COLLEGE READINESS

The Forgotten Middle

Ensuring that All Students Are on Target for College and Career Readiness before High School

ACT®

ACT is an independent, not-for-profit organization that provides assessment, research, information, and program management services in the broad areas of education and workforce development. Each year we serve millions of people in high schools, colleges, professional associations, businesses, and government agencies, nationally and internationally. Though designed to meet a wide array of needs, all ACT programs and services have one guiding purpose—helping people achieve education and workplace success.

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Introduction:

The Overwhelming Importance of Being on Target for College and Career Readiness

ACT defines readiness for college as acquisition of the knowledge and skills a student needs to enroll and succeed in credit-bearing, first-year courses at a postsecondary institution, such as a two- or four-year college, trade school, or technical school. Simply stated, readiness for college means not needing to take remedial courses in college.

Today, college readiness also means career readiness. While not every high school graduate plans to attend college, the majority of the fastest-growing jobs that require a high school diploma, pay a salary above the poverty line for a family of four, and provide opportunities for career advancement require knowledge and skills comparable to those expected of the first-year college student (ACT, 2006b). We must therefore educate all high school students according to a common academic expectation, one that prepares them for both postsecondary education and the workforce. Anything less will not give high school graduates the foundation of academic skills they will need to learn additional skills as their jobs change or as they change jobs throughout their careers.

Improving the college and career readiness of all our students will provide a better foundation of knowledge and skills to allow future workers to adapt to the changing requirements of a more technologically sophisticated and internationally competitive working world.

However, the most recent results for the 2008 ACT-tested high school graduating class are alarming: only one in five ACT-tested 2008 high school graduates are prepared for entry-level college courses in English Composition, College Algebra, social science, and Biology, while one in four are not prepared for college-level coursework in *any* of the four subject areas (ACT, 2008).

Current international comparisons of academic achievement show students in the United States at a deficit compared to students in many other nations. According to the most recent results of the TIMSS (Trends in International Mathematics and Science Study), U.S. eighth graders rank fifteenth of forty-five countries in average mathematics score and ninth in average science score (Gonzales et al., 2004). The most recent results of the PISA (Programme for

International Student Assessment) rank U.S. 15-year-olds twenty-eighth of forty countries in average mathematics performance, eighteenth in average reading performance, and twenty-second in average science performance (Organisation for Economic Cooperation and Development, 2004).

Recent ACT research has investigated the multifaceted nature of college and career readiness. We first analyzed the low level of college and career readiness among U.S. high school graduates in *Crisis at the Core* (ACT, 2004). The critical role that high-level reading skills play in college and career readiness in all subject areas was the focus of *Reading Between the Lines* (ACT, 2006a). And when ACT data showed that many high school students were still not ready for college and career after taking a core curriculum, we examined the need for increased rigor in the high school core curriculum as an essential element of college and career readiness in *Rigor at Risk* (ACT, 2007b).

The Forgotten Middle extends this research. This report examines the specific factors that influence college and career readiness and how these factors can have their greatest impact during a student's educational development. This report suggests that, in the current educational environment, there is a critical defining point for students in the college and career readiness process—one so important that, if students are not on target for college and career readiness by the time they reach this point, the impact may be nearly irreversible. We must therefore also focus on getting more students on target for college and career readiness by the end of eighth grade, so that they are prepared to maximize the benefits of high school.

Our research shows that, under current conditions, *the level of academic achievement that students attain by eighth grade has a larger impact on their college and career readiness by the time they graduate from high school than anything that happens academically in high school.* This report also reveals that students' academic readiness for college and career can be improved when students develop behaviors in the upper elementary grades and in middle school that are known to contribute to successful academic performance.

The implication is clear: if we want not merely to improve but to maximize the college and career readiness of U.S. students, we need to intervene not only during high school but also *before* high school, in the upper elementary grades and in middle school. This research suggests that even improving high school course rigor may not succeed unless we first increase the number of entering high school students who are prepared to benefit from such rigorous courses.

This report continues to underscore that college and career readiness is not something that suddenly "happens" when a student graduates from high school but instead is the result of a process extending through all the years of a student's education. College and career readiness is not a high school issue—it's a K–12 issue.

Recent years have seen a heightened awareness of the importance of early childhood education and high school as intervention points in the educational lives of America's children. Less attention, it seems, has been paid to the importance of the upper elementary grades and middle school and the role they must play in the preparation of students for life after high school. The results of our research show that the amount of progress toward college and career readiness that students have made by eighth grade is crucial to their future success. Despite the fact that students may pass eighth-grade exit tests, too many are arriving at high school so far behind academically that, under current conditions, they cannot become ready for college and career regardless of the rigor of the high school curriculum, the quality of high school instruction, or the amount of effort they put into their coursework.

Students who fall off the college-preparatory track early in high school tend to move ever further from a complete college-preparatory program as they progress through high school.

—Finkelstein & Fong, 2008

Students who leave eighth grade without the essential skills they need to be on target for college and career readiness too often leave high school not ready for any kind of meaningful future. If students are to maximize the benefits of high school, a strong start is essential. It is therefore imperative for us to turn our attention to the students in the "Forgotten Middle" to help ensure that they are prepared to benefit from the high school experience.

1.

A Strong Start

Eighth-grade students' academic achievement has a larger impact on their readiness for college by the end of high school than anything that happens academically in today's high schools.

Among the students in the research study discussed in this report, *fewer than two in ten eighth graders were on target to be ready for college-level work by the time they graduate from high school*. That is, too few eighth graders met all four EXPLORE College Readiness Benchmarks[1], the minimum level of achievement that ACT has shown is necessary if students are to be ready for college and career upon high school graduation. This means that more than eight of ten eighth-grade students do not have the knowledge and skills they need to enter high school and succeed there. And not surprisingly, our research shows that students who are not prepared for high school are less likely than other students to be prepared for college and career by the time they graduate from high school. So although the gates of high school are technically open to all students, for more than 80 percent of them the door to their futures may already be closed.

Nor is the lack of achievement by eighth grade limited to those students traditionally considered at greatest risk of dropping out of high school. Three out of five eighth-grade students in our study whose annual family income was less than $30,000 and whose parents did not attend college were not on target to be ready for college-level reading by the time they graduated from high school. But among those eighth-graders whose annual family income was greater than $100,000 and whose parents both attended college, this figure was still nearly one in four.

The purpose of this study was to determine what influences college and career readiness and what can be done to ensure that more middle school students get off to a strong start in high school.

The Research Study

This study had two primary goals. First, we wanted to examine in greater depth the factors that influence college and career readiness. In doing so, we wanted to identify those factors that are the most effective predictors of college and career readiness from middle school to high school. Second, we wanted to examine the effect that certain steps to improve students' level of academic preparation would have on their

[1] See the sidebar on p. 14 for more information about ACT's College Readiness Benchmarks.

degree of readiness for college and career.[2] That is, what steps, if taken by students, would have the most impact on their college and career readiness?

The study investigated the benefits that certain factors have on college and career readiness, given students' background characteristics, prior academic achievement, and high school attended. Specifically, the analyses were designed to answer the following questions:

- How important is academic achievement in grade 8 for predicting college and career readiness in grade 11 or 12?
- How important are coursework and grades in high school for predicting college and career readiness in grade 11 or 12?
- How much improvement in students' college and career readiness could we expect from their taking additional rigorous courses and earning higher grades in high school?
- How does the academic progress that students make in high school differ given their achievement level in grade 8?

The analyses were based on data from approximately 216,000 members of the high school graduating classes of 2005 and 2006 who had taken all three programs that make up the longitudinal assessment component of ACT's College Readiness System (EXPLORE®, PLAN®, and the ACT® test). The final data set for 2005 contained records for 98,812 students at 4,191 high schools, while the final data set for 2006 contained records for 117,280 students at 4,638 high schools. The 2005 data set contained 17,671 students who are members of racial/ethnic minority groups, while the 2006 data set contained 25,173 such students. (Racial/ethnic minority students were those who identified themselves as one of the following: African American, American Indian, Hispanic, Multiracial, or Other.)

The 2006 data were used to confirm, through cross-validation, the results of the 2005 analyses. Because these data mostly pertain to students who were considering attending college immediately after high

Percentage of High School Classroom Time Spent Re-teaching Prerequisite Entry-level Skills in English, Mathematics, and Science*

Lack of readiness to benefit from high school affects not just the academic development of students but also how instructional time is spent in the classroom. Teachers of entering high school students responding to an ACT survey in spring 2006 said that they spend from about one-fourth to about one-third of their time in the classroom re-teaching skills that should have been learned prior to high school (ACT, 2007b).

High School Course	Percent of Time Spent Re-teaching
English 9	32
Algebra I	24
Biology I	23

* Based on survey responses from 502 teachers of English 9, 613 teachers of Algebra I, and 657 teachers of Biology I.

[2] For detailed information about the study methodology, please see the Appendix.

school, they may not be representative of all high school students. For example, our sample contained a larger percentage of female students, and smaller percentages of African American and Hispanic students, than did the U.S. high school graduating classes in the years under study. See the Appendix for more details.

Eighth-Grade Academic Achievement Is the Best Predictor of College and Career Readiness by High School Graduation

We first constructed predictive models to examine the relative strengths of six classes of predictor variables (hereafter referred to as "factors") in influencing students' college and career readiness, as defined by their performance on the ACT:[3]

- **Background characteristics**—gender, race/ethnicity, parent educational level, annual family income, primary language spoken at home
- **Eighth-grade achievement**—EXPLORE test scores in relevant subject areas
- **Standard high school coursework**—highest level of non-advanced, non-honors courses taken in relevant subject areas
- **Advanced/honors high school coursework**—accelerated, honors, or Advanced Placement courses in relevant subject areas
- **High school grade point average**—self-reported grade average for courses taken in relevant subject areas
- **Student testing behaviors**—students' age and grade level at time of taking the ACT, whether students retook the ACT, whether students provided updated coursework and grade information if retesting. Because student testing behaviors are the result of student decisions about whether, when, and how often to take the ACT, these behaviors reflect traits such as motivation and students' self-perceptions about their academic abilities.

ACT's College Readiness System

ACT's College Readiness System is intended to help states prepare every student for college and career. The system is a fully aligned, research-based solution. (See the Appendix for more information about the College Readiness System.)

The longitudinal assessment component of the system consists of three aligned programs:

- EXPLORE, for students in grades 8 and 9, provides baseline information on the academic preparation of students that can be used to plan high school coursework.
- PLAN, for students in grade 10, provides a midpoint review of students' progress toward their education and career goals while there is still time to make necessary interventions.
- The ACT, for students in grades 11 and 12, measures students' academic readiness to make successful transitions to college and work after high school.

[3] Because we anticipated that the predictive relationships might differ among high schools, we constructed hierarchical linear models in which regression weights relating predictor variables to outcome variables can vary among high schools.

While the factors we examined are not exhaustive of all the factors that could influence students' college and career readiness, they are intended to encompass the major influences on college and career readiness.

As shown in Figures 1a through 1d, eighth-grade achievement (measured by the four EXPLORE scores in English, Mathematics, Reading, and Science) displays a stronger relationship with eleventh- or twelfth-grade ACT scores, and therefore with college and career readiness, than does any other factor—more than students' family background, high school coursework, or high school grade point average. The predictive power of eighth-grade academic achievement ranged from more than two-and-a-half times as strong as the next strongest factor (in English) to three-and-a-half times the strength of the next strongest factor (in Science).

Compared to eighth-grade academic achievement, the predictive power of each of the other factors we examined was small and in some cases negligible. The weakest factor in English and Reading was standard coursework (highest level of non-advanced, non-honors courses taken), while in Mathematics and Science the weakest factor was advanced/honors coursework (whether students had taken accelerated, honors, or Advanced Placement courses).

We found similar results for racial/ethnic minority students, presented in Figures 2a through 2d (p. 10). The results for racial/ethnic minority students were nearly identical to those for the total group of students in each subject area: once again, eighth-grade academic achievement had by far the strongest relationship with college and career readiness. In fact, while the predictive power of the other factors was again small or negligible, the predictive power of eighth-grade achievement was somewhat greater for racial/ethnic minority students than that seen for the total group.

Similar results to those for the total group were also obtained when the data were analyzed by students' annual family income level (less than $30,000, between $30,000 and $100,000, and more than $100,000).

Figure 1: Relative Magnitude of Effect in Predicting Eleventh/Twelfth-Grade College and Career Readiness (All Students)

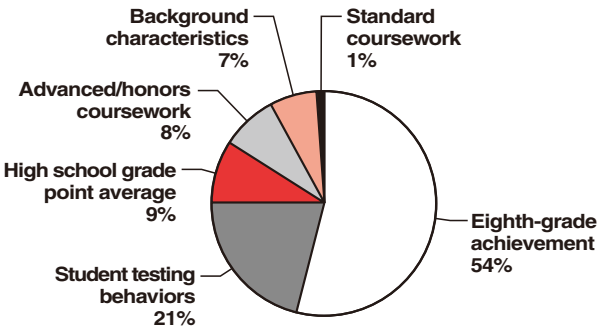


Figure 1a: English

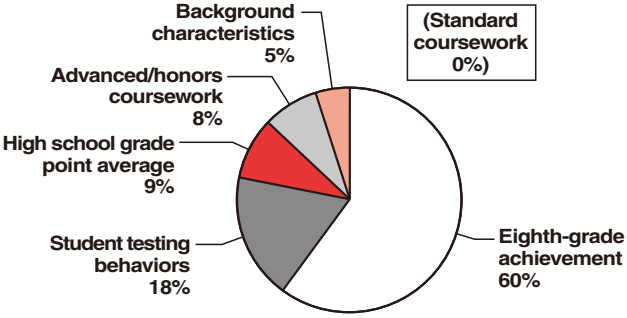


Figure 1c: Reading

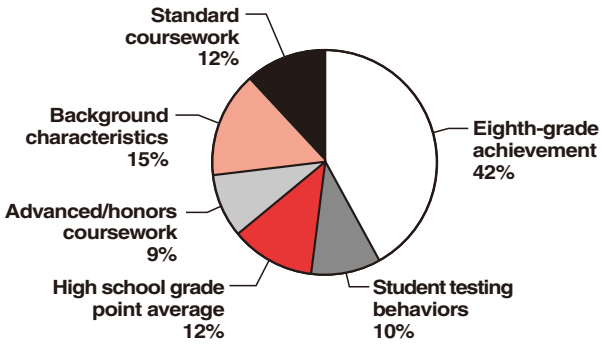


Figure 1b: Mathematics

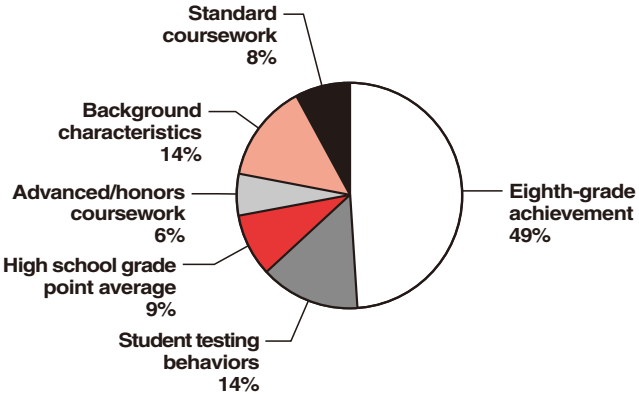


Figure 1d: Science

Figure 2: Relative Magnitude of Effect in Predicting Eleventh/Twelfth-Grade College and Career Readiness (Racial/Ethnic Minority Students)

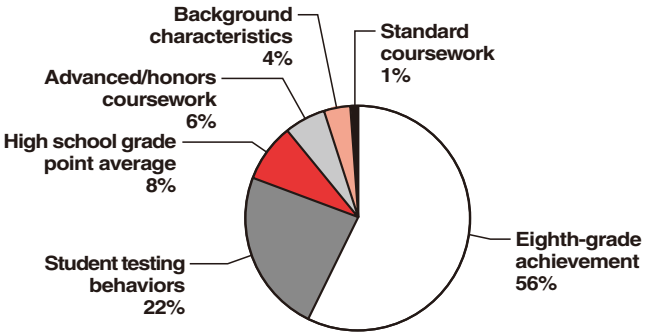


Figure 2a: English[4]

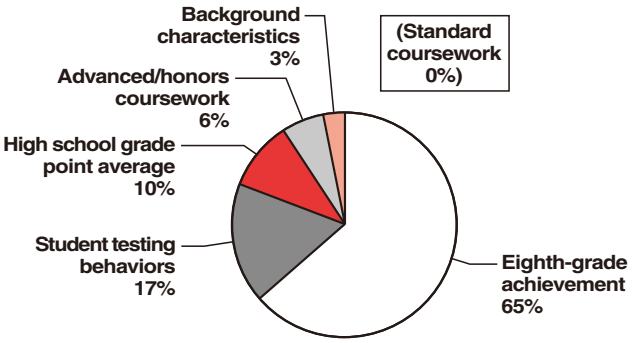


Figure 2c: Reading[4]

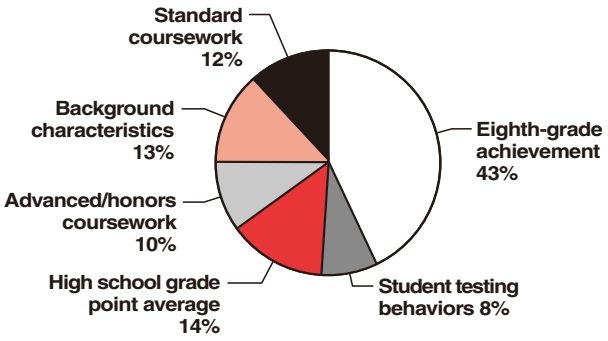


Figure 2b: Mathematics

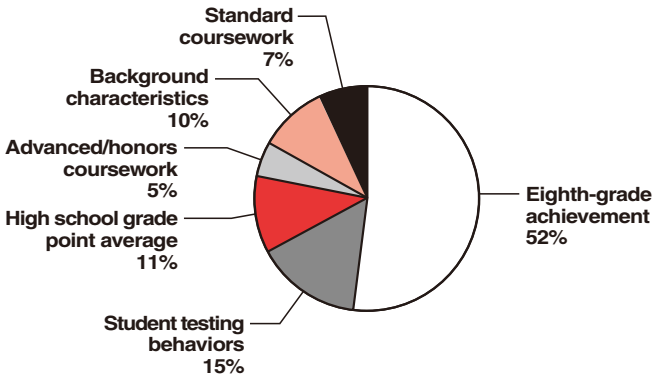


Figure 2d: Science

[4] The percentages in Figures 2a and 2c do not sum to 100 due to rounding.

Improvement in Eighth-Grade Academic Achievement and Being on Target for College and Career Readiness in Eighth Grade Are More Beneficial Than Any High School-Level Academic Enhancement

Next, we examined the impact of a variety of steps students could take to improve their college and career readiness during high school, including:

- **Maintaining a B average** in relevant standard high school courses
- **Earning higher grades** in relevant standard high school courses
- **Taking a core curriculum** in relevant subject areas in high school (for Mathematics and Science only)[5]
- **Taking additional standard courses** in relevant subject areas in high school (for Mathematics and Science only)
- **Taking advanced or honors courses** in relevant subject areas in high school (if not already taken)
- **Meeting EXPLORE College Readiness Benchmarks** in all four subject areas in eighth grade (see sidebar, p. 14)
- **Increasing EXPLORE scores 2 points** in each subject area in eighth grade

We did not study the impact of targeted high school interventions with students identified as having academic difficulty (e.g., remedial coursework); instead, we focused on voluntary steps that are currently available to high school students to improve their college and career readiness themselves.

Figures 3a through 3d show the additional percentages of students who would meet the ACT College Readiness Benchmarks in each subject area if the students took each of the seven steps independently of the others. As the figures show, being on target for college and career readiness in the eighth grade and improving the college and career readiness skills that students possess by grade 8 have the most dramatic impact on high school graduates' ultimate level of college and career readiness. This impact is much larger than that associated with any single high school-level enhancement. These results, however, should not be interpreted to mean that high school-level enhancements have little or no benefit for students. Rather, of the factors studied, modest increases in

[5] The core curriculum in mathematics was defined as Algebra I, Geometry, and Algebra II; in science, the core curriculum was defined as Biology and Chemistry. For English and Reading, there was not enough variation in students' coursework patterns to permit meaningful enhancements with regard to taking either the core curriculum or additional standard courses (see next bullet). This is likely because high schools typically require all students to take the same English courses and many of the same social studies courses.

Figure 3: Increases in ACT College Readiness Benchmark Attainment Associated with Various Academic Interventions (All Students)

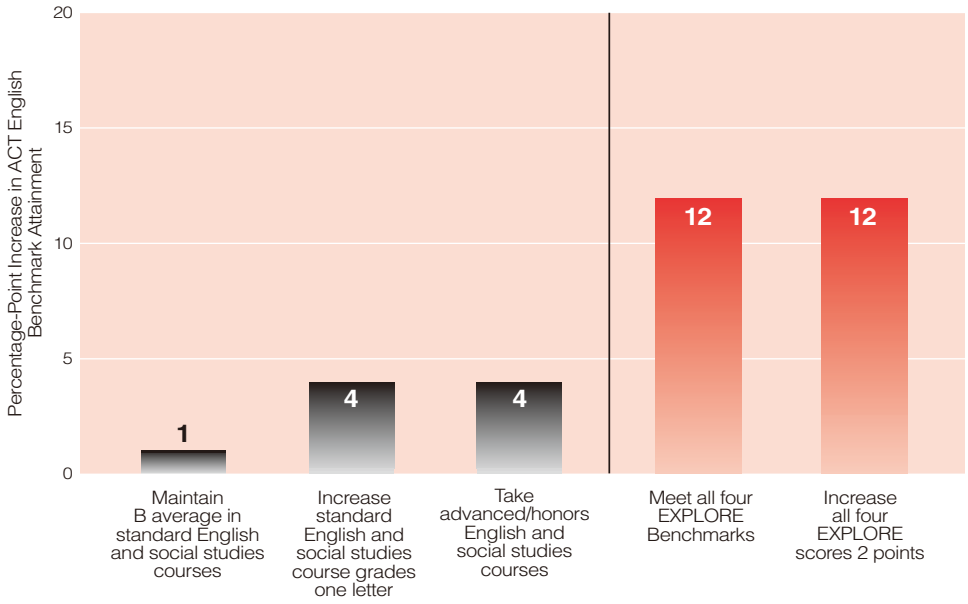


Figure 3a: English

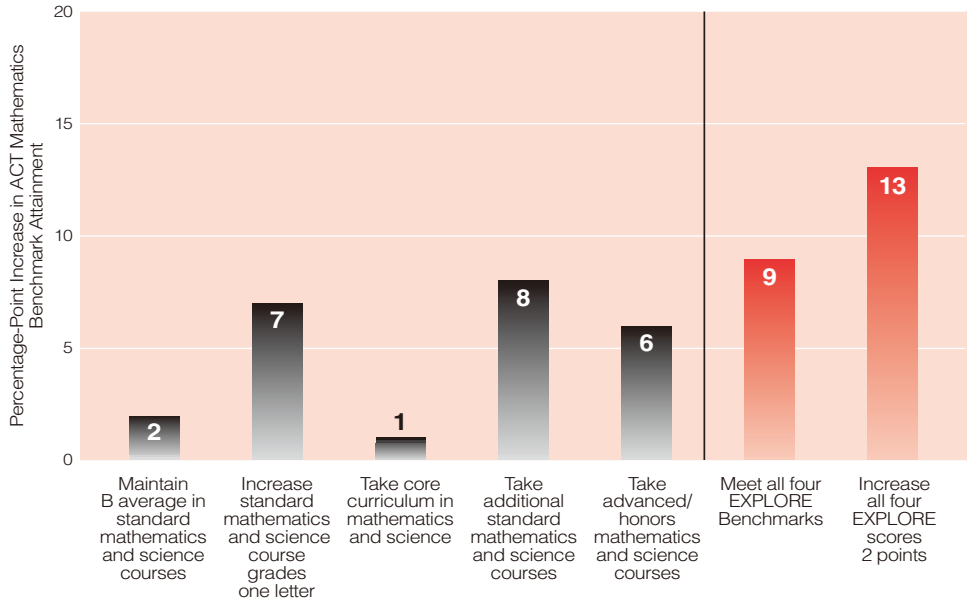


Figure 3b: Mathematics

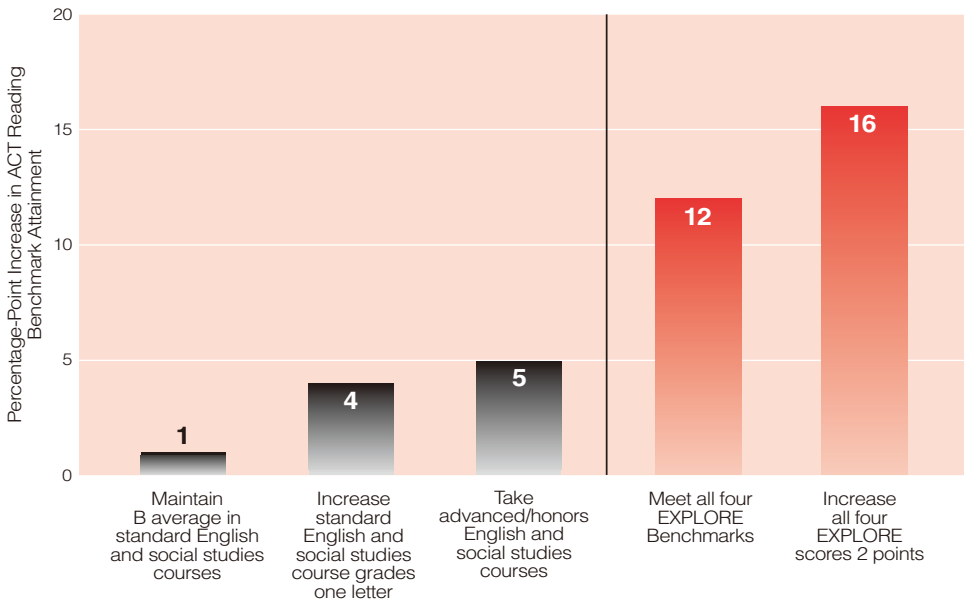


Figure 3c: Reading

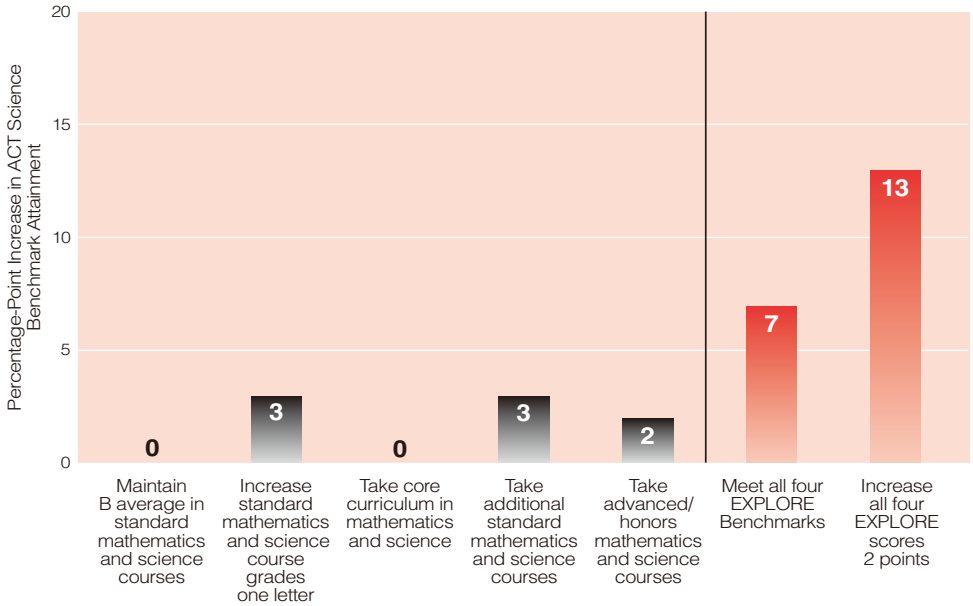


Figure 3d: Science

students' level of academic achievement by the eighth grade and being on target for college and career readiness in the eighth grade had the greatest relative impact on college and career readiness in grade 11 or 12.

Figures 3a through 3d show that the increases in Benchmark attainment associated with higher EXPLORE scores and meeting all four EXPLORE College Readiness Benchmarks were up to three times the size of the largest increase associated with any single high school-level academic enhancement. The level of academic achievement that students reach in all four subject areas by the eighth grade is a crucial element in determining whether they will be ready for college and career by the end of high school.

In English and Reading, maintaining a B average in relevant standard high school courses had the least impact on improving students' college and career readiness. In Mathematics, taking a core curriculum in relevant subject areas had the least impact. In Science, maintaining a B average in relevant standard high school courses and taking a core curriculum in relevant subject areas had no clear impact. Consistent with previous ACT research (2004, 2007b), the small impact of taking a core curriculum in mathematics and science suggests that, as currently constituted, core courses at far too many U.S. high schools are not sufficiently rigorous to prepare students for college and career.

ACT's College Readiness Benchmarks

The ACT College Readiness Benchmarks are scores on the ACT test that represent the level of achievement required for students to have a high probability of success in selected credit-bearing, first-year college courses.

ACT has also established College Readiness Benchmarks for EXPLORE and PLAN. These scores indicate whether students, based on their performance on EXPLORE (grade 8) or PLAN (grade 10), are on target to be ready for first-year college-level work when they graduate from high school.

Test	EXPLORE	PLAN	The ACT
English	13	15	18
Mathematics	17	19	22
Reading	15	17	21
Science	20	21	24

These results are summarized in Table 1.

Table 1: Strongest and Weakest Impact of Various Academic Interventions on ACT College Readiness Benchmark Attainment

Subject Area	Strongest Impact	Weakest Impact
English	Increase all EXPLORE scores 2 points Meet all four EXPLORE Benchmarks	Maintain B average in standard English and social studies courses
Mathematics	Increase all EXPLORE scores 2 points Meet all four EXPLORE Benchmarks	Maintain B average in standard mathematics and science courses Take core curriculum in mathematics and science
Reading	Increase all EXPLORE scores 2 points Meet all four EXPLORE Benchmarks	Maintain B average in standard English and social studies courses
Science	Increase all EXPLORE scores 2 points Meet all four EXPLORE Benchmarks	Maintain B average in standard mathematics and science courses Take core curriculum in mathematics and science

Similar results were also seen for racial/ethnic minority students. These results are presented in Figures 4a through 4d.

Figure 4: Increases in ACT College Readiness Benchmark Attainment Associated with Various Academic Interventions (Racial/Ethnic Minority Students)

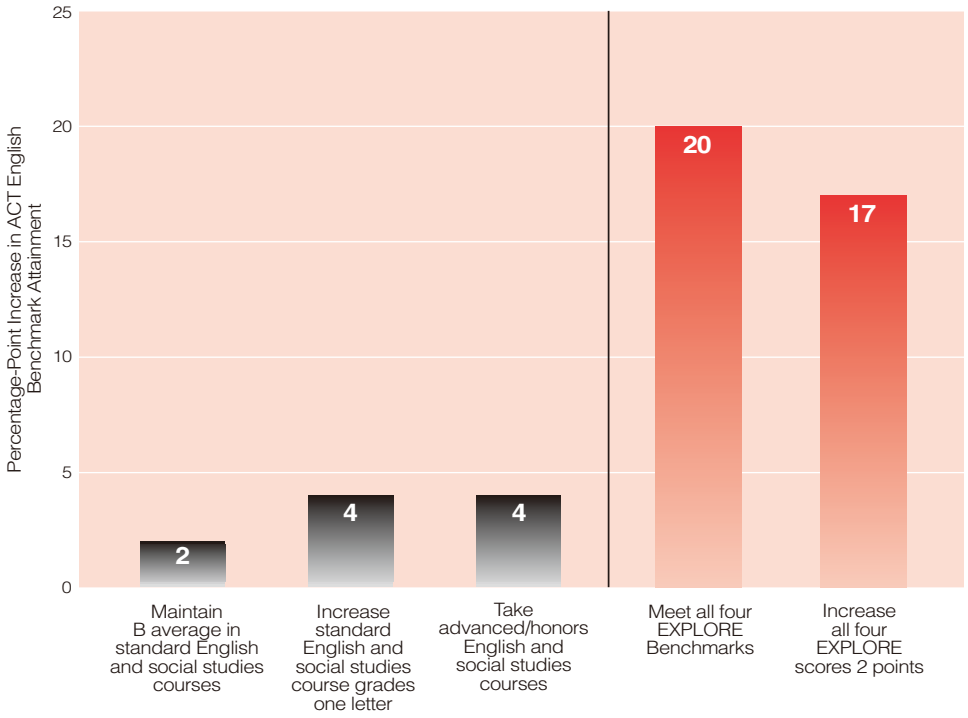


Figure 4a: English

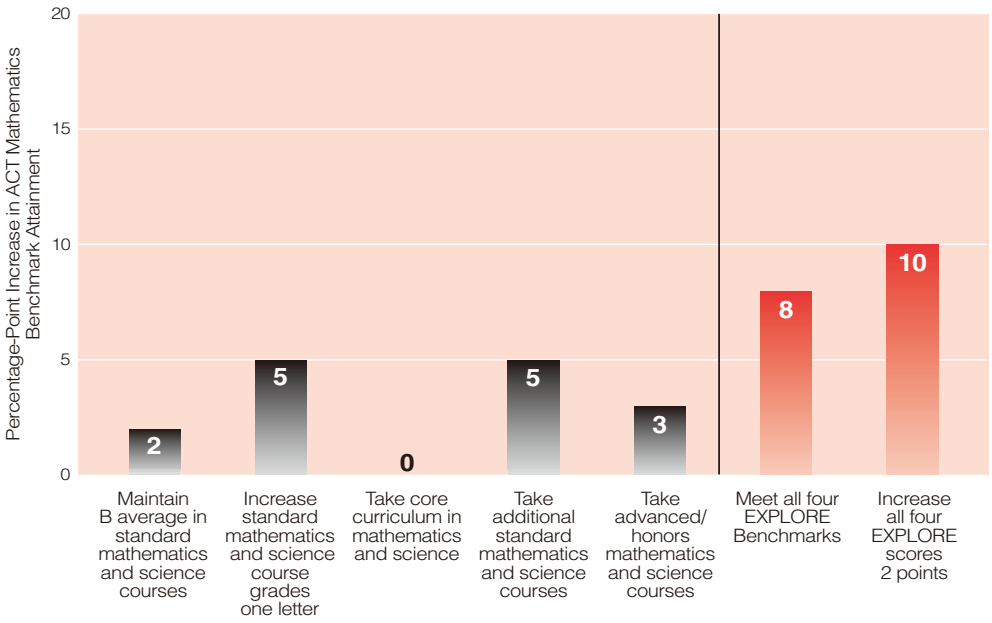


Figure 4b: Mathematics

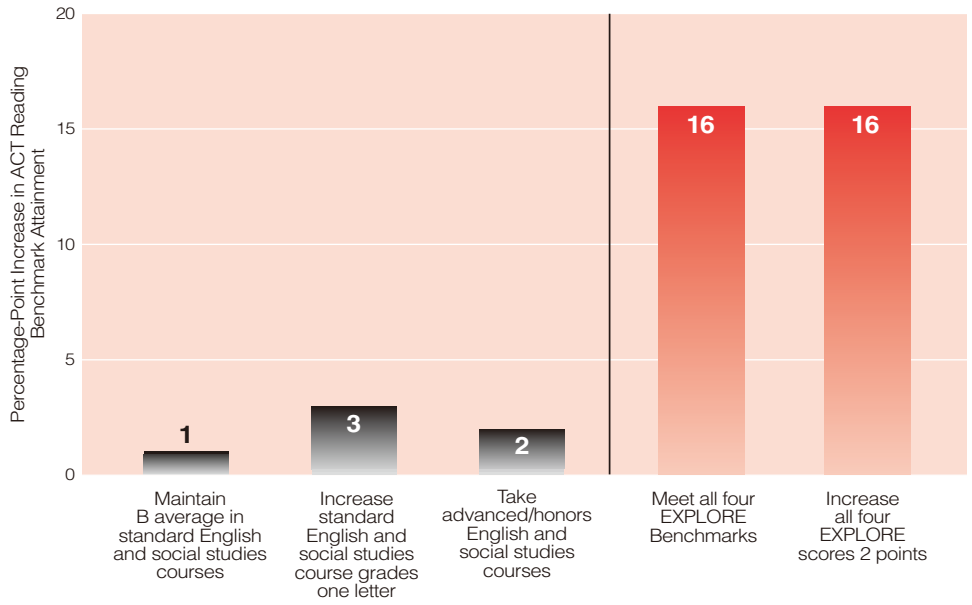


Figure 4c: Reading

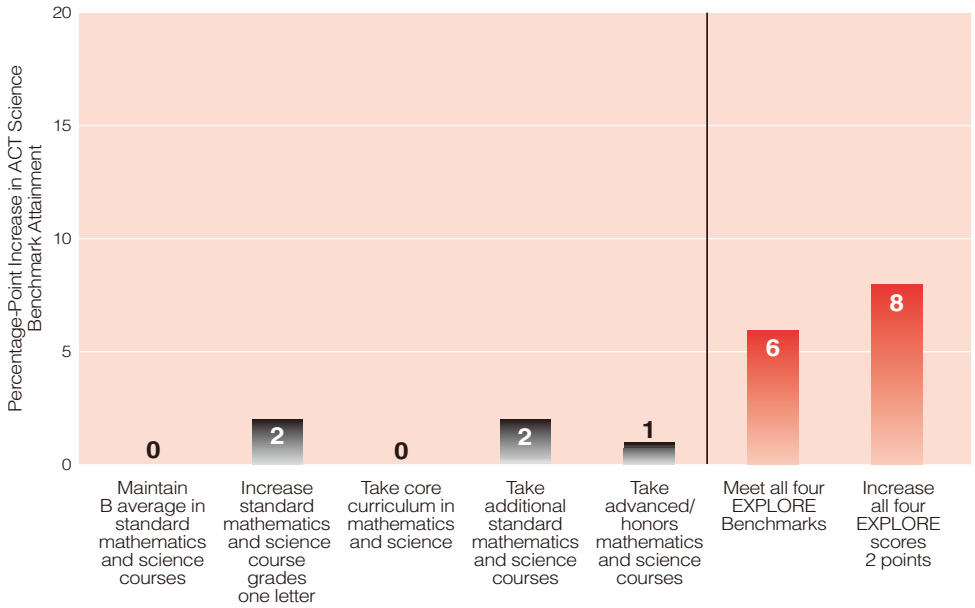


Figure 4d: Science

We also saw comparable results for students at all annual family income levels.

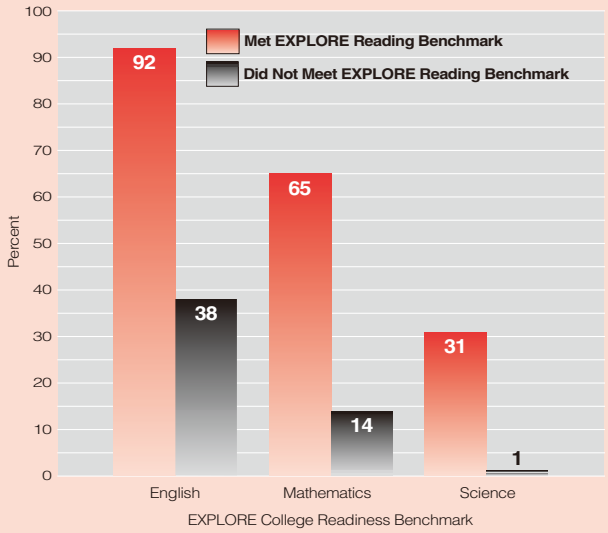
Overall, the results suggest that getting more eighth-grade students on target for college and career readiness and increasing their achievement have the greatest impact across all four subject areas—especially in English and Reading. This is particularly noteworthy given ACT research showing that student readiness for college-level reading has a strong association with their readiness for college in other subject areas (see sidebar). Earning higher grades in standard courses and taking advanced or honors courses provide modest benefits in English, Reading, and Science, and slightly greater benefits in Mathematics. It is clear from these results that major improvements in academic skills need to occur *before* grade 8.

While our study examined the effect of each enhancement separately, several of these enhancements *together* would likely result in a larger increase. But the feasibility and practicality of students' accomplishing multiple enhancements simultaneously—particularly if they start with below-average prior achievement—have yet to be determined.

Reading Achievement and Achievement in Other Academic Areas

Students who are on target in eighth and ninth grade to be ready for college-level reading are substantially more likely to be on target to be ready for college in English, mathematics, and science.

Because reading is likely a strong intervening factor in academic areas across the curriculum, we examined the English, mathematics, and science achievement of eighth-grade students in 2008 who met and did not meet the EXPLORE College Readiness Benchmark in Reading. The figure below shows, for students who met and did not meet the Reading Benchmark, the percentage of students meeting the EXPLORE College Readiness Benchmarks in English, Mathematics, and Science.



Of those students in 2008 who met the EXPLORE Reading Benchmark:

- 92 percent also met the EXPLORE English Benchmark;
- 65 percent also met the EXPLORE Mathematics Benchmark; and
- 31 percent also met the EXPLORE Science Benchmark.

Of those students in 2008 who did NOT meet the EXPLORE Reading Benchmark:

- only 38 percent also met the EXPLORE English Benchmark;
- only 14 percent also met the EXPLORE Mathematics Benchmark; and
- only 1 percent also met the EXPLORE Science Benchmark.

The results show that when students' skills are improved by the end of middle school, the results by the end of high school can be impressive. For example, the percentage of students in our sample who met all four ACT College Readiness Benchmarks after taking EXPLORE and PLAN was 17 percent. Our research indicates that if these students had scored just 2 points higher on each EXPLORE subject test, the percentage who would meet all four ACT Benchmarks would rise 11 percentage points, to 28 percent—a 43-percent increase over their current level of ACT Benchmark attainment.

What's more, improving middle school students' achievement by just 2 score points in each subject area would have a cascading effect over the succeeding levels of education. The 13-point increase in the percentage of high school graduates ready for college-level mathematics (see Figure 5b) should later produce about 25,000 additional degree completers at two- and four-year colleges (and about 25,000 fewer college dropouts) each year in the United States.[6] Extrapolating from U.S. Bureau of Labor Statistics estimates (U.S. Department of Labor, 2007), these new degree completers would enjoy an increase of close to $500 million per year in their combined average salary (i.e., about $20,000 per person) and a drop in their average unemployment rate of 2 percentage points.

Similarly, the 16-point increase in the percentage ready for college-level reading (see Figure 5c) would result in about 20,000 additional college-degree completers each year in the United States.

Our results clearly show that raising eighth-grade students' level of academic achievement and helping them get on target for college and career readiness are the most powerful steps that can be taken to improve these students' college and career readiness by the time they graduate from high school.

Being on Target for College and Career Readiness in Eighth Grade Puts Students on a Trajectory for Success

Because the data for the sample used in this study ranged from the eighth to the twelfth grade for the same group of students, we were able to examine the rate of growth in students' achievement through high school. We examined growth among three categories of students in our sample: those who were on target for college and

[6] Calculations based on estimates in Noble and Radunzel (2007), Table 7. This table compares college-degree completion rates during the 1998–2003 period for students who met the ACT College Readiness Benchmarks in Mathematics and Reading and those who did not. Increases in Benchmark attainment yielded by the present study were multiplied by the Noble and Radunzel completion rates to estimate the additional numbers of associate's degree completers at two-year colleges and bachelor's degree completers at four-year colleges that would result from increasing EXPLORE scores 2 points.

career readiness in the eighth grade, those who just missed being on target for college and career readiness (i.e., by 2 or fewer score points), and those who were more substantially off target (i.e., by more than 2 score points).

Figures 5a through 5e present, for each of the four subject tests and the composite score (which is computed as the average of the four subject-area scores), the average EXPLORE, PLAN, and ACT scores for these three categories of students in our 2005 sample. Figures 5a through 5d show that, on average, *only the group of students who were on target for college and career readiness by the eighth grade were ultimately ready for college and career by the eleventh or twelfth grade*. Even the group of students who just missed being on target in eighth grade fell short, on average, of becoming ready for college and career by the time they reached grade 11 or 12. This was true in each of the four subject areas.

Figure 5: Average Scores for 2005 Sample (All Students)

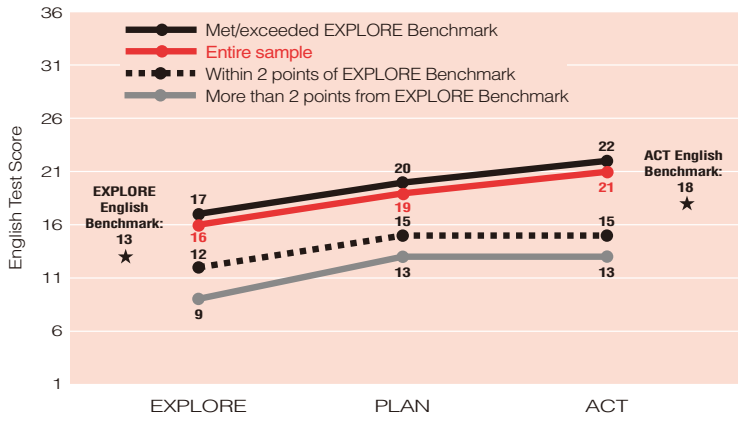


Figure 5a: English

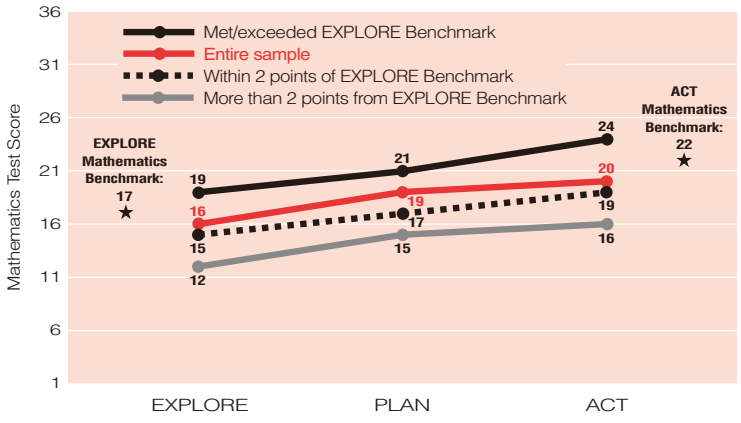


Figure 5b: Mathematics

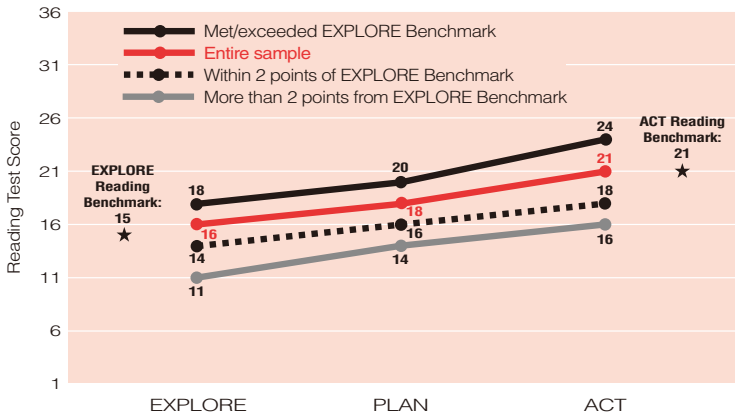


Figure 5c: Reading

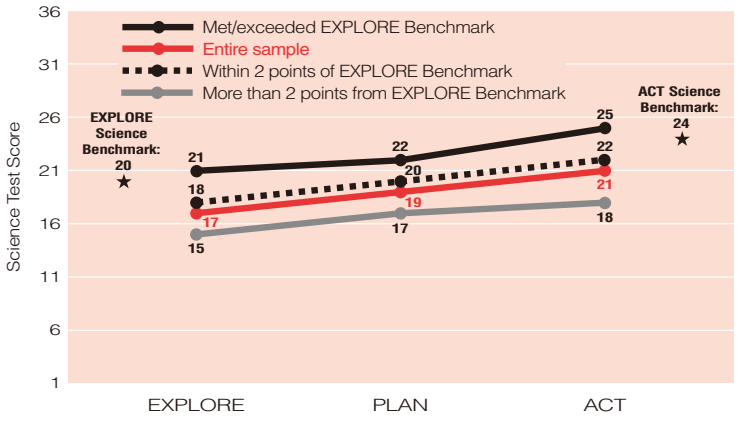


Figure 5d: Science

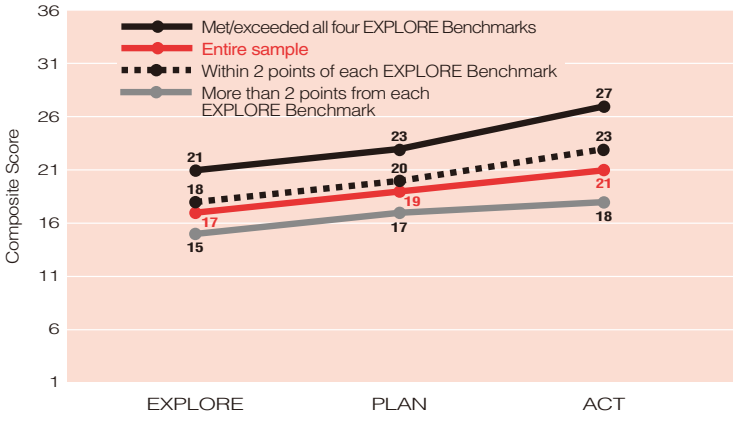


Figure 5e: Composite

Virtually identical results were obtained for a nationally representative sample of students who had taken the tests across a number of years, indicating that the results are not specific to the 2005 and 2006 samples.

Note also that in all subject areas the score increases for the group of students who were on target in eighth grade were steeper than those for the other two groups, especially from PLAN to the ACT. This suggests that the rate of growth in high school is accelerated for students who were on target in eighth grade compared to students who were not on target, particularly during grades 11 and 12.

We conducted the same analysis for racial/ethnic minority students. The results are shown in Figures 6a through 6e. Although in some cases the average scores for these students were slightly lower than those for the total group, the same trends held.

Figure 6: Average Scores for 2005 Sample (Racial/Ethnic Minority Students)

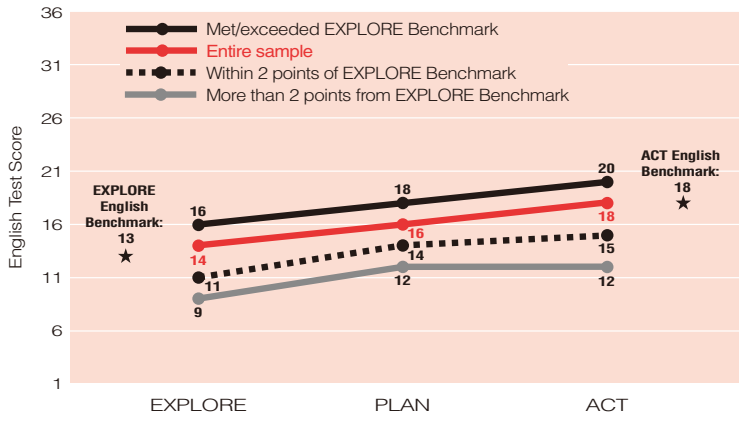


Figure 6a: English

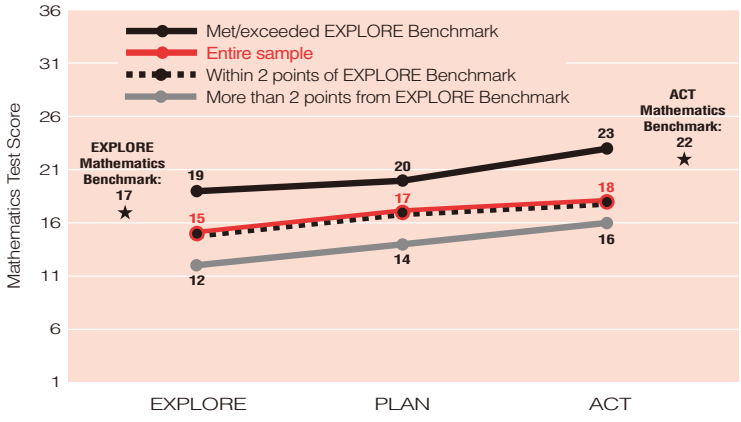


Figure 6b: Mathematics

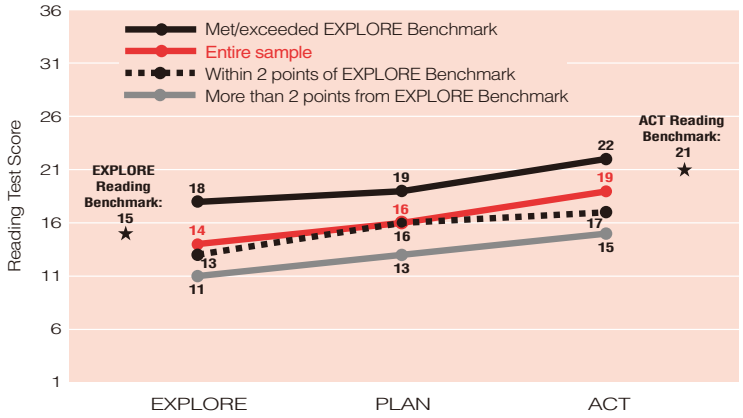


Figure 6c: Reading

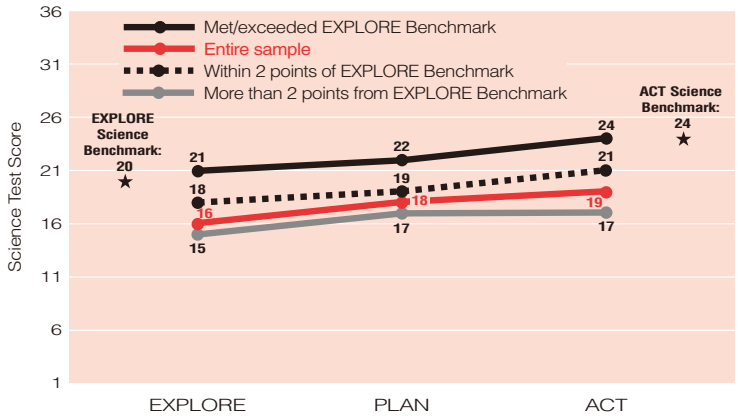


Figure 6d: Science

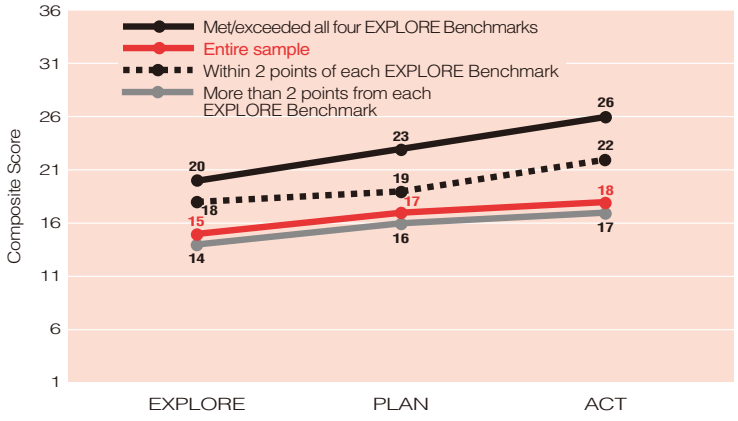


Figure 6e: Composite

Once again, in each of the four subject areas, only the group that was on target for college and career readiness by the eighth grade went on to be ready for college and career by the eleventh or twelfth grade. If students are on target to be ready for college and career in the eighth grade, their chances of being ready for college and career by high school graduation are substantially increased.

Again, similar results were seen by annual family income level.

These results show the critical importance of being on target for college and career readiness in eighth grade: regardless of race/ethnicity or income, those who are on target are on a trajectory of success that enables them to be ready for college and career by high school graduation, while those who are not on target are much less likely to eventually be ready for college and career.

Summary

In all four subject areas, eighth-grade academic achievement (as measured by EXPLORE) and meeting all four EXPLORE College Readiness Benchmarks have a stronger relationship with college and career readiness (as measured by performance on the ACT in grade 11 or 12) than factors such as students' background characteristics, the courses they take in high school, or the grades they earn in those courses.

Under current conditions, increasing eighth-grade students' academic achievement (as represented by increasing their EXPLORE scores just 2 points on each subject test) and helping them get on target for college and career readiness would have a substantially larger impact on students' readiness for college than any single academic enhancement undertaken *during* high school, whether it be taking a minimum core curriculum, increasing course grades or maintaining a B average, or taking additional standard or advanced/honors courses.

Such increases in students' academic skills by grade 8 would continue to pay benefits beyond high school, by increasing the number of students graduating from college and decreasing the number of college dropouts. And just imagine the impact if student achievement could be increased by an even larger amount than the modest increases examined in this study.

Nevertheless, academic achievement is only part of what students need in order to be successful in high school. High school students also need to demonstrate behaviors that contribute to their ability to perform well academically. The next chapter will show that if students are able to develop these behaviors by the end of middle school, they will increase their likelihood of being ready for college and career by the end of high school.

2.

The Benefits of Academic Behaviors in Supporting College and Career Readiness

Improving certain behaviors of middle-school students—particularly academic discipline—can help improve students' readiness for college and career.

Academic achievement is typically defined as the cognitive knowledge, skills, and abilities that are measured by achievement tests such as EXPLORE and the ACT. Our data show that academic achievement—especially the level of achievement students have attained by the eighth grade—plays a substantial role in student readiness for college and career.

Research (e.g., Schweinhart, Barnes, & Weikart, 1993; Reynolds et al., 2007) has shown that academic achievement can be influenced by children's health needs and by their psychosocial (that is, psychological and social) development. Academically related psychosocial behaviors such as motivation, social connectedness, school attendance, obedience of rules, and avoidance of drugs are important predictors of academic success in middle school and high school (Kaufman & Bradbury, 1992; Rumberger, 1995; Worrell & Hale, 2001; Jones & Byrnes, 2006). Other beneficial academic behaviors include academic discipline (i.e., good work and study habits, such as consistently completing homework), orderly conduct, and positive relationships with school personnel (Casillas, Robbins, & Schmeiser, 2007).

The decision to drop out is rarely the result of a single life event; in fact, many students exhibit academic warning signs years before they leave high school. . . . Students who dropped out usually had received a failing grade in core courses (especially in math or English), earned a low grade point average (GPA), or scored low on achievement tests.

—Pinkus, 2008

Recognizing that college and career readiness encompasses a variety of factors, we studied the impact that academic behaviors might have on improving student academic achievement. If educators could intervene effectively with students whose academic behaviors signal a high risk of academic failure, could these students be set on a course by which they could eventually benefit from a rigorous curriculum in high school?

In this phase of our research, ACT collected data from students at twenty-four U.S. middle schools to examine the role that ten academically related psychosocial factors play in predicting two important indicators of students' future academic success: course failure in grade 8 and high school grade point average in grade 9. The ten factors were: academic discipline, commitment, family attitude, family involvement, optimism, orderly conduct, relationships with school personnel, safety of the school environment, steadiness, and thinking before acting. We studied 2,928 students in the course-failure analysis and 2,146 students in the grade point average analysis.

Academic Discipline

Academic discipline is defined as the skill component of motivation, such as the degree to which a student is hardworking and conscientious. It is evidenced by the amount of effort invested into completing schoolwork and engaging in learning new material.

Academic discipline features three primary components, all of which support the various learning processes and goals that ultimately lead to academic success:

- Planning and Organization—thinking about necessary steps and devising plans for achieving objectives. Students skilled in this area have a strong sense of time, organization, and prioritization and use strategic skills to aid in learning new information.
- Follow-through and Action—engaging in behaviors according to previously set plans and remaining engaged in a task until the objective is accomplished in a timely fashion. Students skilled in this area are able to assess their own progress throughout a task and act accordingly based on this assessment.
- Sustained Effort—maintaining focus on longer-term goals and working to achieve individual elements of these goals. Students skilled in this area persist despite challenges, exhibit on-task behavior, and are able to manage distractions in order to achieve a goal.

Academic Discipline Accounts for the Majority of the Predictive Strength of Academic Behaviors

Failing a course is a strong predictor of dropping out of high school (Allensworth & Easton, 2005), and our findings suggest that two of the ten academic behaviors we studied had a substantial impact on whether a course was failed in grade 8: academic discipline and orderly conduct.

As shown in Figure 7a, eighth-grade academic achievement (as measured by EXPLORE Composite score) had the greatest influence on eighth-grade course failure, accounting for 65 percent of the explained variance, vs. 35 percent for the academic behaviors.

Figure 7b gives the relative strengths of the two specific academic behaviors for predicting eighth-grade course failure. Academic discipline alone accounted for 61 percent of the predictive strength of the academic behaviors and therefore proved to be the strongest predictor among all the behaviors studied.

In addition to the effect of academic behaviors on eighth-grade course failure, we looked at their effect on grade point average in ninth grade, an accepted predictor of future academic performance. We found that three of the ten academic behaviors we studied had impact on grade point average in ninth grade: academic discipline, orderly conduct, and having positive relationships with school personnel.

As shown in Figure 8a, eighth-grade academic achievement (as measured by EXPLORE Composite score) had the greatest influence on predicting grade point average in ninth grade, accounting for 53 percent of the explained variance, vs. 47 percent for the academic behaviors.

Figure 7: Predicting Failed Course in Eighth Grade[7]

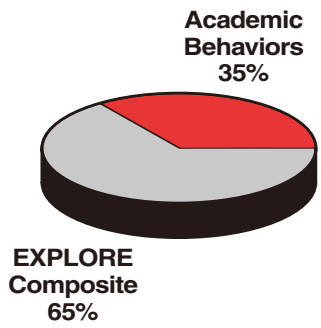


Figure 7a: Relative Strength of Academic Achievement and Academic Behaviors

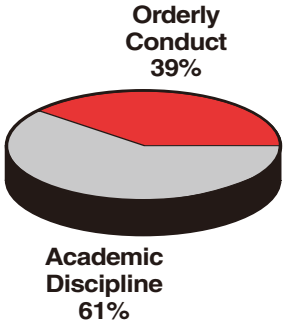


Figure 7b: Relative Strength of Different Academic Behaviors

Figure 8: Predicting Grade Point Average in Ninth Grade

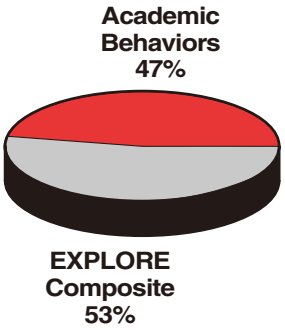


Figure 8a: Relative Strength of Academic Achievement and Academic Behaviors

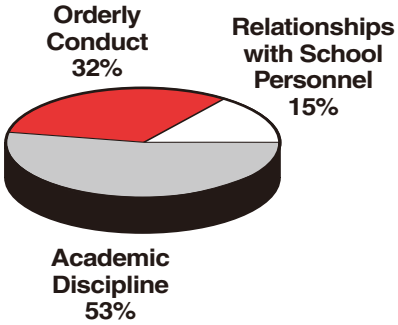


Figure 8b: Relative Strength of Different Academic Behaviors

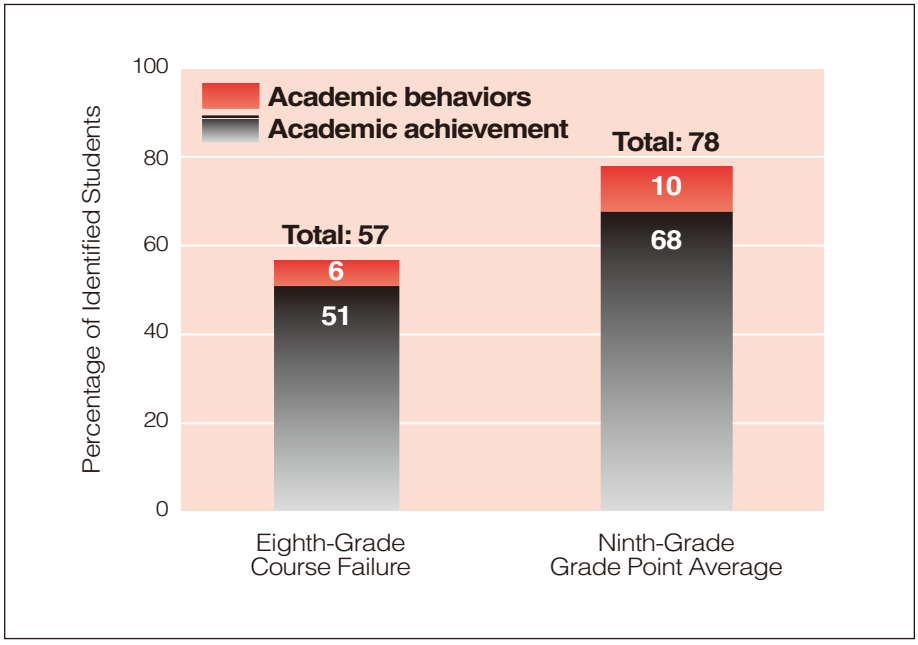
[7] Seventeen percent of the variation in eighth-grade course failure was explained by the predictor variables. The percentages in figures 7a and 7b sum to 100 because they are reported in terms of explained variance only. (This is also true of figures 8a and 8b, where 42 percent of the variation in grade point average in ninth grade was explained by the predictor variables.)

Figure 8b gives the relative strengths of the three specific academic behaviors for predicting grade point average in ninth grade. Once again, academic discipline alone accounted for the majority of the predictive strength of the academic behaviors (53 percent).

Academic Achievement and Academic Behaviors Combined are the Best Predictor of Academic Difficulty

Previous studies have suggested that early remediation of deficiencies in academic behaviors can be an effective strategy for improving later academic achievement (Dadds & Fraser, 2003; Dunn & Mezzich, 2007; Jones & Byrnes, 2006; Kaufman & Bradbury, 1992; Patterson, Reid, & Eddy, 2002; Rumberger, 1995; Worrell & Hale, 2001). What's more, the behaviors associated with academic success serve as useful indicators pointing educators toward needed interventions and guiding the nature of those interventions. The combination of academic achievement and academic behaviors is the best predictor for identifying students at high risk for failing a course or earning a low grade point average (Figure 9).

Figure 9: Rates of Correct Identification of Students Most Likely to Fail at Least One Course in Eighth Grade and Students Most Likely to Earn a Grade Point Average Less than 2.0 in Ninth Grade



The figure shows that if EXPLORE Composite score alone were used to identify the 5 percent of students in the course-failure sample who were at the greatest risk of failing a course, 51 percent of them would have been identified correctly. If the academic behaviors were used in conjunction with EXPLORE Composite score, 57 percent would have been identified correctly. Therefore, including academic behaviors increases the accuracy of identifying students at high risk for failing a course by 6 percentage points.

Similarly, if EXPLORE Composite score alone were used to identify the 5 percent of students in the grade point average sample who were at the greatest risk of earning a grade point average below 2.0, 68 percent of them would have been identified correctly. If the academic behaviors were used along with EXPLORE Composite score for identifying these students, 78 percent would have been identified correctly. So including academic behaviors increases the accuracy of identifying students at high risk for academic difficulty by 10 percentage points.

Summary

Middle-school students who demonstrate those behaviors that enhance academic achievement are more likely to perform well academically in high school, and be ready for college and career by the end of high school, than middle-school students who do not demonstrate these behaviors. By considering these behaviors along with academic achievement, educators can more accurately identify students who are in greatest need of interventions to prevent them from failing courses and dropping out of school, thus increasing the likelihood that these students will graduate from high school ready for college and career.

Teaching students to improve their academic behaviors can aid them in developing their academic skills and thus put them on a path toward improved readiness for college and career. In the next chapter, we return to the subject of academic achievement and focus on identifying the essential knowledge and skills that eighth-grade students need to know to be on target for college and career readiness.

3.

The Nonnegotiable Knowledge and Skills Needed by All Eighth-Grade Students

ACT research shows that eighth-grade students who are on target to be ready for college and career by the end of high school have a high likelihood of attaining that goal. The knowledge and skills needed for high school should therefore be viewed as essential, nonnegotiable standards that all students should attain by the end of eighth grade.

Throughout this report, we have emphasized that all eighth-grade students need to be on target for college and career readiness. But in practical terms, what knowledge and skills do students need to possess to have reached this level of achievement by the time they begin high school?

ACT's empirically based College Readiness Standards™ can be used to define these skills, because the College Readiness Standards represent what students need to know and be able to do by the end of high school.[8] ACT's College Readiness Standards are vertically aligned with what postsecondary educators expect their entering students to know and be able to do. EXPLORE and PLAN are directly connected to the ACT in both content and score scale and measure whether students are on target for college and career readiness by eighth and tenth grade, respectively. The lists of statements associated with the EXPLORE College Readiness Benchmarks in each subject area—which are also empirically based, having been derived from course-grade data on a large sample of first-year students at postsecondary institutions nationwide—therefore represent the essential knowledge and skills that eighth graders need to possess in order to be on target for college and career readiness.

[8] For more information about ACT's College Readiness Standards, please see the Appendix.

Table 2 presents the essential standards that students need to attain by the end of eighth grade in English, mathematics, reading, and science. These standards are not intended to represent everything that should and will be taught and learned by the end of eighth grade, nor how it should be taught. Rather, the standards define the skills that our research tells us are *essential* for entering high school students if they are to be on target for college and career readiness by high school graduation. These standards should be nonnegotiable for all students.

Table 2: Nonnegotiable Knowledge and Skills for Eighth-Grade Students to Be on Target for College and Career Readiness

ENGLISH				
Organization, Unity, and Coherence	**Word Choice in Terms of Style, Tone, Clarity, and Economy**	**Sentence Structure and Formation**	**Conventions of Usage**	**Conventions of Punctuation**
Use conjunctive adverbs or phrases to show time relationships in simple narrative essays (e.g., *then, this time*)	Revise sentences to correct awkward and confusing arrangements of sentence elements Revise vague nouns and pronouns that create obvious logic problems	Use conjunctions or punctuation to join simple clauses Revise shifts in verb tense between simple clauses in a sentence or between simple adjoining sentences	Solve such basic grammatical problems as how to form the past and past participle of irregular but commonly used verbs and how to form comparative and superlative adjectives	Delete commas that create basic sense problems (e.g., between verb and direct object)

MATHEMATICS						
Basic Operations and Applications	**Probability, Statistics, and Data Analysis**	**Numbers: Concepts and Properties**	**Expressions, Equations, and Inequalities**	**Graphical Representations**	**Properties of Plane Figures**	**Measurement**
Perform one-operation computation with whole numbers and decimals Solve problems in one or two steps using whole numbers Perform common conversions (e.g., inches to feet or hours to minutes) Solve routine one-step arithmetic problems (using whole numbers, fractions, and decimals) such as single-step percent Solve some routine two-step arithmetic problems	Calculate the average of a list of positive whole numbers Perform a single computation using information from a table or chart Calculate the average of a list of numbers Calculate the average, given the number of data values and the sum of the data values Read tables and graphs Perform computations on data from tables and graphs Use the relationship between the probability of an event and the probability of its complement	Recognize equivalent fractions and fractions in lowest terms Recognize one-digit factors of a number Identify a digit's place value	Exhibit knowledge of basic expressions (e.g., identify an expression for a total as $b + g$) Solve equations in the form $x + a = b$, where a and b are whole numbers or decimals Substitute whole numbers for unknown quantities to evaluate expressions Solve one-step equations having integer or decimal answers Combine like terms (e.g., $2x + 5x$)	Identify the location of a point with a positive coordinate on the number line Locate points on the number line and in the first quadrant	Exhibit some knowledge of the angles associated with parallel lines	Estimate or calculate the length of a line segment based on other lengths given on a geometric figure Compute the perimeter of polygons when all side lengths are given Compute the area of rectangles when whole number dimensions are given

Table 2 (continued)

READING				
Main Ideas and Author's Approach	**Supporting Details**	**Sequential, Comparative, and Cause-Effect Relationships**	**Meanings of Words**	**Generalizations and Conclusions**
Recognize a clear intent of an author or narrator in uncomplicated literary narratives	Locate basic facts (e.g., names, dates, events) clearly stated in a passage	Determine when (e.g., first, last, before, after) or if an event occurred in uncomplicated passages Recognize clear cause-effect relationships described within a single sentence in a passage	Understand the implication of a familiar word or phrase and of simple descriptive language	Draw simple generalizations and conclusions about the main characters in uncomplicated literary narratives

SCIENCE		
Interpretation of Data	**Scientific Investigation**	**Evaluation of Models, Inferences, and Experimental Results**
Select a single piece of data (numerical or nonnumerical) from a simple data presentation (e.g., a table or graph with two or three variables; a food web diagram) Identify basic features of a table, graph, or diagram (e.g., headings, units of measurement, axis labels) Select two or more pieces of data from a simple data presentation Understand basic scientific terminology Find basic information in a brief body of text Determine how the value of one variable changes as the value of another variable changes in a simple data presentation Select data from a complex data presentation (e.g., a table or graph with more than three variables; a phase diagram) Compare or combine data from a simple data presentation (e.g., order or sum data from a table) Translate information into a table, graph, or diagram	Understand the methods and tools used in a simple experiment Understand the methods and tools used in a moderately complex experiment Understand a simple experimental design Identify a control in an experiment Identify similarities and differences between experiments	Select a simple hypothesis, prediction, or conclusion that is supported by a data presentation or a model Identify key issues or assumptions in a model

Note that, as opposed to the sometimes bewildering array of standards that educators are often expected to teach their students, the standards in Table 2 are neither numerous nor overwhelming in scope: just 7 in English, 26 in mathematics, 6 in reading, and 16 in science (55 in all). But empirical data have shown that they represent the skills needed for high school and, ultimately, for college and career readiness.

In addition, these standards serve as the instructional links among elementary school, middle school, and high school. These standards can and should be used to articulate skills and courses between elementary school and middle school and between middle school and high school. And because these standards were originally based on the expectations of postsecondary educators, the alignment between K–12 and postsecondary education is inherent in their development.

Now that we have seen what level of achievement entering high school students need to be on target for college and career readiness, let's consider what steps we need to take to help our students get there. The next chapter presents detailed recommendations for ensuring that all students who complete eighth grade enter high school ready to succeed and leave high school ready for the challenges of college and career.

4.

Recommendations

To maximize students' readiness for college and career by the time they graduate from high school, we must address the needs of the students in the Forgotten Middle and the role that upper-elementary and middle school must play in college and career readiness.

This research study addressed the following questions:

- **How important is academic achievement in grade 8 for predicting academic achievement in grade 11 or 12?** Of the academic factors we analyzed, eighth-grade academic achievement and being on target for college and career readiness in eighth grade have the greatest impact on college and career readiness by the end of high school.

- **How important are coursework and grades in high school for predicting college and career readiness in grade 11 or 12?** Although high school coursework and high school grades have a positive relationship with college and career readiness by the end of high school, their impact is far outweighed by that of eighth-grade academic achievement and being on target for college and career readiness in eighth grade. Without sufficient preparation before high school, students cannot maximize the benefits of high school–level academic enhancements. All students must be prepared to profit from high school.

- **How much improvement in students' college and career readiness could we expect from their taking additional rigorous courses and earning higher grades in high school?** Taken individually, these enhancements provide modest benefits compared to raising student achievement and helping students get on target for college and career readiness. However, when eighth-grade students are ready for high school coursework, the impact of taking rigorous high school courses and earning higher grades is optimized.

- **How does the academic progress that students make in high school differ given their level of achievement in grade 8?** Compared to students who are not on target for college and career readiness in eighth grade, students who are on target make greater academic progress in high school—particularly between

grades 10 and 12—and are more likely to be ready for college and career when they graduate from high school.

High school coursework and grades are important predictors of students' academic readiness for college-level courses, but the level of academic achievement by eighth grade and being on target for college and career readiness in eighth grade have the most significant impact on college and career readiness. As this report has shown, increasing eighth-grade students' academic achievement by grade 8 and helping them get on target for college and career readiness would result in greater improvement in college and career readiness than their simply taking additional standard courses or advanced/honors courses in high school or earning higher grades in high school. *Thus, making sure that all eighth-grade students have attained the knowledge and skills that put them on target to becoming ready for college and career is the single most important step that can be taken to improve their college and career readiness.*

Requiring high school students to take and pass more challenging courses and to earn higher grades, and working with teachers and administrators to improve the rigor of high school curricula, are important strategies for achieving the broad goal of improving the college and career readiness of our high school graduates. But the results of the research presented in this report suggest that we cannot expect such activities in and of themselves to change the picture of college and career readiness among our students until more of them are ready to learn the content of rigorous high school courses. In the current educational environment, the majority of students in the eighth grade will likely not benefit enough from high school–level enhancements to be prepared for college and career by the time they graduate from high school, so we must also focus on getting more students on target for college and career readiness by the end of eighth grade so that they are prepared to maximize the benefits of high school. Ultimately, we must reduce the number of students who are seriously underprepared by the end of middle school, which will require interventions well before grade 8. Furthermore, if we can improve students' academic skills before grade 8, then the other high school–level enhancements will be far more effective.

College and career readiness does not occur at a single point in time but is the result of a process extending throughout the K–12 years. Given the results of this study about the relationship among high school academic readiness, high school academic success, and college academic readiness, we offer the following recommendations to improve academic achievement and college and career readiness among our nation's high school graduates:

1. **Focus K–8 standards on the knowledge and skills that are essential for college and career readiness, and make these nonnegotiable for all students.** We know that high school students are more likely to be ready for college and career if they complete a rigorous core curriculum, take higher-level courses, and do well in those courses. A key focus for the upper elementary grades and middle school should be to prepare students for the high school curriculum by focusing on the attainment of foundational skills in English, mathematics, reading, and science—the essential skills for college and career readiness by the end of high school. As we have seen, it is especially important that students master foundational English and reading skills by the end of middle school, because the benefits of students being on target for college and career readiness far outweigh the impact of any other action they can take in high school.

   The empirically derived standards identified in Chapter 3 represent the essential knowledge and skills that students need by the end of eighth grade if they are to be on target for college and career readiness by the end of high school. These standards can also help to inform greater articulation of skills and courses among elementary school, middle school, and high school. And at a time when state content standards are often so numerous and diverse that they defy teachers' efforts to teach the most important standards in depth (ACT, 2007a), it is more important than ever before that such a list of essential skills form the basis of what should be taught and mastered before high school. It is then critical that students' high school coursework be of sufficient rigor so that they can build upon this solid foundation of skills and knowledge in order to become ready for college and career by high school graduation.

   Mastery of these foundational skills *must* become a nonnegotiable prerequisite for entry into high school. Given the crucial importance of pre–high school academic achievement level on students' eventual level of college and career readiness, it is no longer acceptable for only some students to possess these skills.

2. **Monitor student progress in becoming ready for college and career, and intervene with students who are not on target to becoming ready, beginning in upper elementary school and continuing through middle school.** College and career readiness is a process, not a point in time. It is therefore important to view the process of preparing students for college and career as one that encompasses all of K–12. If students are to have a fighting chance of being ready for college-level coursework by the time they graduate from high school, their progress must be monitored so that deficiencies in their foundational skills can be

identified early—in the upper elementary grades and at the start of middle school—and interventions can be made. While intervention is not the sole solution to the college and career readiness problem, it is a key element in guaranteeing that these students will have the skills they need to graduate from high school ready to succeed in college.

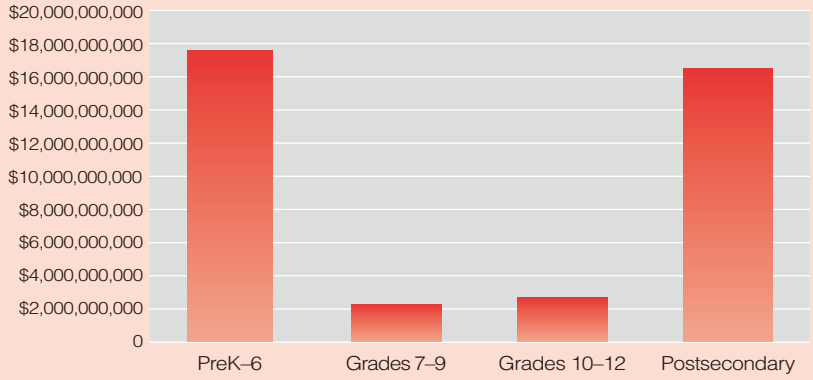
To identify students not on target to be ready for college and career by the time they graduate from high school, educators should assess each student's prior level of academic achievement beginning in grade 4 and continuing through at least the eighth grade. Particular attention should be paid to students' literacy skills, as they enable students to access content in all subject areas. When students' academic readiness is monitored regularly, timely interventions can be targeted at specific students' needs before students veer too far off target. Policymakers can help by providing the necessary resources to schools so that they can implement comprehensive monitoring systems and flexible intervention programs.

3. **Improve students' academic behaviors.** Counterproductive student behaviors that lead to putting off academic work can become habitual. Unfortunately, many students will not realize the consequences until much later, when they drop out of high school, drop out of college, or find themselves stuck in an unrewarding and low-paying career as adults. The earlier a student develops important academically related psychosocial behaviors (such as academic discipline) that contribute to college and career readiness, the more likely those behaviors are to become habitual. And these are also the same behaviors that are conducive to career success.

   Educators must, at a minimum, teach academic discipline skills during the K–8 years. They should also monitor, diagnose, and improve students' academic discipline during the upper elementary and middle school years and intervene assertively to help students who struggle with homework compliance, attendance, and other aspects of academic discipline. They should establish high expectations for all students, engage students and their families in a long-term commitment to high school completion and postsecondary success, and implement activities that highlight and promote strong positive attitudes toward schoolwork and career planning.

4. **Increase federal and state support for schools to implement intervention programs that help all students become ready for college and career.** Not surprisingly, eighth-grade students who are not on target for college and career readiness do not benefit as much from high school–level academic enhancements

The Missing Middle:
FY 2007 U.S. Department of Education Appropriations



Note: The data in this chart are adapted from *FY2007 ED Appropriations: The Missing Middle Chart*, by Alliance for Excellent Education, 2007.

as do students who are on target. Compared to other strategies, improving the academic readiness of these students *before* high school produces the greatest increase in college and career readiness by the end of high school.

At present, far more federal education funding is allocated for students in preschool through sixth grade and in postsecondary education than for students in middle school or high school—and the funding allocated for middle school students is even slightly lower than that for high school students (see sidebar). Increased support is needed for schools to implement interventions designed to bring students with academic deficiencies back on target for college and career readiness. This support should focus on both increasing academic preparation and improving academic behaviors that research shows support student success.

For students behind in their academic progress, educators should aggressively supplement regular instruction with supplemental academic services, such as individual and group tutoring, after-school and weekend classes, and summer bridge programs. These supplemental programs can be made available during the upper elementary grades and middle school, as well as in the summer between middle and high school and during students' first year of high school.

Conclusion

Eighth-grade students who are not on target for college and career readiness face severe academic obstacles in high school and are substantially more likely to be unprepared for college and career when they graduate than students who are on target to become ready for college and career in the eighth grade. Sadly, for far too many of these students, targeted interventions during the high school years come too late to make a difference: ACT data suggest that students who enter high school lacking foundational reading and mathematics skills rarely ever catch up.

The process of preparing students to make successful transitions from middle school to high school is just as important as the process of preparing them to make successful transitions from high school to postsecondary education. Obstacles to college and career readiness must be met head on. A challenge for educators is to integrate activities into the curriculum that promote behaviors that enhance college and career readiness, such as academic discipline. Educators should monitor, diagnose, and improve students' academic behaviors during upper-elementary and middle school. Research has shown that these behaviors can be taught and learned. The earlier that students develop these behaviors, the more likely that the behaviors will become habitual and the more likely that students will be ready for college and career by the end of high school.

Students who are academically ready for the challenges of high school are more likely to finish high school academically ready for college and career. At a time when fewer than two in ten eighth graders are on target to be ready for college-level coursework by the time they graduate from high school, it is crucial that we intervene with the students in the Forgotten Middle—the upper elementary grades and middle school—to ensure that they enter high school ready to benefit from high school coursework. Failure to intervene will mean that, for too many students, it may already be too late to become prepared for life after high school by the time they reach the ninth grade.

We *can* take the steps necessary to ensure that every student learns the essential skills to handle the rigorous high school coursework that prepares them for college and career. Let's make these skills nonnegotiable minimum standards for all K–8 students. They deserve it.

Appendix

This study used a predictive modeling methodology on a sample of students who participated in all three programs that make up the longitudinal assessment component of ACT's College Readiness System: EXPLORE, PLAN, and the ACT.

To construct predictive models, we used data on students who took all three tests (EXPLORE, PLAN, and the ACT) and who graduated from high school in 2005 or 2006. The analysis data set for 2005 contained records for 98,812 students at 4,191 high schools. The analysis data set for 2006 contained records for 117,280 students at 4,638 high schools. Table 3 presents demographic information for the sample used in the study. (Corresponding information for all U.S. high school graduates is given in parentheses, where available.)

The 2005 sample used in the analysis of average EXPLORE, PLAN, and ACT scores (Figure 5, pp. 20–21) was approximately 6 percent larger than the 2005 sample used in Figures 1 (p. 9) and 3 (pp. 12–13). Students who attended small special-purpose high schools or high schools in foreign countries, or who did not enter a verifiable high school code, were not included in the earlier analyses. For the same reason, the 2005 sample used in the analysis of average EXPLORE, PLAN, and ACT scores for racial/ethnic minority students (Figure 6, pp. 22–23) was approximately 8 percent larger than the 2005 sample used in Figures 2 (p. 10) and 4 (pp. 16–17).

We constructed hierarchical prediction models in which regression weights relating predictor variables to outcome variables can vary among high schools. In addition to providing estimates of the variability of regression weights across high schools, hierarchical models lead to more accurate inferences about the statistical significance of the weights at typical high schools.

An important question about statistical relationships such as those presented in this report is whether they hold up over time. Models were constructed from five imputations of the 2005 data. Because the final models involved extensive comparisons among many alternative potential models, there was an inevitable capitalization on chance; although the thresholds were set conservatively, relationships that appear to be statistically significant at a particular threshold in the 2005 data might not be so in the future. Moreover, irrespective of model-fitting artifacts, relationships might themselves change over time. All the models were therefore re-estimated using data from the 2006 graduates.

Table 3: Demographic Information for Research Study Sample (and All U.S. High School Graduates)[9]

Note: All numbers represent percentage values.

	GENDER	
Year	Female	Male
2005	55 (51)	45 (49)
2006	55 (50)	45 (50)

	RACE/ETHNICITY					
Year	African American	American Indian	Asian American	Hispanic	White	Multiracial/ Other[10]
2005	8 (15)	2	3	5 (17)	79 (63)	3 (5)
2006	11 (16)	2	3	5 (16)	76 (62)	3 (6)

	GEOGRAPHIC REGION			
Year	East	Midwest	Southwest	West
2005	12 (41)	48 (22)	29 (12)	11 (25)
2006	11 (41)	43 (22)	36 (12)	10 (25)

	ANNUAL FAMILY INCOME		
Year	Less than $30,000	$30,000 to $100,000	Greater than $100,000
2005	22	64	14
2006	23	63	14

[9] U.S. percentages for gender and race/ethnicity were calculated using National Center for Education Statistics, *Digest of Education Statistics 2005* (2006, Table 9) and *Digest of Education Statistics 2006* (2007, Table 9), and are based on numbers of students 18 and 19 years old who completed high school during the relevant year.

U.S. percentages for geographic region were calculated using data from the Western Interstate Commission for Higher Education, *Knocking at the College Door: Projections of High School Graduates by State and Race/Ethnicity, 1992 to 2022* (2008). Numbers for 2004–05 represent actual figures, while numbers for 2005–06 represent projected figures.

U.S. percentages for annual family income were not available.

[10] The U.S. percentages in this column include American Indian and Asian American students.

The models that used 2006 data cross-validated the results of the models that used 2005 data; that is, in the models that used 2006 data, the same predictors were statistically significant, and had approximately the same weights, as in the models that used 2005 data. Given that the final 2006 sample was larger than the final 2005 sample (117,280 students vs. 98,812 students), the mean test scores for the 2006 sample were about 0.1 score point lower than the mean test scores for the 2005 sample. In nearly all cases, corresponding standard deviations across the two samples were identical to one another and in no case differed by more than 0.1.

We conducted a simulation study to estimate the effect of enhanced preparation activities on increasing the percentage of students who met the ACT College Readiness Benchmarks. We first calculated for each student a predicted ACT score under each scenario of enhanced preparation, using the relevant hierarchical regression model. To each predicted ACT score, we added a random-error term representing the residual variation of actual ACT scores around the predicted ACT scores; the resulting quantity was a simulated ACT score. We then calculated the percentage of the simulated ACT scores that met or exceeded the relevant College Readiness Benchmark.

ACT's College Readiness System

ACT's College Readiness System is intended to help states prepare every student for college and career. The system is a fully aligned, research-based solution.

Our College Readiness Standards and College Readiness Benchmarks (see below) define college readiness empirically, based on what postsecondary educators indicate is important for students to know and on actual student success in college. The Standards and Benchmarks together represent a single academic expectation for all students, regardless of whether they go on to college or career after high school.

The longitudinal assessment component of the system—consisting of EXPLORE, PLAN, and the ACT—is directly tied to and aligned with the College Readiness Standards and College Readiness Benchmarks.

EXPLORE, for students in grades 8 and 9, provides baseline information on the academic preparation of students that can be used to plan high school coursework.

PLAN, for students in grade 10, provides a midpoint review of students' progress toward their education and career goals while there is still time to make necessary interventions.

The ACT, for students in grades 11 and 12, measures students' academic readiness to make successful transitions to college and work after high school. The ACT is the most widely accepted and used test by postsecondary institutions across the U.S. for college admission and course placement.

Unlike other large-scale assessments of academic ability, EXPLORE, PLAN, and the ACT are first and foremost achievement tests. They are measures whose tasks correspond to recognized high school learning experiences, but which at the same time do not precisely duplicate the high school curriculum. EXPLORE, PLAN, and the ACT measure not an abstract quality, such as intelligence or aptitude, but rather what students are able to do with what they have learned in school.

QualityCore®, the instructional improvement component of ACT's College Readiness System, offers rigorous model high school courses designed to prepare all students for postsecondary education, course by course. QualityCore course objectives focus on the course-level knowledge and skills needed for college readiness. As such, they are tied to the College Readiness Standards measured by EXPLORE, PLAN, and the ACT. And because EXPLORE, PLAN, and the ACT are college readiness assessments based on extensive research into postsecondary expectations, they in turn reflect performance in QualityCore courses: as students take rigorous courses in high school, their college readiness will increase.

Finally, ACT's college–to–high school feedback reports enable postsecondary institutions in a state to report back to their feeder high schools about how prepared their high school graduates were for college. Such feedback is an important element in improving the high school curriculum. In turn, strengthening high school curricula helps states meet their ultimate obligation to high school graduates: increasing the likelihood of their success in college and career so that they are prepared to meet the challenges of a changing world.

ACT National Curriculum Survey®

All three programs in the longitudinal assessment component of ACT's College Readiness System (EXPLORE, PLAN, and the ACT) measure achievement because each is firmly based in the curriculum of the grade level for which it is intended. Every three to four years, we conduct our National Curriculum Survey, in which we ask more than 20,000 educators nationwide across grades 7–14 to identify the knowledge and skills that are important for students to know to be ready for college-level work. We examine the objectives for instruction in grades 7 through 12 for all states that have published such objectives. We then analyze the information to refine the scope and sequence for each section of each assessment. In this way, rather than imposing a test construct without empirical support, ACT's College Readiness System is able to represent a consensus among educators and curriculum experts about what is important for students to know and be able to do.

EXPLORE, PLAN, and the ACT

EXPLORE, PLAN, and the ACT, the three programs that make up the longitudinal assessment component of ACT's College Readiness System, each consist of four tests: English, Mathematics, Reading, and Science. Students who take the ACT are also given the option of taking the ACT Writing Test. The skills assessed in each of these five tests are summarized below.

English. The questions in the English tests assess six elements of effective writing in the two broad categories of usage and mechanics (punctuation, grammar and usage, sentence structure) and rhetorical skills (strategy, organization, style). Spelling, vocabulary, and rote recall of rules of grammar are not tested. The revising and editing issues posed by the questions offer a certain richness and complexity. While some questions require students to apply their knowledge of standard written English to the task of deciding the best way to write a sentence or sentences, the surrounding context makes the overriding issue that of clear and effective communication of meaning.

Mathematics. The questions in the Mathematics tests cover four cognitive levels: Knowledge and Skills, Direct Application, Understanding Concepts, and Integrating Conceptual Understanding. Knowledge and Skills questions require the student to use one or more facts, definitions, formulas, or procedures to solve problems that are presented in purely mathematical terms. Direct Application questions require the student to use one or more facts, definitions, formulas, or procedures to solve straightforward problems set in real-world situations. Understanding Concepts questions test

the student's depth of understanding of major concepts by requiring reasoning from a concept to reach an inference or a conclusion. Integrating Conceptual Understanding questions test the student's ability to achieve an integrated understanding of two or more major concepts to solve non-routine problems.

Reading. The questions in the Reading tests require the student to derive meaning from texts by referring to what is explicitly stated and reasoning to determine implicit meanings and to draw conclusions, comparisons, and generalizations. Questions do not test the rote recall of facts from outside the text, isolated vocabulary items, or rules of formal logic. Rather, the test focuses on the complementary and mutually supportive skills that readers must bring to bear in studying written materials across a range of subject areas.

Science. The questions in the Science tests measure students' mastery of the interpretation, analysis, evaluation, reasoning, and problem-solving skills required in the natural sciences. The questions require students to recognize and understand the basic features of, and concepts related to, the provided information; to examine critically the relationships between the information provided and the conclusions drawn or hypotheses developed; and to generalize from given information to gain new information, draw conclusions, or make predictions. The questions emphasize scientific reasoning skills rather than recall of scientific content, skill in mathematics, or pure reading ability. The tests pose the kinds of questions that college students of science must answer in planning, carrying out, and evaluating scientific investigations and in studying scientific theories.

Writing. The Writing Test is an achievement test designed to measure students' writing proficiency. It was developed to reflect the type of writing found in rigorous high school writing curricula and expected of students entering first-year college composition courses. The Writing Test consists of one writing prompt that briefly states an issue and describes two points of view on that issue. Students are asked to write in response to a question about their position on the issue described in the writing prompt. In doing so, students may adopt one or the other of the perspectives described in the prompt, or they may present a different point of view on the issue. Students' scores are not affected by the point of view they take on the issue. Prompts are designed to be appropriate for response in a 30-minute timed test and to reflect students' interests and experiences.

Score Scales

The English, Mathematics, Reading, and Science tests within EXPLORE, PLAN, and the ACT are each scored on a common score scale ranging from 1 (lowest) to 25 for EXPLORE, 32 for PLAN, and 36 for the ACT. The optional ACT Writing Test is scored on a scale ranging from 2 (lowest) to 12. Students receive both total test scores and subtest scores on each assessment. For example, the ACT reports a minimum of 12 scores: four test scores (English, Mathematics, Reading, and Science), one composite score, and seven subscores (two in English, three in Mathematics, and two in Reading). The ACT also reports two additional scores to students who take the optional Writing Test: Writing Test score and combined English/Writing score. Students who take the Writing Test also receive narrative comments intended to help them improve their writing.

ACT's Critical Core Curriculum

The core curriculum we recommend is based on the curriculum proposed in *A Nation at Risk* (National Commission on Excellence in Education, 1983). We have long held that this number of courses best prepares students for college or other forms of postsecondary training. At a minimum, the courses that constitute our definition of the core curriculum, by subject area, are:

- Four years of English
- Three years of mathematics, including rigorous courses in Algebra I, Geometry, and Algebra II
- Three years of science, including rigorous courses in Biology, Chemistry, and Physics
- Three years of social studies

ACT's College Readiness Standards

ACT's College Readiness Standards are precise descriptions of the essential skills and knowledge that students need to become ready for college and career, beginning in grade 8 and continuing through grade 12. The College Readiness Standards are informed by the ACT National Curriculum Survey.

ACT College Readiness Standards—English

The Standards describe what students who score in the specified score ranges are *likely* to know and to be able to do.

		Topic Development in Terms of Purpose and Focus	*Organization, Unity, and Coherence*	*Word Choice in Terms of Style, Tone, Clarity, and Economy*
13–15	**Standards**		■ Use conjunctive adverbs or phrases to show time relationships in simple narrative essays (e.g., *then, this time*)	■ Revise sentences to correct awkward and confusing arrangements of sentence elements ■ Revise vague nouns and pronouns that create obvious logic problems
16–19	**Standards**	■ Identify the basic purpose or role of a specified phrase or sentence ■ Delete a clause or sentence because it is obviously irrelevant to the essay	■ Select the most logical place to add a sentence in a paragraph	■ Delete obviously synonymous and wordy material in a sentence ■ Revise expressions that deviate from the style of an essay
20–23	**Standards**	■ Identify the central idea or main topic of a straightforward piece of writing ■ Determine relevancy when presented with a variety of sentence-level details	■ Use conjunctive adverbs or phrases to express straightforward logical relationships (e.g., *first, afterward, in response*) ■ Decide the most logical place to add a sentence in an essay ■ Add a sentence that introduces a simple paragraph	■ Delete redundant material when information is repeated in different parts of speech (e.g., "alarmingly startled") ■ Use the word or phrase most consistent with the style and tone of a fairly straightforward essay ■ Determine the clearest and most logical conjunction to link clauses
24–27	**Standards**	■ Identify the focus of a simple essay, applying that knowledge to add a sentence that sharpens that focus or to determine if an essay has met a specified goal ■ Delete material primarily because it disturbs the flow and development of the paragraph ■ Add a sentence to accomplish a fairly straightforward purpose such as illustrating a given statement	■ Determine the need for conjunctive adverbs or phrases to create subtle logical connections between sentences (e.g., *therefore, however, in addition*) ■ Rearrange the sentences in a fairly uncomplicated paragraph for the sake of logic ■ Add a sentence to introduce or conclude the essay or to provide a transition between paragraphs when the essay is fairly straightforward	■ Revise a phrase that is redundant in terms of the meaning and logic of the entire sentence ■ Identify and correct ambiguous pronoun references ■ Use the word or phrase most appropriate in terms of the content of the sentence and tone of the essay

Essential skills needed by the end of eighth grade Additional skills needed by high school graduation

In the charts that follow, the essential skills that eighth-grade students need to be on target for college and career readiness are shaded in pink. Additional skills needed for college and career readiness by the time students graduate from high school are shaded in gray. The remaining Standards represent increasingly advanced levels of preparation.

Sentence Structure and Formation	*Conventions of Usage*	*Conventions of Punctuation*
■ Use conjunctions or punctuation to join simple clauses ■ Revise shifts in verb tense between simple clauses in a sentence or between simple adjoining sentences	■ Solve such basic grammatical problems as how to form the past and past participle of irregular but commonly used verbs and how to form comparative and superlative adjectives	■ Delete commas that create basic sense problems (e.g., between verb and direct object)
■ Determine the need for punctuation and conjunctions to avoid awkward-sounding sentence fragments and fused sentences ■ Decide the appropriate verb tense and voice by considering the meaning of the entire sentence	■ Solve such grammatical problems as whether to use an adverb or adjective form, how to ensure straightforward subject-verb and pronoun-antecedent agreement, and which preposition to use in simple contexts ■ Recognize and use the appropriate word in frequently confused pairs such as *there* and *their, past* and *passed,* and *led* and *lead*	■ Provide appropriate punctuation in straightforward situations (e.g., items in a series) ■ Delete commas that disturb the sentence flow (e.g., between modifier and modified element)
■ Recognize and correct marked disturbances of sentence flow and structure (e.g., participial phrase fragments, missing or incorrect relative pronouns, dangling or misplaced modifiers)	■ Use idiomatically appropriate prepositions, especially in combination with verbs (e.g., *long for, appeal to*) ■ Ensure that a verb agrees with its subject when there is some text between the two	■ Use commas to set off simple parenthetical phrases ■ Delete unnecessary commas when an incorrect reading of the sentence suggests a pause that should be punctuated (e.g., between verb and direct object clause)
■ Revise to avoid faulty placement of phrases and faulty coordination and subordination of clauses in sentences with subtle structural problems ■ Maintain consistent verb tense and pronoun person on the basis of the preceding clause or sentence	■ Ensure that a pronoun agrees with its antecedent when the two occur in separate clauses or sentences ■ Identify the correct past and past participle forms of irregular and infrequently used verbs and form present-perfect verbs by using *have* rather than *of*	■ Use punctuation to set off complex parenthetical phrases ■ Recognize and delete unnecessary commas based on a careful reading of a complicated sentence (e.g., between the elements of a compound subject or compound verb joined by *and*) ■ Use apostrophes to indicate simple possessive nouns ■ Recognize inappropriate uses of colons and semicolons

☐ Skills representing increasingly advanced levels of preparation

ACT College Readiness Standards—English (continued)

The Standards describe what students who score in the specified score ranges are *likely* to know and to be able to do.

		Topic Development in Terms of Purpose and Focus	*Organization, Unity, and Coherence*	*Word Choice in Terms of Style, Tone, Clarity, and Economy*
28–32	**Standards**	■ Apply an awareness of the focus and purpose of a fairly involved essay to determine the rhetorical effect and suitability of an existing phrase or sentence, or to determine the need to delete plausible but irrelevant material ■ Add a sentence to accomplish a subtle rhetorical purpose such as to emphasize, to add supporting detail, or to express meaning through connotation	■ Make sophisticated distinctions concerning the logical use of conjunctive adverbs or phrases, particularly when signaling a shift between paragraphs ■ Rearrange sentences to improve the logic and coherence of a complex paragraph ■ Add a sentence to introduce or conclude a fairly complex paragraph	■ Correct redundant material that involves sophisticated vocabulary and sounds acceptable as conversational English (e.g., "an aesthetic viewpoint" versus "the outlook of an aesthetic viewpoint") ■ Correct vague and wordy or clumsy and confusing writing containing sophisticated language
33–36	**Standards**	■ Determine whether a complex essay has accomplished a specific purpose ■ Add a phrase or sentence to accomplish a complex purpose, often expressed in terms of the main focus of the essay	■ Consider the need for introductory sentences or transitions, basing decisions on a thorough understanding of both the logic and rhetorical effect of the paragraph and essay	■ Delete redundant material that involves subtle concepts or that is redundant in terms of the paragraph as a whole

Skills representing increasingly advanced levels of preparation

Sentence Structure and Formation	*Conventions of Usage*	*Conventions of Punctuation*
■ Use sentence-combining techniques, effectively avoiding problematic comma splices, run-on sentences, and sentence fragments, especially in sentences containing compound subjects or verbs ■ Maintain a consistent and logical use of verb tense and pronoun person on the basis of information in the paragraph or essay as a whole	■ Correctly use reflexive pronouns, the possessive pronouns *its* and *your,* and the relative pronouns *who* and *whom* ■ Ensure that a verb agrees with its subject in unusual situations (e.g., when the subject-verb order is inverted or when the subject is an indefinite pronoun)	■ Use commas to set off a nonessential/ nonrestrictive appositive or clause ■ Deal with multiple punctuation problems (e.g., compound sentences containing unnecessary commas and phrases that may or may not be parenthetical) ■ Use an apostrophe to show possession, especially with irregular plural nouns ■ Use a semicolon to indicate a relationship between closely related independent clauses
■ Work comfortably with long sentences and complex clausal relationships within sentences, avoiding weak conjunctions between independent clauses and maintaining parallel structure between clauses	■ Provide idiomatically and contextually appropriate prepositions following verbs in situations involving sophisticated language or ideas ■ Ensure that a verb agrees with its subject when a phrase or clause between the two suggests a different number for the verb	■ Use a colon to introduce an example or an elaboration

ACT College Readiness Standards—Mathematics

The Standards describe what students who score in the specified score ranges are *likely* to know and to be able to do.

		Basic Operations and Applications	*Probability, Statistics, and Data Analysis*	*Numbers: Concepts and Properties*
13–15	**Standards**	■ Perform one-operation computation with whole numbers and decimals ■ Solve problems in one or two steps using whole numbers ■ Perform common conversions (e.g., inches to feet or hours to minutes)	■ Calculate the average of a list of positive whole numbers ■ Perform a single computation using information from a table or chart	■ Recognize equivalent fractions and fractions in lowest terms
16–19	**Standards**	■ Solve routine one-step arithmetic problems (using whole numbers, fractions, and decimals) such as single-step percent ■ Solve some routine two-step arithmetic problems	■ Calculate the average of a list of numbers ■ Calculate the average, given the number of data values and the sum of the data values ■ Read tables and graphs ■ Perform computations on data from tables and graphs ■ Use the relationship between the probability of an event and the probability of its complement	■ Recognize one-digit factors of a number ■ Identify a digit's place value
20–23	**Standards**	■ Solve routine two-step or three-step arithmetic problems involving concepts such as rate and proportion, tax added, percentage off, and computing with a given average	■ Calculate the missing data value, given the average and all data values but one ■ Translate from one representation of data to another (e.g., a bar graph to a circle graph) ■ Determine the probability of a simple event ■ Exhibit knowledge of simple counting techniques	■ Exhibit knowledge of elementary number concepts including rounding, the ordering of decimals, pattern identification, absolute value, primes, and greatest common factor

Essential skills needed by the end of eighth grade Additional skills needed by high school graduation

Expressions, Equations, and Inequalities	*Graphical Representations*	*Properties of Plane Figures*	*Measurement*	*Functions*
■ Exhibit knowledge of basic expressions (e.g., identify an expression for a total as $b + g$) ■ Solve equations in the form $x + a = b$, where a and b are whole numbers or decimals	■ Identify the location of a point with a positive coordinate on the number line		■ Estimate or calculate the length of a line segment based on other lengths given on a geometric figure	
■ Substitute whole numbers for unknown quantities to evaluate expressions ■ Solve one-step equations having integer or decimal answers ■ Combine like terms (e.g., $2x + 5x$)	■ Locate points on the number line and in the first quadrant	■ Exhibit some knowledge of the angles associated with parallel lines	■ Compute the perimeter of polygons when all side lengths are given ■ Compute the area of rectangles when whole number dimensions are given	
■ Evaluate algebraic expressions by substituting integers for unknown quantities ■ Add and subtract simple algebraic expressions ■ Solve routine first-degree equations ■ Perform straightforward word-to-symbol translations ■ Multiply two binomials	■ Locate points in the coordinate plane ■ Comprehend the concept of length on the number line ■ Exhibit knowledge of slope	■ Find the measure of an angle using properties of parallel lines ■ Exhibit knowledge of basic angle properties and special sums of angle measures (e.g., 90°, 180°, and 360°)	■ Compute the area and perimeter of triangles and rectangles in simple problems ■ Use geometric formulas when all necessary information is given	■ Evaluate quadratic functions, expressed in function notation, at integer values

ACT College Readiness Standards—Mathematics (continued)

The Standards describe what students who score in the specified score ranges are *likely* to know and to be able to do.

		Basic Operations and Applications	*Probability, Statistics, and Data Analysis*	*Numbers: Concepts and Properties*
24–27	**Standards**	■ Solve multistep arithmetic problems that involve planning or converting units of measure (e.g., feet per second to miles per hour)	■ Calculate the average, given the frequency counts of all the data values ■ Manipulate data from tables and graphs ■ Compute straightforward probabilities for common situations ■ Use Venn diagrams in counting	■ Find and use the least common multiple ■ Order fractions ■ Work with numerical factors ■ Work with scientific notation ■ Work with squares and square roots of numbers ■ Work problems involving positive integer exponents ■ Work with cubes and cube roots of numbers ■ Determine when an expression is undefined ■ Exhibit some knowledge of the complex numbers
28–32	**Standards**	■ Solve word problems containing several rates, proportions, or percentages	■ Calculate or use a weighted average ■ Interpret and use information from figures, tables, and graphs ■ Apply counting techniques ■ Compute a probability when the event and/or sample space are not given or obvious	■ Apply number properties involving prime factorization ■ Apply number properties involving even/odd numbers and factors/multiples ■ Apply number properties involving positive/negative numbers ■ Apply rules of exponents ■ Multiply two complex numbers

☐ Skills representing increasingly advanced levels of preparation

Expressions, Equations, and Inequalities	*Graphical Representations*	*Properties of Plane Figures*	*Measurement*	*Functions*
■ Solve real-world problems using first-degree equations ■ Write expressions, equations, or inequalities with a single variable for common pre-algebra settings (e.g., rate and distance problems and problems that can be solved by using proportions) ■ Identify solutions to simple quadratic equations ■ Add, subtract, and multiply polynomials ■ Factor simple quadratics (e.g., the difference of squares and perfect square trinomials) ■ Solve first-degree inequalities that do not require reversing the inequality sign	■ Identify the graph of a linear inequality on the number line ■ Determine the slope of a line from points or equations ■ Match linear graphs with their equations ■ Find the midpoint of a line segment	■ Use several angle properties to find an unknown angle measure ■ Recognize Pythagorean triples ■ Use properties of isosceles triangles	■ Compute the area of triangles and rectangles when one or more additional simple steps are required ■ Compute the area and circumference of circles after identifying necessary information ■ Compute the perimeter of simple composite geometric figures with unknown side lengths	■ Evaluate polynomial functions, expressed in function notation, at integer values ■ Express the sine, cosine, and tangent of an angle in a right triangle as a ratio of given side lengths
■ Manipulate expressions and equations ■ Write expressions, equations, and inequalities for common algebra settings ■ Solve linear inequalities that require reversing the inequality sign ■ Solve absolute value equations ■ Solve quadratic equations ■ Find solutions to systems of linear equations	■ Interpret and use information from graphs in the coordinate plane ■ Match number line graphs with solution sets of linear inequalities ■ Use the distance formula ■ Use properties of parallel and perpendicular lines to determine an equation of a line or coordinates of a point ■ Recognize special characteristics of parabolas and circles (e.g., the vertex of a parabola and the center or radius of a circle)	■ Apply properties of 30°-60°-90°, 45°-45°-90°, similar, and congruent triangles ■ Use the Pythagorean theorem	■ Use relationships involving area, perimeter, and volume of geometric figures to compute another measure	■ Evaluate composite functions at integer values ■ Apply basic trigonometric ratios to solve right-triangle problems

ACT College Readiness Standards—Mathematics (continued)

The Standards describe what students who score in the specified score ranges are *likely* to know and to be able to do.

		Basic Operations and Applications	*Probability, Statistics, and Data Analysis*	*Numbers: Concepts and Properties*
33–36	**Standards**	■ Solve complex arithmetic problems involving percent of increase or decrease and problems requiring integration of several concepts from pre-algebra and/or pre-geometry (e.g., comparing percentages or averages, using several ratios, and finding ratios in geometry settings)	■ Distinguish between mean, median, and mode for a list of numbers ■ Analyze and draw conclusions based on information from figures, tables, and graphs ■ Exhibit knowledge of conditional and joint probability	■ Draw conclusions based on number concepts, algebraic properties, and/or relationships between expressions and numbers ■ Exhibit knowledge of logarithms and geometric sequences ■ Apply properties of complex numbers

☐ Skills representing increasingly advanced levels of preparation

Expressions, Equations, and Inequalities	*Graphical Representations*	*Properties of Plane Figures*	*Measurement*	*Functions*
■ Write expressions that require planning and/or manipulating to accurately model a situation ■ Write equations and inequalities that require planning, manipulating, and/or solving ■ Solve simple absolute value inequalities	■ Match number line graphs with solution sets of simple quadratic inequalities ■ Identify characteristics of graphs based on a set of conditions or on a general equation such as $y = ax^2 + c$ ■ Solve problems integrating multiple algebraic and/or geometric concepts ■ Analyze and draw conclusions based on information from graphs in the coordinate plane	■ Draw conclusions based on a set of conditions ■ Solve multistep geometry problems that involve integrating concepts, planning, visualization, and/or making connections with other content areas ■ Use relationships among angles, arcs, and distances in a circle	■ Use scale factors to determine the magnitude of a size change ■ Compute the area of composite geometric figures when planning or visualization is required	■ Write an expression for the composite of two simple functions ■ Use trigonometric concepts and basic identities to solve problems ■ Exhibit knowledge of unit circle trigonometry ■ Match graphs of basic trigonometric functions with their equations

ACT College Readiness Standards—Reading

The Standards describe what students who score in the specified score ranges are *likely* to know and to be able to do.

		Main Ideas and Author's Approach	*Supporting Details*
13–15	**Standards**	■ Recognize a clear intent of an author or narrator in uncomplicated literary narratives	■ Locate basic facts (e.g., names, dates, events) clearly stated in a passage
16–19	**Standards**	■ Identify a clear main idea or purpose of straightforward paragraphs in uncomplicated literary narratives	■ Locate simple details at the sentence and paragraph level in uncomplicated passages ■ Recognize a clear function of a part of an uncomplicated passage
20–23	**Standards**	■ Infer the main idea or purpose of straightforward paragraphs in uncomplicated literary narratives ■ Understand the overall approach taken by an author or narrator (e.g., point of view, kinds of evidence used) in uncomplicated passages	■ Locate important details in uncomplicated passages ■ Make simple inferences about how details are used in passages
24–27	**Standards**	■ Identify a clear main idea or purpose of any paragraph or paragraphs in uncomplicated passages ■ Infer the main idea or purpose of straightforward paragraphs in more challenging passages ■ Summarize basic events and ideas in more challenging passages ■ Understand the overall approach taken by an author or narrator (e.g., point of view, kinds of evidence used) in more challenging passages	■ Locate important details in more challenging passages ■ Locate and interpret minor or subtly stated details in uncomplicated passages ■ Discern which details, though they may appear in different sections throughout a passage, support important points in more challenging passages

Descriptions of the ACT Reading Passages

Uncomplicated Literary Narratives refers to excerpts from essays, short stories, and novels that tend to use simple language and structure, have a clear purpose and a familiar style, present straightforward interactions between characters, and employ only a limited number of literary devices such as metaphor, simile, or hyperbole.

More Challenging Literary Narratives refers to excerpts from essays, short stories, and novels that tend to make moderate use of figurative language, have a more intricate structure and messages conveyed with some subtlety, and may feature somewhat complex interactions between characters.

Complex Literary Narratives refers to excerpts from essays, short stories, and novels that tend to make generous use of ambiguous language and literary devices, feature complex and subtle interactions between characters, often contain challenging context-dependent vocabulary, and typically contain messages and/or meanings that are not explicit but are embedded in the passage.

Essential skills needed by the end of eighth grade Additional skills needed by high school graduation

Sequential, Comparative, and Cause-Effect Relationships	*Meanings of Words*	*Generalizations and Conclusions*
■ Determine when (e.g., first, last, before, after) or if an event occurred in uncomplicated passages ■ Recognize clear cause-effect relationships described within a single sentence in a passage	■ Understand the implication of a familiar word or phrase and of simple descriptive language	■ Draw simple generalizations and conclusions about the main characters in uncomplicated literary narratives
■ Identify relationships between main characters in uncomplicated literary narratives ■ Recognize clear cause-effect relationships within a single paragraph in uncomplicated literary narratives	■ Use context to understand basic figurative language	■ Draw simple generalizations and conclusions about people, ideas, and so on in uncomplicated passages
■ Order simple sequences of events in uncomplicated literary narratives ■ Identify clear relationships between people, ideas, and so on in uncomplicated passages ■ Identify clear cause-effect relationships in uncomplicated passages	■ Use context to determine the appropriate meaning of some figurative and nonfigurative words, phrases, and statements in uncomplicated passages	■ Draw generalizations and conclusions about people, ideas, and so on in uncomplicated passages ■ Draw simple generalizations and conclusions using details that support the main points of more challenging passages
■ Order sequences of events in uncomplicated passages ■ Understand relationships between people, ideas, and so on in uncomplicated passages ■ Identify clear relationships between characters, ideas, and so on in more challenging literary narratives ■ Understand implied or subtly stated cause-effect relationships in uncomplicated passages ■ Identify clear cause-effect relationships in more challenging passages	■ Use context to determine the appropriate meaning of virtually any word, phrase, or statement in uncomplicated passages ■ Use context to determine the appropriate meaning of some figurative and nonfigurative words, phrases, and statements in more challenging passages	■ Draw subtle generalizations and conclusions about characters, ideas, and so on in uncomplicated literary narratives ■ Draw generalizations and conclusions about people, ideas, and so on in more challenging passages

Uncomplicated Informational Passages refers to materials that tend to contain a limited amount of data, address basic concepts using familiar language and conventional organizational patterns, have a clear purpose, and are written to be accessible.

More Challenging Informational Passages refers to materials that tend to present concepts that are not always stated explicitly and that are accompanied or illustrated by more—and more detailed—supporting data, include some difficult context-dependent words, and are written in a somewhat more demanding and less accessible style.

Complex Informational Passages refers to materials that tend to include a sizable amount of data, present difficult concepts that are embedded (not explicit) in the text, use demanding words and phrases whose meaning must be determined from context, and are likely to include intricate explanations of processes or events.

☐ Skills representing increasingly advanced levels of preparation

ACT College Readiness Standards—Reading (continued)

The Standards describe what students who score in the specified score ranges are *likely* to know and to be able to do.

		Main Ideas and Author's Approach	*Supporting Details*
28–32	**Standards**	■ Infer the main idea or purpose of more challenging passages or their paragraphs ■ Summarize events and ideas in virtually any passage ■ Understand the overall approach taken by an author or narrator (e.g., point of view, kinds of evidence used) in virtually any passage	■ Locate and interpret minor or subtly stated details in more challenging passages ■ Use details from different sections of some complex informational passages to support a specific point or argument
33–36	**Standards**	■ Identify clear main ideas or purposes of complex passages or their paragraphs	■ Locate and interpret details in complex passages ■ Understand the function of a part of a passage when the function is subtle or complex

☐ Skills representing increasingly advanced levels of preparation

Sequential, Comparative, and Cause-Effect Relationships	*Meanings of Words*	*Generalizations and Conclusions*
■ Order sequences of events in more challenging passages ■ Understand the dynamics between people, ideas, and so on in more challenging passages ■ Understand implied or subtly stated cause-effect relationships in more challenging passages	■ Determine the appropriate meaning of words, phrases, or statements from figurative or somewhat technical contexts	■ Use information from one or more sections of a more challenging passage to draw generalizations and conclusions about people, ideas, and so on
■ Order sequences of events in complex passages ■ Understand the subtleties in relationships between people, ideas, and so on in virtually any passage ■ Understand implied, subtle, or complex cause-effect relationships in virtually any passage	■ Determine, even when the language is richly figurative and the vocabulary is difficult, the appropriate meaning of context-dependent words, phrases, or statements in virtually any passage	■ Draw complex or subtle generalizations and conclusions about people, ideas, and so on, often by synthesizing information from different portions of the passage ■ Understand and generalize about portions of a complex literary narrative

ACT College Readiness Standards—Science

The Standards describe what students who score in the specified score ranges are *likely* to know and to be able to do.

		Interpretation of Data	*Scientific Investigation*	*Evaluation of Models, Inferences, and Experimental Results*
13–15	**Standards**	■ Select a single piece of data (numerical or nonnumerical) from a simple data presentation (e.g., a table or graph with two or three variables; a food web diagram) ■ Identify basic features of a table, graph, or diagram (e.g., headings, units of measurement, axis labels)		
16–19	**Standards**	■ Select two or more pieces of data from a simple data presentation ■ Understand basic scientific terminology ■ Find basic information in a brief body of text ■ Determine how the value of one variable changes as the value of another variable changes in a simple data presentation	■ Understand the methods and tools used in a simple experiment	
20–23	**Standards**	■ Select data from a complex data presentation (e.g., a table or graph with more than three variables; a phase diagram) ■ Compare or combine data from a simple data presentation (e.g., order or sum data from a table) ■ Translate information into a table, graph, or diagram	■ Understand the methods and tools used in a moderately complex experiment ■ Understand a simple experimental design ■ Identify a control in an experiment ■ Identify similarities and differences between experiments	■ Select a simple hypothesis, prediction, or conclusion that is supported by a data presentation or a model ■ Identify key issues or assumptions in a model

Science College Readiness Standards are measured in the context of science topics students encounter in science courses. These topics may include:

Life Science/Biology	Physical Science/Chemistry, Physics	Earth & Space Science
• Animal behavior • Animal development and growth • Body systems • Cell structure and processes • Ecology • Evolution • Genetics • Homeostasis • Life cycles • Molecular basis of heredity • Origin of life • Photosynthesis • Plant development, growth, structure • Populations • Taxonomy	• Atomic structure • Chemical bonding, equations, nomenclature, reactions • Electrical circuits • Elements, compounds, mixtures • Force and motions • Gravitation • Heat and work • Kinetic and potential energy • Magnetism • Momentum • The Periodic Table • Properties of solutions • Sound and light • States, classes, and properties of matter • Waves	• Earthquakes and volcanoes • Earth's atmosphere • Earth's resources • Fossils and geological time • Geochemical cycles • Groundwater • Lakes, rivers, oceans • Mass movements • Plate tectonics • Rocks, minerals • Solar system • Stars, galaxies, and the universe • Water cycle • Weather and climate • Weathering and erosion

Essential skills needed by the end of eighth grade

ACT College Readiness Standards—Science (continued)

The Standards describe what students who score in the specified score ranges are *likely* to know and to be able to do.

		Interpretation of Data	*Scientific Investigation*	*Evaluation of Models, Inferences, and Experimental Results*
24–27	**Standards**	■ Compare or combine data from two or more simple data presentations (e.g., categorize data from a table using a scale from another table) ■ Compare or combine data from a complex data presentation ■ Interpolate between data points in a table or graph ■ Determine how the value of one variable changes as the value of another variable changes in a complex data presentation ■ Identify and/or use a simple (e.g., linear) mathematical relationship between data ■ Analyze given information when presented with new, simple information	■ Understand the methods and tools used in a complex experiment ■ Understand a complex experimental design ■ Predict the results of an additional trial or measurement in an experiment ■ Determine the experimental conditions that would produce specified results	■ Select a simple hypothesis, prediction, or conclusion that is supported by two or more data presentations or models ■ Determine whether given information supports or contradicts a simple hypothesis or conclusion, and why ■ Identify strengths and weaknesses in one or more models ■ Identify similarities and differences between models ■ Determine which model(s) is (are) supported or weakened by new information ■ Select a data presentation or a model that supports or contradicts a hypothesis, prediction, or conclusion
28–32	**Standards**	■ Compare or combine data from a simple data presentation with data from a complex data presentation ■ Identify and/or use a complex (e.g., nonlinear) mathematical relationship between data ■ Extrapolate from data points in a table or graph	■ Determine the hypothesis for an experiment ■ Identify an alternate method for testing a hypothesis	■ Select a complex hypothesis, prediction, or conclusion that is supported by a data presentation or model ■ Determine whether new information supports or weakens a model, and why ■ Use new information to make a prediction based on a model
33–36	**Standards**	■ Compare or combine data from two or more complex data presentations ■ Analyze given information when presented with new, complex information	■ Understand precision and accuracy issues ■ Predict how modifying the design or methods of an experiment will affect results ■ Identify an additional trial or experiment that could be performed to enhance or evaluate experimental results	■ Select a complex hypothesis, prediction, or conclusion that is supported by two or more data presentations or models ■ Determine whether given information supports or contradicts a complex hypothesis or conclusion, and why

Additional skills needed by high school graduation Skills representing increasingly advanced levels of preparation

ACT's College Readiness Benchmarks

We work with colleges to help them develop guidelines that place students in courses that are appropriate for their level of achievement as measured by the ACT. In doing this work, we have gathered course grade and test score data from a large number of first-year students and across a wide range of postsecondary institutions. These data provide an overall measure of what it takes to be successful in a standard first-year college course. Data from 98 institutions and more than 90,000 students were used to establish the ACT College Readiness Benchmarks, which are median course placement scores that are directly reflective of student success in a college course.

Success here is defined as approximately a 75 percent chance that a student will earn a grade of C or better, or a 50 percent chance that a student will earn a grade of B or better. The courses are the ones most commonly taken by first-year college students in the areas of English, mathematics, social sciences, and natural sciences, namely: English Composition; College Algebra; History, Psychology, Sociology, Political Science, and Economics; and Biology, respectively. The ACT scores established as College Readiness Benchmarks are 18 on the English Test, 22 on the Mathematics Test, 21 on the Reading Test, and 24 on the Science Test.

ACT's College Readiness Benchmarks

Test	EXPLORE	PLAN	The ACT
English	13	15	18
Mathematics	17	19	22
Reading	15	17	21
Science	20	21	24

The College Readiness Benchmarks were based upon a sample of postsecondary institutions from across the U.S. The data from these institutions were weighted to reflect postsecondary institutions nationally. The Benchmarks are median course placement values for these institutions and as such represent a *typical* set of expectations. We will work with individual postsecondary institutions, or groups of institutions within a state, to conduct validation studies to establish local benchmarks that take specific institutional and student characteristics into account.

We have also established scores on EXPLORE and PLAN that correspond to the College Readiness Benchmarks for the ACT. These scores indicate, based on their performance on EXPLORE (grades 8 and 9) and PLAN (grade 10), whether students are on target to be ready for college-level work when they graduate from high school. In EXPLORE, these scores are 13 on the English Test, 17 on the Mathematics Test, 15 on the Reading Test, and 20 on the Science Test; in PLAN, the scores are 15 on the English Test, 19 on the Mathematics Test, 17 on the Reading Test, and 21 on the Science Test.

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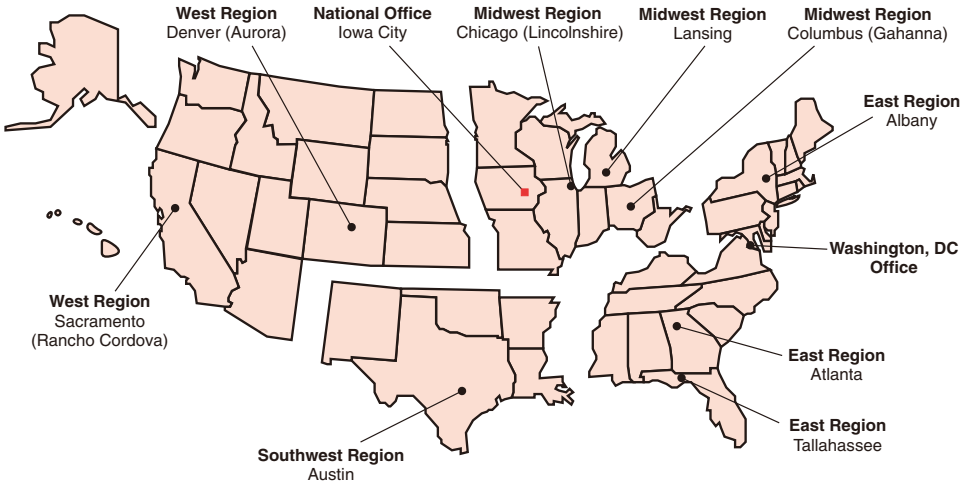

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