

Developing the STEM Education Pipeline



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For almost 50 years, ACT has played a pivotal role in promoting student access into and success in science, technology, engineering, and mathematics (STEM) careers. Through academic and career assessments, career development tools, and extensive research, we have helped inform students, parents, teachers, career counselors, employers, and policymakers about the skills that are needed to perform effectively in STEM fields.

Our research and recommendations for policymakers and educators are based on the more than one million U.S. high school graduates who take the ACT® college admission and placement exam each year. The ACT is the only national college admission test that includes an interest inventory as well as both math and science assessments. The results provide a clear picture of high school students' interest and academic achievement in STEM, and the news is mixed. Interest in STEM is declining, and most students are not adequately prepared to succeed in college-level coursework. However, students who plan early and strategically and have access to high-level and rigorous coursework are more likely to be prepared for and succeed in the STEM fields.

Measuring Student Readiness, Progress, and Success

ACT's EPAS™ (Educational Planning and Assessment System) is the only longitudinal assessment system that begins measuring students' college readiness in middle school and follows students into high school and college to evaluate their persistence and success. The data gathered through EPAS provide ACT with keen insight into what works in preparing students to succeed in college science, technology, engineering, and mathematics coursework. What ACT's research shows is clear: The students most likely to major in STEM fields in college and persist to earn their degrees are those who develop interests in STEM careers through early career planning and take challenging classes that prepare them for college-level science and math coursework.

Declining Student Interest in STEM Majors

ACT research suggests that, at the very time our nation most needs promising students to enter STEM majors and careers, students' interest in these fields is on the decline.

FACT: Over the past ten years, the percentage of ACT-tested students who said they were interested in majoring in engineering has dropped steadily from 7.6 percent to 4.9 percent.¹

FACT: Over the past five years, the percentage of ACT-tested students who said they were interested in majoring in computer and information science has dropped steadily from 4.5 percent to 2.9 percent.²

Fewer Than Half of High School Graduates Ready for First-Year College Math and Science

ACT developed College Readiness Benchmarks based on a nationally representative sample of thousands of ACT-tested students enrolled at U.S. colleges and universities. With respect to these College Readiness Benchmarks, score results for the 2005 high school graduating class are not encouraging:

FACT: Fewer than half (41 percent) of ACT-tested 2005 high school graduates achieved or exceeded the ACT College Readiness Benchmark in Math.³

FACT: Only a quarter (26 percent) of ACT-tested 2005 high school graduates achieved or exceeded the ACT College Readiness Benchmark in Science.⁴

Students who fall short of ACT's College Readiness Benchmark scores likely lack at least some of the skills they'll need during their first year of college. Although some of these students may still succeed in college though hard work, our research shows—not surprisingly—that they are more likely to require remedial help, which is expensive and time-consuming, and less likely to persist to a degree than students who leave high school ready for college-level coursework.

The ACT College Readiness Benchmark for Math is 22 and for Science 24. Students who meet or surpass the Benchmark in a particular subject area have a high chance—75 percent or greater—of earning a course grade of C or higher and a 50 percent chance of earning a B or higher in a typical first-year college course in that area.

FACT: Nearly three-quarters (70 percent) of college students majoring in science fields who met the ACT College Readiness Benchmark in Science persist in those majors, compared to only 61 percent of students who did not meet the benchmark.⁵

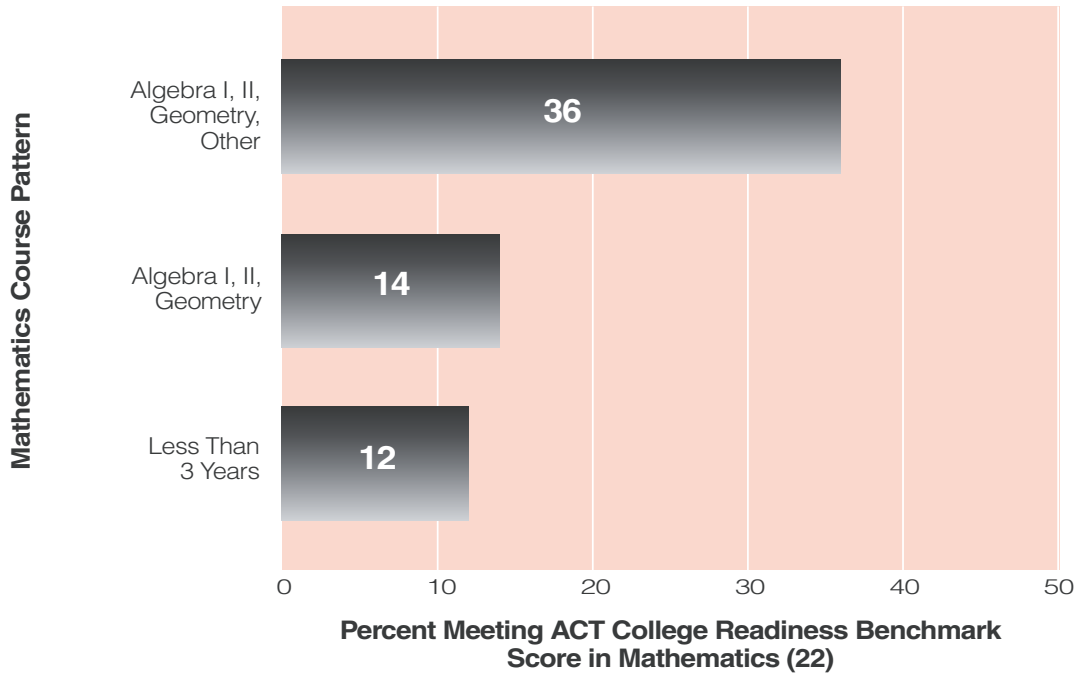
Course Selection and Rigor—Keys to College Readiness

ACT research clearly demonstrates a strong relationship between the amount and kind of high school courses students take and their readiness for college.

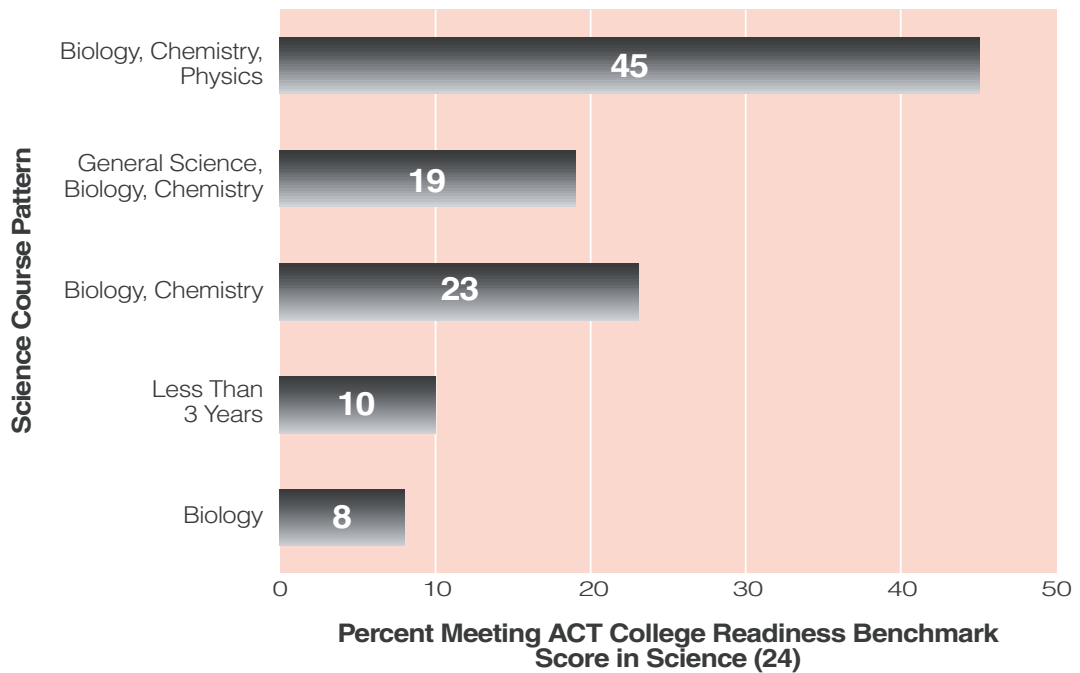
FACT: In the graduating class of 2005, just slightly more than half (56%) of ACT-tested students reported taking the recommended core curriculum for college-bound students: four years of English and three years each of math (algebra and higher), science, and social studies.⁶

ACT data indicate that high school students must take not only the right *number* of courses in high school, but also the right *kinds* of courses—rigorous courses that will prepare them for the demands of college and the workplace.⁷

Students who take more than three years of math (Algebra I & II, Geometry, and additional higher-level courses) are significantly more likely to meet the College Readiness Benchmark in Math (22) than those who take only three years or less of mathematics.⁸



Similarly, students who take an upper-level sequence of science courses that includes Physics are substantially more likely to reach the College Readiness Benchmark in Science (24) than students who took only Biology and Chemistry or less.⁹



What Can Policymakers and Educational Leaders Do?

ACT research points to several key steps federal and state policymakers and educational leaders can take to strengthen science, technology, engineering, and mathematics education.

Common Focus

- Align rigorous, relevant academic standards—across the entire K–16 system—that prepare all students for further education and work.
- Establish a common understanding among secondary and postsecondary educators and business leaders of what students need to know to be ready for college and workplace success in scientific, technological, engineering, and mathematical fields.
- Evaluate and improve the alignment of K–12 curriculum frameworks in English/language arts, mathematics, and science to ensure that the important college and work readiness skills in STEM fields are being introduced, reaffirmed, and mastered at the appropriate times.

High Expectations

- Raise expectations that all students need strong skills in mathematics, science, and technology and that all students can meet rigorous college and workplace readiness standards.
- Require all high school students to take at least three years of rigorous, specific college-preparatory course sequences in math and science.
- Recruit, train, mentor, motivate, reward, and retain highly qualified mathematics, science, and technology professionals to teach in middle school and beyond.

Expanded, Rigorous 8–12 Course Offerings

- Ensure that every student has the opportunity to learn college readiness skills and has access to key courses in the STEM fields.
- Evaluate and improve the quality and intensity of all STEM core and advanced courses in high schools to ensure both greater focus on in-depth content and greater secondary-to-postsecondary curriculum alignment.

- Sponsor model demonstration programs that develop and evaluate a variety of rigorous science, mathematics, and technology courses and end-of-course assessments for all students.
- Provide opportunities for dual enrollment, distance learning, and other enrichment activities that will expand opportunities for students to pursue advanced coursework in STEM areas.

Student Guidance and Motivation

- Establish and support model programs that identify students with STEM academic potential and interests and expose them to STEM opportunities.
- Include parents, teachers, and counselors in outreach programs that help them learn about STEM professions so they can encourage students to go into those fields.
- Initiate new and expand existing scholarship programs to attract more students into STEM fields.

Measure Progress

- Assess foundational science and math skills in elementary school to identify students who are falling behind while there is still time to intervene and strengthen their skills.
- Identify and improve middle and high school student readiness for college and work using longitudinal student progress assessments that include science and mathematics components.
- Establish and support model programs that utilize end-of-course assessments for STEM courses to ensure rigor and effectiveness.
- Incorporate college and workforce readiness measures into federal and statewide school improvement systems.

Helping Students Prepare

Students who participate in a longitudinal college readiness system, like ACT's EPAS, are significantly more likely than those who do not to:

- earn higher scores on the ACT,
- take a college-preparatory core curriculum in high school that includes rigorous courses,
- be ready for credit-bearing college work,
- enroll in college, and
- return for their second year.

Conclusion

Not since the mid-1950s has our nation faced a more serious shortage of skilled workers in science, technology, engineering, and mathematics fields. We can and must reinvigorate these professions if the United States is to maintain a strong position in the competitive global marketplace. The solution lies in education—inspiring our young people to enter these challenging fields and providing the rigorous education these disciplines demand. ACT is well equipped and eager to support policymakers, educators, parents, and students in this important endeavor. Working together to provide all students with the opportunity and resources to succeed in STEM, we can ensure that our nation continues to be a global leader.

References

¹ *ACT National High School Profile Reports, 1995–2005*

² *ACT National High School Profile Report, 2000–2005*

³ *ACT National High School Profile Report, 2005*

⁴ *ACT National High School Profile Report, 2005*

⁵ *ACT Science Literacy Research Report* (in progress, 2006)

⁶ *ACT National High School Profile Report, 2005*

⁷ *Crisis at the Core: Preparing All Students for College and Work*, ACT, 2005

⁸ Data based on ACT-tested 2005 high school graduates.

⁹ Data based on ACT-tested 2005 high school graduates.

About the ACT

The ACT is a unique resource that provides information useful to STEM education:

- The only nationally standardized college entrance exam that covers science and higher-level mathematics.
- A *curriculum*-based assessment developed from nationwide curriculum surveys of high school and college faculty to determine the skills taught in high school that are needed to succeed in college.
- The third part of a comprehensive developmental system—EXPLORE® at the 8th grade, PLAN® at the 10th grade, and the ACT at the 11th and 12th grades. These assessments track progress toward college readiness and include education and career exploration and planning components.

ACT Programs and Services

EXPLORE (8th grade), PLAN (10th grade), and the ACT (11th/12th grade) inform the nation about:

- The readiness of our high school graduates for entry-level college mathematics and science classes
- Their levels of interest in science, technology, engineering, and mathematics fields
- The skills and interests of middle school and high school students who are in the pipeline to enter college and the workforce in the coming years

ACT's WorkKeys® system, first introduced in the early '90s, measures the foundational skills required to enter occupations and job training programs. The WorkKeys assessments include Applied Mathematics and Applied Technology, and more than 2.7 million of those exams have been administered in the last decade. The system also includes a substantial database of information from thousands of job profiles—more than 70 percent of them concerning STEM-related occupations—that have been conducted by trained job profilers. These data provide valuable insights into the current match between the skills required for occupations in science, technology, engineering, and mathematics and the current level of these skills in the U.S. workforce.

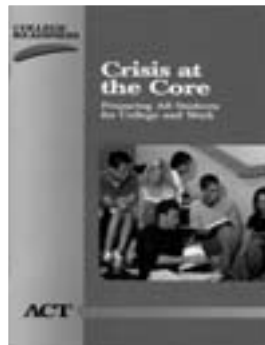
ACT's DISCOVER® is an Internet-delivered educational and career planning system that provides accurate information to middle school, high school, and college students about STEM and other careers.

For more information:

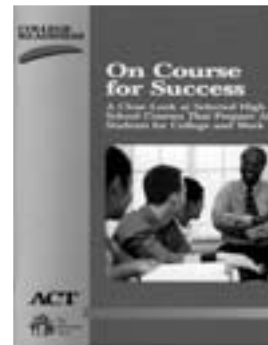
- Each year ACT produces High School Profile Reports—a national report and one for each state. The 2005 national report can be found at www.act.org/news/data.html and reports for each state at www.act.org/news/data/05/states.html. Using ACT test score results for the current year and preceding years, the reports offer a wealth of information—presented in tabular format by academic preparation, gender, racial/ethnic group, and other characteristics—that educators can use to evaluate the effectiveness of their curricula and the college readiness of their students.
- ACT policy reports and other information are available for reading and downloading at www.act.org/path/policy/index.html.



This 2003 report, which focuses on the national need to attract and develop a well-prepared and diverse engineering workforce, is based on 12 years of data for 750,000 college-bound students planning to major in engineering.



This 2004 report urges high schools and state education leaders to strengthen the required core curriculum to better prepare all students for college and work.



This 2005 report—prepared in collaboration with The Education Trust—documents that high schools with sizable minority and low-income student populations can prepare their students to succeed in college if they provide rigorous coursework, well-qualified teachers, and tutorial support.



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