ACT's College Readiness System

Meeting the Challenge of a Changing World

ACT®

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The Challenge: A Changing World

The United States faces the challenge of adapting to the demands of a globalized economy. Jobs have become more specialized and more driven by technology, requiring higher levels of education and training–especially in mathematics and science–than did many of the jobs available to high school graduates of the past.

Are we ready as a nation to meet the demands of 21st-century jobs?

Not yet.

To enter the workforce with the math, science, and problem-solving skills they need to succeed in the knowledge economy, young Americans must be able to succeed in postsecondary education. Postsecondary education and training lead to better jobs and to greater career options. Without education and training beyond high school, it is difficult to earn a self-sufficient living or to support a family. Until more U.S. students are able to succeed in postsecondary education, the nation's children, for the first time in generations, could face poorer prospects than those of their parents and grandparents.

But it all starts with P–12. Students must graduate from high school ***ready*** for the demands of postsecondary education. And rigorous academic preparation during the P–12 years is essential to students' college readiness.

College Readiness Equals Career Readiness

ACT defines college readiness as the level of achievement a student needs to be ready to enroll and succeed–without remediation–in credit-bearing first-year postsecondary courses. And by postsecondary we mean primarily two-year or four-year institutions, trade schools, and technical schools.

Today, however, workplace readiness demands the same level of knowledge and skills as college readiness. While not every student plans to attend college after high school, many of the jobs that can support a family require knowledge and skills comparable to those expected of the first-year college student (ACT, 2006c).

College readiness, therefore, is now no longer a privilege of the few. It is a right of all students that P–12 must fulfill. If we define readiness for work as pertaining to jobs that (1) require at least a high school diploma, (2) pay a salary above the poverty line for a family of four, (3) provide the potential for career advancement, and (4) are projected to grow in the next five to ten years, then our high school graduates ***must*** have access to courses that give them a sound foundation of academic skills to prepare them to succeed in workforce training programs. Improved college readiness will provide a better foundation of knowledge and skills that will allow our future workers to adapt to the changing requirements of a more technologically sophisticated working world.

The Facts: Our Students Are Not Ready

International comparisons of academic achievement show U.S. students 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), United States eighth-graders rank 15th (of 45) in average mathematics score and 9th in average science score (Gonzales et al., 2004).
- According to the most recent results of the PISA (Programme for International Student Assessment), United States 15-year-olds rank 28th (of 40) in average mathematics performance, 18th in average reading performance, and 22nd in average science performance (Organisation for Economic Co-operation and Development, 2004).

The evidence is overwhelming: too few U.S. high school graduates are prepared for either their first year of college or for workforce training. Here are just a few of the sobering facts about the state of college readiness, based on the 1.3 million 2007 high school graduates who took the ACT® test (ACT, 2007a):

- Only 1 in 4 ACT-tested 2007 high school graduates are prepared for entry-level college courses in English composition, algebra, social science, and biology.
- One in 4 ACT-tested 2007 high school graduates are not prepared for college coursework in ***any*** of the four subject areas.

Students currently in the education pipeline are not doing much better. The 2007 data from ACT's early college readiness programs, EXPLORE® and PLAN® (ACT, 2007a), show that:

- Only 1 in 10 students in 8th grade are on target to be ready for entry-level college courses in English composition, algebra, social science, and biology.
- Only 1 in 5 students in 10th grade are on target to be ready for entry-level college courses in these four subject areas.

High Schools Redesigned: State Policy Actions to Help Prepare Every Student for College and Work

In today's changing world, the goal of high school should be clear: to prepare graduates for life after high school by teaching them the skills and knowledge that are ***essential to college and workforce training readiness***. Less obvious is how best to meet this goal.

Based on its decades of research into student academic achievement and educational success, ACT offers the following six action steps that states should take to maximize their students' chances of graduating from high school ready for the challenges of the future. These six steps are presented below, along with discussions of the research findings that led ACT to make each recommendation.

1. States should adopt fewer–but essential–college- and career-readiness standards as their new high school graduation standards.

States should adopt empirical college readiness standards as the cornerstone of their state standards. Then states can add additional state-specific standards as necessary to supplement the essential college readiness standards. States should then map these standards downward through the P–12 grades. It is only when college and workforce training readiness standards pervade P–16 that we have a fully aligned set of standards.

What ACT Research Tells Us:

Results of the most recent ACT National Curriculum Survey® (ACT, 2007b) indicate that what postsecondary instructors expect entering college students to know and be able to do is far more targeted and specific than what high school teachers view as important. This is consistent with recent evaluations of state standards, raising concerns that some states require too many standards to be taught and measured, rather than becoming more selective in identifying the most important state standards for students to attain. The long lists of content topics and skills defy teachers' efforts to teach them in detail within the confines of a single school year. It may be that the extensive demands of state standards are forcing high school teachers to treat *all* content topics as important, sacrificing depth for breadth.

In light of this finding, it is clear that, rather than trying to define all content and skills covered by the high school curriculum, state standards should instead focus on communicating the essential knowledge and skills needed for postsecondary education. It is less important for state standards to reflect all of what students are exposed to in high school and more important to focus on the essential knowledge and skills for college readiness.

The ACT College Readiness Standards™ (see pp. 18–24) are precise descriptions of the essential skills and knowledge that students need to become ready for college, beginning in grade 8 and continuing through grade 12. The College Readiness Standards are informed by the ACT National Curriculum Survey.

What is the ACT National Curriculum Survey?

The ACT National Curriculum Survey is a one-of-a-kind nationwide survey of educational practices and expectations conducted by ACT every three to four years. This survey tells us what postsecondary institutions believe is important and necessary for their entering students to know and what middle and high school teachers are teaching. It can therefore identify the gap between postsecondary expectations and high school practice. ACT surveys thousands of middle school, high school, and postsecondary teachers in English/writing, reading (including English language arts and social studies teachers), mathematics, and science for the purpose of determining what skills and knowledge are currently being taught that are considered important for college readiness from grade 7 through the first year of college.

2. States should adopt a rigorous core curriculum for *all* high school graduates, whether they are bound for college or work.

States should require all students to take a challenging core preparatory curriculum as a prerequisite for a high school diploma—a curriculum that prepares them for postsecondary education and workforce training. Rather than have students opt into such a curriculum, it should be the default option. This communicates a clear expectation for what courses students should take and removes many of the obstacles that students encounter when seeking access to these courses.

What ACT Research Tells Us:

While not every student plans to attend college after high school, many of the jobs that can support a family and offer the potential for career advancement require a level of knowledge and skills that is comparable to the level expected of the first-year college student. ACT (2006c) provided the first empirical evidence that *all* high school students need to be educated to a comparable level of readiness in reading and mathematics, regardless of whether they plan to enter college or a workforce training program after graduation.

This conclusion is supported by commonalities seen in the specific knowledge and skills students need to be ready for college and workforce training programs, even though these skills are often taught and assessed in different contexts. All of these skills can be acquired through rigorous high school core courses.

What are these courses? The ACT Critical Core Curriculum is defined as at least:

- 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 research shows that students who take the ACT-recommended core curriculum are more likely to be ready for college when they graduate from high school than students who do not take this curriculum (ACT, 2006a). Further, ACT research demonstrates the substantial value added to students' college readiness when they take mathematics courses such as Algebra II and beyond, or science courses such as Chemistry and Physics (ACT, 2004).

3. States must define "how good is good enough" for college and career readiness.

States should establish performance targets for communicating students' readiness for postsecondary education to the students and their teachers and parents.

What ACT Research Tells Us:

ACT has developed its College Readiness Benchmarks (2005) to identify students who are prepared for college-level

coursework. The ACT Benchmarks are minimum scores on the ACT English, Mathematics, Reading, and Science Tests that reflect at least a 50 percent chance of achieving a B or higher grade, or at least a 75 percent chance of a C or higher grade, in entry-level, credit-bearing college English Composition, College Algebra, social science, and Biology courses, respectively. (See table, p. 7.)

ACT research (in press) demonstrates that, compared to students who do not meet the Benchmarks, students who meet the Benchmarks are more likely to:

- persist to the second year at the same institution,
- achieve a grade of B or higher in first-year college courses,
- achieve a first-year college grade point average (GPA) of 2.5 or higher,
- progress toward a college degree, and
- complete a college degree.

The ACT College Readiness Benchmarks also provide important cross-disciplinary information about students' readiness for postsecondary education and workforce training. Reading, for example, is a critical skill that influences college readiness in all subject areas. Students who meet the ACT College Readiness Benchmark for Reading are substantially more likely to meet the College Readiness Benchmarks for English, Mathematics, and Science. Conversely, students who do not meet the Reading Benchmark are substantially less likely to meet the other three Benchmarks.

4. States should strengthen the rigor of their courses.

States should ensure that high school coursework be of sufficient rigor to prepare their graduates for postsecondary education and workforce training. States should also train teachers—perhaps the most critical element in preparing students for life after high school—in standards-based education so that they will be clear about what students need to know to be ready for college.

What ACT Research Tells Us:

While taking the right number of courses is certainly better than not, it is no longer enough to guarantee that all students will graduate ready for life after high school. Nor are monitoring students' college readiness and making necessary interventions sufficient to solve the college readiness problem. Research shows that the academic quality and intensity of the high school curriculum is a key determinant of success in postsecondary education (Adelman, 2006).

ACT research (2007c) indicates that even when students take substantial numbers of additional courses, no more than three-fourths of them are ready for first-year college coursework in mathematics, social science, or natural science. Only in English does the percentage of students who are ready for college-level work after taking additional courses in high school exceed 75 percent.

Why should so many students who take a core curriculum in high school be unprepared for the challenges of first-year college coursework? Why should it be necessary for students to take additional courses beyond the core in order to prepare for credit-bearing first-year college courses? And why should so many of even these students still graduate unprepared? Perhaps the underlying reason is that high school core courses lack rigor and are simply not focused on the essential outcomes that postsecondary institutions want their entering students to know and be able to do. Is it not reasonable to expect that students who satisfactorily complete a core curriculum be ready for college?

Ironically, however, many students are receiving high grades in their high school courses, leading them to believe they are ready for college. Are course grades giving students and their parents mixed messages about college readiness?

Nearly half of ACT-tested 2005 high school graduates who earned a grade of A or B in high school Algebra II did not meet the ACT College Readiness Benchmark for Mathematics, and more than half of the graduates who earned a grade of A or B in high school Physics did not meet the ACT College Readiness Benchmark for Science (ACT, 2007c). How can 43 percent of the students who received an A or B in Algebra II not be ready for College Algebra? Whether as a result of grade inflation or a lack of challenging course content, it is clear that course grades are not accurately reflecting what is needed to meet the challenges of a college education. It is time to define essential course outcomes so that teachers can teach to these outcomes and student grades can more accurately reflect how well students are learning the knowledge and skills that are necessary for college readiness.

Schools can achieve high levels of college readiness by reinforcing high expectations, focusing on clear standards and skills, providing high-quality curricula and instruction, and offering student support (ACT & The Education Trust, 2004). Specifically, high school courses that succeed at preparing students for college provide students with four crucial resources:

- college-oriented content in the courses,
- qualified and experienced teachers,
- teaching that is flexible and responsive to students, and
- extra student support when needed.

5. States should begin monitoring early to make sure younger students are on target to be ready for college and career.

States should monitor college readiness beginning in at least the eighth grade so that student progress can be measured reliably over time, and so that students who need academic interventions can be identified early before it is too late to get them back on target for college readiness.

What ACT Research Tells Us:

Effective use of EXPLORE, PLAN, and the ACT involves using scores to identify students' strengths and weaknesses, help

guide students, and inform curriculum decisions. Initially lower-scoring students attending schools who use EXPLORE, PLAN, and the ACT effectively experience greater-than-expected academic growth. More important, this growth is most pronounced between eighth and tenth grades–the early years of high school, when students who perform well begin to establish themselves on the path to college and workforce training readiness. Schools that use EXPLORE, PLAN, and the ACT effectively, therefore, are likely to help those students who need help most.

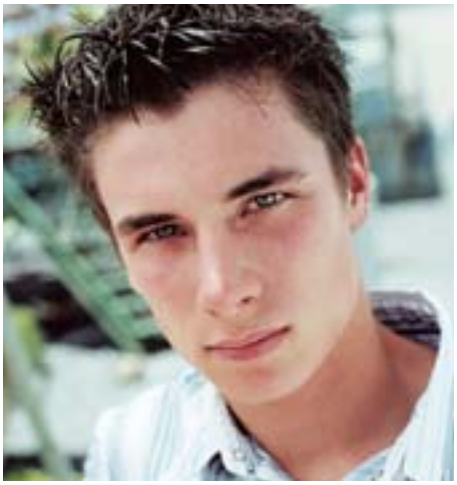
Students who participate in EXPLORE, PLAN, and the ACT are more likely to be ready for college than those who do not participate (ACT, 2006b). For example, compared to students not participating in both EXPLORE and PLAN, students who participate in both programs increase their odds of meeting the ACT College Readiness Benchmarks by anywhere from 24 to 44 percent.

In addition to the College Readiness Benchmarks for the ACT, ACT has also developed College Readiness Benchmarks for EXPLORE and PLAN to identify students in grades 8 and 10, respectively, who are on target to be ready for college by the time they graduate from high school. Students who meet the EXPLORE and PLAN College Readiness Benchmarks have a very high chance of meeting the College Readiness Benchmarks for the ACT and of being ready for entry-level college courses by the time they graduate from high school (ACT, 2006b):

- 89 percent of students who meet both the EXPLORE and PLAN English Benchmarks are likely to be prepared for college English Composition by the time they graduate from high school.
- 85 percent of students who meet both the EXPLORE and PLAN Mathematics Benchmarks are likely to be prepared for College Algebra by the time they graduate from high school.
- 76 percent of students who meet both the EXPLORE and PLAN Reading Benchmarks are likely to be prepared for college social sciences courses by the time they graduate from high school.
- 82 percent of students who meet both the EXPLORE and PLAN Science Benchmarks are likely to be prepared for college Biology by the time they graduate from high school.

EXPLORE, PLAN, and the ACT

The ACT EXPLORE program, used in grade 8, provides baseline information on the academic preparation of students that can be used to plan high school coursework. The ACT PLAN program, 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 workforce training programs after high school.



ACT's College Readiness Benchmark Scores

Test	College Course	EXPLORE	PLAN	ACT
English	English Composition	13	15	18
Mathematics	College Algebra	17	19	22
Reading	Social Science	15	17	21
Science	College Biology	20	21	24

6. States need to establish longitudinal P–16 data systems.

States should provide educators with the tools to make good use of all kinds of data in the classroom and in instructional planning. Data can help teachers and administrators learn how to interpret information gathered in the process of monitoring students' college readiness and, more important, how to use this information in making critical educational decisions.

What ACT Research Tells Us:

ACT's research (2006b) has shown repeatedly that students benefit from participating in a longitudinal college readiness system that includes EXPLORE, PLAN, and the ACT. Data from this system show that using these programs:

- increases educational achievement,
- encourages students to take more college-preparatory courses in high school,
- increases students' college readiness,
- promotes educational and career planning,
- promotes college readiness of underrepresented minority students, and
- promotes educational achievement in college, college enrollment, and persistence in college.

Moreover, more states are providing feedback reports from colleges to high schools that examine how well prepared each high school's graduates were for college. These reports are being used to strengthen high school curricula.

QualityCore™

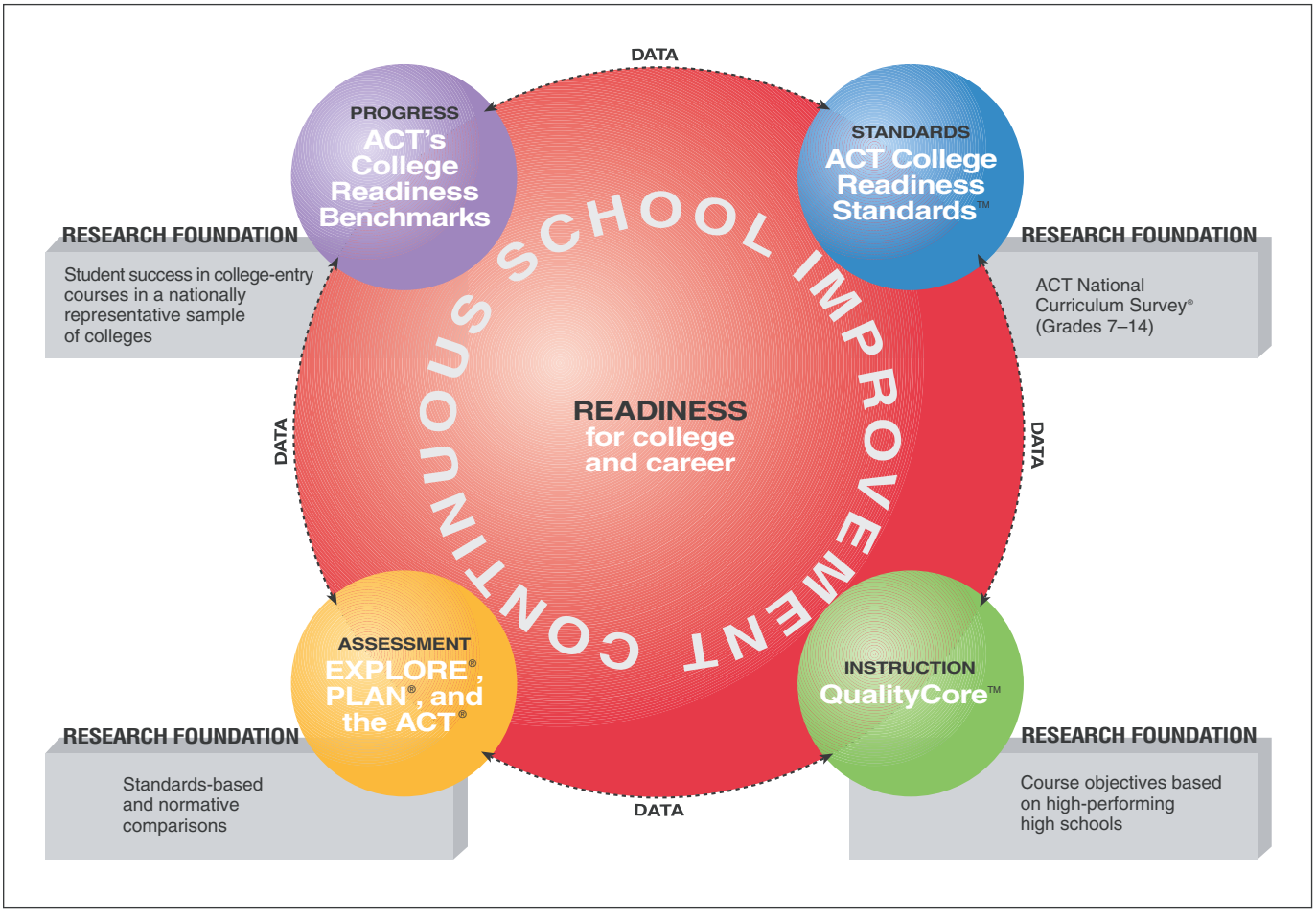
The ACT QualityCore program is designed to invigorate the watered-down curriculum found in too many of our high schools today. QualityCore improves the quality of high school core preparatory courses by helping teachers learn how to teach the essential skills that students need to learn in each core course to become ready for college. QualityCore also documents and verifies the rigor of core course content.

ACT's College Readiness System

ACT's *College Readiness System* is intended to help states implement the policy actions necessary to help prepare every student for college and work. This system is a fully aligned, research-based solution.

Our College Readiness Standards and College Readiness Benchmarks 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 workforce training after high school.

ACT's College Readiness System



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. These assessments allow states to monitor students' college readiness beginning in eighth grade so that necessary interventions can be made.

QualityCore, the instructional improvement component of ACT's College Readiness System, offers rigorous model high school courses designed to prepare all students for college, 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 are for college. Such feedback is an important element in the high school improvement process. In turn, strengthening high school curricula helps states meet their ultimate obligation to high school graduates: maximizing their success in college and workforce training so that they are prepared to meet the challenges of a changing world.

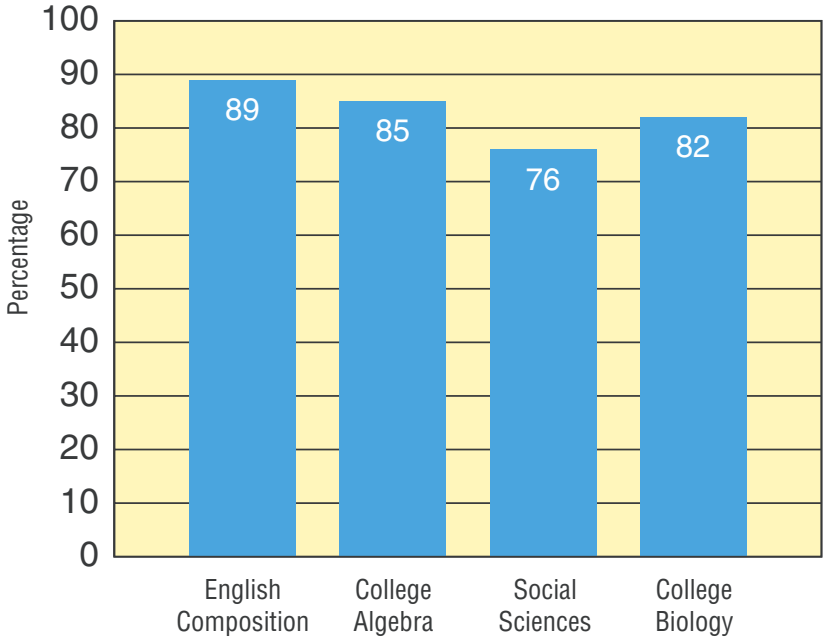
Results of ACT's College Readiness System

In its nearly half-century existence as a not-for-profit organization dedicated to helping students meet their educational goals, ACT has amassed a wealth of data showing the many benefits of its programs and services. Following is a summary of the benefits offered by the three assessment components of ACT's College Readiness System: EXPLORE, PLAN, and the ACT.

EXPLORE and PLAN

- States that have adopted EXPLORE, PLAN, or both EXPLORE and PLAN statewide have experienced
  - Higher average ACT Composite and subject area scores
  - Increased percentages of students meeting ACT's College Readiness Benchmarks
  - Increased percentages of students meeting statewide minimum ACT scores for admissions and/or course placement
- Students who participate in EXPLORE and PLAN have higher college aspirations (twice as likely to consider college or graduate school) and are more certain of those aspirations than students who do not participate (30 percent more likely to be certain).
- Students who meet the EXPLORE and PLAN College Readiness Benchmarks have a very high chance of meeting the College Readiness Benchmarks on the ACT and of being ready for entry-level college courses by the time they graduate from high school.

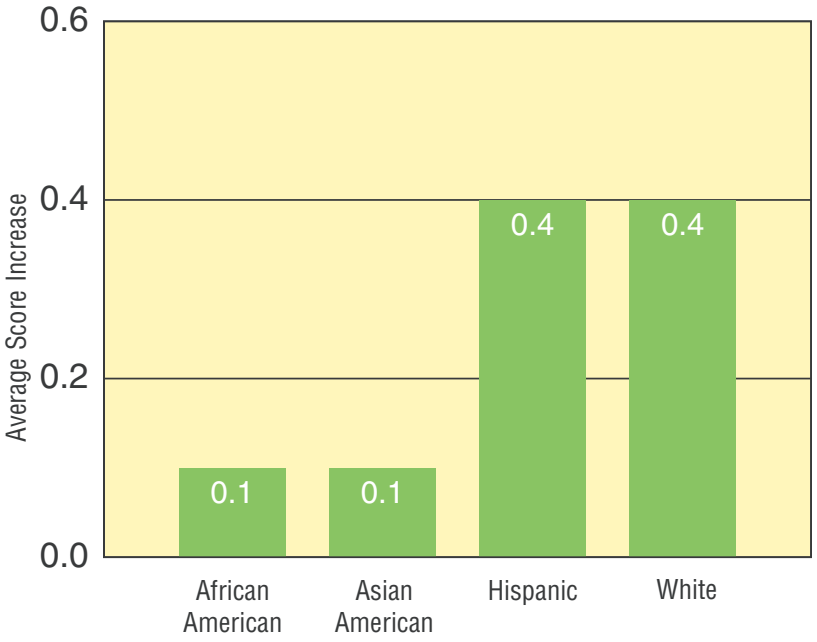
Percentage of students meeting EXPLORE and PLAN Benchmarks who are ready for college by high school graduation



Based on 237,794 ACT-tested graduates from 2002, 2003, and 2004 who had also taken EXPLORE in grade 8 and PLAN in grade 10.

- Schools that use PLAN achieve larger gains over time in average ACT scores than do schools that do not use PLAN.
- In schools that use PLAN consistently, average ACT Composite scores of students of all racial/ethnic backgrounds increase over time more than they do in schools not using PLAN.

Increase over time in schools' average ACT Composite score associated with participation in PLAN



Based on average ACT scores before and after PLAN implementation for 1,145 schools that used PLAN consistently between 2000 and 2003 (at a minimum) and 1,565 schools that had not used PLAN at all as of 2003.

- Students who participate in both PLAN and the ACT
  - Achieve higher grades in college than students who participate only in the ACT
  - Are more likely to enroll in college and re-enroll in the same college their second year than students who participate only in the ACT

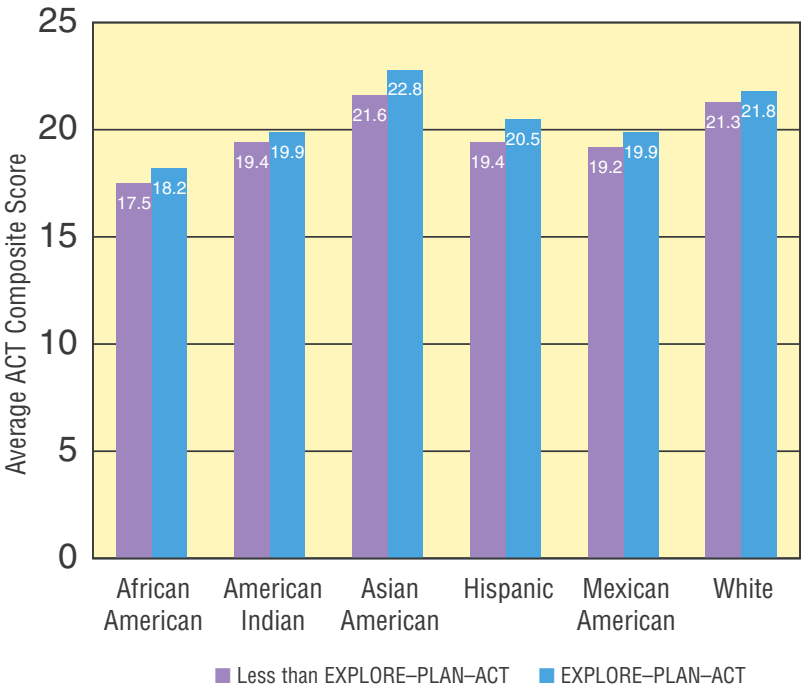
The ACT

- States that have adopted the ACT statewide have experienced
  - Increases in average ACT Composite and subject area scores
  - Increased percentages of students taking the core curriculum in high school–while at the same time the corresponding percentage of ACT-tested high school students nationwide taking the core curriculum decreased
  - Increased percentages of students meeting ACT's College Readiness Benchmarks
  - Increased percentages of students enrolling in college the fall following high school graduation

EXPLORE, PLAN, and the ACT

- Students who attend schools that use EXPLORE, PLAN, and the ACT for educational planning and guidance are more likely to attain higher scores on PLAN and the ACT than students attending schools that do not use all three assessments (up to 1.0 score point higher).
- Students who participate in EXPLORE, PLAN, and the ACT are more likely to be ready for college than those who do not participate in all three assessments (up to 76 percent more likely to meet a given ACT College Readiness Benchmark).
- Students of all racial/ethnic backgrounds who participate in EXPLORE, PLAN, and the ACT attain higher scores on the ACT than similar students who do not participate in all three assessments, regardless of the high school they attend (up to 1.2 score points higher).

Average ACT Composite scores for racial/ethnic group members who do and do not participate in EXPLORE, PLAN, and the ACT



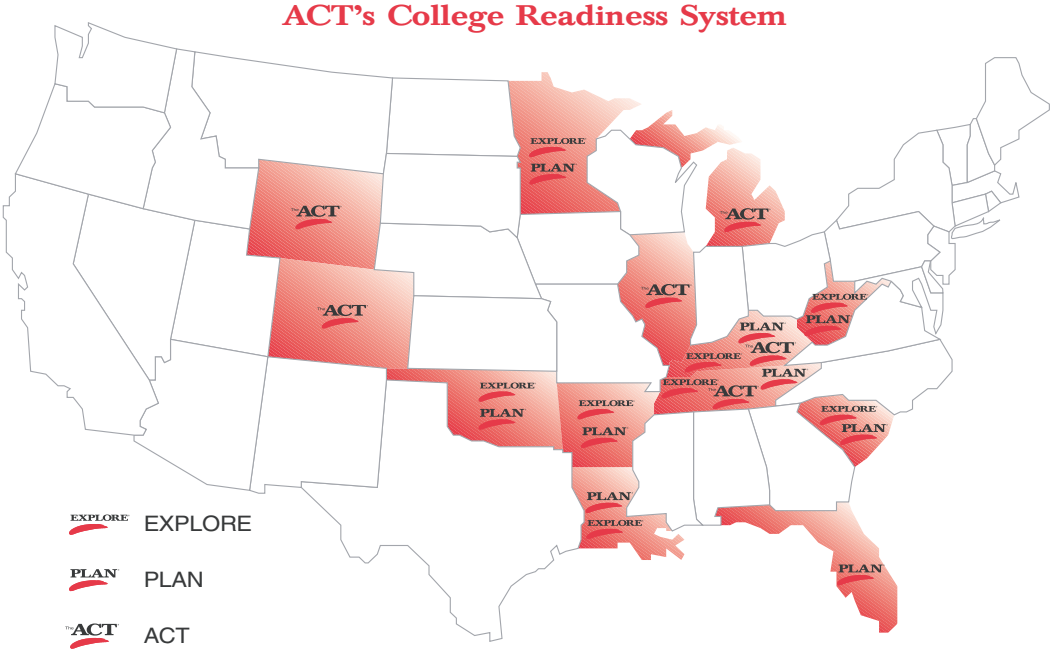
Based on comparisons of 237,794 ACT-tested graduates from 2002, 2003, and 2004 who had also taken EXPLORE in grade 8 and PLAN in grade 10 to 3,036,903 ACT-tested graduates from 2002, 2003, and 2004 who had not previously taken both EXPLORE and PLAN.

EXPLORE, PLAN, and the ACT are designed to help students plan for further education and explore career options based on their own skills, interests, and aspirations. And the assessments are empirically proven to work. Each program gives high schools and districts a way to get students engaged in planning their own futures. When students know what colleges expect, in terms they can understand, they can use their own information to help make a smooth transition to postsecondary education or training.

Which states have adopted elements of ACT's College Readiness System statewide?

A growing number of states are recognizing the importance of curricular alignment and assessment in ensuring the college readiness of their high school graduates. As of April 2008, seven states–Arkansas, Kentucky, Louisiana, Minnesota, Oklahoma, South Carolina, and West Virginia–administer EXPLORE to all of their 8th-grade students. Six of these states–Arkansas, Kentucky, Louisiana, Minnesota, Oklahoma, and West Virginia–also administer PLAN to all of their 10th-grade students. Two additional states–Florida and South Carolina–allow 10th-grade students to take PLAN at no cost to them or their families.

Statewide adoption of elements of ACT's College Readiness System



For the past six years, the states of Colorado and Illinois have paved the way in adopting the ACT as part of their statewide assessment programs. Colorado uses the ACT in the Colorado Student Assessment Program (CSAP) as an 11th-grade achievement-based assessment that gives the state an indication of how well its public schools are performing at educating students at the P–12 level. Illinois also administers the ACT to all of its public high school juniors as part of its Prairie State Achievement Exam (PSAE). Illinois uses the ACT to measure student progress at meeting state learning standards.

Michigan has recently adopted the ACT as part of its new statewide high school assessment program, the Michigan Merit Examination (MME). The MME replaced the Michigan Educational Assessment Program (MEAP) for all Michigan high school students beginning in the 2007–2008 school year. Similar statewide adoptions of the ACT have been implemented in Kentucky and Wyoming.

Tennessee has instituted a voucher program in which students may take the ACT at no cost to them or their families. A similar voucher program is planned in Arkansas.

Summary

Education and training beyond high school are crucial to the ability of U.S. high school graduates to earn a self-sufficient living or support a family. Students who are not ready for college are less likely to enroll in college, more likely to need remedial coursework during their first year, less likely to succeed in their college courses, and less likely to earn a college degree.

U.S. students are in danger of entering the workforce unprepared for the challenges of the 21st-century economy. If U.S. high school graduates are unable to compete in a global labor market, then not just the graduates themselves but the nation at large will suffer.

But it all starts with P–12. College readiness is no longer a privilege but a right–a right of ***all*** students that P–12 must fulfill.

ACT has a long-standing commitment to effective educational and career planning. As education in the United States responds to the changing needs of its constituents and the changing circumstances of a global marketplace of ideas, risks, and opportunities, ACT stands ready with the programs and the research and development capabilities to help students become ready for college.

Are we ready as a nation to meet the educational demands of the 21st century?

Not yet. But we can do it.

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ACT Research: Setting the Standard for College Readiness

ACT is a national leader in policy research on the topic of college and workforce training readiness. In recent years, we have added our distinctive voice to the debate over what it means for students to be truly ready for postsecondary education. By developing new empirical approaches to the issue, ACT capitalizes on a wealth of longitudinal data that no one else possesses. Here are summaries of a few of our most recent cutting-edge reports, all of which are available on ACT's website (www.act.org).

Rigor at Risk: Reaffirming Quality in the High School Core Curriculum

2007

www.act.org/research/policymakers/pdf/rigor_report.pdf

Our latest policy report on the subject of college readiness demonstrates that even students who take the ACT-recommended number of core courses in high school are often ill prepared to handle college material, and that many of these students are not ready for college even after taking a substantial number of additional higher-level courses. *Rigor at Risk* cites a number of factors that contribute to inadequate college preparation in high schools and argues for immediate improvements in the content and quality of high school core courses.

Aligning Postsecondary Expectations and High School Practice: The Gap Defined (Policy Implications of the ACT National Curriculum Survey® Results 2005–2006)

2007

www.act.org/research/policymakers/pdf/NCSPolicyBrief.pdf

The results of our most recent National Curriculum Survey define the troubling gap that persists between what students are being taught in high school and what instructors of first-year college courses expect their entering students to know. What college instructors want their students to know and be able to do is far more targeted and specific than what high school teachers actually teach. The gap is defined for English/writing, mathematics, reading, and science. This report argues for the adoption of fewer but more targeted state standards at the high school level–standards that focus on the essential knowledge and skills for postsecondary success.

Ready for College and Ready for Work: Same or Different?

2006

www.act.org/research/policymakers/pdf/ReadinessBrief.pdf

In this report, ACT offers the first empirical evidence that college readiness and workforce training readiness require comparable levels of skill and knowledge in mathematics and reading. *Ready for College and Ready for Work* argues that all high school students need to be educated to the same standard, whether they ultimately intend to go on to a two-year college, a four-year college, or workforce training after graduation.

Reading Between the Lines: What the ACT Reveals about College Readiness in Reading

2006

www.act.org/research/policymakers/pdf/reading_report.pdf

Reading is crucial to college success, affecting performance across the curriculum. But high school graduates are not ready for the demands of college-level reading, and *Reading Between the Lines* shows why. The report also identifies empirically that student comprehension of complex text is the key differentiator between students who are ready for college-level reading and those who are not. *Reading Between the Lines* argues that progressive, targeted reading strategies must be taught throughout all four years of high school and across all subject areas.

On Course for Success: A Close Look at Selected High School Courses That Prepare All Students for College and Work

2004

www.act.org/research/policymakers/pdf/success_report.pdf

What differentiates schools that prepare high percentages of their students for postsecondary education from those who do not, particularly in high-poverty/high-minority districts? This report, a collaboration with the Education Trust, found that the most successful schools provide all students with rigorous, college-level content, qualified teachers with flexible teaching styles, and extra tutorial support. *On Course for Success* also contains detailed syllabi for rigorous core courses in English, mathematics, and science.

Crisis at the Core: Preparing All Students for College and Work

2004

www.act.org/research/policymakers/pdf/crisis_report.pdf

This groundbreaking report showed definitively that U.S. high school students must take a core curriculum. *Crisis at the Core* emphasizes the importance of increasing the college readiness of all U.S. high school graduates. Among other findings, the report demonstrates the importance of taking Chemistry in high school, as well as higher-level mathematics courses beyond Algebra II.

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The Standards shaded in yellow show the level(s) of knowledge and skills students need to reach by 12th grade if they are to be considered ready for college. (The areas shaded in blue represent advanced levels of preparation.)

English

ACT Benchmark for College English Composition: 18

	Topic Development in Terms of Purpose and Focus	Organization, Unity, and Coherence	Word Choice in Terms of Style, Tone, Clarity, and Economy	
13–15		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	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	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	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	
28–32*	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†	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	

* Applies to PLAN and the ACT only
† Applies to the ACT only

DINESS STANDARDS

	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
	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

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Mathematics

	Basic Operations & Applications	Probability, Statistics, & Data Analysis	Numbers: Concepts & Properties	Expressions, Equations, & Inequalities	
13–15	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	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	
16–19	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	Substitute whole numbers for unknown quantities to evaluate expressions Solve one-step equations having integer or decimal answers Combine like terms (e.g., $2x + 5x$)	
20–23	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	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*	
24–27	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†	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*	
28–32*	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†	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	
33–36†	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	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	

ACT Benchmark for College Algebra: 22

* Applies to PLAN and the ACT only
† Applies to the ACT only

DINESS STANDARDS

	Graphical Representations	Properties of Plane Figures	Measurement	Functions
	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	
	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	
	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†
	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†
	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†
	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†

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Reading

ACT Benchmark for Introductory College Social Science Courses: 21

	Main Ideas and Author's Approach	Supporting Details	
13–15	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	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	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	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	
28–32*	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†	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	

Descriptions of the EXPLORE, PLAN, and 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.

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.

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ADINESS STANDARDS

	Sequential, Comparative, and Cause-Effect	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
	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

	Interpretation of Data	Scientific Investigation	Evaluation of Models, Inferences, and Experimental Results
13–15	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	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	
ACT Benchmark for College Biology: 24 20–23	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
24–27	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*	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†	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

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

Life Science/Biology
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

Physical Science/Chemistry, Physics
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

Earth & Space Science
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

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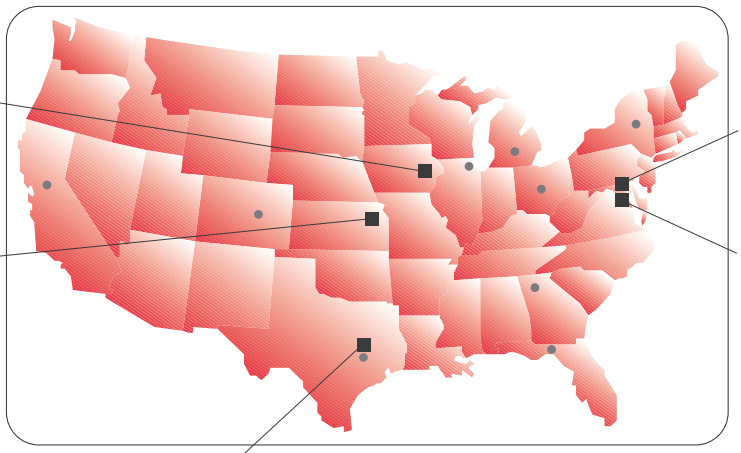

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