



Getting It Right

Progress and Problems in Raising Science Achievement in Boston

The Boston
Foundation 

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U N D E R S T A N D I N G B O S T O N

Getting It Right

Progress and Problems in Raising Science Achievement in Boston

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Preface

As often happens when we undertake an investigation of a social issue here in Boston, our close look at progress in science achievement in Boston schools has turned up a good news/bad news story.

As the author notes, standardized testing doesn't present us with a complete picture of an individual's or a system's status or potential. We know that despite some dire numbers in this report, there are students, teachers and schools doing amazing things today and paving the way for tomorrow's breakthroughs in science. But testing, and more specifically the Massachusetts Comprehensive Assessment System, or MCAS, does allow us to track performance over time, and that's what this report does.

The good news is that we're seeing some improvement in students' performance on the MCAS Science and Technology/Engineering test across the board. Notably, test results in high school science have trended up—both in the Boston Public Schools and across the state. And while there is significant school-to-school variation in the city, there are spots of high achievement that are encouraging and may serve as models.

The bulk of the findings in this report, however, are sobering. To see that there are multiple schools in which the percentage of students scoring in the Proficient or Advanced level is zero should raise alarms for all of us who care about our students' futures. That there has been a flattening of the slowly climbing MCAS Science results in the lower grades in the last few years is also worrying. Perhaps most disturbing is to see the racial disparities in some results, which can be logically traced to so many other disparities in our society.

And yet, despite this somewhat disheartening picture, we are certainly not without hope. This report identifies some policies and practices that may be contributing to the faltering advances in MCAS Science. One of these is simply acknowledging the importance of science understanding as a skill that a well-informed resident and hopeful workforce participant needs to have today, and adjusting expectations and approaches accordingly. To date, high school graduation requirements for MCAS Science are lower than they are for English Language Arts and Mathematics, which may send a message reverberating down to kindergarten that the subject is less important.

Living in an economy buzzing with technology, health care and life sciences activity, we know that science education here must keep pace. This status report on how our public schools are doing in science opens many doors for conversation and innovation around ways to prepare the next generation of students—wherever they live in the Commonwealth—not just to pass the required tests but to grasp and benefit from knowing the essential human endeavor that is science.



Paul S. Grogan
President & CEO
The Boston Foundation

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Public School Population in Boston

As of January 2018 approximately **66,500** students attended public schools in the city of Boston.

More than **79%** or nearly **53,000** were enrolled in one of **118** schools in the Boston Public School district.

21% or close to **14,000** were enrolled in one of **22** Boston-based Charter public schools.

Massachusetts has two primary types of charter schools

Commonwealth

authorized solely by the State Board of Elementary and Secondary Education.

>11,000 charter school students

attend **16** Commonwealth schools

Horace Mann

also authorized by the local school committee and, in certain cases, the local teachers' union.

<3,000 charter school students

attend **6** Horace Mann schools

Each type of charter school is considered an independent "Local Education Agency," or school district, by the state. Accordingly, data for each individual charter school is reported separately from the local city or town within which the charter school is located.

The majority of analyses in this report focus on MCAS results for BPS students; however, the report also contains analyses of results for Boston-based charter schools.

Introduction

The Boston Foundation has long held education as one of its core strategic focus areas, aiming to strengthen the education-to-career pipeline and bolster pathways from early childhood through postsecondary completion for Boston residents. Intended to inform the Foundation’s potential direction and activities related to science, technology, engineering, and mathematics (STEM) education in particular, this report examines Massachusetts Comprehensive Assessment System (MCAS) Science and Technology/Engineering test results for students residing in the city of Boston and enrolled in Boston Public Schools (BPS) and Boston-based charter public schools (“charters”). In so doing, the report begins to explore how prepared Boston public school students are to successfully pursue employment or postsecondary education in the STEM disciplines.

The report analyzes Boston elementary, middle, and high school students’ achievement on the MCAS Science and Technology/Engineering (“Science”) exams, primarily focusing on the degree to which students demonstrate grade-level mastery on MCAS (scoring at the Proficient or Advanced achievement levels), identifying trends and variation over time by grade level, school type, and student subgroup. The report also compares Boston student results with those of all students in the state and in other urban school districts in Massachusetts. Lastly, the report discusses the potential impact of state and local policies, including graduation requirements, on students’ MCAS Science performance.

What Is MCAS?

The Massachusetts Comprehensive Assessment System comprises a set of standardized tests administered annually to all public school students in Massachusetts. MCAS English Language Arts and Mathematics tests were first administered in 1998 in grades 4, 8, and 10, and MCAS Science tests were first administered in 2003 in grades 5 and 8. Currently, in accordance with federal and state laws, students in grades 3 through 8 and grade 10 must take annual English Language Arts and Mathematics MCAS tests. Additionally, students in grade 5, grade 8, and either grade 9 or 10 must participate in annual Science and Technology/Engineering MCAS tests. The Massachusetts Department of Elementary and Secondary Education is responsible for the development, administration, and reporting of MCAS tests. Annual results are available for all public schools, school districts, and the state at <http://profiles.doe.mass.edu>.

Summary of Key Findings

1. For both the state as a whole and for Boston Public Schools students, MCAS Science and Technology/Engineering (Science) achievement in elementary school and middle school has historically been lower than achievement in MCAS English Language Arts (ELA) and Mathematics; it has increased less over time than ELA and Math; and it is stagnant or declining since 2014.
2. For BPS students, MCAS Science achievement is higher in high school than in grades 5 and 8, but the gap between BPS and statewide achievement persists; BPS lags average state performance as much in high school as in earlier grades.
3. Average MCAS Science achievement in grades 5 and 8 is lower for BPS students than for students in the majority of comparison school districts in Massachusetts. However, MCAS Science achievement in high school is higher for BPS students than for students in most comparison districts.
4. A substantial amount of school-level variation exists in elementary, middle, and high school MCAS Science achievement, both among individual BPS schools and among individual Boston-based charter schools. On average, Boston-based Commonwealth charter schools have higher percentages of students demonstrating mastery on grade 5 and 8 MCAS Science tests than do BPS non-Exam schools. Among all public high schools in Boston, students attending the three BPS Exam schools have average scores on MCAS Science tests that are higher than at other categories of high schools. Commonwealth charter schools represent the next-highest scoring group of Boston high schools.
5. The majority of BPS high school students participate in the MCAS Introductory Physics exam, followed in frequency by the Biology exam. Few BPS students take the MCAS Technology/Engineering or Chemistry exams. In all but two of the Boston-based charter high schools, charter school students take the Biology exam.
6. Compared with the state overall, BPS serves large percentages of students from traditionally disadvantaged subgroups. Among racial/ethnic groups, over 40 percent of BPS students are Hispanic/Latino and more than 30 percent of students are in the African-American/Black subgroup. Asian and White students comprise relatively small percentages of the overall BPS population but on average score higher on grade 5, 8, and high school MCAS Science exams than their Black and Latino peers. Boston-based Commonwealth charter schools serve small numbers of White students; as in BPS, White students score higher on average on MCAS Science exams than Black and Latino students.

Analysis and Key Findings

State and federal laws require all students who attend public schools to participate in annual statewide assessments. Massachusetts meets this requirement through administration of the Massachusetts Comprehensive Assessment System (MCAS). While standardized testing is often a target of certain criticisms, results from standardized tests—because they are administered to all students in a particular school system—serve as a useful tool to compare performance across groups and over time. This report uses publicly available MCAS results as a means of exploring Boston students’ Science and Technology/Engineering performance.

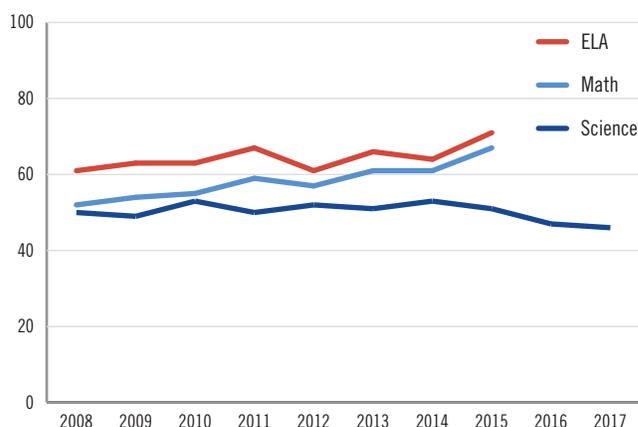
Statewide MCAS Science and Technology/Engineering Results

Statewide MCAS results are averages, compiled using the results of all students in the state who take the exams in a given year. As such, many of Massachusetts’ 404 operating school districts¹ score higher than the state average and many school districts score lower. In this way, statewide results provide context and serve as a benchmark for interpreting individual school district results.

In Massachusetts, all public school students participate in English Language Arts (ELA) and Mathematics MCAS tests every year in grades 3 through 8, and in grade 10, and participate in Science and Technology/Engineering (Science) tests in grades 5, 8, and grade 9 or 10. All students must take a high school MCAS Science test by the end of grade 10. Grade 5, grade 8, and high school statewide MCAS results—specifically, percentages of students scoring in the Proficient or Advanced achievement levels—for the 10-year period from 2008 through 2017 are displayed in **Figures 1–3**. Note that Massachusetts has transitioned to its Next Generation MCAS ELA and Math tests in grades 3–8, and no statewide legacy MCAS results for grade 5 and grade 8 ELA and Math are available after 2015. In future years, the state plans to continue the transition to Next Generation MCAS for all high school tests, and for elementary and middle school Science tests.

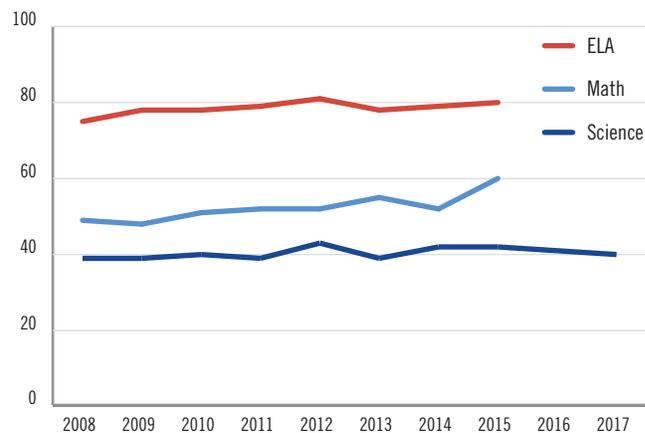
In all grades, statewide MCAS Science results are consistently lower than results in ELA and Mathematics (see **Figures 1** and **2**). In grades 5 and 8, statewide Science results have been stagnant over the entire

FIGURE 1
Statewide Grade 5 MCAS Results, 2008–2017
Percent of students scoring Proficient or Advanced



Note: Statewide Grade 5 MCAS ELA or Math results are not available for 2016 or 2017 due to implementation of PARCC and Next Generation MCAS.
Source: Massachusetts Department of Elementary and Secondary Education

FIGURE 2
Statewide Grade 8 MCAS Results, 2008–2017
Percent of students scoring Proficient or Advanced



Note: Statewide Grade 8 MCAS ELA or Math results are not available for 2016 or 2017 due to implementation of PARCC and Next Generation MCAS.
Source: Massachusetts Department of Elementary and Secondary Education

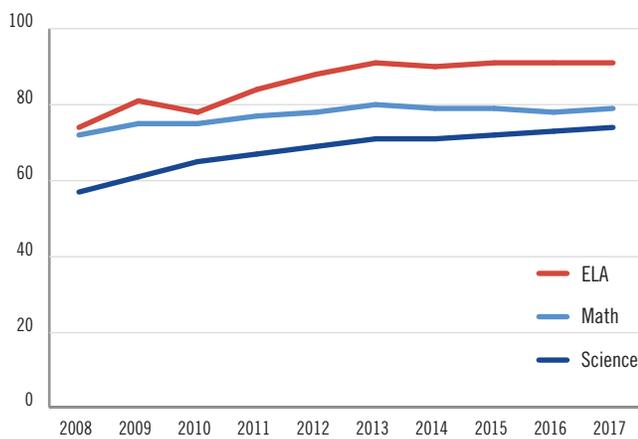
10-year period, with a slight decline evident in grade 5. In 2017, just 46 percent of grade 5 students and 40 percent of grade 8 students statewide demonstrated grade-level mastery (scoring in the Proficient or Advanced achievement level).

Statewide MCAS Science results for high school are higher than results for grades 5 and 8, with 74 percent of students demonstrating grade-level mastery on high school Science tests in 2017 (see **Figure 3**). Statewide, the gap between Science, ELA, and Math at the high school level has consistently narrowed over time.

FIGURE 3

Statewide High School MCAS Results, 2008–2017

Percent of students scoring Proficient or Advanced



Source: Massachusetts Department of Elementary and Secondary Education

Statewide & Boston Public Schools MCAS Science and Technology/Engineering Results

As described at the beginning of this report, nearly 67,000 students are enrolled in the Boston Public Schools or Boston-based charter public schools. Of those, close to 80 percent are enrolled in BPS and the remaining 20 percent attend Boston-based charter schools. Four out of five Boston charter school students, approximately 11,000, attend Commonwealth charter schools, and nearly 3,000 students attend Horace Mann charters. The 2008 through 2017 MCAS results for students enrolled in BPS, compared with statewide results, are displayed in **Figures 4–9**.

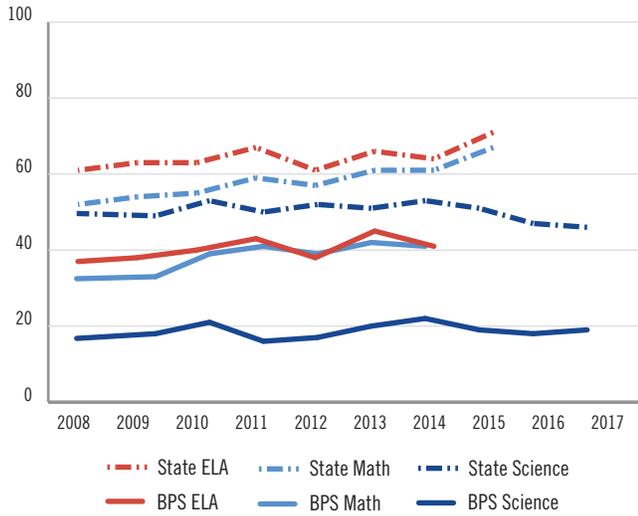
In grade 5 in all tested subject areas, BPS performance is lower than statewide performance (see **Figure 4**). BPS began transitioning to new statewide assessments in 2015; as a result, no legacy MCAS ELA or Math results are available for the district in grades 3–8 after 2014. In 2014, 41 percent of BPS grade 5 students scored in the Proficient or Advanced achievement levels on the MCAS ELA and Math tests. The gap between BPS and statewide results in 2014 was 23 percentage points in ELA and 20 percentage points in Math.

As **Figure 5** shows, the gap between BPS and statewide results for grade 5 MCAS Science tests is substantially larger than that and has remained so over time. In 2017, the gap for grade 5 MCAS Science was 27 points. Although the grade 5 MCAS Science gap has narrowed between 2008 and 2017, the narrowing is primarily due to a decline in statewide results rather than an increase in BPS results.

As with the grade 5 results, BPS student performance in all tested subject areas in grade 8 is lower than statewide performance (see **Figure 6**). In 2014, the last year legacy MCAS ELA and Math results were available, 63 percent of BPS grade 8 students in ELA and 37 percent of BPS students in Math scored in the Proficient or Advanced achievement levels. On 2017 MCAS Science tests, only 15 percent of grade 8 BPS students scored Proficient or Advanced. The gap between BPS and statewide results in 2014 was 16 percentage points in ELA and 15 percentage points in Math.

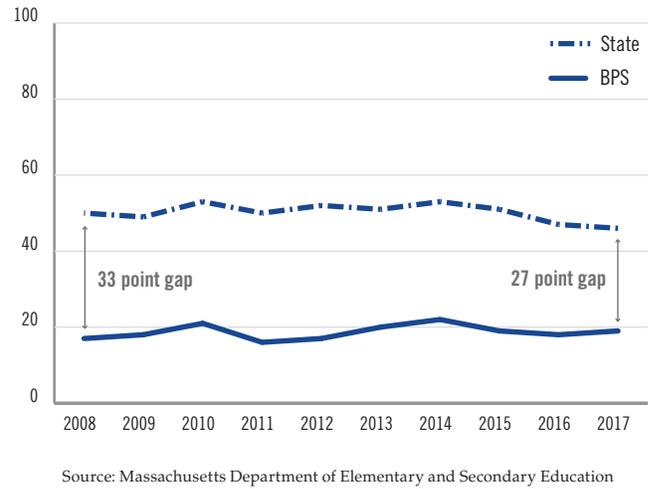
In grade 8 science, the gap between BPS and statewide results began at 29 percentage points in 2008 and was 25 percentage points in 2017 (see **Figure 7**). Between 2008

FIGURE 4
Grade 5 MCAS Results:
Statewide & Boston Public Schools, 2008–2017
 Percent of students scoring Proficient or Advanced



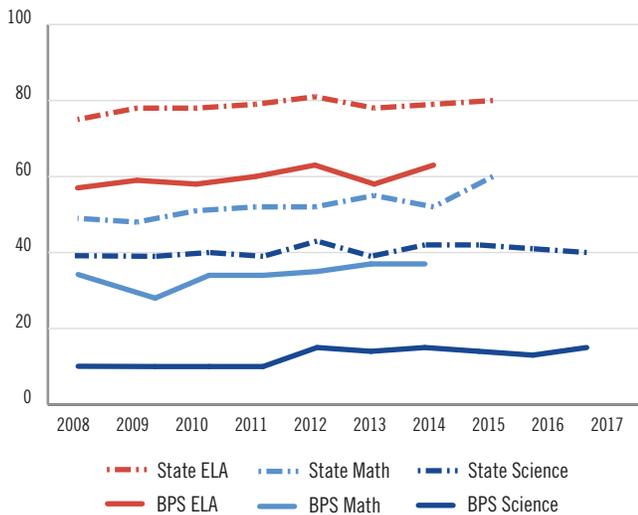
Note: Statewide Grade 5 MCAS ELA or Math results are not available for 2015 (for BPS), 2016, and 2017 due to implementation of PARCC and Next Generation MCAS.
 Source: Massachusetts Department of Elementary and Secondary Education

FIGURE 5
Grade 5 MCAS Science Results:
Statewide & Boston Public Schools, 2008–2017
 Percent of students scoring Proficient or Advanced



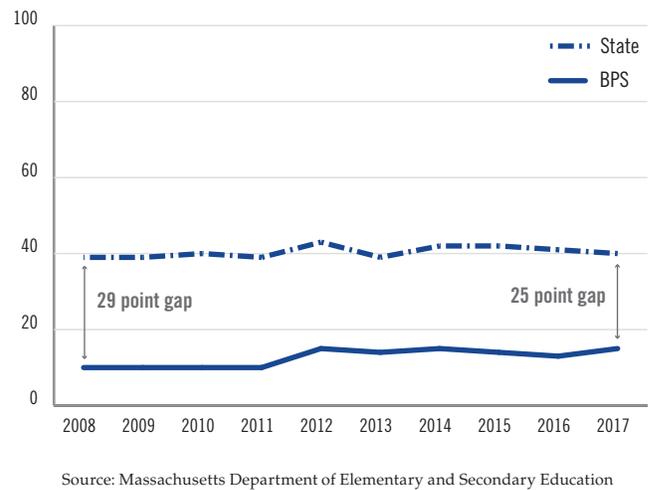
Source: Massachusetts Department of Elementary and Secondary Education

FIGURE 6
Grade 8 MCAS Results:
Statewide & Boston Public Schools, 2008–2017
 Percent of students scoring Proficient or Advanced



Note: Statewide Grade 5 MCAS ELA or Math results are not available for 2015 (for BPS), 2016, and 2017 due to implementation of PARCC and Next Generation MCAS.
 Source: Massachusetts Department of Elementary and Secondary Education

FIGURE 7
Grade 8 MCAS Science Results:
Statewide & Boston Public Schools, 2008–2017
 Percent of students scoring Proficient or Advanced



Source: Massachusetts Department of Elementary and Secondary Education

and 2017, grade 8 MCAS Science performance in BPS has remained generally flat and extremely low. In 2008, just 10 percent of BPS students scored in the Proficient or Advanced range. In 2017, 15 percent scored Proficient or Advanced.

MCAS results for BPS high schools are more promising than for grades 5 and 8, with absolute performance increasing in all high school subject area tests—ELA, Math, and Science—between 2008 and 2017 (see **Figure 8**). The gap between BPS and statewide percentages scoring Proficient or Advanced in 2017 was 10 percentage points in ELA and 12 percentage points in Math, narrower than in grades 5 and 8. The gap for high school Science, however, was 25 points in 2017, as

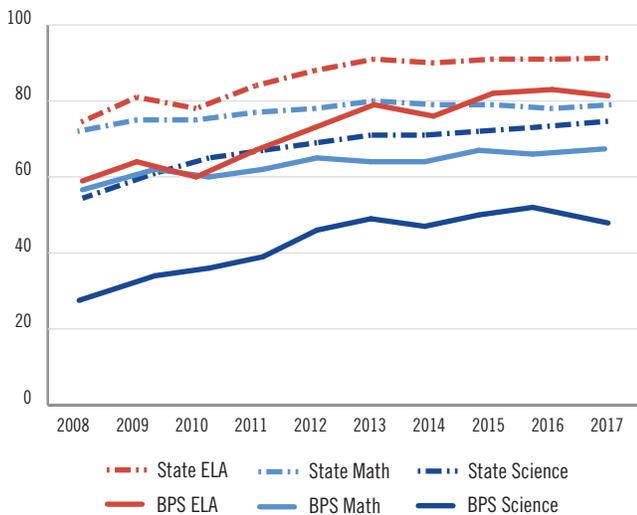
large as the gap demonstrated in the earlier grades (see **Figure 9**). In other words, although BPS high school MCAS Science performance has improved over time, on average BPS students are lower performing compared with students statewide—and more so on MCAS Science tests than on MCAS ELA or Math tests.

The high school MCAS Science gap remains large but has narrowed slightly between 2008 and 2017. In 2008 the gap between BPS and statewide results was 28 percentage points, and had narrowed to 21 percentage points in 2016. In 2017 BPS high school MCAS Science performance dropped, and the gap increased to 25 percentage points.

FIGURE 8

High School MCAS Results: Statewide & Boston Public Schools, 2008–2017

Percent of students scoring Proficient or Advanced

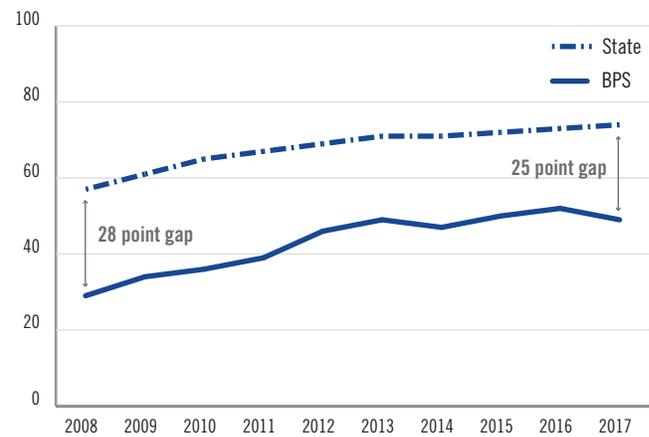


Source: Massachusetts Department of Elementary and Secondary Education

FIGURE 9

High School MCAS Science Results: Statewide & Boston Public Schools, 2008–2017

Percent of students scoring Proficient or Advanced



Source: Massachusetts Department of Elementary and Secondary Education

MCAS Science and Technology/Engineering Results for Boston Students – Grades 5 and 8

The previous section of this report explored Boston Public School students’ MCAS Science and Technology/Engineering performance over time in relation to other tested subjects and overall statewide results. This section delves deeper into MCAS Science results for Boston students in grades 5 and 8, comparing results against other Massachusetts school districts, across school type, and by individual school.

DISTRICT-LEVEL RESULTS

Figures 10–13 display MCAS Science performance over time for Boston Public Schools, the state, and 10 comparison school districts. The comparison districts were identified through the Massachusetts Department of Elementary and Secondary Education’s District Analysis and Research Tool (DART), which uses enrollment and demographic data to categorize and assign comparison groups.²

As Figure 10 shows, from 2015 to 2017, BPS performance on the grade 5 MCAS Science tests was lower than that of nine comparison Massachusetts school districts. Only students enrolled in the Holyoke Public Schools performed lower than BPS grade 5 students. In 2008, two districts, Lawrence and Lowell, performed as low or

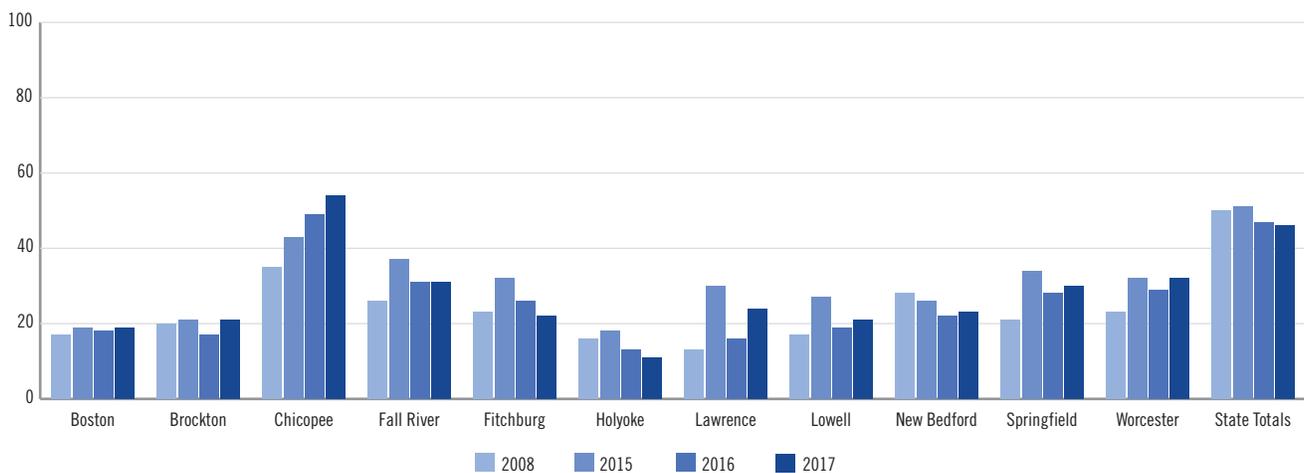
What Are DARTs?

The Massachusetts Department of Elementary and Secondary Education has created a set of District Analysis and Review Tools (DARTs) as part of the Department’s efforts to help make data that it collects from school districts more accessible and easier to use. DARTs allow users to view snapshots of individual districts or schools across a variety of indicators, and to quickly compare district and school performance. DARTs that focus on student assessment, English language learners, high school success, and staffing and performance data are currently available. <http://www.doe.mass.edu/dart/>.

lower than BPS; however, by 2015 Lawrence and Lowell had increased their performance above that of BPS.

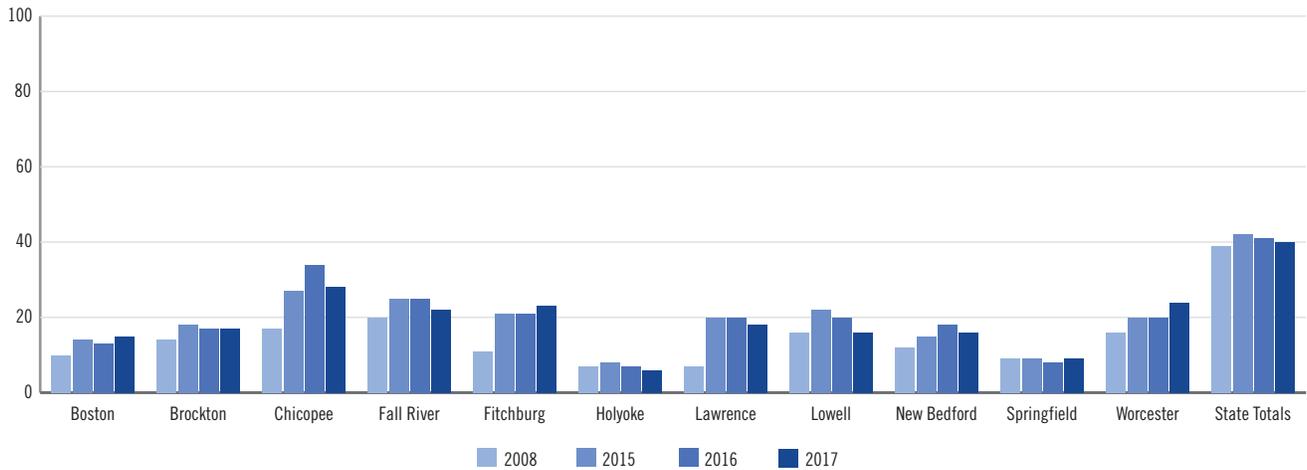
The pattern is similar for grade 8 (see Figure 11). BPS performance on the grade 8 MCAS Science tests from 2015 to 2017 was lower than that of eight comparison districts. Only Holyoke and Springfield demonstrated lower performance than BPS. While BPS’ performance on this assessment increased by five percentage points from 2008 to 2017, the majority of comparison districts show greater improvement over the same number of years.

FIGURE 10
Grade 5 MCAS Science Results: Boston Public Schools and Other Urban School Districts
 Percent of students scoring Proficient or Advanced



Source: Massachusetts Department of Elementary and Secondary Education

FIGURE 11
Grade 8 MCAS Science Results: Boston Public Schools and Other Urban School Districts
 Percent of students scoring Proficient or Advanced

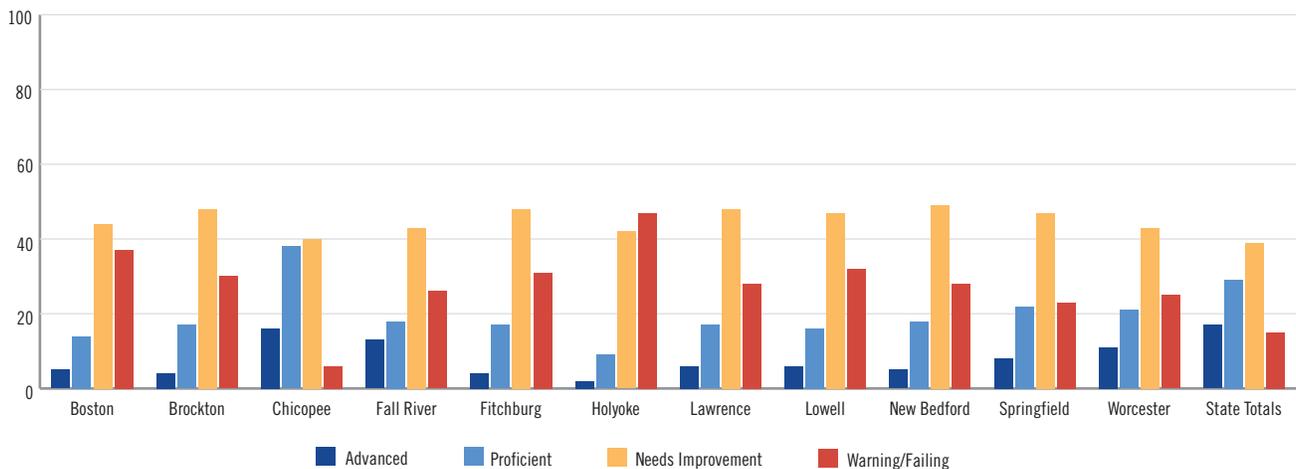


Source: Massachusetts Department of Elementary and Secondary Education

Figures 12 and 13 show the distribution of students scoring in different achievement levels—Advanced, Proficient, Needs Improvement, and Warning/Failing—on the 2017 grade 5 and 8 MCAS Science tests. In both grades, the majority of urban districts, including Boston, had very few students who scored in the Advanced range. Results for the grade 8 MCAS

Science test are particularly low. In 2017, only 3 percent of students statewide scored Advanced (blue column), while 20 percent scored in the Warning/Failing (red column) range. 2017 grade 8 MCAS Science results for BPS show no students scoring in the Advanced range and 42 percent of students scoring in the Warning/Failing range.

FIGURE 12
Grade 5 MCAS Science Results: Boston Public Schools and Other Urban School Districts, 2017
 Percent of students scoring at each achievement level

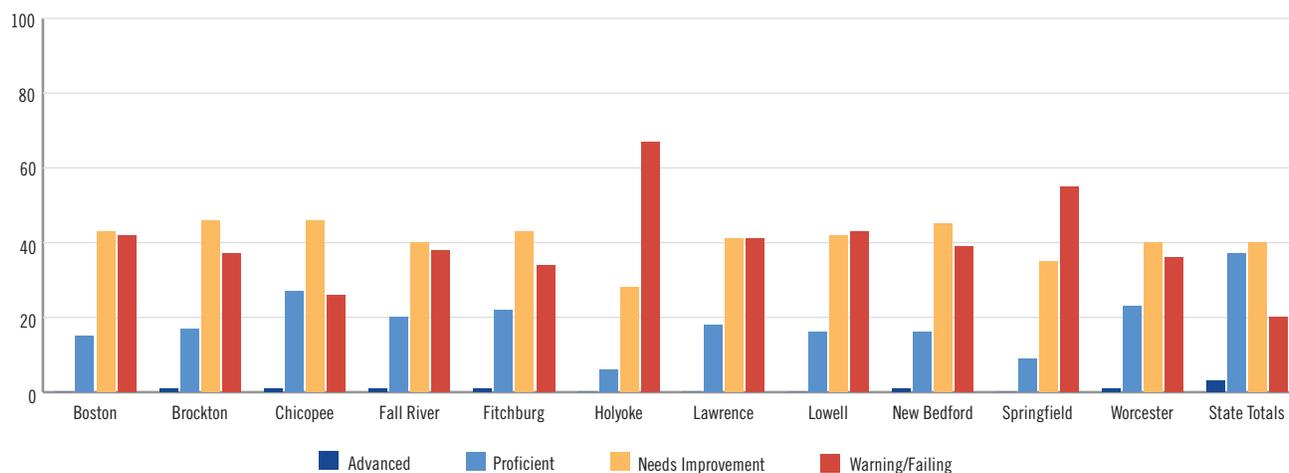


Source: Massachusetts Department of Elementary and Secondary Education

FIGURE 13

Grade 8 MCAS Science Results: Boston Public Schools and Other Urban School Districts, 2017

Percent of students scoring at each achievement level



Source: Massachusetts Department of Elementary and Secondary Education

SCHOOL-LEVEL RESULTS

Approximately 80 percent of students attending public schools in Boston are enrolled in one of BPS' 118 schools.³ While most are "traditional" schools, a sizable percentage of schools may have certain flexibilities or focus areas, and are identified as Pilot or Innovation schools. Boston also has three Examination schools that serve grades 7–12: Boston Latin School, Boston Latin Academy, and the John D. O'Bryant School of Mathematics and Science—all of which have admission criteria that include participation in an entrance exam.

The remaining 20 percent of students are enrolled in one of 22 Boston-based charter public schools, each of which the state considers a separate "Local Educational Agency" or district. Massachusetts state law has established two primary types of charter schools: Commonwealth charters and Horace Mann charters. Commonwealth charter schools are authorized solely by the State Board of Elementary and Secondary Education, while Horace Mann Charter Schools must also be authorized by the local school committee and, in certain cases, the local teachers' union. As previously noted, four out of five Boston charter school students attend Commonwealth charters, and the remainder attend Horace Mann charters. The Boston

Public Schools (BPS) considers Boston-based Horace Mann charter schools to be "in-district" charters, and includes them when listing BPS schools.⁴

On average, as **Figure 14** shows, Boston-based Commonwealth charter schools have higher percentages of students scoring Advanced or Proficient on 2017 grade 5 MCAS Science tests than Boston-based Horace Mann charters, Innovation, Pilot, and traditional non-Exam BPS schools. Across all Boston-based Commonwealth charters, 37 percent of students scored in the Proficient or Advanced range on the 2017 grade 5 MCAS Science tests, compared with 17–19 percent in that range for other school types.

On the 2017 grade 8 MCAS Science tests, combined results for the three BPS Exam schools exceeded those of any other school type, with 40 percent of Exam school students scoring in the Proficient or Advanced achievement levels (see **Figure 15**). On average, Boston-based Commonwealth charter schools were the next highest performing school type, with 28 percent of students scoring Proficient or Advanced. When 2017 grade 8 MCAS Science results for BPS traditional non-Exam and Exam schools are combined, approximately 19 percent of students scored in the Proficient and Advanced achievement levels.

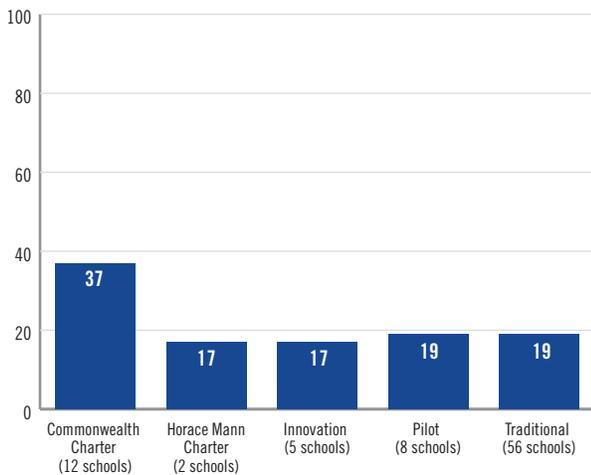
At the same time, there is a substantial amount of school-to-school variation in performance, even within school types. **Figures 16 and 17** show the variation that exists among schools on the 2017 grade 5 and grade 8 MCAS Science tests across all Boston schools, including charters. Schools are ranked based on the

percentage of students scoring in the Proficient and Advanced achievement levels, with charter schools grouped together at the top of the figures. In these figures, Commonwealth charter schools are shaded in dark blue, Horace Mann in-district charter schools are shaded in red, and the remainder of Boston public schools are shaded in light blue.

The percentage of students scoring Proficient or Advanced in BPS schools on the 2017 grade 5 MCAS Science varies from a low of 0 percent to a high of 50 percent (see **Figure 16**). For Boston-based charters, the range is from 2 to 63 percent. On the 2017 grade 8 MCAS Science test, the percentages of students scoring Proficient or Advanced runs from 0 percent to 44 percent for BPS schools and 0 to 60 percent for Boston-based charters (see **Figure 17**).

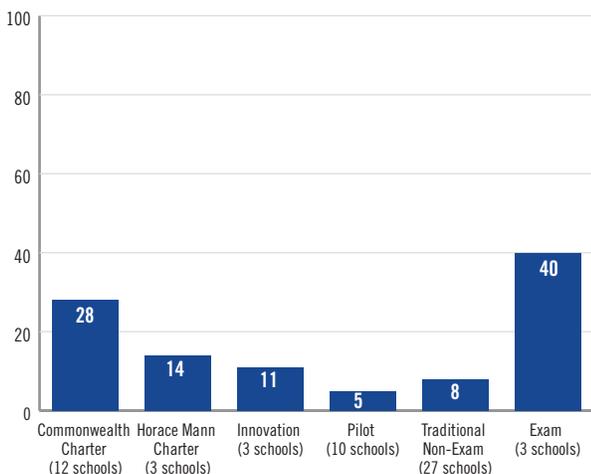
As with the previously-discussed district-level results, the majority of BPS and Boston-based charter schools had few students who scored in the Advanced range on the 2017 grade 5 or grade 8 MCAS Science tests. On the 2017 grade 5 MCAS Science test, three BPS schools and three charter schools had between 20 and 26 percent of students scoring Advanced; in the remaining BPS and charter schools the percentage scoring Advanced ranged from 0 to 12 percent. On the 2017 grade 8 MCAS Science test, two BPS schools and three charter schools had Advanced percentages between 1 and 4 percent, while the remaining BPS and charter schools had no students scoring Advanced.

FIGURE 14
Grade 5 MCAS Science Results, by School Type in Boston, 2017
 Percent of students scoring Proficient or Advanced



Source: Massachusetts Department of Elementary and Secondary Education

FIGURE 15
Grade 8 MCAS Science Results, by School Type in Boston, 2017
 Percent of students scoring Proficient or Advanced



Source: Massachusetts Department of Elementary and Secondary Education

FIGURE 16

Grade 5 MCAS Science Results for Boston Schools, 2017

Percent of students scoring Proficient or Advanced

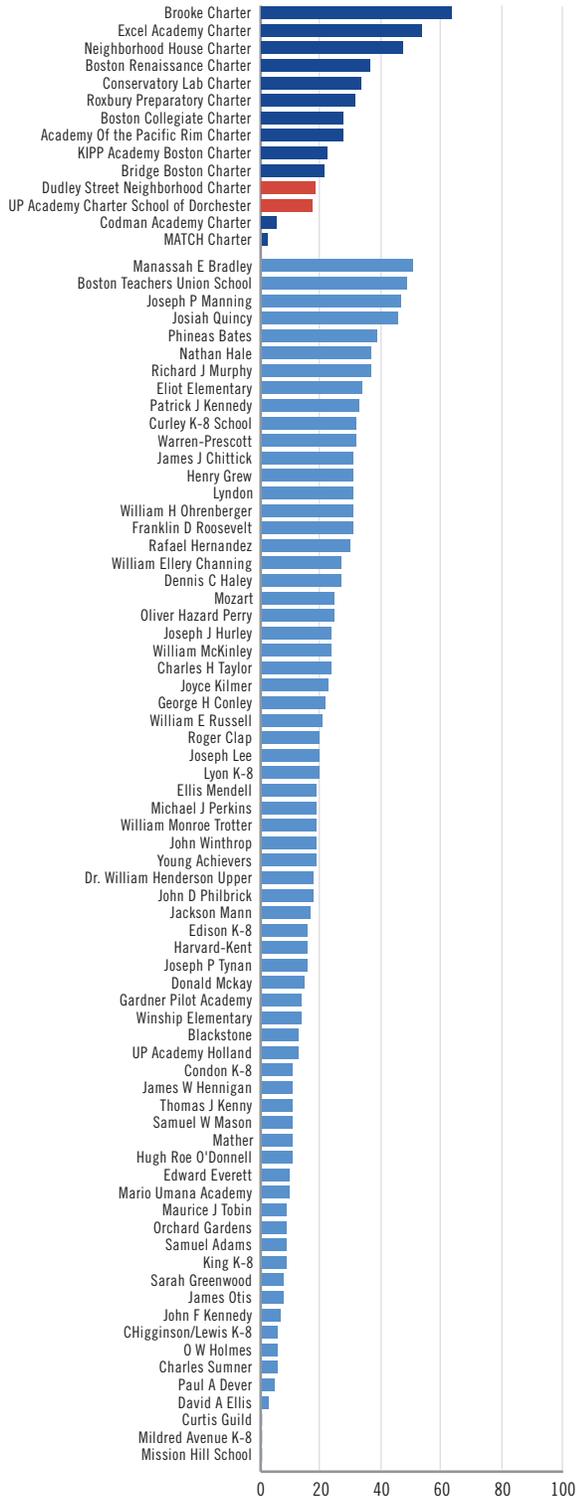
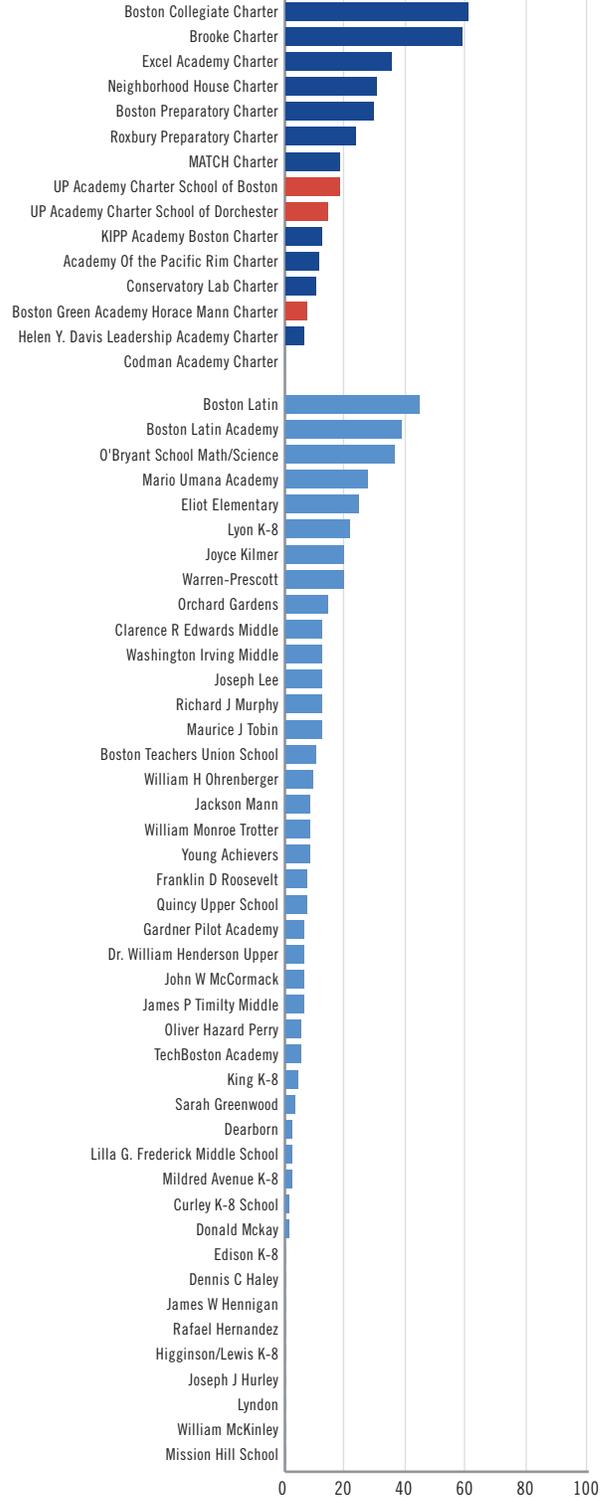


FIGURE 17

Grade 8 MCAS Science Results for Boston Schools, 2017

Percent of students scoring Proficient or Advanced



Notes: Commonwealth Charter schools are shaded in dark blue. Horace Mann in-district charter schools are shaded in red. BPS schools are shaded in light blue.

Source: Massachusetts Department of Elementary and Secondary Education

MCAS Science and Technology/Engineering Results for Boston Students – High School

This section of the report reviews MCAS Science results for Boston high school students, comparing results against other Massachusetts school districts, across school type, and by individual school.

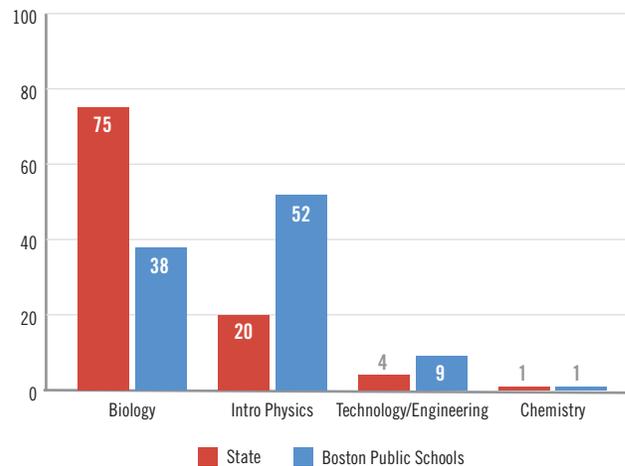
Currently, the state offers four different high school MCAS Science test options: Biology, Introductory Physics, Technology/Engineering, and Chemistry. High school MCAS Science tests may be administered to students either in grade 9 or grade 10. The state Department of Elementary and Secondary Education encourages grade 9 students who take a high school science course that corresponds to one of the MCAS test options to take the MCAS Science test in grade 9, as doing so provides students the opportunity to participate in the same or a different MCAS Science test in grade 10 if necessary. Schools may choose to administer one or more of the four high school MCAS Science tests in a given year.

High School MCAS Graduation Requirements

Massachusetts state law requires all public school students to attain passing scores on high school MCAS English Language Arts (ELA), Mathematics, and Science and Technology/Engineering exams to be eligible for graduation, with a higher standard set for ELA and Math than for Science. Specifically, to meet state requirements, students must score in the Proficient or Advanced range on MCAS ELA and Math tests, and must score in the Needs Improvement range or above on one of the high school MCAS Science tests. Students who are unable to attain the requisite score on any test during the initial test administration period are provided retest opportunities prior to graduation. The current requirements were first implemented in 2010 and have been in effect through the 2017–18 school year. As Massachusetts transitions to Next-Generation MCAS tests at the high school level, the state Board of Elementary and Secondary Education is expected to establish new graduation requirements linked to the new tests.

Statewide, the MCAS Biology test is the most frequently administered high school MCAS Science test (see **Figure 18**). In 2017, 75 percent of high school MCAS Science test-takers across Massachusetts took the Biology test; 20 percent took the Introductory Physics test; 4 percent took the Technology/Engineering test; and only 1 percent took the Chemistry test. In the Boston Public Schools, Introductory Physics is more frequently administered than Biology, Technology/Engineering, and Chemistry. In 2017, 52 percent of BPS high school MCAS Science test-takers participated in the Introductory Physics test; 38 percent participated in the Biology test; 9 percent participated in the Technology/Engineering test; and 1 percent participated in the Chemistry test.

FIGURE 18
High School MCAS Science Tests Participation Rates, 2017
Percent of students taking each test



Source: Massachusetts Department of Elementary and Secondary Education

As described earlier, average MCAS performance of BPS high schools is higher than the performance of elementary and middle schools in all three tested subjects: English Language Arts, Mathematics, and Science and Technology/Engineering. In 2017, the gaps between BPS and statewide results in grade 10 MCAS ELA and Math are narrower than the gaps in grades 5 and 8; however, the 2017 gap for high school MCAS Science, at 25 percentage points, is as large as the gaps demonstrated in the earlier grades (see **Figures 8–9**).

Figures 19–22 compare 2017 high school MCAS Science performance for Boston Public Schools, Boston-based charter schools, the state, and 10 comparison school districts. (See **Table 1** for test participation rates across these districts.) The measure used in these analyses is the percentage of students scoring in the Proficient or Advanced achievement levels. Comparison districts were identified using the Massachusetts Department of Elementary and Secondary Education’s District Analysis and Research Tool (DART), which uses enrollment and demographic data to categorize and assign comparison groups, and are the same comparison districts used in analyses of grade 5 and grade 8 MCAS Science results earlier in this report.

One important note of caution when interpreting comparative MCAS results for high school science tests: Percentages displayed in these figures may in certain cases—particularly for Chemistry, Technology/Engineering, and Introductory Physics tests—be generated based on relatively small numbers of test-takers.

MCAS Biology results vary substantially by district, with most urban districts demonstrating meaningful improvement from 2008 to more recent years. In 2017, 64 percent of students attending BPS schools who took the MCAS Biology exam scored in the Proficient or Advanced achievement levels, putting Boston ahead of all but one of 10 comparison districts (see **Figure 19**).

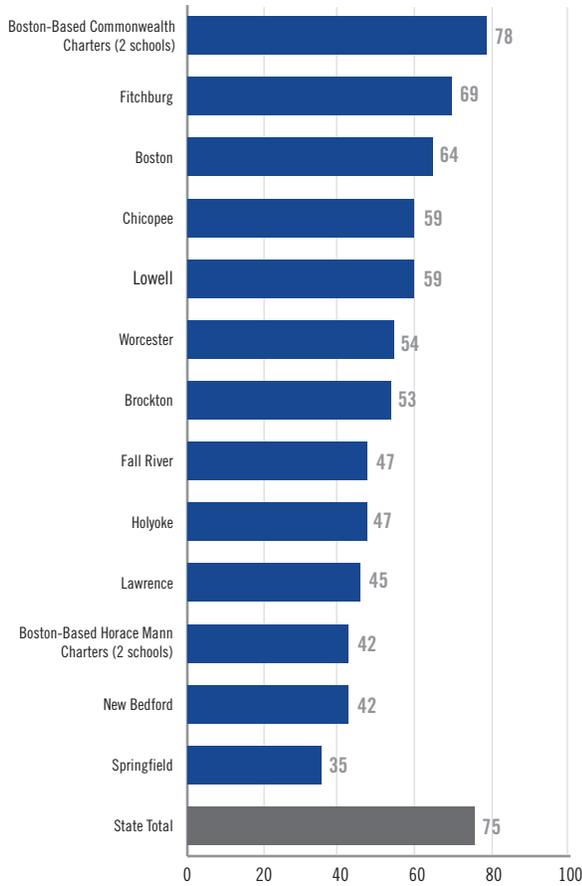
TABLE 1
High School MCAS Science Tests Participation, by District, 2017
 Number and percent of students taking each test

District Name	2017 MCAS Biology		2017 MCAS Introductory Physics		2017 MCAS Technology/Engineering		2017 MCAS Chemistry		2017 Total	
	#	%	#	%	#	%	#	%	#	%
State Totals	53432	75	14178	20	2601	4	769	1	70980	100
Boston	1257	38	1748	52	303	9	42	1	3350	100
Boston-based Horace Mann Charters (2 Schools)	172	100		0		0		0	172	100
Boston-based Commonwealth Charters (10 Schools)	708	85	127	15		0		0	835	100
Brockton	974	79		0	42	3	215	17	1231	100
Chicopee	74	84	14	16		0		0	88	100
Fall River	534	100		0		0		0	534	100
Fitchburg	108	37		0	182	63		0	290	100
Holyoke	296	100		0		0		0	296	100
Lawrence	645	86	103	14		0		0	748	100
Lowell	713	100		0		0		0	713	100
New Bedford	277	55	224	45		0		0	501	100
Springfield	1222	72	324	19	161	9		0	1707	100
Worcester	1660	98		0	34	2		0	1694	100

Source: Massachusetts Department of Elementary and Secondary Education

FIGURE 19

**High School MCAS Biology Results:
Boston Public Schools, Boston-Based Charters,
and Other Urban School Districts, 2017**
Percent of students scoring Proficient or Advanced

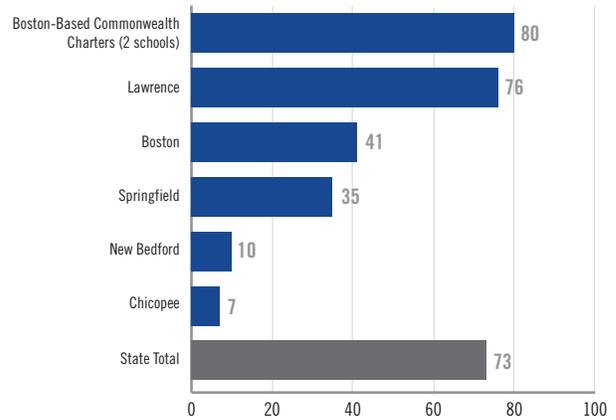


Source: Massachusetts Department of Elementary and Secondary Education

Figure 20 displays Introductory Physics results. In addition to BPS, just four comparison urban districts administered the Introductory Physics exam to students in 2017. Forty-one percent of BPS students taking the 2017 MCAS Introductory Physics test scored in the Proficient or Advanced range. Three of the four comparison districts had smaller percentages of students scoring Proficient or Advanced in 2017; only Lawrence Public Schools had higher percentages of students demonstrating mastery, with 76 percent scoring Proficient or Advanced. See Table 1 for high school MCAS Science test participation for comparison urban districts.

FIGURE 20

**High School MCAS Introductory Physics Results:
Boston Public Schools, Boston-Based Charters,
and Other Urban School Districts, 2017**
Percent of students scoring Proficient or Advanced



Source: Massachusetts Department of Elementary and Secondary Education

Figures 21–22 show MCAS Technology/Engineering and Chemistry results for BPS, the state, and comparison urban districts that had students who participated in these tests. Results vary by district, and, in some cases, they are based on a relatively small number of students. Approximately 300 BPS students took the 2017 MCAS Technology/Engineering test and approximately 40 BPS students took the 2017 MCAS Chemistry test. In 2017 the majority of Boston-based charter schools only administered the MCAS Biology exam. In addition, two Boston-based charter schools administered the MCAS Introductory Physics exam. No Boston-based charter schools administered MCAS Technology-Engineering or Chemistry exams in 2017. In the aggregate, Boston-based Commonwealth charter schools had higher percentages of students scoring in the Proficient or Advanced achievement levels than BPS, the state, and selected Massachusetts urban districts on both the 2017 MCAS Biology and Introductory Physics exams (**Figures 19–20**). The percentage of BPS students scoring Proficient or Advanced on the 2017 MCAS Biology test was 64 percent, higher than nine comparison districts. Across all Boston-based Commonwealth charters, 78 percent of participating students scored Proficient or Advanced.

On the 2017 MCAS Introductory Physics exam, 41 percent of participating BPS students scored in the Proficient or Advanced achievement levels, while 80 percent of participating students attending the two Boston-based Commonwealth charter schools that administered the exam scored in the same range.

Based on 2017 official results, approximately 2,900 public high school students in the city of Boston who took MCAS Science exams (79 percent of the total) were enrolled in BPS, and 750 students (21 percent) were enrolled in Commonwealth or Horace Mann

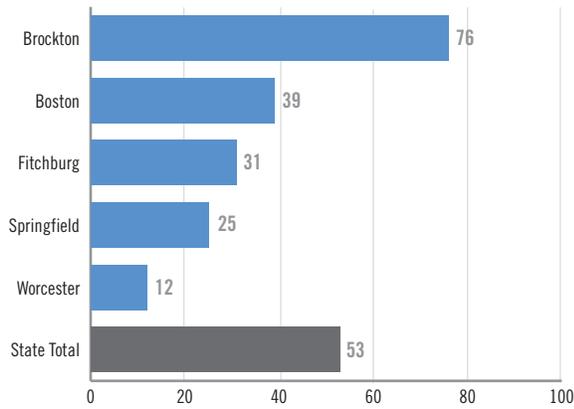
charter schools. Twelve BPS high schools with 2017 MCAS Science results are considered “traditional” non-Exam schools; eight are classified as Pilot schools; three are classified as Innovation schools; and three are considered Exam schools.

On average, when results across all four subject area tests are combined and aggregated by school type, the three BPS Exam schools scored highest among Boston high schools that administered 2017 grade 10 MCAS Science tests, with 90 percent of students in the Proficient or Advanced achievement levels (see Figure 23). By comparison, 45 percent of students attending BPS Pilot schools scored Proficient or Advanced, and 31 percent of students attending traditional non-Exam BPS high schools scored in the same range. When 2017 high school MCAS Science results for BPS traditional non-Exam and Exam schools are combined,

FIGURE 21

High School MCAS Technology/Engineering Results: Boston Public Schools and Other Urban School Districts, 2017

Percent of students scoring Proficient or Advanced

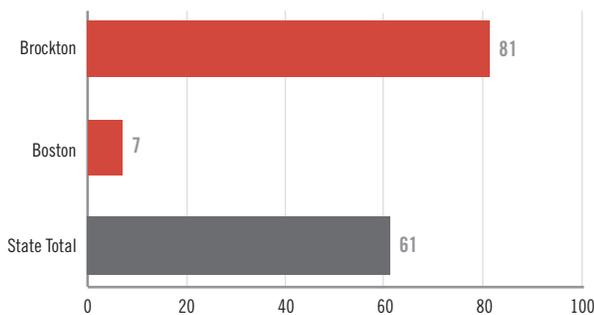


Source: Massachusetts Department of Elementary and Secondary Education

FIGURE 22

High School MCAS Chemistry Results: Boston Public Schools and Other Urban School Districts, 2017

Percent of students scoring Proficient or Advanced

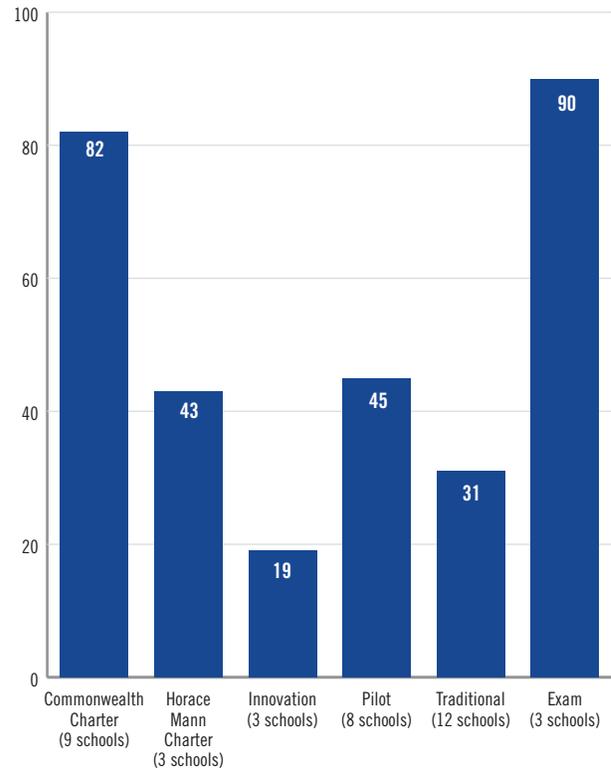


Source: Massachusetts Department of Elementary and Secondary Education

FIGURE 23

High School MCAS Science Results, by School Type in Boston, 2017

Percent of students scoring Proficient or Advanced



Note: Data excluded for any school that only administered 2017 HS STE exams to Grade 9 students.

Source: Massachusetts Department of Elementary and Secondary Education

58 percent of students scored in the Proficient and Advanced achievement levels. In the nine Boston-based Commonwealth charter schools with 2017 grade 10 MCAS Science results, 82 percent of students scored Proficient or Advanced.

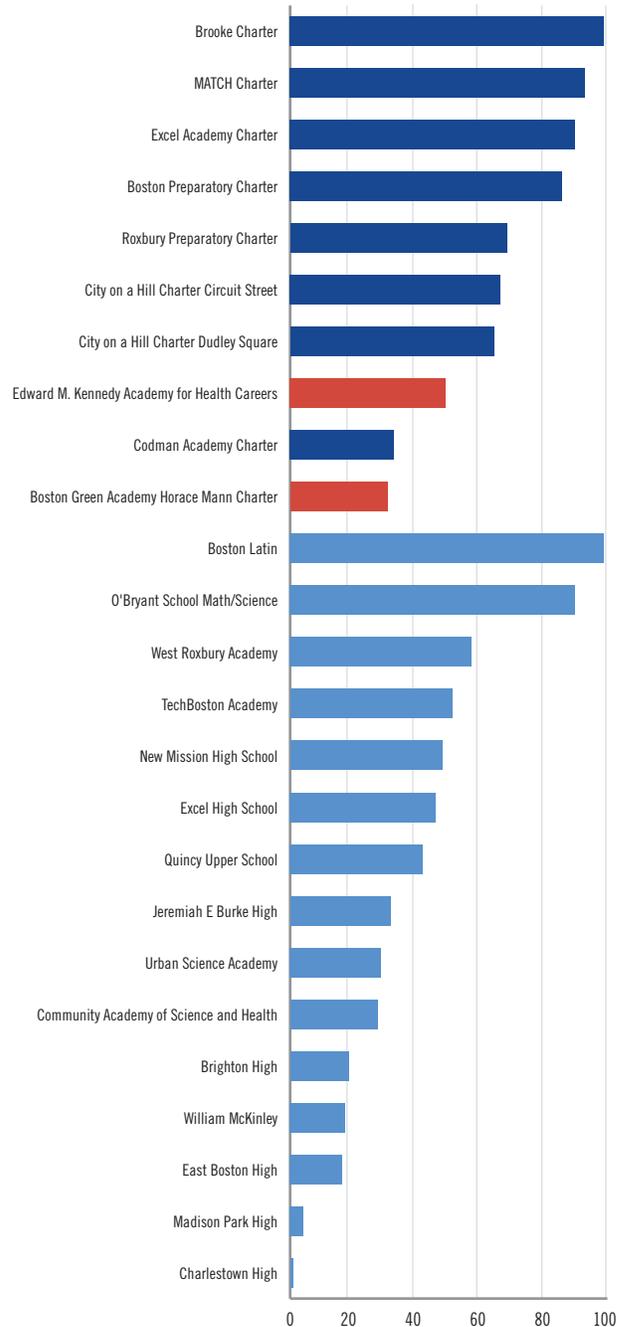
School-level variation on three 2017 high school MCAS Science tests—Biology, Introductory Physics, and Technology/Engineering—across all Boston schools, including charters—is displayed in **Figures 24–26**. Schools are ranked based on the percentage of students scoring in the Proficient and Advanced achievement levels, with charter schools grouped together at the top of the figures. In these figures, Commonwealth charter schools are shaded in dark blue, Horace Mann in-district charter schools are shaded in red, and the remainder of Boston public schools are shaded in light blue.

As with the grade 5 and grade 8 MCAS Science results, there is a substantial amount of school-to-school variation in performance on high school MCAS Science tests, both among Boston-based charter high schools and BPS high schools. The range in percentage of students scoring Proficient or Advanced in Boston-based charters on the 2017 MCAS Biology test varies from a low of 32 percent to a high of 99 percent (see **Figure 24**). Among BPS high schools, the range of students scoring Proficient or Advanced runs from 0 percent to 99 percent.

On the 2017 MCAS Introductory Physics test, students at the two Boston-based charter schools that administered the test scored between 62 and 95 percent Proficient and Advanced (see **Figure 25**). Across the 15 BPS high schools that administered the 2017 MCAS Introductory Physics test, the range in percent Proficient and Advanced was 9 percent to 92 percent. Four BPS high schools, and no Boston-based charter schools, administered the 2017 MCAS Technology/Engineering test. The percentage of BPS students scoring Proficient and Advanced ranged from 8 to 85 percent (see **Figure 26**).

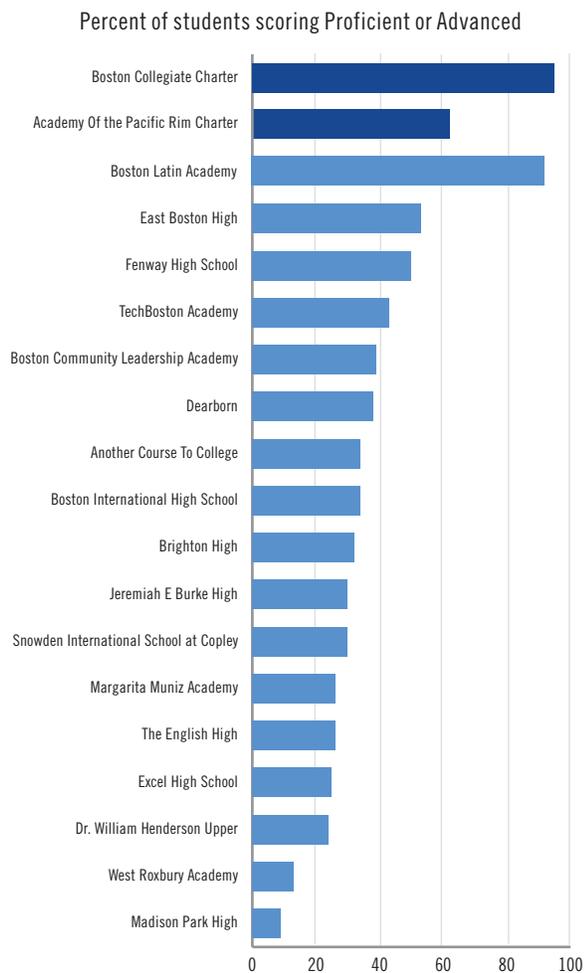
Only one BPS school administered the 2017 Chemistry exam, and no students scored Proficient or Advanced.

FIGURE 24
High School MCAS Biology Results for Boston Schools, 2017
 Percent of students scoring Proficient or Advanced



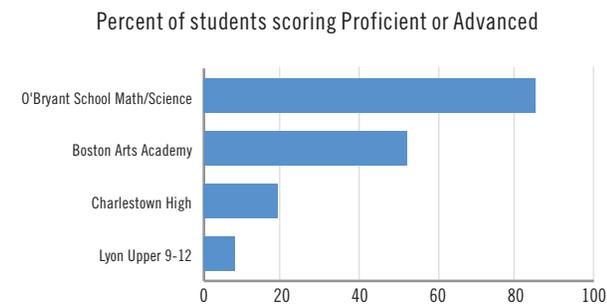
Notes: Commonwealth charter schools are shaded in dark blue. Horace Mann in-district charter schools are shaded in red. BPS schools are shaded in light blue.
 Source: Massachusetts Department of Elementary and Secondary Education

FIGURE 25
High School MCAS Introductory Physics Results for Boston Schools, 2017



Notes: Commonwealth charter schools are shaded in dark blue. BPS schools are shaded in light blue.
 Source: Massachusetts Department of Elementary and Secondary Education

FIGURE 26
High School MCAS Technology/Engineering Results for Boston Schools, 2017



Source: Massachusetts Department of Elementary and Secondary Education

MCAS Science and Technology/Engineering Results for Boston Students by Subgroup

This section reviews how results on the MCAS Science exams vary by student subgroup—race/ethnicity, gender, students with disabilities, English language learners, and economically disadvantaged students—at both BPS schools and Commonwealth charter schools.

Compared with the state, the Boston Public Schools serves large percentages of students from traditionally disadvantaged subgroups. Among racial/ethnic groups, over 40 percent of BPS students are Hispanic/Latino and more than 30 percent of students are African-American/Black. As **Figures 27–28, 31–32, and 35–36** show, Asian and White students comprise relatively small percentages of the overall BPS population but, on average, score highest on grade 5, 8, and high school MCAS Science exams. On the grade 5 and 8 MCAS Science tests, the percentage of BPS Asian and White students scoring Proficient or Advanced is three or more times higher than that of Black and Latino students (see **Figures 28 and 32**). On high school MCAS Science tests, BPS Asian and White students on average score nearly twice as high as Black and Latino students (see **Figure 36**).

The lowest scoring BPS student subgroups on MCAS Science tests across all three grade spans are English language learners and students with disabilities. On 2017 grade 5 and grade 8 MCAS Science tests, an average of 3 to 6 percent of BPS English language learners and students with disabilities scored in the Proficient and Advanced range (see **Figures 28 and 32**). On the 2017 high school MCAS Science tests, the percentage of students in these groups scoring Proficient or Advanced averaged from 14 to 16 percent (see **Figure 36**). Male and female students in BPS score similarly on MCAS Science tests in grade 5 and grade 8. On the grade 10 MCAS Science tests, female students have performed higher than male students in each of the past three years by between 1 and 8 percentage points.

On average, Boston-based Commonwealth charters⁵ with 2017 grade 5, grade 8, or grade 10 MCAS Science results served smaller percentages of English language learners, White students, and Asian students than BPS. In the same year, the comparative percentages between

BPS and Boston-based Commonwealth charters for students with disabilities, economically disadvantaged students, and Hispanic/Latino students varied by grade level. At all grade levels, however, Boston-based Commonwealth charter schools with 2017 MCAS Science results served higher percentages of African-American/Black students than BPS. Commonwealth charter schools in Boston currently serve too few Asian students to generate results on MCAS Science tests at any grade level (see **Figures 27, 29, 31, 33, 35, and 37**).

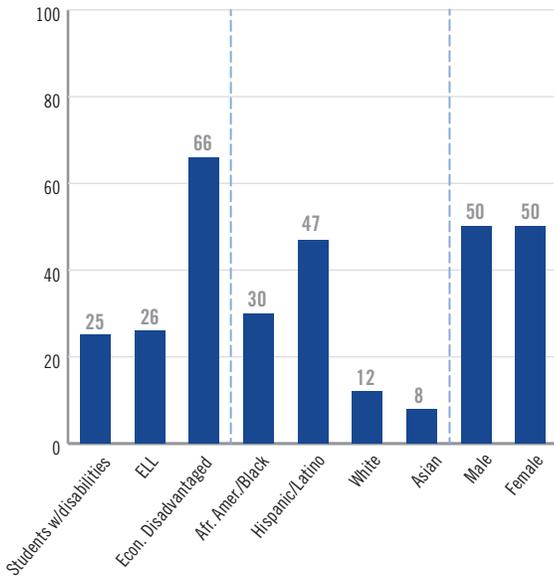
Similarly to BPS, within charter schools, White students were more likely to score in the Proficient or Advanced achievement levels than other subgroups in grade 5, grade 8, and grade 10. At the high school level, Hispanic/Latino students are the next highest performing subgroup in Boston-based Commonwealth

charter schools. On the 2017 grade 10 MCAS Science test, 100 percent of White students and 91 percent of Hispanic/Latino students attending Boston's 10 Commonwealth charter schools scored in the Proficient or Advanced achievement levels.

As in BPS, in Boston-based Commonwealth charters, the lowest scoring student subgroups on MCAS Science tests across all three grade spans were English language learners and students with disabilities. Male and female students in Boston-based Commonwealth charters scored similarly on MCAS Science tests in grade 5 and grade 10. On the 2017 grade 8 MCAS Science tests, male students performed higher than female students by 6 percentage points; however, in the two prior years male and female students scored similarly (see **Figures 30, 34, and 38**).

FIGURE 27

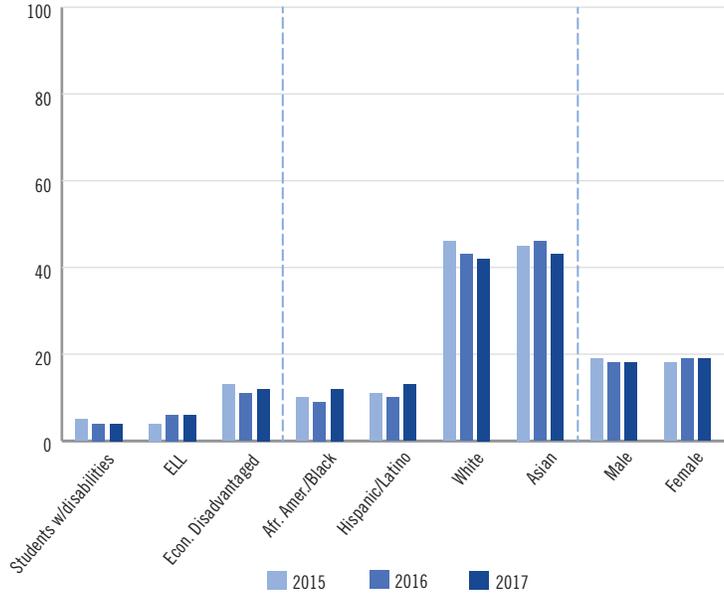
Grade 5 MCAS Science Tests: Student Subgroups at Boston Public Schools, 2017
Percent of all test-takers who belong to each subgroup



Source: Massachusetts Department of Elementary and Secondary Education

FIGURE 28

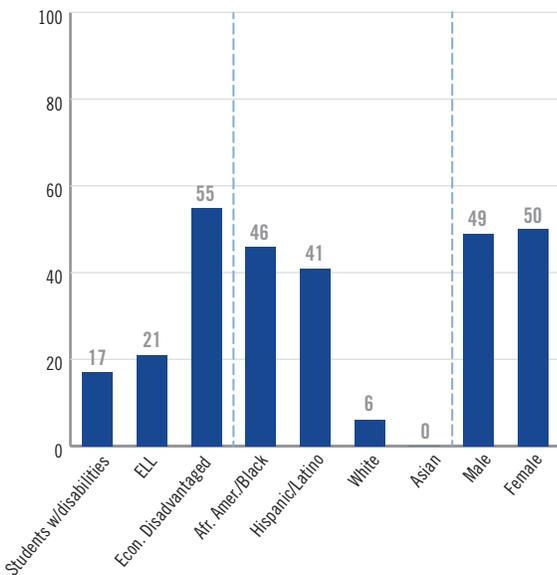
Grade 5 MCAS Science Results, by Student Subgroup at Boston Public Schools, 2015–2017
Percent of students in each subgroup scoring Proficient or Advanced



Source: Massachusetts Department of Elementary and Secondary Education

FIGURE 29

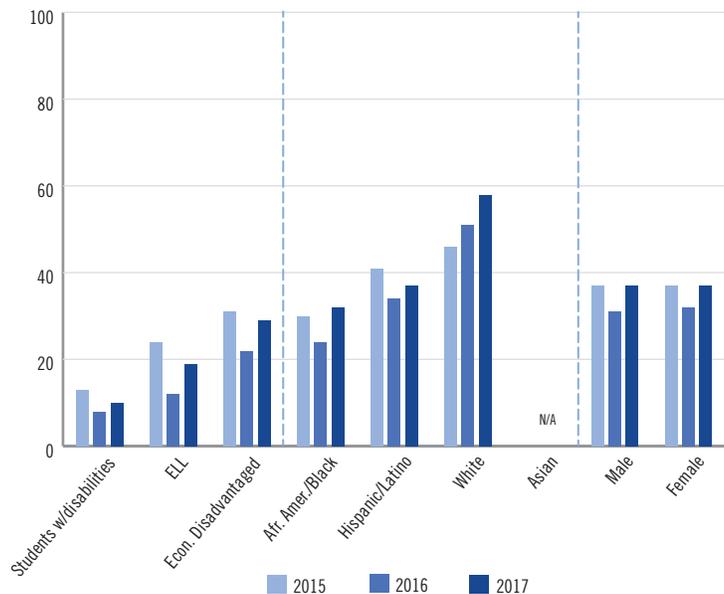
Grade 5 MCAS Science Tests: Student Subgroups at Boston-Based Commonwealth Charter Schools, 2017
Percent of all test-takers who belong to each subgroup



Source: Massachusetts Department of Elementary and Secondary Education

FIGURE 30

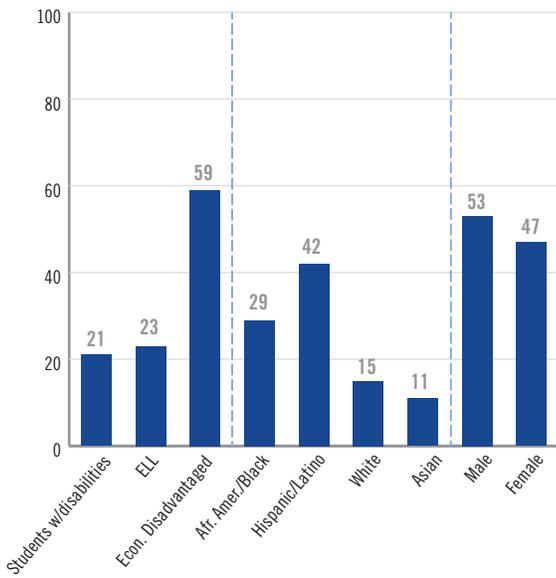
Grade 5 MCAS Science Results, by Student Subgroup at Boston-Based Commonwealth Charter Schools, 2015–2017
Percent of students in each subgroup scoring Proficient or Advanced



Source: Massachusetts Department of Elementary and Secondary Education

FIGURE 31

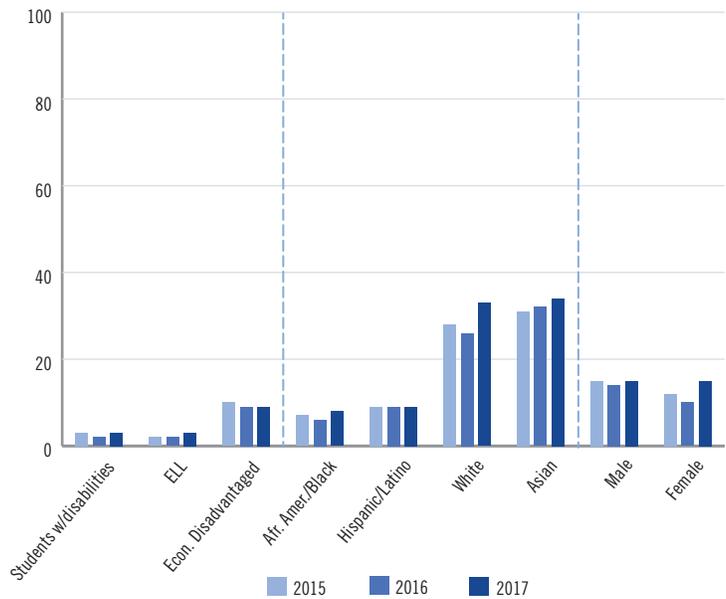
Grade 8 MCAS Science Tests: Student Subgroups at Boston Public Schools, 2017
Percent of all test-takers who belong to each subgroup



Source: Massachusetts Department of Elementary and Secondary Education

FIGURE 32

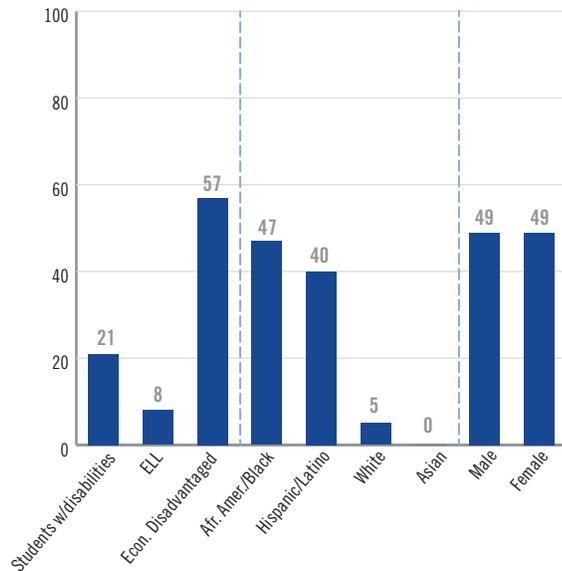
Grade 8 MCAS Science Results, by Student Subgroup at Boston Public Schools, 2015–2017
Percent of students in each subgroup scoring Proficient or Advanced



Source: Massachusetts Department of Elementary and Secondary Education

FIGURE 33

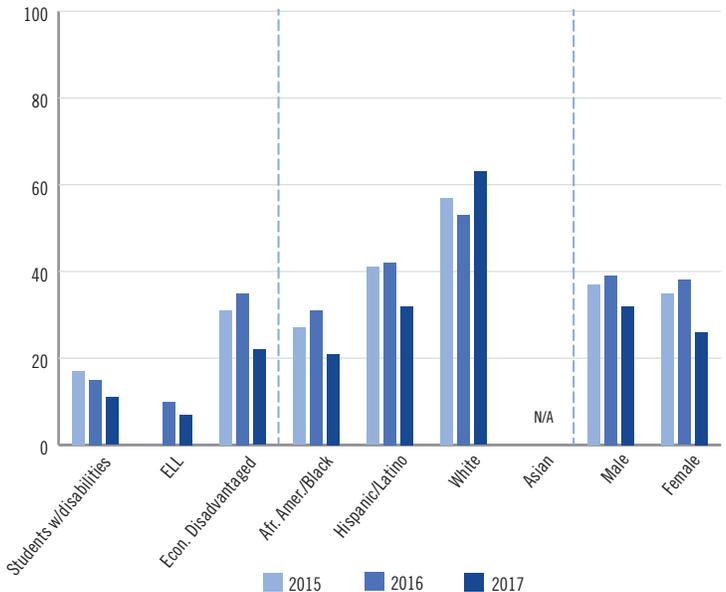
Grade 8 MCAS Science Tests: Student Subgroups at Boston-Based Commonwealth Charter Schools, 2017
Percent of all test-takers who belong to each subgroup



Source: Massachusetts Department of Elementary and Secondary Education

FIGURE 34

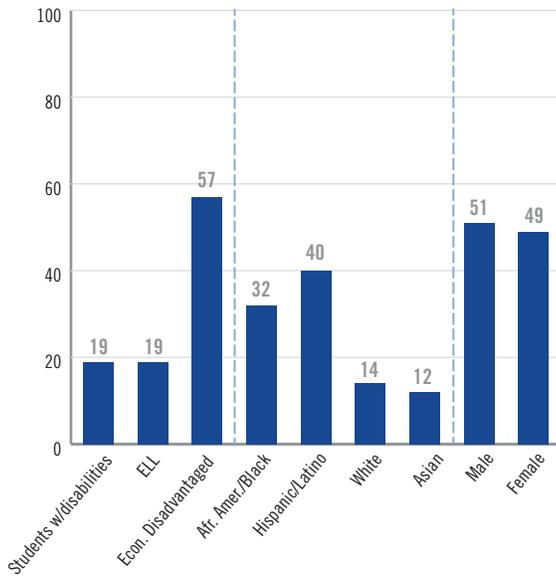
Grade 8 MCAS Science Results, by Student Subgroup at Boston-Based Commonwealth Charter Schools, 2015–2017
Percent of students in each subgroup scoring Proficient or Advanced



Source: Massachusetts Department of Elementary and Secondary Education

FIGURE 35

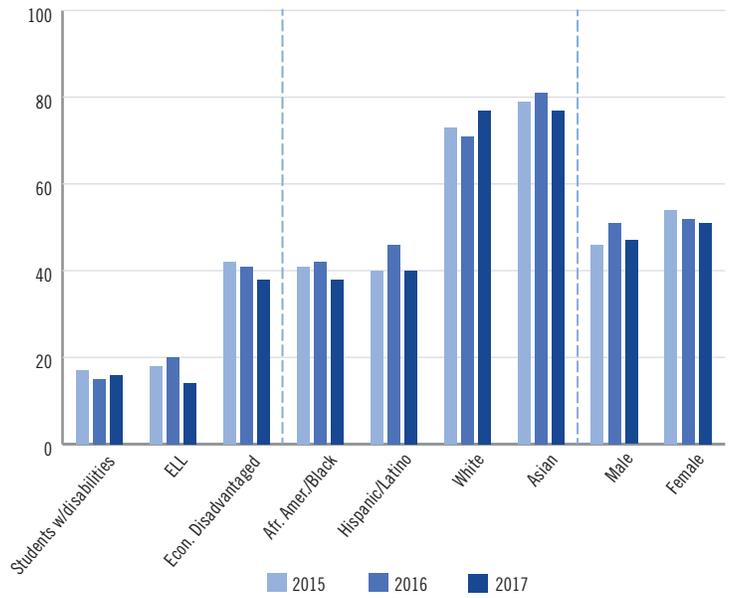
High School MCAS Science Tests: Student Subgroups at Boston Public Schools, 2017
Percent of all test-takers who belong to each subgroup



Source: Massachusetts Department of Elementary and Secondary Education

FIGURE 36

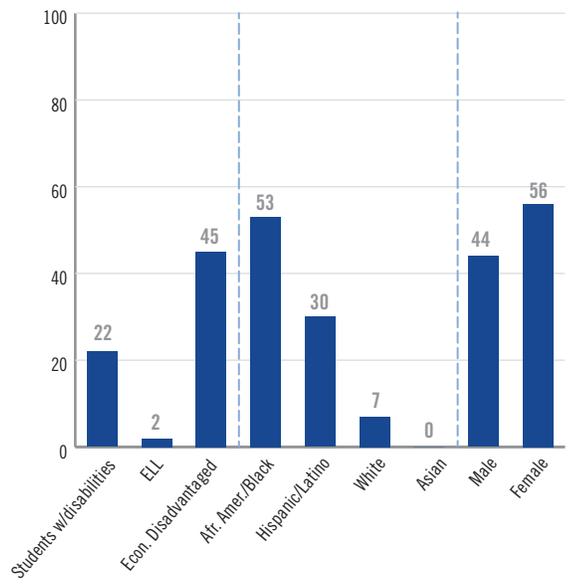
High School MCAS Science Results, by Student Subgroup at Boston Public Schools, 2015–2017
Percent of students in each subgroup scoring Proficient or Advanced



Source: Massachusetts Department of Elementary and Secondary Education

FIGURE 37

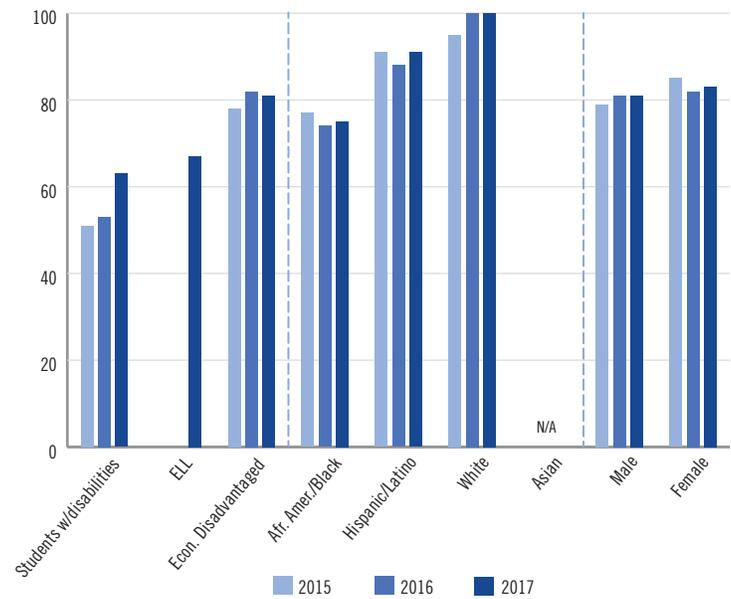
High School MCAS Science Tests: Student Subgroups at Boston-Based Commonwealth Charter Schools, 2017
Percent of all test-takers who belong to each subgroup



Source: Massachusetts Department of Elementary and Secondary Education

FIGURE 38

High School MCAS Science Results, by Student Subgroup at Boston-Based Commonwealth Charter Schools, 2015–2017
Percent of students in each subgroup scoring Proficient or Advanced



Source: Massachusetts Department of Elementary and Secondary Education

Potential Impact of Policies on Student Performance

MCAS Science achievement statewide and for Boston public school students is typically lower than achievement in English Language Arts and Math. What policy-based solutions might this situation call for? This final section of the report briefly highlights several conditions that may relate to the current gap in MCAS Science achievement for students in Boston, and identifies two potential policy changes that state or local school officials could implement with the aim of positively impacting future science achievement.⁶

Current and Historical Conditions – MCAS Science Achievement

Before noting conditions, both historical and current, that might help explain the gap in MCAS Science achievement that exists for many Boston students, it is worth pausing to take stock of some of the positive outcomes that educators in Boston—and Boston public school students themselves—have achieved over time.

Most importantly, more BPS students are staying in school and graduating. The four-year graduation rate for the Boston Public Schools has increased nearly 13 percentage points since 2008, from 60 percent to almost 73 percent in 2017. The five-year graduation rate for BPS has increased by the same amount, with more than 78 percent of students in the 2016 graduation cohort having graduated by the end of 2017. Over the same time period, BPS' annual high school dropout rate, which includes students across all four high school grades who drop out of school in a given year, has decreased from 7.6 percent in 2008 to 4.4 percent in 2017. Furthermore, these positive gains occurred during a period within which statewide high school graduation requirements became more rigorous.

BPS high school MCAS achievement has also increased substantially, particularly in ELA and Science. From 2008 to 2017, the percentage of BPS students scoring Proficient or Advanced on the high school MCAS ELA test increased 23 percentage points, from 58 to

81 percent. High school MCAS Science achievement increased 20 percentage points, from 29 percent Proficient or Advanced in 2008 to 49 percent in 2017. Achievement on the high school MCAS Math test increased 8 percentage points, from 59 percent Proficient or Advanced in 2008 to 67 percent Proficient or Advanced in 2017. The majority of Boston-based charter schools have also demonstrated positive gains over time as measured by MCAS achievement.

In brief, while focusing on opportunities for continued improvement such as science achievement, it is important not to lose sight of gains that have been made for and by Boston public school students. At the same time, in establishing the current policy framework, state and federal policy-makers arguably may have signaled to educators and students that science is not as important—or at minimum does not have the same priority—as English language arts and mathematics.

The message that science does not warrant the same attention as English language arts or mathematics may have been conveyed in several ways. MCAS tests in ELA and Mathematics have been administered for more years than MCAS Science tests. ELA and Math tests were first implemented in 1998 and have been administered in every grade between 3 and 8, and in high school, since 2003. MCAS Science tests were first administered five years later, in 2003, and to date are only administered in grades 5, 8, and high school.⁷ Because MCAS ELA and Math tests have been implemented for a longer period of time and are administered more frequently, it would not be surprising for school district staff to prioritize student achievement on those tests over achievement on MCAS Science tests.

Perhaps more importantly, statewide graduation requirements for science achievement are lower than those for English language arts and math. Specifically, the state requires a student to score at the Proficient or Advanced level on high school MCAS ELA and Math

tests to be eligible for a high school diploma, and only requires a student to score at the Needs Improvement level on the high school MCAS Science test. The MCAS Science component of the graduation requirement first took effect in 2008 for the graduating class of 2010, while the state's initial MCAS ELA and Math-based graduation requirements were established for the graduating class of 2003. Now, more than 10 years after the MCAS Science graduation requirement was first implemented, the bar remains lower for science than for ELA and math. It is possible that maintaining this lower standard signals to educators and students that science mastery is a lower priority than mastery in English language arts and math, and, in essence, that attaining a minimum passing score on a test of science mastery is good enough for entry to employment or postsecondary education.

At the beginning of Massachusetts' journey toward standards-based education and outcomes-based accountability, the choice to focus first on English language arts and mathematics may have been perfectly reasonable. However, it is now 25 years after the passage of Massachusetts' 1993 Education Reform Act and standards-based education is the norm. If state policy-makers truly believe in the importance of science and technology/engineering, perhaps it is time to enhance the prominence of science achievement.

One final notable condition related to science achievement is Massachusetts' lack of statewide course requirements. Unlike in the majority of states, Massachusetts state law does not set minimum requirements related to the specific coursework a student in high school must complete to be eligible for promotion or graduation. Rather, although the Massachusetts Department of Elementary and Secondary Education has developed a recommended high school program of studies (known as MassCore⁸), each school district is able to establish its own local requirements, which may include more, fewer, and/or different science course credits than other districts.

A recent national survey of high school science course requirements for graduation completed by the Education Commission of the States (ECS) finds that three states require high school students to complete four science credits, 33 states require three high school

science credits, seven states require two high school science credits, two states have varying requirements based on diploma pathway, and six states—including Massachusetts—have no specific statewide high school science credit requirements.⁹ Providing local school districts the flexibility to determine their own course requirements in response to local needs may be considered laudable, but, at the same time, establishing a statewide minimum set of requirements could help ensure that all students across the state are provided access to a certain degree and quality of high school science coursework.

Implications for State and/or Local Policy

As Massachusetts moves toward implementing Next-Generation MCAS tests in high school over the next few years, two policy changes could potentially have a positive impact on future science achievement for students in Boston and other school districts across the state.

1. When establishing high school graduation requirements for Massachusetts' Next-Generation High School MCAS, the state Board of Elementary and Secondary Education could set an equivalent standard for student achievement in Science as it sets for English Language Arts and Mathematics. Should the state choose instead to set a lower standard for Science than for other subjects, local districts could potentially opt to set their own higher standard that would be required for a student to attain a local high school diploma. Under state law individual school districts have the flexibility to adopt additional local graduation requirements beyond minimum statewide requirements.
2. The state Board of Elementary and Secondary Education could establish rigorous science course requirements at the high school level as part of a minimum required course of study. Massachusetts' current recommended high school course of study, MassCore, for instance, includes three years of lab-based high school science. Adopting MassCore as a requirement could ensure a minimum standard of science course participation for all high school students in the

state. Should state policy-makers not opt to adopt MassCore or another statewide high school course of study for all students, local school districts could individually choose to establish their own rigorous high school science course requirements.

Of course, a state or local policy change that would increase the rigor of high school graduation requirements may result in more students being unable to meet the new requirements, at least initially. Any such change should only be considered after careful analysis and consideration of potential impact. In the case of MCAS test score requirements, Massachusetts'—and the city of Boston's—experience since 2008 might be instructive. While MCAS graduation requirements were first applied to the graduating class of 2003, MCAS Science requirements were added and ELA and Math score requirements were increased for the graduating class of 2010.¹⁰ Statewide, and as described above in the Boston Public Schools, graduation rates have increased and dropout rates have decreased over this same period.¹¹

Further, it is reasonable to anticipate that setting more rigorous standards at the high school level, whether statewide or locally, could potentially also have a positive impact on science education and achievement in middle and elementary schools as districts and schools work to better align science curricula and achievement expectations across grades with the aim of better preparing younger students for success at the high school level. In fact, following the state's 2016 adoption of a revised statewide Curriculum Framework for Science and Technology/Engineering, many Massachusetts districts have recently begun to review and re-align their science curricula across grades.¹² The new standards include a specific focus on embedding core science principles and practices in each grade level, and on implementing a coherent progression of science learning from the early grades to high school. Massachusetts elementary and middle school students will be fully assessed on these new science standards via the spring 2019 Next-Generation MCAS Science tests.

Conclusion

The intent of this report is to begin exploring how prepared public school students in the city of Boston are to successfully pursue employment or postsecondary education in the STEM disciplines. To this end, the report has analyzed Boston elementary, middle, and high school students' achievement on the Massachusetts Comprehensive Assessment System (MCAS) Science and Technology/Engineering (Science) exams, primarily focusing on the degree to which students demonstrate grade-level mastery (achieving a score at the Proficient or Advanced level) on these tests. Although the results of standardized tests are unlikely to provide a complete picture of the knowledge and skills an individual student has gained in studying a particular topic, MCAS test results do reliably serve as a benchmark for comparison and, as such, can provide an entry point for further, more nuanced investigation.

To recap, central findings from this analysis include the following:

- For both the state as a whole and for BPS students, MCAS Science achievement in elementary school and middle school has historically been lower than MCAS English Language Arts (ELA) and Math achievement; has increased less over time than ELA and Math; and is stagnant or declining since 2014.
- MCAS Science achievement is higher for BPS high school students than for BPS fifth and eighth graders, but the gap between BPS and statewide achievement for Science remains as large in high school as in grades 5 and 8.
- MCAS Science achievement for BPS students in grades 5 and 8 is lower than for students in the majority of comparison school districts in Massachusetts. However, MCAS Science achievement in high school is higher for BPS students than for students in most comparison districts.

- A substantial amount of school-level variation exists in elementary, middle, and high school MCAS Science achievement, both among individual BPS schools and among individual Boston-based charter schools. On average, Boston-based Commonwealth charter schools have higher percentages of students demonstrating mastery on grade 5 and 8 MCAS Science tests than do BPS non-Exam schools. Among all public high schools in Boston, students attending the three BPS Exam schools have average scores on MCAS Science tests that are higher than those at other categories of high schools. Commonwealth charter schools represent the next-highest scoring group of Boston high schools.

As described in the final section of this report, the state's current education policy framework may potentially send a signal to Massachusetts educators and students that science achievement does not have the same priority as English language arts and mathematics achievement. MCAS tests in ELA and Mathematics have been administered for more years and in more grade levels than MCAS Science tests, and, as a result, typically draw more attention than Science tests. Importantly, statewide graduation requirements for science achievement are lower than those for English language arts and math. Also, unlike the majority of states, Massachusetts has not established statewide course requirements.

Two policy changes identified in this report could potentially have a positive impact on future science achievement for students in Boston and other school districts across the state. First, when establishing high school graduation requirements for Massachusetts' Next-Generation High School MCAS, the state Board of Elementary and Secondary Education could set an equivalent standard for student achievement in Science as the Board sets for English Language Arts and Mathematics. Additionally, the state Board of Elementary and Secondary Education could consider

establishing rigorous science course requirements at the high school level as part of a minimum required course of study. Should policy-makers not opt to implement these changes at the statewide level, local school districts could individually choose to set their own higher standard that would be required for a student to attain a local high school diploma or establish their own rigorous high school science course requirements. It is reasonable to anticipate that modifications such as these which are focused on the high school level may also have a positive impact on science education and achievement in middle and elementary schools, as districts and schools work to prepare students by better aligning science curricula and achievement expectations across grades.

Endnotes

1. As of 2016–17 school year. See <http://profiles.doe.mass.edu/general/generalstate.aspx>.
2. See <http://www.doe.mass.edu/dart/>.
3. School enrollment data as of January 2018. <http://profiles.doe.mass.edu>. Does not include Boston-based Horace Mann or Commonwealth charter schools.
4. See <https://www.bostonpublicschools.org/>.
5. This subgroup analysis excludes MCAS results for Boston-based Horace Mann charter schools. In 2017, MCAS Science results were also available for two Boston Horace Mann charters serving grade 5, three Boston Horace Mann charters serving grade 8, and two Boston Horace Mann charters serving grade 10. Tested populations in the Horace Mann charters are generally similar to those in Boston Commonwealth charters.
6. See <http://urbancharters.stanford.edu/states.php> for a detailed analysis of Boston charter school student achievement.
7. Massachusetts administers MCAS tests in accordance with requirements of federal education law, which requires annual testing in English Language Arts/Reading and Mathematics in grades 3 through 8 and in high school, and Science testing in at least one grade in elementary, middle, and high school.
8. See <http://www.doe.mass.edu/ccr/masscore/>.
9. See https://www.ecs.org/wp-content/uploads/State-Information-Request_Math-Science-Computer-Science-in-Graduation-Requirements.pdf.
10. In implementing MCAS graduation requirements, Massachusetts officials have also ensured the availability of alternate pathways to graduation for students who may have difficulty demonstrating subject matter mastery through the standard MCAS tests. Such pathways include MCAS retest opportunities, educational proficiency plans, alternate assessments, and performance appeals.
11. The statewide four-year graduation rate increased from 81 percent in 2008 to over 88 percent in 2017. The statewide dropout rate decreased from 3.4 percent in 2008 to 1.8 percent in 2017. Furthermore, the majority of students currently dropping out of high school in 2017 have already met their MCAS graduation requirements. See <http://www.doe.mass.edu/infoservices/reports/dropout/>.
12. See <http://www.doe.mass.edu/stem/st/>.

