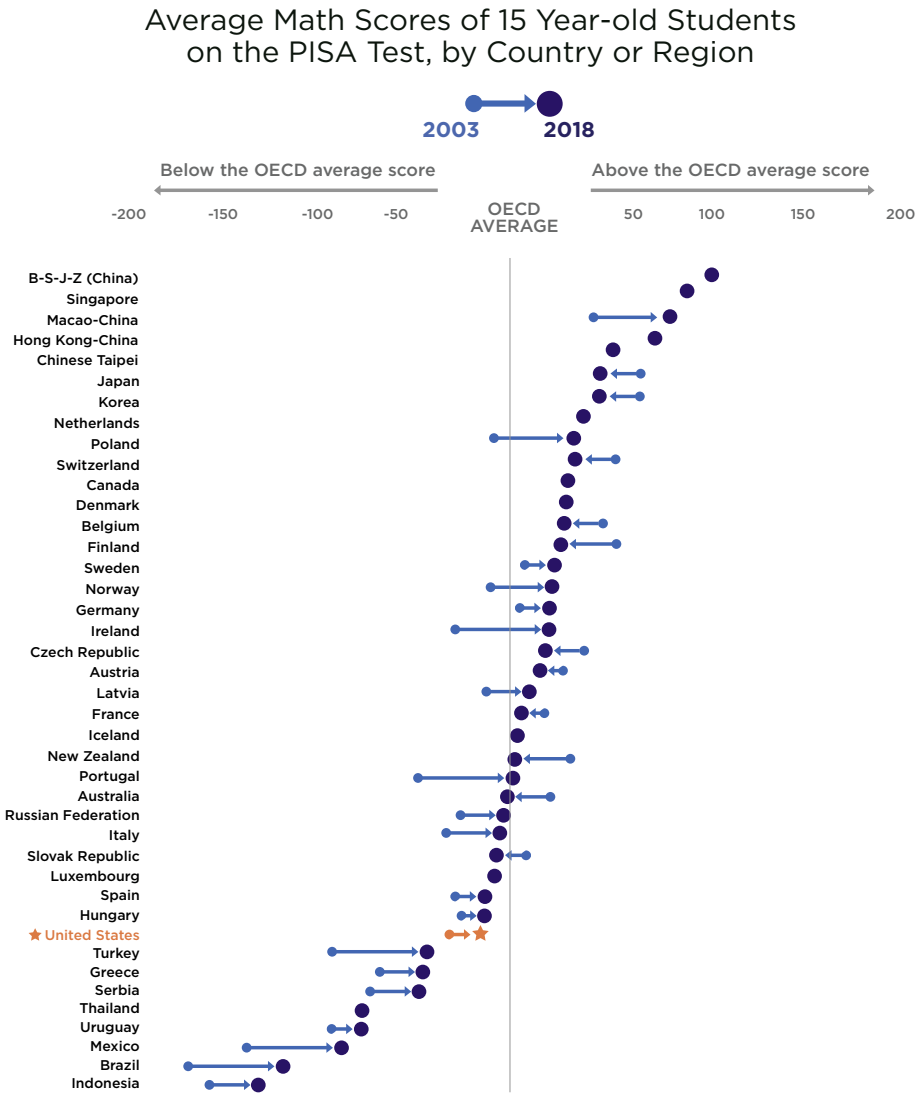
National Science Board
Science & Engineering Indicators 2022

The U.S. Must Improve K-12 STEM Education for All

K-12 education in science, technology, engineering, and math (STEM) is the foundation of the nation's future science and engineering (S&E) workforce and, in turn, U.S. prosperity and security. The National Science Board's Elementary and Secondary STEM Education report shows that U.S. student performance on standardized tests in science and math has not improved in over a decade, placing the U.S. in the middle of a long list of global competitors. Long-standing disparities persist in student science and math scores across racial, ethnic, and socio-economic groups. These disparities have been exacerbated by the COVID-19 pandemic. To be a global S&E powerhouse, the U.S. must do more to educate our domestic talent in STEM, including the Missing Millions across the many dimensions of diversity.

Achieving competence in math and science during elementary and secondary education prepares students to obtain post-secondary STEM degrees and jobs that require STEM skills. These paths provide lucrative career options that are resilient to economic fluctuations. To advance individual and national prosperity and competitiveness, the U.S. needs "all hands on deck" to modernize K-12 STEM education and to hold itself accountable with reliable, up-to-date data.

Average Math and Science Scores for the U.S. Are Lackluster, Stagnant



When examining K-12 student performance in science and math, the U.S. places in the middle of a long list of countries. Among our largest S&E competitors (G-7 members, Korea, and China), the U.S. is in last place. As the graph shows, 15-year-olds performed below the mean in mathematical literacy on the Program for International Student Assessment (PISA) examination. Results for U.S. science literacy were somewhat better. While U.S. math scores have improved by 13.4 points between 2003 and 2018, many other countries and regions have improved their test scores by significantly greater amounts, within the same time period. In addition, data from the U.S. National Assessment of Education Progress (NAEP) test show that fourth and eighth grade math scores have been largely stagnant for 13 years.

Irrespective of population size, countries are gaining on the U.S. as their students outperform our students, year after year. This lackluster performance is a risk to our future economic competitiveness and leadership in innovation and must be addressed. As policymakers and educators, our message must be clear: just as illiteracy is unacceptable, it can no longer be acceptable for anyone to be "bad at math."

The PISA exam, coordinated by the Organization for Economic Cooperation and Development (OECD), measures reading, mathematics, and science literacy of 15-year-olds internationally every three years. Mean scores for OECD countries are around 500, with about two-thirds of students scoring between 400-600 points. Data are plotted as deviation from the mean to account for variations in test ranges that have changed over the time period shown. Scores for China are reported by region; only Macao has administered PISA tests over the full time period presented. For other regions of China, only the 2018 PISA scores are shown. B-S-J-Z is an acronym for the four Chinese provinces that participated: Beijing, Shanghai, Jiangsu and Zhejiang. The NAEP tests measure ten academic subjects, including mathematics and science, for U.S. 4th, 8th, and 12th graders.

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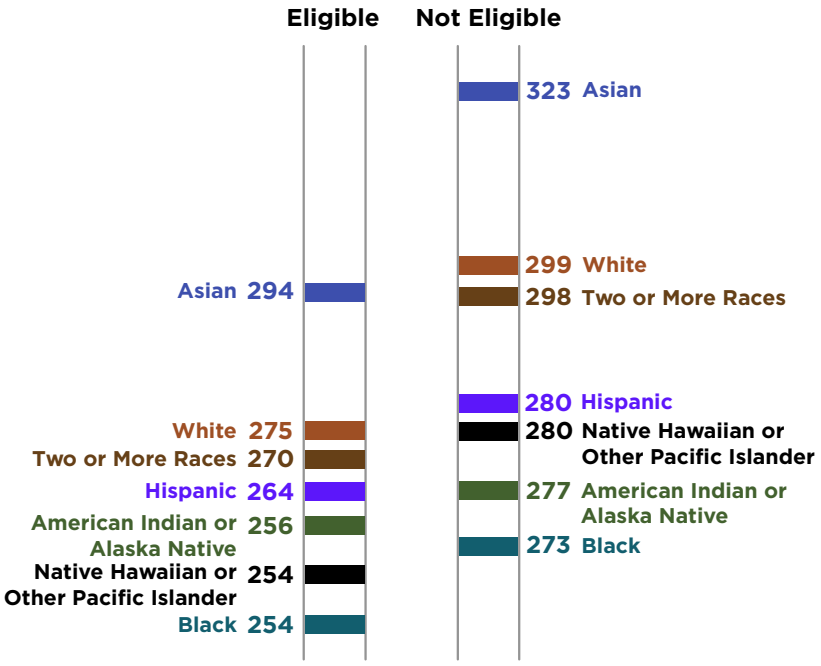
Large Gaps In STEM Achievement Persist

STEM performance also varies greatly across different demographic groups in the U.S. Except for Asian students, racial and ethnic minority students scored far lower than their white peers on critical standardized tests. Performance dropped even further for students of lower socio-economic status (SES), as measured through their eligibility to receive free and reduced-price school lunches. About half of all U.S. public school students attend schools where the majority of students are eligible for the National School Lunch Program. Notably, for *all* racial/ethnic groups, low-SES students consistently perform significantly worse on these standardized tests than their higher-SES peers in the same demographic group.

Multiple factors likely contribute to these disparities. What is clear is that the country's inability to effectively educate wide swaths of our population in STEM will limit future employment options. In addition, it will weaken U.S. competitiveness, as today's STEM knowledge and skills matter not only for scientists and engineers engaged in research & development, but also for a range of jobs across the economy that historically did not require such skills.

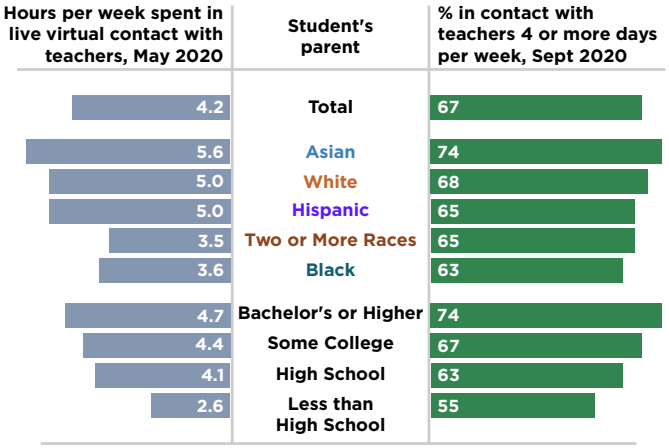
Average Scores for 8th Grade Students on the NAEP Mathematics Assessment, by Race, Ethnicity, and Eligibility for Free or Reduced School Lunch



COVID-19 Pandemic Impact: More STEM Education Setbacks

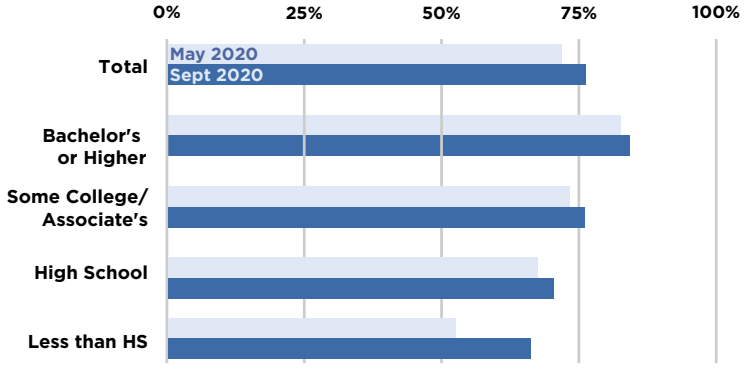
Children's Interaction Time with Teachers was Unevenly Distributed During the Pandemic

Live virtual teaching/contact time by race/ethnicity and parental education level



Children In Households with Higher Parental Education Levels Had Better Access to Internet for Online Instruction During the Pandemic

Access to consistent internet availability improved for all groups between May and Sept 2020



The COVID-19 pandemic caused significant disruption to K-12 education, as many school districts suspended in-person learning and moved to computer-based, online instruction delivered at home. Students whose parents had higher educational status were better equipped at the start of the pandemic to provide access for online instruction. At the beginning of the emergency school closures, there was a large gap in internet access between households with higher and lower parental education. This gap was significantly narrowed by the start of the following academic year.

Preliminary data indicate that this disruption has exacerbated disparities in math education across the nation. Variable access to technological resources and live (virtual) instruction and contact time with teachers are factors that are likely to impact STEM education and test scores.

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