

VITAL SIGNS

Reports on the condition of STEM learning in the U.S.



STEM HELP WANTED

Demand for Science, Technology, Engineering and Mathematics Weathers the Storm

If you were unemployed in the past three years, you probably faced stiff odds. On average, unemployed people outnumbered online job postings by well more than three to one. Yet if you have a strong background in science, technology, engineering or math (STEM), your odds may have been very different. Across the STEM fields, job postings outnumbered unemployed people by almost two to one.

These numbers are telling. Online job postings, which capture the large majority of the nation's job openings, represent one of the most robust available measures of job demand.

The contrast between STEM occupations and other major occupational areas is striking. In Office and Administrative Support occupations, for example, there were about four unemployed people for every job posting. The picture was also dark, if less dire, in Management occupations (2.2 unemployed per posting) and Business and Financial occupations (1.7 unemployed per posting).

Our analysis of online job postings and unemployment data in the past three years found similar patterns in every state in the union. No matter where we looked, unemployed people with a STEM background fared much better on our measure than unemployed people in general. (See Table 1, on page 3, for a full summary of our state-by-state findings.)

Even in a tough economy, STEM opens doors. States that improve the STEM performance of their youth will be best equipped to meet the strong and growing demand for STEM talent and attract businesses that require such talent.

More Evidence of a STEM Shortage

So is there a shortage of STEM talent? Employers answer this question with an emphatic "yes": They say they cannot find the STEM talent they need, even in what should be a "buyer's market" for labor.¹ Skeptics counter with an equally emphatic "no": Our nation's colleges and universities graduate

Measuring the Demand for STEM skills

To gain perspective on the supply of and demand for STEM skills, we compared average monthly online job postings to average monthly unemployment numbers across a range of occupations over the past three years. Our data on job postings come from WANTED Analytics, which aggregates job postings from thousands of online job, newspaper and corporate websites. Our data on unemployment came from the Current Population Survey. (For a similar approach to calculating supply/demand ratios, see the Conference Board's Help Wanted Online reports at www.conference-board.org/data/helpwantedonline.cfm.)

Our measure is not perfect. Online job sites may undercount the total number of available jobs, especially in occupational areas like building maintenance, food service, retail and construction, skewing some supply/demand ratios. Also, we cannot prove that the skills of individual unemployed people in STEM fields line up with the specific requirements of individual STEM jobs. Nor does our measure count the number of people new to the job market.

That said, online job postings represent a new and robust measure of our ability to meet the real-time demand for STEM skills and knowledge. Their power as a tool to understand the labor market is likely to grow as online data mining and analysis tools grow more sophisticated. For more on our methodology, see www.changetheequation.org/stemdemand.



Improving teaching and learning in science, technology, engineering and mathematics

more than enough people with STEM degrees to fill new STEM positions, and STEM wages aren't rising fast enough to indicate scarcity, they argue.² This debate rages on in part because we have little data on the number of STEM jobs that go unfilled for lack of qualified candidates, or on the extent to which factors like the geographic mismatch between candidates and job openings might exacerbate hiring challenges. Still, our analysis strengthens the employers' case, even if it doesn't conclusively end the debate.

Our data corroborate other evidence that STEM skills have been in high demand.³ For example, unemployment rates in STEM occupations have been historically low—generally lower than overall rates for workers with a bachelor's or higher degree.⁴ And despite what skeptics claim, STEM workers command higher salaries, and that wage premium is rising, even when education level and other factors are taken into account. STEM workers with less than a bachelor's degree earn 32 percent more than their non-STEM counterparts, up from 25 percent in 1994. Those with a bachelor's degree earn 23 percent more, up from 18 percent over the same time period.⁵

The nation also relies heavily on foreign-born workers to meet the demand for STEM skills. Such workers hold 18 percent of Math and Computer Science jobs and a whopping 25 percent of Physical Science jobs, even though they comprise only 12 percent of the workforce.⁶ These workers have been a boon to the U.S. economy, but there are signs that many are being lured away from the United States by growing economic opportunities in their home countries.⁷

Moreover, the demand for STEM skills extends well beyond STEM-specific jobs. A recent report from Georgetown University's Center on Education and the Workforce finds that the nation faces "a broader scarcity of workers with basic STEM competencies across the economy." Even if we do

What is STEM?

There is no single, universally accepted definition of what constitutes a STEM-specific job. Our definition is broader than some, in that it encompasses those healthcare and management occupations that require strong STEM skills. We feel this broader definition allows us to offer a fuller account of the demand for STEM talent.

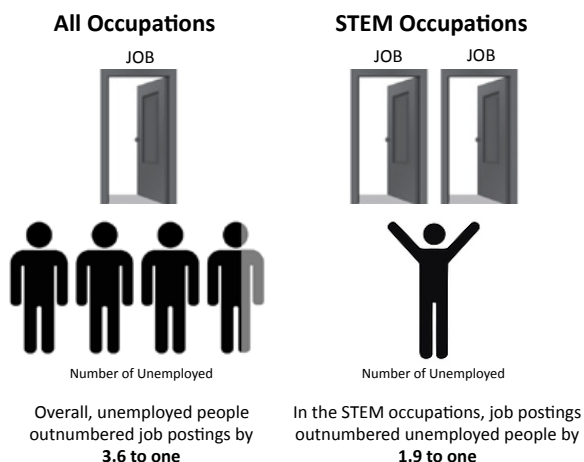
Our definition includes Computer and Mathematical occupations, Architecture and Engineering occupations, Life and Physical Science occupations, several Management occupations in STEM fields, and select Healthcare Practitioner and Technical occupations. In 2011, there were about 13.6 million people in these jobs, and they comprised about 11 percent of the total workforce.

For a more detailed list of occupations included in this definition, see www.changetheequation.org/stem-vital-signs/stemdemand.

graduate enough people with STEM degrees to fill available STEM-specific positions, more employers from across industry and occupational sectors are competing for those people.⁸

In light of such evidence of strong and growing demand for STEM skills, it should come as no surprise that STEM job postings have outnumbered the STEM unemployed over the past three years. We can expect the number of jobs requiring a STEM background to grow as the dampening effects of the recession wear off. STEM employment is expected to have grown 17 percent between 2008 and 2018, far faster than the 10 percent growth projected for overall employment.⁹

STEM OPENS DOORS



HEALTHCARE WEATHERS THE STORM

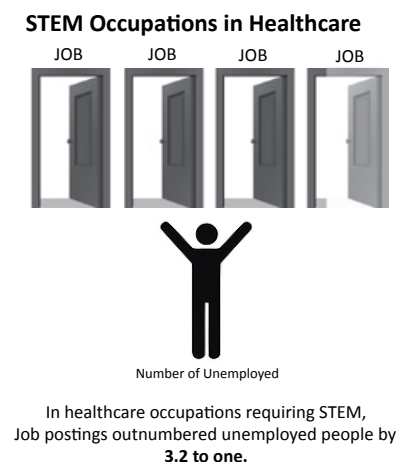


TABLE 1: Ratio of Online Job Postings to Unemployed People, by Occupational Category and by State*

RATIO OF JOBS OVER UNEMPLOYED								
STATE	ALL STEM	STEM (WITHOUT HEALTHCARE)	STEM (HEALTHCARE ONLY)	ALL OCCUPATIONS	FINANCE	MANAGEMENT	ADMIN	
US	1.91	1.43	3.20	0.26	0.58	0.45	0.23	
AK	3.63	1.50	9.82	0.49	1.26	0.97	0.63	
AL	1.42	1.27	1.54	0.20	0.53	0.42	0.18	
AR	2.36	1.41	3.41	0.23	0.72	0.52	0.24	
AZ	1.70	1.12	3.05	0.24	0.62	0.31	0.23	
CA	1.43	1.17	2.42	0.20	0.43	0.35	0.18	
CO	1.49	1.07	3.36	0.34	0.45	0.47	0.31	
CT	2.82	2.88	2.70	0.45	1.34	0.76	0.33	
DC*	16.23	18.12	10.59	1.72	3.27	2.64	1.11	
DE	3.82	3.17	6.02	0.61	1.87	1.24	0.42	
FL	1.36	0.67	3.03	0.24	0.36	0.28	0.21	
GA	1.95	1.39	4.32	0.22	0.36	0.36	0.17	
HI	2.34	1.79	3.71	0.34	0.92	0.58	0.36	
IA	3.39	2.25	5.67	0.37	1.07	0.87	0.47	
ID	2.41	1.04	14.50	0.27	0.56	0.43	0.25	
IL	1.63	1.29	2.65	0.22	0.64	0.48	0.18	
IN	2.36	1.90	2.93	0.20	0.63	0.37	0.24	
KS	2.02	1.01	4.99	0.29	0.44	0.42	0.22	
KY	1.45	0.89	2.34	0.19	0.43	0.36	0.16	
LA	2.77	1.53	4.70	0.27	0.60	0.64	0.27	
MA	2.14	1.61	5.28	0.43	0.64	0.72	0.30	
MD	3.39	3.37	3.44	0.50	0.75	0.78	0.38	
ME	3.29	2.01	5.32	0.35	0.82	0.47	0.35	
MI	1.05	0.79	1.86	0.17	0.41	0.29	0.18	
MN	2.44	2.19	3.12	0.37	0.66	0.63	0.38	
MO	3.06	2.55	3.73	0.27	0.58	0.39	0.23	
MS	1.68	0.78	2.79	0.15	0.48	0.29	0.12	
MT	2.96	1.20	5.03	0.32	0.61	0.33	0.41	
NC	1.69	1.32	2.45	0.22	0.44	0.29	0.20	
ND	8.59	4.87	14.62	0.65	1.96	0.82	0.69	
NE	4.75	4.16	5.31	0.59	0.80	0.79	0.51	
NH	2.26	1.25	6.87	0.49	0.87	0.53	0.36	
NJ	1.44	1.29	1.83	0.32	0.56	0.44	0.23	
NM	2.11	0.75	5.19	0.31	0.41	0.43	0.24	
NV	1.59	0.71	3.59	0.24	0.41	0.33	0.21	
NY	1.69	1.72	1.64	0.30	0.78	0.69	0.25	
OH	2.28	2.04	2.63	0.26	0.71	0.47	0.27	
OK	2.92	1.68	4.91	0.36	0.50	0.66	0.38	
OR	1.75	1.16	3.85	0.24	0.28	0.26	0.22	
PA	2.42	1.96	3.28	0.33	0.64	0.67	0.28	
RI	2.40	1.92	3.33	0.30	0.67	0.52	0.23	
SC	1.81	1.08	2.99	0.20	0.28	0.36	0.23	
SD	2.69	1.19	6.56	0.43	0.68	1.59	0.33	
TN	2.14	1.17	4.70	0.23	0.47	0.38	0.24	
TX	2.52	1.64	5.38	0.31	0.73	0.51	0.27	
UT	1.48	1.04	4.29	0.32	0.73	0.42	0.31	
VA	3.34	2.98	4.55	0.47	1.16	0.74	0.34	
VT	4.75	2.54	8.56	0.43	0.77	0.63	0.37	
WA	2.08	1.56	3.90	0.30	0.71	0.47	0.27	
WI	2.19	1.45	4.19	0.27	0.78	0.41	0.23	
WV	3.12	1.70	5.76	1.03	0.38	0.49	0.28	
WY	3.83	1.53	10.54	0.40	1.02	0.51	0.33	

* "All STEM" refers to all occupations included in Change the Equation's STEM definition. "STEM (without Healthcare)" refers to the same definition without Healthcare Practitioner and Technical occupations. "STEM (Healthcare only)" refers to only those Healthcare Practitioner and Technical occupations we included in our STEM definition. "Finance" refers to all Business and Financial Operations occupations. "Management" refers to all Management occupations except the three management occupations we included in our STEM definition: Computer and Systems Information managers, Architectural and Engineering managers, and Natural Sciences managers. "Admin" refers to Office and Administrative Support occupations.
 † Ratios for the District of Columbia are almost certainly vastly inflated as a result of its unique job market. Jobs advertised in the District attract many candidates from neighboring Maryland and Virginia, yet our ratio counts only the unemployed who live in the District.

Different Degrees of Demand

Of course, demand will always vary from one STEM occupational category to the next. Our data suggest that the STEM unemployed fared well overall, but some weathered the downturn better than others.

There were marked differences among specific STEM occupations in the past three years:

- Within Computer and Mathematical occupations, for example, there were about 1.4 computer programming job postings for every unemployed computer programmer, but more than four network and computer systems administration jobs for every unemployed network or computer systems administrator.
- Within Engineering, job postings outnumbered the unemployed by 1.3 to one in electronic and electrical engineering and by more than three to one in industrial, health and safety engineering. The situation in civil engineering appeared much worse, presumably because money for public works dried up during the recession: Unemployed civil engineers outnumbered civil engineering job postings by almost two to one.
- In healthcare occupations that require STEM, advertised jobs outnumbered unemployed people by a whopping 3.2 to one. In all other STEM occupations jobs outnumbered the unemployed by 1.4 to one.

Even though STEM skills held up well in general, our state-by-state analysis suggests that supply and demand of STEM skills varies considerably by state as well. An unemployed STEM worker may well have more prospects in Delaware, where STEM job postings outnumbered the STEM unemployed about three to one, than in Michigan, where there was about one STEM job posting for every unemployed person in STEM.

Different states will of course need distinct education and workforce strategies for filling the pipeline of STEM talent in areas of greatest need. A state that foresees acute shortages of network and computer systems administrators might, for example, promote stronger pathways into the field through industry certifications in high school, dual enrollment programs that allow high school students to get

college credit in the field, community college programs to equip workers with the skills they need to enter the field, or incentives to attract skilled workers from other places.

Yet our findings are remarkable in large part because they are so consistent across states. STEM demand appears strong in every state, even throughout very lean recent years. The implication is clear: all states need to ensure that their youth gain a broad and early foundation in the STEM disciplines.

Building a Foundation for Future Prosperity

Students who gain a strong STEM foundation today will face brighter prospects in years to come: Their skills will be resilient even as markets and technologies change. States that focus on the STEM learning of their youth are investing in a prosperous future where they can attract innovative new industries.

Our data also drive home the scale of the problem we face in STEM education. An enormous share of our young people, particularly low-income and minority youth, lacks foundational skills and knowledge in STEM.¹⁰ Unless states change the equation for those young people, the doors of opportunity will remain closed to them.

- 1 See, for example, the "Point of View" column by Siemens Corporation President and CEO Eric Spiegel in the March 2012 (*Change the Equation*) Now newsletter. <http://changetheequation.org/change-equation-now-newsletter-march-2012#pov>.
- 2 For a summary and rebuttal of skeptics' arguments, see Atkinson, R.D., & Mayo, M. (2010). *Refueling the U.S. Innovation Economy: Fresh Approaches to Science, Technology, Engineering and Mathematics (STEM) Education*. Washington, DC: Information Technology and Innovation Foundation, 29–42.
- 3 The definitions of STEM cited in this and the following paragraph do not include healthcare occupations and are therefore not strictly comparable with our definitions. That said, Healthcare Practitioner and Technical occupations are also characterized by very low unemployment—2.5 percent in 2010—high wages, and fast projected growth. (Bureau of Labor Statistics, 2010; Carnevale, Smith & Melton, 2011.)
- 4 Atkinson & Mayo, 2010.
- 5 Langdon, D., McKittrick, G., Beede, D., Khan, B., & Doms, M. (2011). "STEM: Good Jobs Now and for the Future." *ESA Issue Brief #03-11*. Washington, DC: U.S. Department of Commerce. See also Carnevale, Smith & Melton, 2011.
- 6 Atkinson & Mayo, 2010; Carnevale, Smith & Melton, 2011.
- 7 See Wadhwa, V., Jain, S., Saxanian, A., Gereffi, G. & Wang, H. (2011). *The Grass Is Indeed Greener in India and China for Returning Entrepreneurs*. Kansas City, MO: Ewing Marion Kauffman Foundation.
- 8 Carnevale, Smith & Melton, 2011.
- 9 Langdon et al., 2011.
- 10 In 2011, only slightly more than a third of all 8th graders reached the Proficient level on the National Assessment of Educational Progress in mathematics, and 27 percent scored below the Basic level. Almost 40 percent of Hispanic 8th graders and half of Black 8th graders performed below Basic. (U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress, 2011 Mathematics Assessment.



Change the Equation (CTEq) is a nonprofit, nonpartisan, CEO-led initiative that is mobilizing the business community to improve the quality of science, technology, engineering and mathematics (STEM) learning in the United States. Since its launch in September 2010, CTEq has helped its more than 100 members connect and align their philanthropic and advocacy efforts so that they add up to much more than the sum of their parts. CTEq's coalition of members strives to sustain a national movement to improve PreK-12 STEM learning by leveraging and expanding its work focusing on three goals: improving philanthropy, inspiring youth and advocating for change.