■ ACT Research & Policy

ISSUE BRIEF

MAY 2017

Preparation Matters Most in STEM

SHANNON HAYES

Serious attention has been directed in recent years towards the need for increasing the number of high school graduates in the United States who are prepared for postsecondary education, training, and careers in the fields of science, technology, engineering, and mathematics (STEM). The number of jobs in U.S. STEM occupations grew by 10.5 percent from May 2009 to May 2015—more than twice the rate of growth of non-STEM occupations—and this trend is not expected to slow; the U.S. Bureau of Labor Statistics projects that computer occupations alone will create nearly 500,000 new jobs between 2014 and 2024.[1]

Due to the rapid expansion of STEM careers and the accompanying need for STEM majors, ACT introduced a STEM score in 2015: the average of a student's scores on the ACT® mathematics and science tests. ACT also established a benchmark STEM score of 26, indicating that high school students who earn this score or higher are academically prepared for the kind of credit-bearing first-year coursework that majors in STEM-related undergraduate programs are typically required to take.[2]

The initiatives by ACT to draw attention to the importance of preparing students for, and encouraging them to pursue education and careers in, STEM fields also include an ACT report series, *The Condition of STEM: National*, released each year since 2013. The results from ACT-tested students who graduated in 2016 indicate that among the students who expressed interest in pursuing a STEM major or field after high school, only about one-fourth (roughly 225,000) met the ACT STEM Benchmark.[3] This is of special concern given that the population of STEM-interested students shows higher levels of college readiness than the general ACT-tested population to begin with.[4] As a result, approaches meant to widen the STEM pipeline by drawing in students not currently interested in STEM are rendered less effective due to levels of preparation, for postsecondary education generally and STEM majors more specifically, which are even lower than those of STEM-interested students.

For more detailed information on this topic, see Paul Westrick, *Profiles of STEM Students: Persisters, Joiners, Changers and Departers* (Iowa City, IA: ACT, 2017) and *Profiles of High-Performing STEM Majors* (Iowa City, IA: ACT, 2017). The author thanks Paul, senior research scientist at ACT, for his invaluable assistance.

Shannon Hayes is a program manager in the Office of Public Affairs at ACT.

Policymakers at the federal, state, and local levels have worked to promote STEM pathways and increase the numbers of students preparing for a career in one of these fields. The federal Every Student Succeeds Act of 2015 (ESSA) has a provision to allow local education agencies to use federal grant funding to implement programs designed to improve engagement in STEM subjects.[5] The U.S. Department of Education took the additional step of releasing a "Dear Colleague" letter specifically enumerating the ways that ESSA could be used to encourage access to STEM education at the state and local levels.[6] Statewide programs such as the Massachusetts STEM Pipeline Fund and the Iowa Governor's STEM Advisory Council seek to increase the number of students planning to enter STEM careers.[7]

Though interest in STEM fields is certainly vital, and ACT too has promoted the growth of the pipeline that leads students to STEM careers, recent ACT research has shown that ACT scores and high school grade point averages are a significantly better predictor of success in a STEM major than is interest in STEM.[8] Thus, simply encouraging students to major in a STEM field in college (or other postsecondary training programs) is insufficient; students must be properly prepared for STEM studies.

Policymakers must make sure that schools and teachers are given the resources necessary to ensure that all students, including students who choose to concentrate in a STEM field, have the precollege academic preparedness to succeed in their college coursework. While most, if not all, K–12 STEM programs give at least some attention to quality of instruction, current student achievement levels show that students are still not adequately prepared by current programs, and more needs to be done to ensure that high school students in the STEM pipeline are ready for the postsecondary courses necessary to join the STEM workforce.

Costs of Underpreparedness

When students begin college in a STEM major but change majors or depart school because of a lack of academic preparedness, they incur more student loan debt and waste time and resources. These changing or departing students are just as interested in STEM fields as those who persist in their majors, but lack the requisite preparation to succeed in college-level STEM courses.

Increased preparation is especially urgent for underserved learners, who express interest in STEM at the same high levels as their peers, but whose preparedness lags far behind—especially for those students with multiple "underserved characteristics."[9] These characteristics include belonging to certain racial/ethnic groups, coming from a low-income household, and having parents who have not attended educational institutions beyond high school.

Of STEM-interested students in the ACT-tested 2016 high school graduating class, 39% with zero underserved characteristics met the STEM benchmark, but only 15% with one characteristic—and a mere 3% of students with all three of the characteristics mentioned above—did so (Figure One).[10]

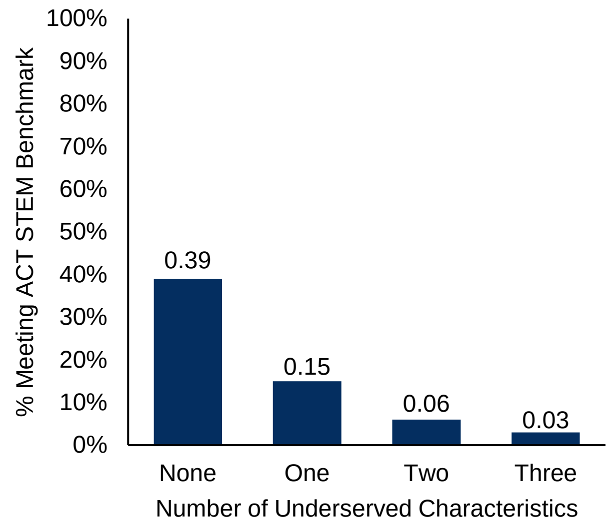

Figure 1. *Percent of 2016 ACT-tested high school graduates meeting the ACT STEM Benchmark, by number of underserved characteristics*

This gap only furthers the inequities between those who come from underserved groups and those who do not, as 93% of STEM occupations have wages above the national average and STEM occupations have higher-than-average growth in the job market.[11]

Policy Recommendations

These data show the importance of adequately preparing high school students academically in STEM, especially those already interested in earning STEM degrees at a four-year college. On the federal level, it is important to maintain or even increase funding for STEM education programs such as the NASA Education Office, training for STEM teachers through Title II, access to college-level STEM courses through Title IV, and more. These programs, designed to improve students' achievement in STEM courses and better prepare them for college-level coursework, especially underserved students, have all been targeted for reduction or elimination in the White House's proposed 2018 budget.[12]

State governments, especially with proposed federal disinvestment, should also increase funding for and attention given to programs designed to prepare high school students for future success in STEM fields. The Every Student Succeeds Act granted states more flexibility to use federal funds for dual-credit or concurrent enrollment programs; STEM teacher professional development; support for STEM content, courses, and activities; and use of technology in instruction. States should supplement this with their own investment in their future STEM workforces; these programs should guarantee that all students receive access to rich curricula (including access to college-level STEM courses in high school, an excellent preparatory tool for postsecondary STEM success), well-trained STEM teachers, and the necessary resources.

Students across the U.S., from every demographic, are interested in STEM fields, and this is good news for the future of the country's workforce. However, encouraging students to pursue STEM fields cannot be the sole or even primary focus—sufficient preparation throughout their K–12 education is essential to ensuring that these students succeed in college and that the STEM pipeline continues to flow.

Notes

1. Stella Fayer, Alan Lacey, and Audrey Watson, *STEM Occupations: Past, Present, and Future* (U.S. Bureau of Labor Statistics, January 2017), https://www.bls.gov/spotlight/2017/science-technology-engineering-and-mathematics-stem-occupations-past-present-and-future/pdf/science-technology-engineering-and-mathematics-stem-occupations-past-present-and-future.pdf.

2. The validity of the ACT STEM Benchmark was recently underscored by ACT research showing that both the mean ACT STEM score among STEM majors who persisted through eight semesters of college and the mean STEM score for students earning a semester grade point average (SGPA) of 3.0 or above were 26—exactly at the ACT STEM Benchmark. Further, more successful students (those earning SGPAs of 3.0 or higher consecutively in semesters five through eight, when students generally take more difficult, major-focused courses) had a mean STEM score of 27, exceeding the ACT STEM Benchmark. See Paul Westrick, *Profiles of STEM Students: Persisters, Joiners, Changers and Departers* (Iowa City, IA: ACT, 2017).

3. ACT, *The Condition of STEM 2016: National* (Iowa City, IA: ACT, 2016).

4. ACT, *The Condition of STEM 2016.*

5. *Every Student Succeeds Act*, Pub. L. 114-95, §§ 2245 & 4107 (2015).

6. United States Department of Education, Dear Colleague letter, January 18, 2017 (revised). https://innovation.ed.gov/files/2017/01/FINAL_signed-letter-1-18-17.pdf.

7. For more information, see http://www.mass.edu/stem/initiatives/pipeline.asp and http://www.iowastem.gov/.

8. Paul Westrick, *Profiles of High-Performing STEM Majors* (Iowa City, IA: ACT, 2017); Westrick, *Profiles of STEM Students*.

9. ACT, *The Condition of STEM 2016*.

10. ACT, *The Condition of STEM 2016*.

11. Fayer, Lacey, and Watson, *STEM Occupations*.

12. United States Office of Management and Budget, *America First: A Budget Blueprint to Make America Great Again*, March 13, 2017. https://www.whitehouse.gov/sites/whitehouse.gov/files/omb/budget/fy2018/2018_blueprint.pdf.