

The Commonwealth's STEM Talent Pipeline: Update for 2008

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To be competitive in the global economy, Massachusetts companies need to develop innovative, high value added products and services, and its nonprofit and governmental institutions must continue to improve productivity by using technology based tools. Engineers, scientists and technology specialists are the critical personnel needed to make this happen. The Commonwealth must have more than its "fair share" of science, technology, engineering and math prepared (STEM) talent.

Where are we in 2008?

To assess our current status we can look at how our high school students think about college majors that require a strong foundation in mathematics and science. This is an early indicator of the pipeline for future engineers, scientists and technology specialists.

According to the College Board, there were 60,962 Massachusetts' students who took the 2007 SAT. The following table summarizes data for six Science, Technology, Engineering and Mathematics (STEM) areas of study in which these students plan to major, and compares these with nationwide SAT test takers data:

Areas of Study	Massachusetts	Nationwide
	% of SAT Test Takers	% of SAT Test Takers
Biological Sciences	3.1%	3.8%
Computer or IT	1.8%	2.3%
Engineering	4.8%	6.0%
Health & Allied Services	9.1%	12.5%
Mathematics	.6%	.6%
Physical Sciences	.9%	1.2%
Total	20.3%	26.4%

Underlying these data are differences between the way male and female high school students visualize their academic and potential career plans. The following summarizes these differences based on 2007 Massachusetts SAT and 2006 National test taker college plans:

Area of Study	Massachusetts - 07		National - 06	
	Men	Women	Men	Women
Biological Sciences	34%	66%	36%	64%
Computer or IT	90%	10%	88%	12%
Engineering	88%	12%	85%	15%
Health & Allied Services	20%	80%	25%	75%
Mathematics	62%	38%	60%	40%
Physical Sciences	61%	39%	60%	40%

More than 58% of all college students are women. It is ironic that we spend more energy and resources trying to find ways to recruit foreign students to STEM fields of study than to systematically tap into the large pool of college bound females already in the United States.

Comparison with Other States

It's revealing to compare these Massachusetts data with other states. In 2007 Massachusetts ranked second from the bottom, just before Connecticut among the innovation economy competitor states tracked in the Massachusetts Technology Collaborative's Innovation Index.

Below is a comparison of Massachusetts with its competitor states for 2007 and 1999. These data indicate the ranking by percentage of SAT test takers planning on STEM college majors as follows:

MTC Innovation Economy Competitor States

	2007		1999
NC	32%	MN *	38%
IL*	29%	NC	37%
MN*	26%	IL*	37%
VA	26%	VA	(Not included)
CA	26%	CA	34%
PA	26%	PA	31%
NJ	22%	NJ	28%
NY	21%	MA	26%
MA	20%	NY	24%
CT	19%	CT	23%

* IL and MN are states where the majority of students take the ACT versus the SAT.

Among the competitor states, North Carolina was the only one with a significant increase in the number of its students choosing STEM fields. In 1999, there were 15,229 and in 2007 the number had increased to 17,677. In contrast, Massachusetts's numbers declined from 12,480 in 1999 to 12,414 in 2007.

While the Massachusetts STEM Collaborative has set a goal of having more than 15,700 of the Commonwealth's SAT test takers choose STEM fields by 2010, North Carolina already had exceeded this number in 2007!

So, what's the problem?

While our colleges and universities attract large numbers of students from outside Massachusetts, those who grow up here are much more likely to stay for the remainder of their careers. We need to plant, grow and harvest a much larger percentage of our high school graduates for our local STEM talent pool.

Massachusetts high school graduates are projected to decline from 2007 to 2010 by about (2%). This decline in graduates will not yield enough potential STEM prepared talent unless a larger percentage of students plan to major in STEM disciplines. We need to attract dramatically larger numbers of female and minority students to STEM fields, while steadily increase non-minority male students.

Mathematics is the foundation for engineering, science and technology careers. Massachusetts math MCAS data indicate our students need to improve. However, even in high schools with strong MCAS math performance, the portion of students planning to major in STEM fields often falls below the statewide percentage. We appear to be facing both a "cultural" obstacle among students who are well prepared in math and a "capacity" obstacle among students who lack a strong foundation in math.

How do we address this challenge?

Solving this problem requires a high priority commitment from employers, the educational community and government leaders. A good first step was the establishment of the STEM Pipeline Fund in 2004. This legislative initiative established three key objectives:

1. to increase the number of students choosing to prepare in STEM fields;
2. to increase the number of qualified STEM teachers; and
3. to improve the knowledge, skill and performance of all students in mathematics and science.

In 2006, the Legislature and Governor approved an additional \$4 million for the STEM Pipeline Fund and added another \$4 million in 2007, bringing the total to date to \$10.5 million. The Massachusetts Board of Higher Education has begun to award grants to fund for programs that will address the above mentioned objectives.

What the specific goals we need to set for 2010?

In order to focus K-12 schools systems, higher educational institutions, employers and government on improving our STEM talent pool, we need to have concrete goals that drive strategies, tactics and resources over the next four years. I suggest that the following goals and challenges be considered.

K-12 Part of the pipeline:

Increase the number of students preparing for STEM fields

Increase the percentage of MA SAT test takers planning on STEM fields from 20% (12,414) in 2007 to 26% (15,769) in 2010.

Challenges:

- We need to at least triple the number of girls planning on computer science and engineering.

- We need to dramatically increase the number of students at “high math performance” high schools planning on STEM college majors.

- We need to help students from lower math performance high schools who indicate high aspirations for STEM fields build their math and science foundational education in order to succeed.

Increase the number of qualified STEM teachers by 30%

Challenges:

- We need good baseline data and a system to measure progress.

- We need a more flexible certification process to attract STEM content prepared professionals to teaching.

- We need to provide requirements and incentives for people preparing for teaching to be highly qualified in STEM disciplines.

Improve math and science education for all students

Increase the MCAS math scores so that 40% more students are performing at proficient and advanced levels

Broaden the MCAS science test performance beyond biology and increase the number of students performing at proficient and advanced levels.

Challenges:

- We need to shift from 4 of 5 students taking the biology MCAS to 2 of 5 students taking biology and 3 of 5 taking other sciences or technology/engineering.
- We need to improve math performance in schools with under represented populations.

13- 16 Part of the Pipeline

Improve graduation yields from students entering STEM fields by 50%.

Challenges:

- We need to better integrate K-12 STEM curriculum and instruction with college level requirements.
- We need to make better use of our community college system in filling math and science educational gaps for students whose high school preparation was inadequate.

Conclusion

Improving the supply and quality of the Commonwealth's STEM talent pool should be one of our most important priorities. It will take time and consistent effort to accomplish our goals. There is no "magic bullet" to "fix" the problem. This is not an impossible task, just one that requires a long term perspective and commitment.