

Engagement in STEM Education

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Recent efforts by federal, state and local governments and private sector demand have made STEM-related fields of study much more accessible to students across the country. Both private and public school choice are providing students educational opportunities focused on STEM — the academic disciplines of science, technology, engineering and mathematics.



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New, STEM-focused private schools are appearing, and public schools are adding STEM magnet programs or converting traditional public schools into STEM-focused charter schools. Chartered and magnet public schools can help produce more diversity in schooling options. Currently, 43 states have public charter schools. Government policies must facilitate increased online instruction and blended learning, making it easier for students to enroll in a mixture of face-to-face and online schooling options, especially in rural areas.

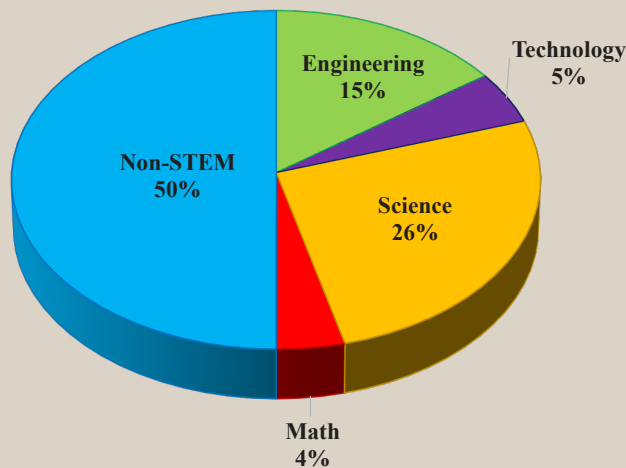
The STEM Gap. There is a growing shortage of STEM-skilled workers, but many STEM graduates are not working in STEM fields. According to the U.S. Census Bureau and other data: ¹

- Total STEM employment in 2012 was 5.3 million (immigrant and native), while there are over 12.1 million STEM degree holders (immigrant and native).
- Only one-third of employed native-born Americans with an undergraduate STEM degree actually work in a STEM occupation.
- Thus, there are more than 5 million native-born Americans with STEM undergraduate degrees working in non-STEM occupations — 1.5 million with engineering degrees, half a million with technology degrees, 400,000 with math degrees and 2.6 million with science degrees.
- An additional 1.2 million American natives with STEM degrees were not working, were unemployed or were out of the labor force in 2012.
- According to the U.S. Census Bureau, 74 percent of individuals with a STEM bachelor's degree are not employed in STEM occupations.²

Too many vacancies in STEM occupations are unfilled. Despite the economic downturn, Census Bureau data shows that about 700,000 new immigrants with STEM degrees moved to the United States between 2007 and 2012, yet at the same time, total STEM employment grew by only about 500,000.³ Each year, colleges deliver 271,000 bachelor's degrees in STEM. Yet, there are 277,000 STEM job vacancies, and by 2018, there could be 2.4 million STEM job vacancies.⁴

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Figure I
STEM Degrees in the U.S. Workforce



Source: "Census Bureau Reports Majority of STEM College Graduates Do Not Work in STEM Occupations," Press Release, United States Census Bureau, July 10, 2014. Available at <http://www.census.gov/newsroom/press-releases/2014/cb14-130.html>.

Some 16.5 percent of the U.S. population 25 and older is foreign-born, as is a similar proportion of the U.S. population with bachelor's degrees or higher (15.8 percent). But one-third (33 percent) of all graduates with engineering degrees are foreign-born, along with 27 percent of graduates in computers, math and statistics and 24 percent in physical sciences.⁵

Our Below-average Education System. The Programme for International Student Assessment (PISA) tests a sample of 15-year-old students from countries that account for 80 percent of the world's economy. In 2012:⁶

- The United States' PISA scores ranked 36th among developed countries in mathematics, with a score of 481 out of a possible 1,000 and below the average (mean) score of 494.
- In science, U.S. students scored 497 out of a possible 1,000 and below the average (mean) score of 501.
- By contrast — students in Singapore scored 573 in mathematics and 551 in science; Japan, Korea and parts of China scored at the top with Singapore.

The Disconnect on Engagement. The education establishment's disconnect is an age-old problem, because widespread disengagement is widely misperceived as a problem of under-motivated students and inadequately trained teachers.⁷ Thus, we assume one size fits all and that improved teacher training, including strategies to motivate the disengaged, will succeed at teaching the

same things in the same way. However, we know that students have different learning styles, and the subject themes that can hold students' attention and create a passion for learning difficult concepts differ, especially in our increasingly distraction-laden environments. But the system remains committed to comprehensive uniformity rather than a dynamic, diverse menu of schooling choices, never recognizing that uniformity may very well be the key source of student disengagement.

The public school system tries to address student diversity by creating options within large, mall-like campuses and sometimes with ability grouping within classrooms. That method has achieved unmanageable school goliaths, student alienation and stressed teachers, but not improved performance. Efforts to make that particular approach to student diversity yield acceptable outcomes will continue, but the evidence is overwhelming in both volume and urgency that policymakers need to find other ways to pursue the engagement of diverse children. One clear alternative to the present public policy strategy should be developed through the entrepreneurial initiative that drives most of our economy.

The entrepreneurial initiative enabled by a school choice program that levels the tuition cost of public and private schooling options would help increase production of home-grown STEM talent. But continuing to expand school choice — specifically, private school choice — while providing more STEM opportunities is only half the solution. The other half of the solution is combining the STEM opportunities of school choice with students who are actively engaged in STEM fields of study. Our educational system should tailor instruction to each student's individual needs and interests through school choice and school/program specialization. Increasing student engagement through school/program specialization in K-12 schools would greatly increase completion rates in STEM fields of study.

Lecture-only Courses Are Now Obsolete. According to a new study published by the National Academy of Sciences, lectures don't work in the STEM fields.⁸ Students in traditional, "sage on the stage" lecture environments are 1.5 times more likely to fail compared to their peers in engaging, active-learning environments.⁹ Analyzing 67 studies on student performance, the authors report that 3,500 more students, out of 29,000 studied,

would have passed their classes if these lecture-based classrooms had utilized active learning methods, saving close to \$3.5 million in tuition.

According to a 2013 Gallup Poll, students who strongly agreed with both of the following two statements were 30 times more likely to be emotionally engaged at school than those who strongly disagreed:¹⁰

- My school is committed to building the strengths of each student.
- I have at least one teacher who makes me excited about the future.

The survey also reported that:¹¹

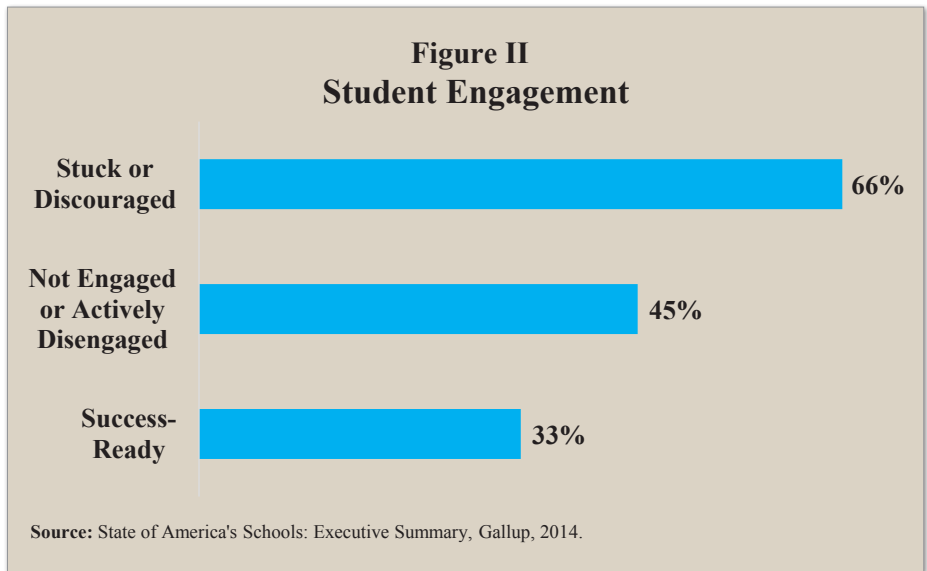
- Nearly half of students feel stuck or discouraged by their ability to succeed at school and beyond.
- Further, 45 percent of students are not engaged or — even worse — are actively disengaged while at school.
- Only 33 percent of students in grades five through 12 are “success-ready,” meaning they scored highly on measures of hope, engagement and well-being.

A STEM Solution. Private school choice would:

- Allow students to connect with schools and teachers that best fit their learning styles.
- Let students choose their schools and encourage schools to work harder to create effective, engaging lesson plans, in order to attract new students.

Specialized schools such as sports-themed or music-themed schools must also be included as choice options. Theme-based schools that might engage some children would disengage the vast majority. But sports-themed schools, for instance, could be highly successful as chartered public schools or as private schools if vouchers, tuition tax credits or education savings accounts were available to defray the tuition cost.

A theme school would be financially feasible if it could recruit enough children so that the combination of public and private funding is sufficient to deliver the curriculum. The school’s profit is a short-term reward for entrepreneurial risk and wisdom and a magnet for increased investment and competition that would force



the tuition price of sports-themed schooling down to the cost achievable by the most efficient schools. That combination of idea-driven enterprise, profit-loss and price change would determine the public-private mix of diverse schooling options.

Conclusion. Support for STEM engagement in education exists. However, simply providing the funding for that education is not enough. Talented teachers — found through competition — and engaged students in STEM courses are both needed and lacking in our educational system. If we are truly interested in engaging our students in the education process, we must foster an environment conducive to learning. Allowing students to choose the school that makes them the most comfortable and best fits their needs is the best way to ensure that happens.

Real education reforms are needed to help the education systems in each state. Universal private school choice options have the best chance to open each state to a free-market school system that promotes school specialization that engages students in difficult subjects like STEM-related education.

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Notes

- ¹. Karen Zeigler and Steven A. Camarota, “Is There a STEM Worker Shortage?” Center for Immigration Studies, May 2014. Available at <http://cis.org/no-stem-shortage>.
- ². “Census Bureau Reports Majority of STEM College Graduates Do Not Work in STEM Occupations,” Press Release, United States Census Bureau, July 10, 2014. Available at <http://www.census.gov/newsroom/press-releases/2014/cb14-130.html>.
- ³. Karen Zeigler and Steven A. Camarota, “Is There a STEM Worker Shortage?” Center for Immigration Studies, May 2014. Available at <http://cis.org/no-stem-shortage>.
- ⁴. Anthony P. Carnevale, Nicole Smith and Michelle Melton, “STEM,” Georgetown University Center on Education and the Workforce, October 20, 2011. Available at <https://georgetown.app.box.com/s/cyrrqbjyirjy64uw91f6>.
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- ⁶. “PISA 2012 Results in Focus: What 15-year-olds know and what they can do with what they know,” Organization for Economic Cooperation and Development, Programme for International Student Assessment, 2012. Available at <http://www.oecd.org/pisa/keyfindings/pisa-2012-results-overview.pdf>.
- ⁷. Sarah Sparks, “Student Motivation: An Age-Old Problem Gets New Attention,” *Education Week*, June 5, 2014. Available at <http://www.edweek.org/ew/articles/2014/06/05/34overview.h33.html?intc=EW-DPCT14-TOC>.
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- ¹⁰. Shane J. Lopez, “What Students Need to Be Engaged,” Gallup, April 9, 2014. Available at <http://www.gallup.com/opinion/gallup/173612/students-need-engaged.aspx>.
- ¹¹. Shane J. Lopez, “Not Enough Students Are Success-Ready,” Gallup, April 10, 2014. Available at <http://www.gallup.com/businessjournal/168242/not-enough-students-success-ready.aspx>.

About the NCPA

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