VITALSIGNS

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

ALL OVER THE MAP

Comparing States' Expectations for Student Performance in Science

If you're a parent in Virginia, and the state tells you your 8th-grade daughter is "proficient" in science, you would likely think she's on track to succeed in high school and beyond, no matter where she goes to school. Think again. Your "proficient" daughter might be performing in the bottom quartile of all 8th graders nationwide. Moreover, had she taken Louisiana's state science test, she may not have been "proficient" by a long shot.

How is it possible that the performance of one 8th-grade girl could be described in such dramatically different ways? The first-ever analysis of states' 8th-grade science tests finds that states have radically different targets for what their 8th graders should know and be able to do. At a time when the demand for robust skills and knowledge in science has gone global, "proficiency" may have more to do with where you live than what you have learned. This hodgepodge undercuts a major reason why we have tests in the first place: to provide reliable information on how well we're preparing students for the challenges of the global economy.

Measuring States' Definitions of Proficiency Against a Common Yardstick

The federal Elementary and Secondary Education Act (ESEA) requires all states to test students in science at least three times: once each in grades K through 5, 6 through 8 and 9 through 12. For each test, states must set the bar for proficiency—that is, the score students need to pass—and then report test results to parents, teachers and schools.

Change the Equation (CTEq), with its research partner American Institutes for Research (AIR), compared the passing scores states set on their 2009 8th-grade science tests by measuring them against a common yardstick: the 2009 National Assessment of Educational Progress (NAEP). We examined the 37 states that have data available for comparison. All 37 states administered their own 8th-grade science tests in 2009, and all participated in NAEP's 2009 8th-grade science test.

We took each state's passing score and mapped it onto the 300-point NAEP scale. In cases where states set standards for Basic or Advanced performance, we mapped those onto the NAEP scale, too. This analysis allowed us to equate states' standards for Basic, Proficient and Advanced performance with scores on a common scale. (For full results and more information about our methodology, visit www.changetheequation.org/scienceproficiency).[1]

A Motley Patchwork

The gaps among states are enormous. The least demanding state set the bar for proficient performance near 112 on the 300-point scale of the National Assessment of Educational Process (NAEP). That is far below 141, NAEP's cutoff for Basic performance. The most demanding state set it near 181, well above 170, where NAEP set the bar for proficiency. "Proficient" students from the two least demanding states might be in the bottom quartile of all students across the country. Those in the two most demanding states are in the top quartile.

In all, 15 of the 37 states we examined set the bar for proficiency below NAEP's threshold for Basic. Only four states set the bar near or above NAEP's cutoff for Proficient.[2] (See Figure 1)

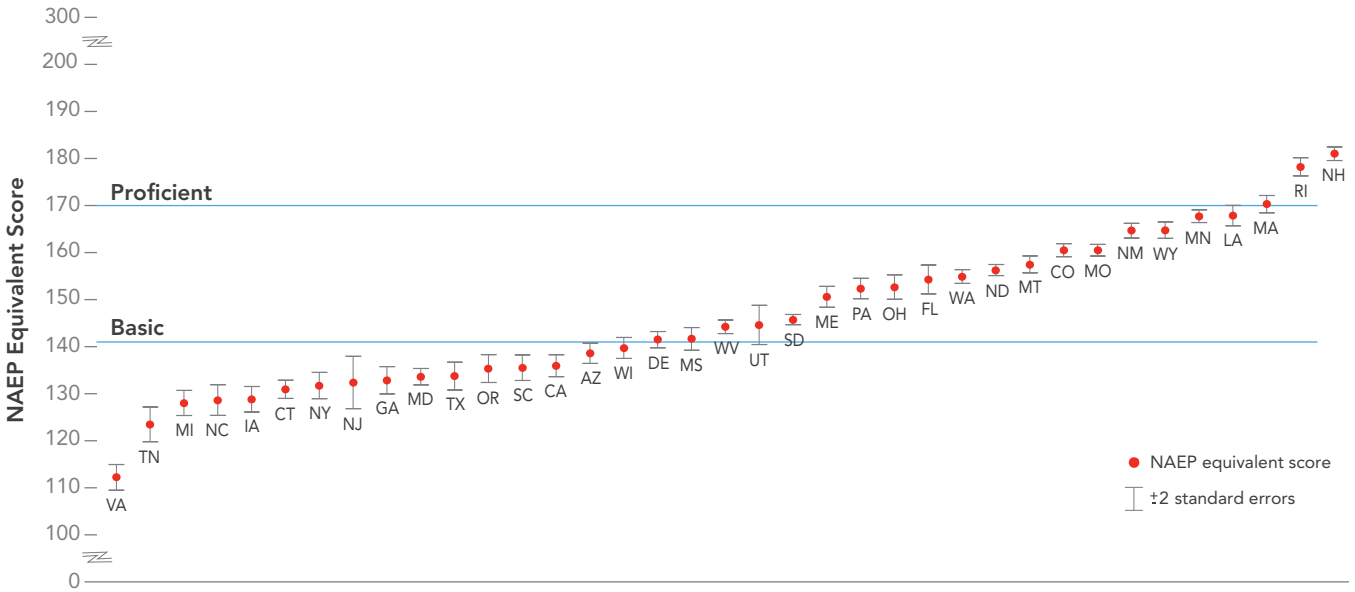
What Does "Proficiency" Mean in Most States?

So what does "proficiency" in 8th-grade science really mean? Does it mean, as many parents might assume, that students are being prepared for college and rewarding careers? The answer in most states is probably "no." Two-thirds of the states we studied reported that most of their 8th-grade students were proficient in science in 2009. By contrast, ACT reported that, in 2009, only 13 percent of U.S. 8th graders were on track to do well in introductory college science courses.[3]

States that set a high bar are most likely to offer a realistic sense of students' prospects for success in college. In Minnesota, whose passing score is near NAEP's proficiency cutoff, 43 percent of 8th graders were proficient on the state test. According to ACT, 43 percent of the state's high school graduates were ready for college-level science in 2011.[4] In Louisiana, which set the bar near Minnesota's passing score, 23 percent of 8th graders were proficient on the state test, and 21 percent of high school graduates met ACT's college readiness benchmark in science.

Things look very different at the other end of the scale. Seventy-eight percent of Michigan 8th graders, for example, met Michigan's standard for proficiency, which was well below Basic on the NAEP scale. Yet only 26 percent of the state's high school graduates met the benchmark for college readiness in science. Tennessee, which also set a low bar, rated 77 percent of its 8th graders as proficient, yet only 20 percent of its 2011 graduates were rated as college ready. Overwhelming majorities of American teens believe they will finish college.[5] All too many are in for an unpleasant shock.

FIGURE 1: NAEP scale equivalents of state grade 8 science standards for proficient performance, by state: 2009



Understanding NAEP Performance Levels.

Gaps among states represent real differences in what they expect students to know and be able to do. The National Assessment Governing Board, which oversees and sets policies for NAEP, defines NAEP's performance levels as follows:

Advanced signifies superior performance.

Proficient represents solid academic performance for each grade assessed. Students reaching this level have demonstrated competency over challenging subject matter, including subject-matter knowledge, application of such knowledge to real-world situations, and analytical skills appropriate to the subject matter.

Basic denotes partial mastery of prerequisite knowledge and skills that are fundamental for proficient work at each grade.

The Dangers of Complacency

Setting a low bar in science breeds complacency and takes our eye off the ball. If we lull parents, teachers, schools and communities into believing that their children are doing just fine in science, thank you very much, we deprive them of the information and the sense of urgency they need to improve the quality of teaching and learning.

We have every reason for urgency. In an international test of 15-year-olds' performance in science, for example, the United States ranks significantly behind 12 other developed nations and significantly ahead of only nine.[6] We rank 27th in the share of college students who receive undergraduate degrees in science or engineering.[7]

Where Do We Go From Here?

What company would maintain different standards of quality in different states or countries, especially as they try to compete in a global market? The time has come to put an end to arbitrary and inconsistent standards for performance in education as well.

There is already a promising movement in mathematics and English language arts. Forty-six states and the District of Columbia have adopted common standards describing the content students should learn in these two subjects.[8] States are now working together to develop common tests aligned with the new standards,[9] raising hopes that they will collaborate to set passing scores at an appropriately high level.[10]

A similar effort is afoot in science, though it is still in the early stages. States are coming together to help develop Next Generation Science Standards, which will describe the science content students should learn at every grade level.[11] Yet content standards are only half the battle. The best content standards imaginable will not amount to much if we do not ask students to demonstrate that they have truly mastered them.

It is not too soon for states to plan how they will set the bar for proficiency in ways that reflect the demands students must face in a competitive global marketplace. This is by no means an easy task. One possibility is to benchmark state definitions of proficiency against an international definition embodied in international tests of student performance in science.[12] Students who clear an international bar are more likely to meet global demands for knowledge and skill.

Aiming for the Right Target

Of course, simply setting the bar at an appropriate level does little to ensure that more students can reach it. Schools and communities still need to do the heavy lifting of helping many more students reach tougher requirements for proficiency, and they will need strong support for this work.

If we do not clearly define what students need to know and be able to do—both through excellent content standards and truly meaningful passing scores on state tests—the work of school improvement will be futile. When we aim for proficiency, we should not be shooting in the dark.

At a time when the demand for robust skills and knowledge in science has gone global, "proficiency" may have more to do with where you live than what you have learned.

[1] Five states did not participate in the 2009 NAEP science assessment and could not be included in the analysis: Alaska, District of Columbia, Kansas, Nebraska and Vermont. Another seven states did not test science in 8th grade in 2009 and therefore did not have state data available for comparison with NAEP's 8th-grade assessment: Alabama, Arkansas, Hawaii, Idaho, Illinois, Indiana and Kentucky. Two states—Nevada and Oklahoma—were not able to provide state assessment data in time for this analysis.

[2] NAEP achievement levels are used to provide a context for describing the stringency of performance standards adopted by states.

[3] ACT, *The Condition of College and Career Readiness 2009*.

[4] ACT, *The Condition of College and Career Readiness 2011*.

[5] S.J. Ingels, B. Dalton, T.E. Holder, E. Lauff, and L.J. Burns, *High School Longitudinal Study of 2009 (HSLS:09): A First Look at Fall 2009 Ninth Graders* (NCES 2011-327), Washington, DC: National Center for Educational Statistics, U.S. Department of Education, 2011.

[6] H.L. Fleishman, P.J. Hopstock, M.P. Pelczar, and B.E. Shelley, *Highlights from PISA 2009: Performance of U.S. 15-Year-Old Students in Reading, Mathematics, and Science Literacy in an International Context* (NCES 2011-004), Washington, DC: National Center for Education Statistics, U.S. Department of Education, 2010.

[7] Organisation for Economic Cooperation and Development, *Education at a Glance 2009: OECD Indicators*; Table A-3.5. Cited in The National Academies Press, *Rising Above the Gathering Storm, Revisited: Rapidly Approaching Category 5*, 2010.

[8] See www.corestandards.org.

[9] See the Partnership for Assessment of Readiness for College and Careers (http://www.parcconline.org/) and the SMARTER balanced assessment consortium (http://www.k12.wa.us/smarter/).

[10] Studies of state tests in math and English language arts have revealed stark inconsistencies in what states consider proficient performance. See V. Bandeira de Mello, *Mapping State Proficiency Standards Onto the NAEP Scales: Variation and Change in State Standards for Reading and Mathematics, 2005–2009* (NCES 2011-458), Washington, DC: National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education, 2010.

[11] See www.nextgenscience.org.

[12] Gary Phillips of the American Institutes for Research proposes a similar solution for mathematics and English language arts. See G.W. Phillips, *International Benchmarking: State Education Performance Standards*. Washington, DC: American Institutes for Research, 2010.

Change the Equation (CTEq) is a non-partisan, non-profit CEO led coalition of corporate leaders dedicated to mobilizing the business community to improve the quality of Science, Technology, Engineering and Mathematics (STEM) learning in the United States. With a focus on girls and students of color who trail in mastering the essentials of STEM, the pioneering CTEq coalition influences and supports STEM learning by strategically leveraging and expanding its work centered on three goals: great teaching, inspired learning and a committed nation.

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