to the surface the “elephant” in the room—that getting students into college isn’t enough, especially for students from low-income families. ***Figuring out how to prepare students for college, and to accelerate this process in urban and low-income communities, is the tangled knot that states, districts, and schools must now unravel.*** We now turn to a few of the known and well-researched reasons for why so many students are unable to persist and succeed in college, focusing on challenges that can be directly influenced while a student is still in high school.

³ Table 1 and Table 2 sources: Table 1: National Data (NCES): College Attendance: Digest of Educational Statistics, 2011 (Table 210); College Graduation: NCES October 2012 preliminary report, 4-year institutions; National (U.S. Census): Postsecondary Education Opportunity, Issue Brief # 235; Massachusetts: ESE Website <http://profiles.doe.mass.edu/>; Boston data (Sum et al., 2008). Table 2: National: Postsecondary Education Opportunity, Issue Brief # 235; Massachusetts and Boston: MA Department of Education Website; 4-year adjusted cohort graduation rate (Note: Data for Boston is for 2011).

Barriers to College Graduation

Once enrolled in college, students face academic and non-academic challenges to persisting, staying “on-track”, and successfully graduating from college. These challenges are manifest in higher rates of remediation among low-income students and among Blacks and Hispanics, higher rates of failure to complete remediation courses, and low credit accumulation after one year in college (Complete College America, 2012). Remediation rates are particularly acute in 2-year colleges, although the rates of remediation for Blacks and Hispanics are disproportionately high at 4-year colleges as well. As displayed in Table 3, 51.7% of students first attending a 2-year college enrolled in developmental course and 19.9% of those first attending a 4-year college took a developmental course. In Massachusetts’ 2-year colleges, only 1 of every 10 students that enrolls in a remediation course goes on to graduate. In 4-year public colleges, approximately 5 of every 10 students that take a remediation course ultimately graduate from college (Ibid.).

Another way to understand barriers to college graduation is to explore first to second year persistence rates (e.g., retention rates). Nationally, approximately 78% of first-time college students persist from their first to second year (see Table 4)⁴. In 2-year community colleges, where we also find higher rates of remediation, the persistence rate hovers around 53% (NCHEMS, 2010). Significant numbers of students are not making it beyond their first year in college.

The data on remediation and first- to second-year persistence point out the shortfalls in our k-12 system of education. However, ***there is growing evidence that college graduation rates can be increased, if the right strategies are put into place and when k-12, higher education, and outside partners works together.*** For instance, we know that those students who stay

Table 4: Second Year Persistence Rates (Retention Rates) for U.S. and Massachusetts, 2- and 4-year public IHEs

	4-Year College	2-Year College
National data		
All Students	78.4%	53.0%
Massachusetts		
All Students	79.4%	53.6%

Table 3: Remediation Rates for U.S. and Massachusetts, 2- and 4-year public IHEs

	4-Year College	2-Year College
National data		
All Students	19.9%	51.7%
African American	39.9%	67.7%
Hispanic	20.6%	58.3%
Massachusetts (Multiple Cohorts)		
All Students	26.6%	61.7%
African American	46.4%	70.7%
Hispanic	41.8%	66.6%
Massachusetts (2005 Cohort)		
		2- and 4-year combined remediation rate
All Students	37%	
African American	59%	
Hispanic	58%	

continuously enrolled in college are more likely to persist and graduate (Adelman, 2006). Academically, students who are exposed to a rigorous high school course of study and who leave high school with “college-acumen”, such as a good understanding of what is expected in college and how to manage time, are more likely to persist (Stoutland and Coles, 2009; Hirsch & Savitz-Romer, 2007). When interviewed, students report that having access to mentoring and being supported by teachers goes a long way towards helping them to stay in college (Stoutland and Coles, 2011). Nationally, there are many promising *college readiness programs* that range from having an academic focus to programs designed to increase students’ knowledge and understanding of college (Barnett, et al. 2012).

Figuring out the right mix of college readiness strategies, programs, and interventions is an important and daunting task. Part of designing a systems-based approach to improving college graduation is identifying high-leverage policies and interventions that can be implemented by educational leaders and policy makers. Fortunately, there is an emerging set of academic-focused keys—high leverage strategies—to college persistence and success.

What are these strategies and how does the MMSI program contribute to efforts to bring these strategies to scale?

Keys to College Persistence and Success: Advanced Placement as a Key Lever

There is emerging research, from districts, external researchers and policy advocates, that clearly specifies the high school classes and experience that directly impact students' likelihood of persisting beyond their first year in college and succeeding in college. Klepfer and Hull (2012) found that students who take a high-level math course are 10 to 20 % more likely to persist into their second year of college. Similarly, students taking an Advanced Placement or International Baccalaureate course (AP/IB) are significantly more likely to persist in college, particularly for low income (or low SES) students (Ibid.). Research conducted by Montgomery County Public Schools (Maryland), one of the largest districts in the country, reinforces the importance of math, science and AP courses as keys to success.

Research-based Indicators of College Readiness: Montgomery County, Maryland

Montgomery County (MD) was one of the early adopters of a college readiness framework, named the Seven Keys to College Readiness Framework. A 2011 district-sponsored study analyzed the results of the full cohort of 2003 graduates through college to assess the extent to which the Seven Keys serve as predictors for bachelor's degree attainment. The study validated the Seven Keys, with the following factors having the greatest impact on college readiness and success in college:

- Taking an academically rigorous high school course of study
- Taking and scoring a 3 or higher on an AP course
- Passing Algebra 2 with a grade of C or higher by grade 11
- Passing Algebra 1 with a grade of C or higher by grade 8

Source: Zhao, H. & Liu, S. (2011)

We now have a solid understanding of what an “academically rigorous course of study” means for all students.

We know that taking high level math and science courses, including Advanced Placement courses, are no longer “capstone” courses for the academically gifted; rather, they are courses that should be taken by all high school students expecting to attend and succeed in college and the workforce.

The MMSI program **directly** and **indirectly** influences how a district, school leaders and teachers, and ultimately students, think about how core classes—the keys to college persistence and success—are distributed and taught. We have evidence that when teachers and students are incentivized and encouraged to take AP Math, Science, and English courses, when AP entry requirements and barriers are minimized, and when teachers are provided with high quality professional development, *that more students do take and succeed in AP courses*. Schools, when faced with the task of increasing student participation in AP math and science courses, begin to drill down, through 9th and 10th grade and into the middle school years, to figure out how to raise expectations, align curriculum, and increase the numbers of students successfully taking and passing Algebra 1 and 2 level courses. And there is growing evidence that merely taking an AP course, presuming the instruction is of high quality and students make their best effort, can positively impact students' persistence and success in college. Klepfer and Hull (2012) make the following important observation about the importance of AP course taking, based on their research.

"It's noteworthy that for both two and four-year institutions, low SES/achievement students who take an AP/IB class have as good or better chance of persisting than high SES/achievement students who do not take an AP/IB course." (Klepfer & Hull, 2012, p.9)

The Mass Math + Science Initiative is at the nexus of transforming expectations from “who should” take an AP course to “how can” every student have access to an academically rigorous course of study that will ensure students' readiness and success in college.

Mass Math + Science Initiative: A Framework for Assessing College Success

Our February 2012 Impact Study described the impact that MMSI is having on closing achievement gaps. In MMSI schools, the number and percent of students taking AP English, Math, and Science exams and succeeding (e.g., scoring a 3 or better) on AP exams increased significantly among each cohort of MMSI schools and in comparison to similar, non-MMSI schools. Students in MMSI schools are more than 4 times as likely to take an AP English, Math, or Science exam than students in similarly situated schools. A noteworthy finding is that mid- and high-need schools (e.g., schools with greater than 35% of students identified as low income) are able to dramatically increase AP participation rates while maintaining AP success rates, suggesting that there is a tremendous untapped capacity among students capable of succeeding in an AP course.

MMSI's College Success Goal

To increase college success, as measured by an increase in the number of students attending college and graduating from college.

Notwithstanding the success that MMSI has experienced in meeting its first two goals, AP participation and AP success, the *full measure of MMSI's impact will be determined by whether or not MMSI graduates attend and succeed in college.*

The evaluation framework for the *Achieving College Success* report series is based on the following hypotheses, that subsequently drive evaluation questions and our analysis.

MMSI schools will experience *slight increases in high school graduation* due to improved instruction and a shift in expectations among teachers and students.

MMSI students will *attend college at higher rates* than similarly situated students in non-MMSI schools and equal or surpass state averages and exemplar benchmarks set by high performing districts.

MMSI students will *persist and graduate from college at higher rates* than similarly situated students in non-MMSI schools and equal or surpass state averages and exemplar benchmarks set by high performing districts.

High School Completion Rate



College Attendance Rate



College Graduation Rate

Presentation of Data and Findings. Evaluation findings and data are presented in the aggregate and for different subgroups and categories (e.g., high-, mid-, and low-need schools). When appropriate, the performance of MMSI students and schools is compared with national, state, and district measures of college attendance, persistence, and success to identify trends. Finally, MMSI data and comparison data is used to forecast the performance of MMSI students to illustrate the potential of the MMSI program to increase students' persistence and success in college, and to set program benchmarks to assess program impact and inform future research.

Designation of High-, Mid-, and Low-need schools. Appendix A provides a full listing of MMSI and non-MMSI schools by school type, including the methodology used to categorize schools. Briefly, high-need schools are schools with over 60% of students designated as low-income and a school accountability status of 3 or 4. Mid-need schools are schools with over 35% of students designated as low-income, and a school accountability status of 2 or 1.

Data Sources and Analysis Years: The analysis includes MMSI students that graduated from high school in 2009, 2010, and 2011. Appendix B provides a complete listing of data sources and a brief overview of the full data set.

Study Limitations: Evaluation findings are presented as statements regarding the current performance of MMSI schools and national and state averages; findings regarding the actual effect of MMSI cannot be computed at this time. A rigorous quasi-experimental study, inclusive of matched comparison schools and students, is necessary to be able to make claims about the causal impact of MMSI on students' college attendance and persistence.

MMSI Cohorts and Student Population

Evaluations of college persistence and success take time. Although MMSI has been operational since 2008-2009, data on college persistence for sufficient numbers of students to allow for analysis is just now (October 2012) available. Table 5 displays the high school to college cycle for MMSI cohorts and students and the approximate date when information is available to compute college attendance, persistence, and college graduation rates. The cells shaded in green represent the data that is available and presented in this report. Table 6 provides an overview of the MMSI students by year of high school graduation and the demographics of MMSI students.

Table 5: Timeline of MMSI students' potential college attendance and graduation

	# of Schools	Year Entered Program	First Students in College	Date at which data is available to measure...		
				First- to Second Year Persistence	College graduation rate for 2-year colleges (3year adjusted)	College graduation rate for 4-year colleges
Cohort 1	8	2008	Fall 2009	Fall 2010	Fall 2012	Fall 2013
Cohort 2	11	2009	Fall 2010	Fall 2011	Fall 2013	Fall 2014
Cohort 3	26	2010	Fall 2011	Fall 2012	Fall 2014	Fall 2015
Cohort 4	9	2011	Fall 2012	Fall 2013	Fall 2015	Fall 2016
Cohort 5	13	2012	Fall 2013	Fall 2014	Fall 2016	Fall 2017

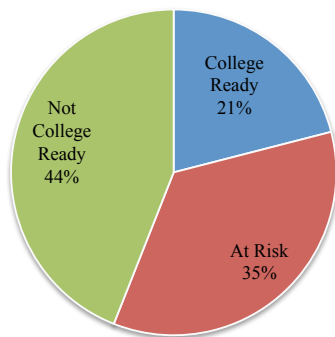
Table 6. Number of Participating MMSI High School Students included in the study by Graduation Year, Low Income designation, and racial/ethnic classification.

	# of High School Grads	# of High School Grads (2009-10-11)	
		Low Income	Not Low Income
2009 Graduates	634		
2010 Graduates	1455		
2011 Graduates	3040	2076	3043
Total (2009-2011)	5129		

# of High School Grads (2009-10-11)	
White	2868
Black or African American	698
Asian	601
Hispanic	689
Other	271

Who Are MMSI Students? It is important to highlight the fact that many of the students “recruited” to take AP courses in MMSI schools are not those who would typically take an AP course, and may not have had college aspirations prior to taking an AP course. Nearly 95% of the students in MMSI’s “high-need” schools (e.g., schools over 65% low income) can be classified as “not college ready” according to the PSAT/NMSQT indicators of college readiness. Chart 1

Chart 1. Distribution of MMSI students by measure of college readiness



displays the distribution of MMSI students across all MMSI schools (Cohorts 1, 2, and 3) by a *readiness for college* indicator. The high percentage of “not college ready” students (44%) among all MMSI students is an indicator that MMSI schools are expanding access and including those who are not typically encouraged to take AP courses.

There is often a tendency to look at AP data and dismiss positive results because “AP students are supposed to do well in college”. We ask our readers to look at the data presented here as objectively as possible. Many MMSI students are individuals who, in a non-MMSI school, would not be encouraged to take AP or even considered as eligible for AP. It is important to recognize that MMSI is striving to change the paradigm of AP from an exclusive gateway for the academically gifted to a common expectation for all students; so that students think first “how many AP classes will I take?” rather than “am I able to take an AP course?”

Summary of Key Evaluation Findings and Hypotheses

How is MMSI increasing High School Graduation?

High School graduation rates in MMSI schools have increased 3.2% (from 81.4% to 84.6%) since 2009. Graduation rates for MMSI high-need schools improved by 3.1% while graduation rates in similar, non-MMSI schools experienced a slight decrease. Similarly, graduation rates for low-income students in MMSI schools increased by 4.1%, outpacing gains made in non-MMSI comparison schools and among all low-income students in the Massachusetts.

Our analysis suggests the following hypothesis regarding the impact of MMSI on high school graduation:

- ***Students from low-income families in MMSI schools are more likely to graduate from high school than low-income students in non-MMSI schools.***

How is MMSI improving College Attendance?

The overall college attendance rate for MMSI students is 79.6%, which is slightly higher than the national rate (75%) and Massachusetts' college attendance rate (74%). The percentage of MMSI low-income (76%) and Hispanic students (69%) attending college are 12 % higher than college attendance rates for the same student populations across Massachusetts.

Our analysis highlights the following hypotheses regarding the impact of MMSI on college attendance:

- ***Students from low-income families are significantly more likely to attend college if they complete a Math, Science, or English AP course.***
- ***Taking an AP course dramatically increases a student's likelihood of attending a 4-year college directly from high school, rather than first attending a 2-year college.***

How is MMSI contributing to College Persistence?

Over 90 percent of MMSI students persist and return for a second year of college, a first- to second-year retention rate that is higher than retention rates in Massachusetts and across the U.S. Seventy-seven percent of MMSI students attending 2-year colleges return for a second year of college, a rate that is 26 percentage points higher than the retention rate for all students in Massachusetts attending a public 2-year college. Retention rates for MMSI's low-income students (76.6%), African American students (91.4%), and Hispanic students (79.7%) similarly outpace Massachusetts' retention rates for all students and for each group.

Our analysis highlights the following hypotheses:

- ***Students from low-income families are significantly more likely to persist in college if they complete a Math, Science, or English AP course.***
- ***Taking an AP exam in Math, Science, or English AP exam significantly increases the likelihood that a student will persist in and graduate from college, irrespective of the AP score attained by the student.***
- ***Scoring a 3 or better on a Math, Science, or English AP exam dramatically increases the likelihood that a 2-year college attendee will persist from year one to year two.***

Goal: MMSI schools will experience slight increases in high school graduation due to improved instruction and a shift in expectations among teachers and students.

High School Graduation

Prior to conducting this analysis, MMSI’s leaders at Mass Insight Education expressed the belief (and hope) that MMSI schools might experience slight increases in overall rates of high school graduation, due to raised expectations for all students and improvements in the instructional core. However, since the focus on the MMSI program is on increasing AP course taking and scores among students that take AP courses, MMSI’s leaders were unsure to what extent, if at all, high school graduation rates might increase. Exploring the potential impact of MMSI on an entire school’s culture will be explored in greater detail in future reports and in the MMSI implementation analysis. However, there is evidence that there may be some transference of raised expectations that is influencing high school graduation rates.

Evaluation Findings: High School Graduation

High School graduation rates in MMSI schools have increased 3.2% (from 81.4% to 84.6%) since 2009. Graduation rates for MMSI high-need schools improved by 3.1% while graduation rates in similar, non-MMSI schools experienced a slight decrease. Similarly, graduation rates for low-income students in MMSI schools increased by 4.1%, outpacing gains made in non-MMSI comparison schools and among all low-income students in the Massachusetts.

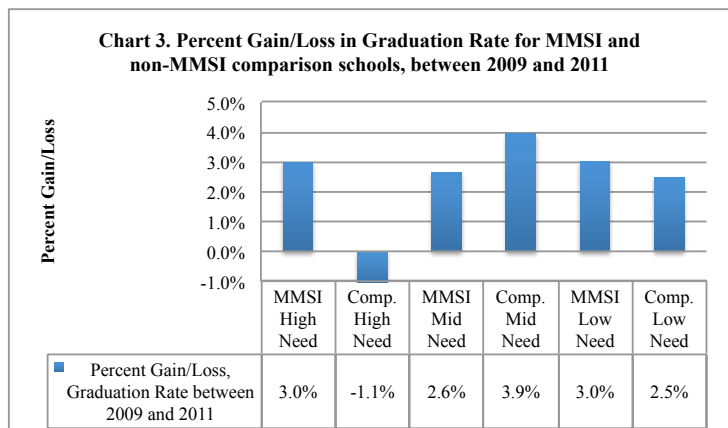
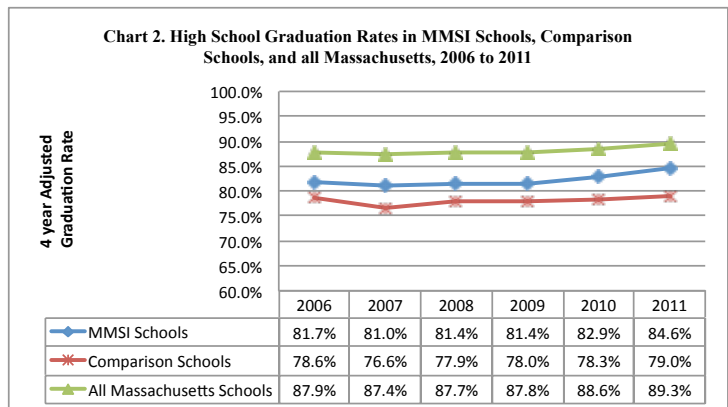
Our analysis suggests the following hypothesis regarding the impact of MMSI on high school graduation:

- **Students from low-income families in MMSI schools are more likely to graduate from high school than low-income students in non-MMSI schools.**

Analysis

An analysis of graduation rates from 2006 through 2011 shows that *MMSI schools have experienced a slight increase in graduation rates since 2009, from 81.4% to 84.6%*. Using 2006 to 2008 as baseline data, we see that high school graduation rates in MMSI schools, comparison schools, and for all of Massachusetts remained constant through 2009. Since 2009, overall graduation rates for all students have risen, which may account for some of the gains in MMSI schools.

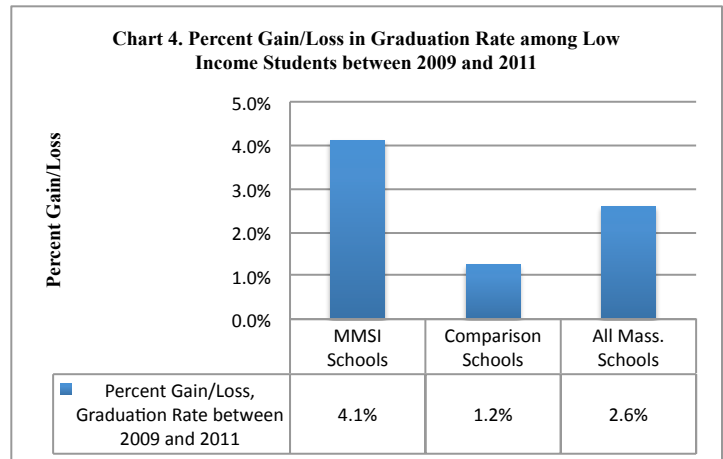
A closer look at the graduation rates among MMSI schools and similar, need-categorized comparison schools suggests that MMSI has a greater impact on graduation rates in high-need schools (e.g., schools designated as “level 3” schools and over 65 low-income) and among low-income students. Chart 3 displays the percent gain in graduation rates in MMSI high-need schools (3%) between 2009 and 2011, compared to a 1.1% decrease in graduation rates in similar non-MMSI high-need schools across the state.



High School Graduation

Chart 4 highlights the percent gain in graduation rates among low-income students (4.1%) between 2009 and 2011, compared to smaller percent gains in all comparison schools and across the state.

While the graduation rate for low-income students across Massachusetts continues to improve, the comparatively rapid increase among MMSI's low-income students is a positive trend that will continue to be tracked over time.



College Attendance

Goal: MMSI students will attend college at higher rates than similarly situated students in non-MMSI schools and equal or surpass state averages and exemplar benchmarks set by high performing districts.

Evaluation Findings: College Attendance

The overall college attendance rate for MMSI students is 79.6%, which is slightly higher than the national rate (75%) and Massachusetts' college attendance rate (74%). In particular, the percentage of MMSI low-income students, and African American and Hispanic students, attending college is considerably higher than college attendance rates for the same student populations statewide, ranging from 14 % higher for low-income students to 18 % higher for African American students.

Our analysis highlights the following hypotheses regarding the impact of MMSI on college attendance:

- ***Students from low-income families are significantly more likely to attend college if they complete a Math, Science, or English AP course.***
- ***Taking an AP course dramatically increases a student's likelihood of attending a 4-year college directly from high school, rather than first attending a 2-year college.***

Analysis ⁵

In MMSI Cohorts 1, 2, and 3, there are 5129 MMSI students (e.g., a student who took a MMSI supported AP Math, Science, or English course) that graduated from high school in 2009, 2010, or 2011. Of these students, 4085 attended college within one year of graduating from high school, for an overall college attendance rate of 79.6%.

Table 7. College Attendance for MMSI graduates from 2009, 2010, and 2011 cohorts, by income and gender

	# of MMSI graduates from HS	# of MMSI graduates attending college	College Attendance Rate
All Students	5129	4085	79.6%
Low Income	2076	1572	75.7%
Not Low Income	3043	2505	82.3%
Females	2994	2405	80.3%
Males	2132	1677	78.7%

Table 8. College Attendance for MMSI graduates from 2009, 2010, and 2011 cohorts, by ethnicity

White	2868	2387	83.2%
African American	698	528	75.6%
Asian	601	485	80.7%
American Indian or Alaskan Native	37	28	75.7%
Native Hawaiian or Pacific Islander	60	44	73.3%
Hispanic	689	478	69.4%

⁵ Additional research and access to current statewide data is needed to compare MMSI students with similar non-MMSI students and determine how much of the increase is due to the MMSI program and not an artifact of selection bias.

College Attendance

College Attendance by income and race/ethnicity.

College attendance rates for MMSI students vary by students' family income (low-income or non low-income) and by students' race and ethnicity; however, the gaps in college attendance rates among MMSI students is considerably less than observed in national and Massachusetts data. Table 9 displays the overall college attendance rates for MMSI students (all and for selected groups) compared with national and Massachusetts data. MMSI's overall college attendance rates for low-income, African American, and Hispanic

students are higher than national and state rates. Gaps in college attendance rates between subgroups and all students are considerably less among MMSI students than in the entire student population.

The data presented here and supported later in this report suggests the following hypothesis, which will inform future analysis and be explored in subsequent reports.

Hypothesis: Students from low-income families are significantly more likely to attend college if they complete a Math, Science, or English AP course.

Table 9. Comparison of MMSI College Attendance Rates with National and Massachusetts Rates

	MMSI Students' College Attendance Rate	Gap between ALL and Subgroup	National College Attendance Rate	Massachusetts College Attendance Rate	Gap between ALL and Subgroup
All Students	79%		75%	74%	
Low-Income	75.7%	3.3%	64%	62%	12%
African American	75.6%	3.4%		71%	3%
Hispanic	69.4%	9.6%		62%	12%

College Attendance by Highest AP Score.

A key part of MMSI's theory of action *is that exposing students to college level instruction through AP courses will encourage more students, especially those who may not have been previously encouraged, to attend college.*

The data on MMSI's impact in high schools shows that a substantial percentage of "MMSI students" would not—in a different school or in prior years—have taken an AP course. As more and more students take AP courses, some of these students may not "succeed" (e.g., score a 3, 4, or 5 on the AP exam). This observation prompts the following questions:

- Is it beneficial for students to take an AP course and score only a 1 or 2?
- What are the college attendance rates for students scoring at different levels on AP exams?

We analyzed students' college attendance rates by the highest AP score attained (Table 10). The college attendance rates for students with at least one score of 3, 4, or 5 on an AP exam are slightly higher than the attendance rates for students with a highest score of 1 or 2, although the gap between high and low scorers is not as large as was expected. In fact, college attendance rates for students scoring a 1 or 2 on an AP exam outpace

national and state college attendance rates for all students. Focusing solely on low-income students, we find that 71% of MMSI's low-income students with a highest score of 1 are attending college and 76.3% of those scoring 2 are attending college.

Table 10. College Attendance for MMSI graduates from 2009, 2010, and 2011 cohorts, by Highest Exam Score

	# of MMSI Graduates from HS	# of MMSI graduates attending college	College Attendance Rate
Did Not Take Exam	175	93	53.1%
Highest Score =1	1382	1060	76.7%
Highest Score =2	1254	992	79.1%
Highest Score =3	1145	945	82.5%
Highest Score =4	704	604	85.8%
Highest Score =5	469	391	83.4%

Hypothesis: The data suggests that those low-income high school graduates who have taken an AP course, regardless of their success on the AP exam, are significantly more likely to attend college than those students not exposed to AP.

College Attendance

College Attendance by School Need

Highly correlated with students' income and race/ethnicity, college attendance rates range from 73% in high need schools to 88.8% in low need schools.

Financial resources remain an obstacle for many students striving to attend college. However,

Massachusetts is a state that has an extensive state and community college system that is intended to minimize barriers to higher education. *MMSI leadership expects to improve the college attendance rate in high need schools and shrink the college attendance gap.*

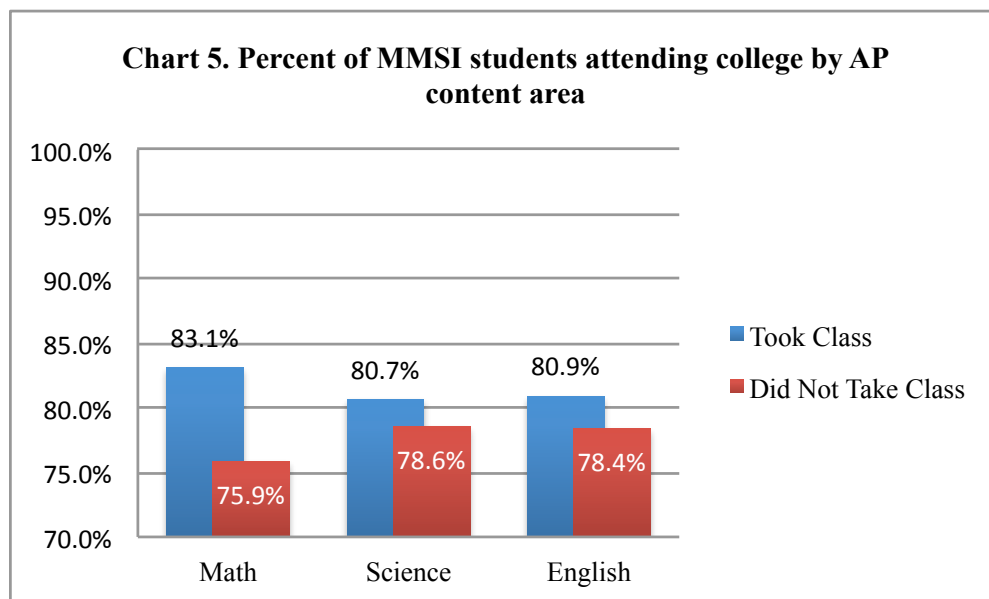
Table 11. College Attendance by School Need Status (High-Need, Mid-Need, Low-Need)

	# of MMSI Graduates from HS	# of MMSI graduates attending college	College Attendance Rate
High Need Schools	1663	1214	73.0%
Mid Need Schools	2319	1852	79.9%
Low Need Schools	1147	1019	88.8%

College Attendance by AP Content Area

Looking at college attendance rates by AP content area (e.g., whether or not a student took a Math, Science, or English AP course), we see somewhat higher college attendance rate for students who took a Math AP course compared to those that did not take a Math AP course. Displayed in Chart 5, the college attendance rate for

those who took an AP Math course (and possibly other courses) is 83.1%, while the college attendance rate those who took AP Science or English (or both) courses but not AP Math is 75.9%. This difference is statistically significant and makes sense, given research on the importance of taking high-level math courses as an indicator of college success.



College Attendance

College Attendance: What types of colleges are MMSI students attending?

The vast majority (86.3%) of the college-attending MMSI students from 2009, 2010 or 2011 are attending a 4-year college (Table 12). Differences among MMSI students by income and racial/ethnic background are minimal; all populations have at least an 82% attendance rate (or higher) at 4-year colleges. Of those who attended a 4-year college, a bit more than half (52.3%) attended a 4-year public institution.

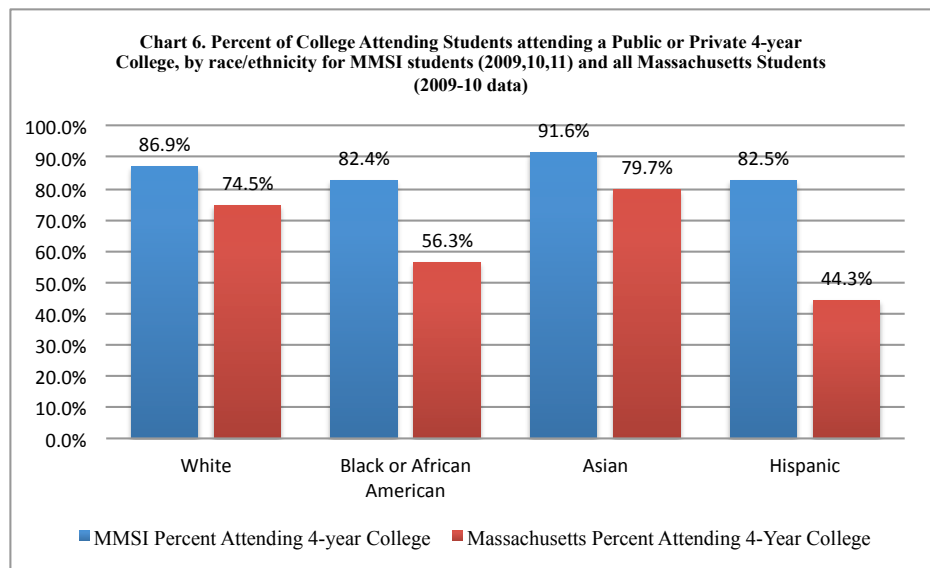
Table 12. College Attendance for MMSI graduates from 2009, 2010, and 2011 cohorts, Initial College Type

	# and % of MMSI students	# of MMSI graduates attending college	# and % of MMSI students
Attend 2-year college	559 (13.7%)	2-year private:	8 (1%)
		2-year public	551 (99%)
Attend 4-year college	3526 (86.3%)	4-year public	1879 (53.2%)
		4-year private:	1647 (46.8%)

A closer analysis of where MMSI students are attending college, and in particular the distribution of students by ethnic and racial background, suggests a potential hypothesis not yet considered by the MMSI team.

Hypothesis: Taking an AP course increases a college-going student's likelihood of attending a 4-year college instead of a 2-year college.

Chart 6 displays the percent of MMSI students attending a public or private 4-year college rather than a 2-year community college. Comparing the college attendance rates for MMSI students with data for all 2009-10 Massachusetts students, we see that MMSI students are attending 4-year colleges at a higher rate than observed among all students attending public institutions in Massachusetts (Massachusetts Department of Education, 2009-10 data profiles).



MMSI's African American and Hispanic students are much more likely to attend a 4-year college than their counterparts in non-MMSI schools, and are attending 4-year colleges at rates that mirror the overall state average.

Setting College Attendance Performance Benchmarks

Benchmarking our Progress

Setting performance benchmarks provide stakeholders, including policymakers and school committee members, a way to measure whether or not school systems are improving and doing all that they can to meet the needs of all students. Based on the data from MMSI schools, Mass Insight Education offers the following performance benchmarks for College Attendance.

The listed performance benchmarks (Table 13) are intended to drive efforts to improve college attendance rates and are being shared with participating schools to develop school-level goals and to track the progress of individual schools.

Mass Insight Education proposes that these benchmarks be considered by districts across the state, as part of a statewide effort to close achievement gaps and improve college readiness and success for all students.

Table 13. College Attendance (Current and Benchmarks) for MMSI graduates from 2009, 2010, and 2011 cohorts, by income, gender, race/ethnicity, highest score, and school type			
	Massachusetts College Attendance Rate	Current MMSI College Attendance Rate	MMSI Performance Benchmarks
All Students	74%	79.6%	80%
Low Income	60%	75.7%	75%
Not Low Income		82.3%	85%
Females		80.3%	80%
Males		78.7%	80%
Target populations			
African American	57%	75.6%	80%
Hispanic	51%	69.4%	77%
Highest Score =1	Not Available	76.7%	78%
Highest Score =2	Not Available	79.1%	80%
High Need Schools	Not Available	73.0%	75%
Mid Need Schools	Not Available	79.9%	85%
Low Need Schools	Not Available	88.8%	90%

College Persistence

Goal: MMSI students will *persist in college at higher rates* than similarly situated students in non-MMSI schools and equal or surpass state averages and exemplar benchmarks set by high performing districts.

Evaluation Findings: College Persistence

Over 90 percent of MMSI students persist and return for a second year of college, a first- to second-year retention rate that is higher than retention rates in Massachusetts and across the U.S. Seventy-seven percent of MMSI students attending 2-year colleges return for a second year of college, a rate that is 26 percentage points higher than the retention rate for all students in Massachusetts attending a public 2-year college. Retention rates for MMSI's low-income students (76.6%), African American students (91.4%), and Hispanic students (79.7%) similarly outpace Massachusetts' retention rates for all students and for each group.

Our analysis highlights the following hypotheses:

- *Students from low-income families are significantly more likely to persist in college if they complete a Math, Science, or English AP course.*
- *Taking an AP exam in Math, Science, or English AP exam significantly increases the likelihood that a student will persist in and graduate from college, irrespective of the AP score attained by the student.*
- *Scoring a 3 or better on a Math, Science, or English AP exam dramatically increases the likelihood that a 2-year college attendee will persist from year one to year two.*

Analysis

Table 14 displays the persistence rates for 2009, 2010, and 2011 MMSI graduates. The data on 2010 graduates represents a pure, first- to second-year rate of persistence, measured as the percent of students first enrolled in college in fall 2010 that successfully returned for a complete second year of college (e.g., enrolled in fall and winter/spring terms during the 2011-12 academic year). Persistence rates for the 2009 graduates measure whether or not a student persisted into their third year of college (or graduated from a 2-year college). Subsequent reports will document first to second year, second to third year, and third to fourth year persistence rates for each MMSI graduating class, to set annual benchmarks for persistence.

Table 14. College Attendance and College Persistence Rates for MMSI graduates from 2009, 2010, and 2011 cohorts, by Initial Attending College Type (Public and Private IHEs)

	# of MMSI High School Graduates	# of MMSI graduates attending college	# Currently Attending College (or Graduated)	College Attendance Rate	College Persistence Rate
2009 Graduates	634	423	374	66.7%	88.4%
	2-Year College	31	18		60.6%
	4-Year College	350	317		90.8%
2010 Graduates	1455	1192	1084	81.9%	90.9%
	2-Year College	124	98		77.3%
	4-Year College	904	834		92.9%
2011 Graduates	3040	2470	2354	81.3%	95.3%
Total (2009-2011)	5129	4085	3812	79.6%	93.3%

College Persistence

College Persistence by income and race/ethnicity

First to second year retention rates among 2010 MMSI graduates are consistently higher than U.S. and Massachusetts retention rates (Table 15). Focusing exclusively on graduates attending public IHEs, almost 9 of every 10 MMSI students persist to their second year in 4-year colleges, and almost 8 of every 10 persist in 2-year colleges. In comparison, retention rates for students attending 4-year colleges range from 78% to 79% in Massachusetts and across the U.S., and stand at 53% for those attending 2-year colleges. Of particular note is the 24% difference in 2-year college retention rates, with 77% of MMSI students persisting from their first to second year, compared to 53% of students across Massachusetts.

Retention rates for MMSI students mirror the trends observed in the analysis of college attendance rates. Low-income students attending 2-year colleges are much less likely to persist to a second year than those attending 4-year colleges. However, the retention rate for low-income students in 2-year colleges is 23% higher than Massachusetts' overall retention rate in 2-year colleges, ***which suggests that taking an AP course does increase the likelihood of persisting in college, despite financial or other barriers related to income.***

Further, the retention data for different populations shows that MMSI schools are making great strides in reducing gaps in retention rates among African American and Hispanic students.

Table 15. Comparison of MMSI College Persistence Rates (2010 high school graduates) with U.S and Massachusetts Persistence Rates, Public IHEs

	College Type	MMSI Students' College Persistence Rate	U.S. College Persistence Rate	Massachusetts College Persistence Rate
All Students	2-Year College	77.4%	53.0%	53.6%
	4-Year College	89.6%	78.4%	79.4%
Low-Income	2-Year College	73.6%	N/A	N/A
	4-Year College	91.5%	N/A	N/A
2- and 4-year combined rate				
Race/Ethnicity, (in Public Institutions)	White	85.9%		82%
	African American	89.2%		74%
	Asian	95.5%		83%
	Hispanic	79.7%		69%

The higher rates of persistence for all students, low-income students, and diverse populations of students is important and must be emphasized. In combination with increased college attendance rates, the fact that low-income students are persisting in college points to a multiplying effect that MMSI may be having with traditionally underserved populations, contributing to closing of achievement gaps and increased numbers of students succeeding in college.

Hypothesis: Students from low-income families are significantly more likely to persist in college if they complete a Math, Science, or English AP course.

College Persistence

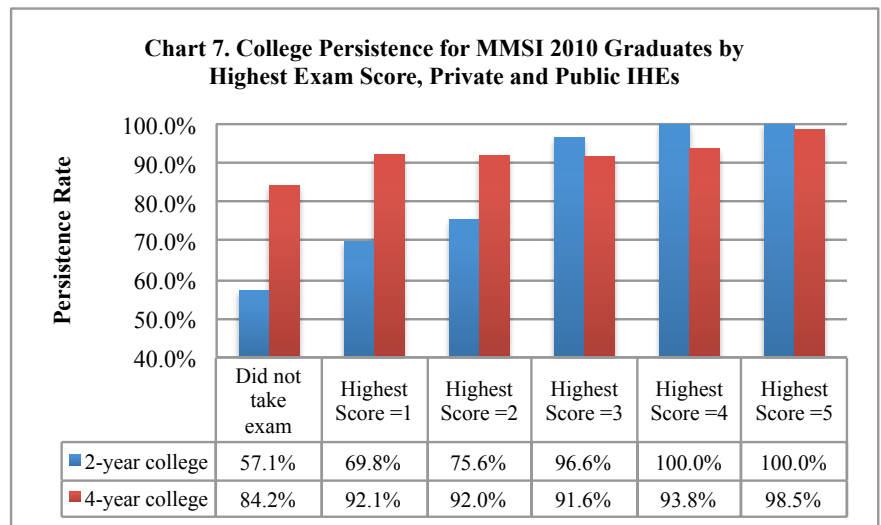
College Persistence by Highest AP Score.

Our analysis of the relationship between students' performance on AP exams and college attendance showed that college attendance rates are consistently high for all AP course-takers. A similar analysis of the relationship between AP scores and college persistence suggests that how a student performs on an AP test may be particularly important for students attending 2-year and 4-year colleges, but with very different implications.

Chart 7 displays the retention rates for MMSI students in 2- and 4-year colleges, by the highest score that a student attains on an AP exam. As seen visually and in the data, retention rates for MMSI students in 4-year colleges are consistently high for all AP exam-takers, regardless of the score attained on the exam. Those students who score a 1 on an AP exam and enroll in a 4-year college are just as likely to persist as those who score a 3, 4, or 5. This finding remains the same for low-income students, where only 70 % and 76 % of individuals scoring a 1 or 2 (respectively) persist in a 2-year college, compared to 94% of low-income students scoring a 1 persisting at a 4-year college. Data from additional cohorts of MMSI students will be necessary to substantiate this as a potentially significant and groundbreaking hypothesis.

Hypothesis: Taking an AP exam in Math, Science, or English AP exam significantly increases the likelihood that a student will persist and graduate from college, irrespective of the AP score attained by the student.

The data paints a very different picture for students attending 2-year colleges. In contrast to the consistently high retention rates across all scores observed for students attending 4-year colleges, students scoring a 1 or 2 that attend a 2-year college are much less likely to persist compared individuals scoring at least one 3, 4, or 5. The data is consistent across income levels and student populations, suggesting the following hypothesis:



Hypothesis: Scoring a 3 or better on a Math, Science, or English AP exam dramatically increases the likelihood that a 2-year college attendee will persist from year one to year two.

Setting College Persistence Performance Benchmarks

Benchmarking our Progress

Setting performance benchmarks provide stakeholders, including policymakers and school committee members, a way to measure whether or not school systems are improving and doing all that they can to meet the needs of all students. Based on the data from MMSI schools, Mass Insight Education offers the following performance benchmarks for **College Persistence**.

The listed performance benchmarks (Table 16) are intended to drive efforts to improve college persistence rates and are being shared with participating schools to develop school-level goals and to track the progress of individual schools.

Mass Insight Education proposes that these benchmarks be considered by districts across the state, as part of a statewide effort to close achievement gaps and improve college readiness and success for all students.

Table 16. College Persistence Rates (Current and Benchmarks) for MMSI graduates from 2010 Graduating Cohort				For Public IHEs	
	Current MMSI College Attendance Rate	MMSI College Attendance Goals	College Type	Current MMSI College Persistence one year rate (2010)	MMSI College Persistence Performance Benchmark
All MMSI Students, Attending All Public and Private IHEs	79.6%	80%	2-Year	77.3%	80%
			4-Year	92.9%	93%
Low Income	75.7%	77%	2-Year	73.6%	75%
			4-Year	91.5%	93%
Not Low Income	82.3%	85%			
Gender					
Females	80.3%	80%		87.1%	88%
Males	78.7%	80%		86.3%	88%
Race/Ethnicity					
White	83.2%	80%	Combined	85.9%	93%
Black or African American	75.6%	80%		89.2%	93%
Asian	80.7%	80%		95.5%	93%
American Indian or Alaskan Native	75.7%	77%		n>20	
Native Hawaiian or Pacific Islander	73.3%	77%		n>20	
Hispanic	69.4%	77%		79.7%	93%
By Highest Score Achieved, Attending All Public and Private IHEs					
Highest Score =1	71.5%	77%	2-Year	69.8%	80%
			4-Year	92.1%	93%
Highest Score =2	77.3%	80%	2-Year	75.6%	80%
			4-Year	92.0%	93%
High Need Schools	73.0%	75%			90%
Mid Need Schools	79.9%	85%			90%
Low Need Schools	88.8%	90%			90%

Discussion: The Pathway to College Success

All indicators point to MMSI as having a multiplying positive impact on students' persistence and success in college, especially among low-income, African American, and Hispanic students. Low-income MMSI students are more likely to graduate from high school, attend college (and in particular, 4-year colleges), and persist through their first year of college. As such, MMSI has the potential to dramatically improve students' chances of making it through the pathway to college success.

Research and data on college success tells us that there are three critical points at which students fall off of the pathway to college graduation.

- ☛ First, students must graduate from high school in order to apply for college. High school graduation rates for underserved populations are rising, but remain below national rates.
- ☛ Second, high school graduates must apply to and matriculate to college. Like high school graduation, college attendance rates have improved, but still have much room to grow.
- ☛ Third, students must persist in college, which entails that students have the right mix of academic skills, college acumen, and support systems to make it through. National data shows that college persistence is the critical juncture and obstacle at which large percentages of low-income, African American and Hispanic students lose track, fall off of the path, and fail to graduate from college.

How does MMSI help students along this pathway to college success?

1. There is some evidence that low-income students in MMSI schools are more likely to graduate from high school than low-income students in non-MMSI schools. This is the first multiplying effect of MMSI.
2. There is strong evidence that MMSI students, including students that would not have previously taken AP courses, are more likely to attend college than their counterparts at non-MMSI schools. This is the second multiplying impact of MMSI. The differences are particularly strong among low-income students and Hispanic students. Also, the data suggests that taking an AP course increases the likelihood that a student will attend a 4-year college rather than a 2-year college. Notwithstanding the importance of our community college system, national and state data tell us that those who attend 4-year colleges are much more likely to persist and succeed in college. So not only are MMSI students attending college at higher rates, but they are attending 4-year colleges at higher rates.
3. MMSI students are persisting in college at rates that far outpace national and state averages, especially among low-income students. MMSI's potential impact on persistence is the third multiplying factor that, when combined with growing high school graduation rates and improved rates of college attendance, illustrates how MMSI can be a key strategy for closing achievement gaps and improving students' success in college, particularly in STEM degrees and careers.

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Appendix A: Listing of High- and Mid-need schools used in comparison analysis

High Need/Low Income (Group A) MMSI Program Schools	Enroll	% Low Income	High Need/Low Income (Group A) Comparison Schools	Enroll	% Low Income
Boston - Brighton High	1233	79.5	Boston - Burke High	697	76.0
Boston - East Boston High	1382	84.2	Boston - Charlestown High	942	79.7
Chelsea - Chelsea High	1353	75.1	Boston - Madison Park Voc Tech	1286	69.8
Fall River - Durfee HS	2258	70.2	Boston - The English High	777	71.7
Revere - Revere High	1474	68.8	Brockton - Brockton HS	4145	71.4
Salem - Salem High	1231	53.2	Everett - Everett High	1710	61.6
Springfield - HS of Science and Technology	1267	83.7	Fitchburg - Fitchburg High	1146	62.9
Springfield - Springfield Central HS	2046	73.5	Holyoke - Holyoke HS	1268	64.0
Worcester - Burncoat HS	1072	59.3	Lowell - Lowell HS	3403	66.0
Worcester - North HS	1149	77.1	Lynn - Classical High	1401	77.0
Worcester - South HS	1297	72.4	Lynn - Lynn English High	1739	73.5
			Lynn - Lynn Voc Tech Institute	809	87.1
			New Bedford - New Bedford HS	2711	63.2
			Somerville - Somerville High	1344	70.8
			Springfield - HS Of Commerce	1286	80.9
			Springfield - Putnam Voc Tech HS	1545	79.8

Mid Need (Group B) MMSI Program Schools	Enroll	% Low Income	Mid Need (Group B) Comparison Schools	Enroll	% Low Income
Athol-Royalston - Athol High	451	49.2	Adams-Cheshire - Hoosac Valley High	668	35.9
Boston - O'Bryant Math & Science	1234	49.8	Haverhill - Haverhill High	1748	41.1
Boston Collegiate Charter	554	41.2	Holbrook - Holbrook Jr Sr High	472	37.5
Gill-Montague - Turners Fall High	294	50.7	Leominster - Leominster Center Tech	655	47.8
Greenfield - Greenfield High	483	61.1	Mohawk Trail - Mohawk Trail Reg'l High	566	32.0
Malden - Malden High	1799	61.0	North Adams - Drury High	578	52.2
Marlborough - Marlborough High	1457	36.4	North Central Essential	368	46.2
Quaboag Regional - Quaboag Regional High	582	39.7	Palmer - Palmer High	558	34.6
Randolph - Randolph High	744	55.2	Pioneer Charter Science	294	51.7
Salem Academy Charter	309	42.1	Pioneer Valley - Pioneer Valley Reg'l	536	25.4
Ware - Ware High	498	46.8	Pittsfield - Pittsfield High	976	44.1
Worcester - Worcester Tech HS	1400	61.2	Quincy - Quincy High	1441	53.9
			Taunton - Taunton High	1920	39.9
			Winchendon - Murdock Middle/High	755	49.5

Appendix A: Methodology for developing comparison groups

The District Analysis and Review Tool (DART) developed by the Massachusetts Department of Elementary and Secondary Education was used to identify the comparison schools used in the analysis. Extensive information on the DART, including the statistical method used by DART to identify “comparable” districts and schools, is located at: <http://www.doe.mass.edu/apa/dart/>.

While the DART is designed to identify comparable districts and schools for a single district (or school), the tool is not specifically designed to identify a set of comparison schools for a group of schools. However, the DART provides an excellent starting point for identifying a potential pool of comparison schools. The following is the process used by INSTLL to use the DART to develop a meaningful set of comparison schools.

1. We grouped the MMSI schools into three groups, based on percentage of low-income students, each school’s accountability status, and based on discussions with MMSI program staff. As described in the body of the report, we used the following criteria:

- Group A Criteria: Low Income greater than (>) 60 percent or School Accountability Status: Level 3 or 4
- Group B Criteria: Low Income greater than (>) 35 percent and does not meet Group 1 Criteria
- Group C Criteria: Low Income less than (<) 35 percent

2. Using DART, we identified the 9 comparison schools for each school in Group A (and then Group B and Group C) and listed these schools in a spreadsheet, for the purposes of analysis and sorting. Through this process, we identified a pool of potential comparisons for each Group. For instance, the pool of potential comparison schools for Group A included 24 schools.

3. Each pool of potential comparison schools was reduced and the final set of comparison schools selected based on the following decision rules: (1) meeting the criteria for the Group, as defined in 1, above; (2) being identified (through DART) as a potential comparison school by 2 or more of the MMSI schools in the Group.

Following the preliminary selection of comparison schools, we met with MMSI program staff to discuss potential issues and needed additions. Based on discussions with MMSI program staff, it was mutually decided to add three schools to the non-MMSI Group A set of comparison schools, in a desire to compare MMSI high need/low income schools to higher performing high schools with similar populations of low income students. Specifically, Brockton High School, Lynn Classical High School, and Lynn English High were added to the Group A comparison schools, even though they are currently designed as Level 2 schools in the state’s accountability system.

Appendix B

All student records are stored in a password protected Filemaker Pro database. Individual, student-level data provided by the College Board, obtained via data sharing agreements with each participating high school, represents the full sample of MMSI students and includes 13,431 individual student records for students who enrolled in at least one MMSI sponsored AP course between 2009 and 2012. Information on students' attendance and success in college was accessed through a data sharing agreement with the National Student Clearinghouse (NSC). The latest data request from NSC was made in July 2012 and included records for students enrolling in college in fall 2009, 2010, and 2011. Whether or not a student is "persisting" in college was determined according to the following criteria: Students with an active record of attending college after January 1, 2012 were considered to be persisting (e.g., still in college), regardless of whether or not the student had transferred.

The full data set links student AP course-taking and performance with college attendance and persistence, as provided by NCS data categories. The data set includes variable distinguishing whether or not students took one of 13 discrete AP courses, the score students received on each AP exam, and students' PSAT scores. Summary variables were computed as follows:

- Highest AP score achieved: The highest AP score attained by a student across all AP exams taken.
- Total number of AP courses taken: The sum total of AP courses taken by a student.
- Measure of College Readiness, using PSAT as proxy
- Math Take (1=student took a Math AP course)
- Science Take (1=student took a Science AP course)
- English Take (1=student took an English AP course)