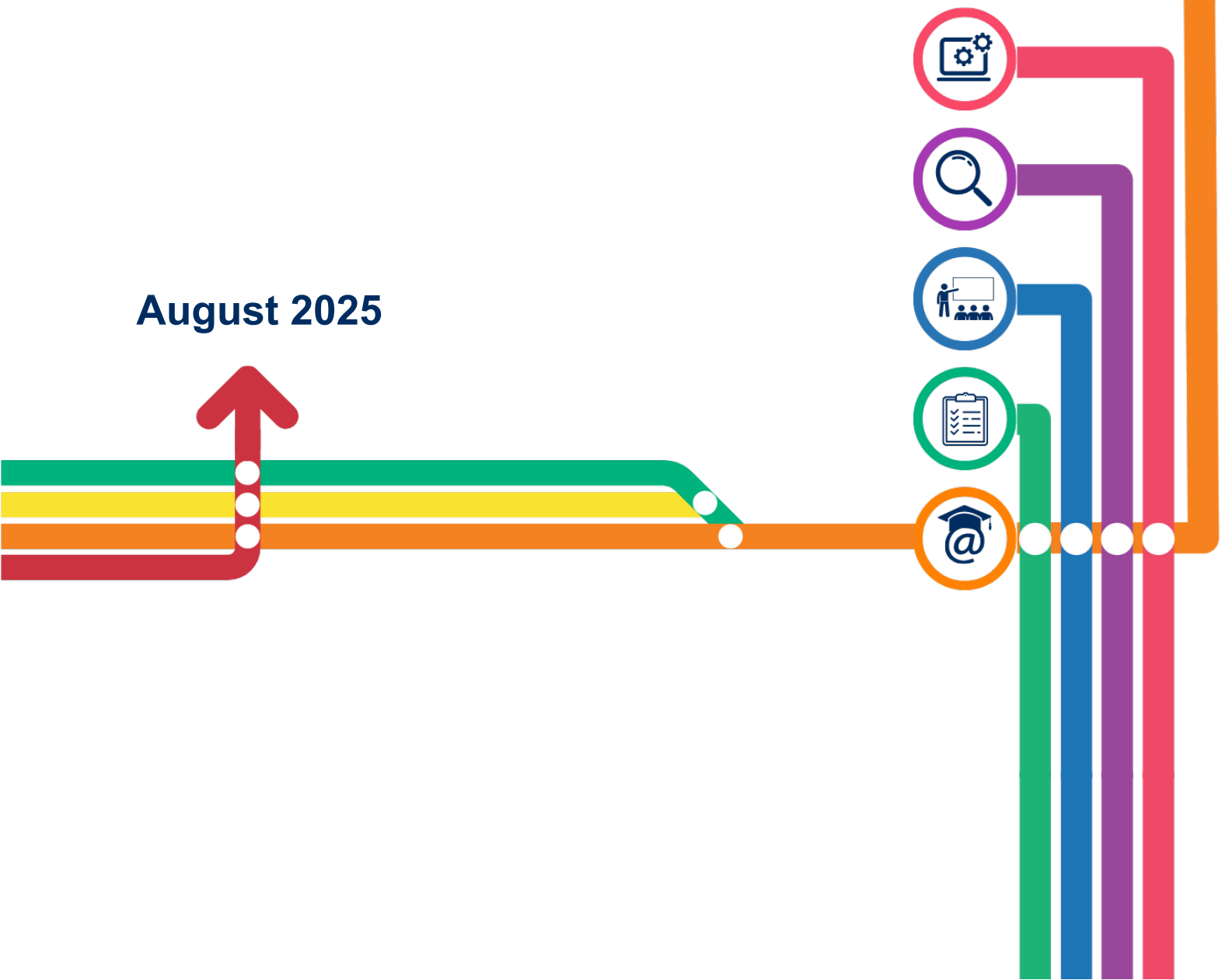
PreACT® Technical Manual

August 2025



Commitment to Fair Testing

ACT endorses and is committed to complying with *The Standards for Educational and Psychological Testing* (AERA, APA, & NCME, 2014). ACT also endorses the Code of Fair Testing Practices in Education (Joint Committee on Testing Practices, 2004), which is a statement of the obligations to test takers of those who develop, administer, or use educational tests and test data in the following four areas: developing and selecting appropriate tests, administering and scoring tests, reporting and interpreting test results, and informing test takers. ACT endorses and is committed to complying with the *Code of Professional Responsibilities in Educational Measurement* (NCME Ad Hoc Committee on the Development of a Code of Ethics, 1995), which is a statement of professional responsibilities for those involved with various aspects of assessments, including development, marketing, interpretation, and use.

We encourage individuals who want more detailed information on a topic discussed in this manual, or on a related topic, to contact ACT.

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Preface

The *PreACT® Technical Manual* contains technical information about the PreACT® test. The principal purpose of the manual is to document technical characteristics of the PreACT test in light of its intended purposes. The *PreACT Technical Manual* documents the collection of validity evidence that supports appropriate interpretations of test scores and describes various content and psychometric aspects of the PreACT. Multiple test design and development processes are articulated documenting how ACT builds the assessment in line with the validity argument and how concepts like construct validity, fairness, and accessibility are attended to throughout the process. Also described are routine analyses designed to support ongoing and continuous improvement and research intended to assure that the program remains psychometrically sound.

We encourage individuals who want more detailed information on a topic discussed in this manual, or on a related topic, to contact ACT.

Please direct comments or inquiries to the address below:

Research Services
ACT, Inc.
500 ACT Drive
Iowa City, Iowa 52243-0168

Chapter 1
The PreACT®

ACT's Mission

ACT has been dedicated to improving college and career readiness for all students since its inception in 1959. ACT's renowned longitudinal system of assessments, with the ACT® test as a capstone, has provided students, educators, and policy makers with unparalleled measures of college and career readiness. ACT's mission is helping people achieve education and workplace success.

1.1 Philosophical Basis for ACT Tests

PreACT® shares a philosophical basis with the ACT. These two testing programs measure student development in the same subject areas of English, math, reading, and science. The principal difference between the two programs is length: PreACT is a shorter version of the ACT in terms of both testing time and the number of items. PreACT, targeted for 10th grade, has a greater emphasis on knowledge and skills typically attained early in students' secondary school experience (by the end of Grade 10). The ACT, for 11th and 12th grades, focuses on knowledge and skills attained as the cumulative effect of the school experience.

Because the content of PreACT is linked to the ACT framework, understanding the philosophical basis of PreACT requires an appreciation of the philosophical basis of the ACT.

The ACT is designed to measure how prepared students are for college academics. The principal philosophical basis for the ACT is that college preparedness is best assessed by measuring, as directly as possible, the academic skills that students will need to perform college-level work. Thus, the ACT is designed to determine how skillful students are at solving problems, grasping implied meanings, drawing inferences, evaluating ideas, and making judgments in subject-matter areas important to success in college.

Also, the ACT is oriented toward the general content areas of college and high school instructional programs. The test questions require students to integrate the knowledge and skills they possess in major curriculum areas with the stimulus material provided by the test. Briefly, then, the philosophical basis for the ACT rests on two pillars: (a) the tests should measure academic skills necessary for education and work after high school, and (b) the content of the tests should be related to major curriculum areas.

1.2 Overview of PreACT

PreACT is designed to predict performance on the ACT test for English, math, reading, and science; it is targeted for 10th grade but can be administered to students at any grade level.

Like all ACT assessment programs, PreACT is based on the belief that students—and their parents or guardians, teachers, counselors, and school administrators—will make more

productive plans and decisions if they have organized, relevant information available when they need it most.

PreACT is designed to measure educational progress in the context of preparing for the ACT and planning for college and careers. The results from PreACT can be used to help students plan their coursework and other learning opportunities to help ensure that they are prepared for the ACT and their postsecondary goals. High schools can use PreACT data for academic advising, counseling, and program evaluation.

PreACT includes four multiple-choice tests—English, math, reading, and science. PreACT also collects information about student interests, needs, plans, and backgrounds, all of which can be useful in guidance and planning activities.

ACT provides customers with administration materials, including interpretive guides for score reports. The PreACT student score report, which each PreACT examinee receives, contains sections about the student's scores, plans, career interests, and skills. The interpretive guide called Using Your PreACT Results, along with the PreACT student report, can help students get a better sense of where they are, where they might want to go, and how to get there.

PreACT functions as a stand-alone assessment and as a precursor to the ACT. When used together, these assessments give high school educators a powerful interrelated sequence of instruments for measuring student development. PreACT 8/9® can also be used with PreACT and the ACT, providing an earlier measure of development toward college and career readiness.

PreACT and ACT test scores are reported on the same scale; the range of PreACT scale scores is from 1 to 35, while the range of ACT scale scores is from 1 to 36.

PreACT also provides standards-based interpretations through the ACT College and Career Readiness Standards—statements that describe the knowledge and skills students have demonstrated through their performance on the test. Because the Standards focus on the integrated higher-order thinking skills that students develop in Grades K–12 and that are important for success both during and after high school, the Standards provide a common language for secondary and postsecondary educators.

Using the Standards, secondary educators can determine the skills students are likely to have and those they are ready to learn next. The Standards clarify college expectations in terms that high school teachers understand.

The Standards also offer teachers guidance for improving instruction to help correct student deficiencies in specific areas. PreACT and ACT results can be used to identify students who are college ready or on target for college readiness. The ACT College Readiness Benchmarks—for English, math, reading, science, and STEM—were developed to help identify examinees that would likely be ready for college-level work in these subject areas. The PreACT Readiness Benchmarks are the scores indicating that students are on target for meeting or exceeding the

ACT College Readiness Benchmarks. Chapter 5 provides details about the College and Career Readiness Standards and Benchmarks.

PreACT 8/9, PreACT, and ACT results give schools a way to get students engaged in planning their futures. Table 1.1 summarizes the assessments' components.

Table 1.1. Components of ACT College and Career Readiness Assessments

Component		Assessment		
		PreACT 8/9	PreACT	ACT
Academic Assessments	English	X	X	X
	Math	X	X	X
	Reading	X	X	X
	Science	X	X	X
	Writing (optional)	—	—	X
Career and Education Planning	Interest Inventory	X	X	X
	Educational Opportunity Service	X	X	X
	Coursework and Grades	X	X	X
	Needs Assessment	X	X	X
	College and Career Plans	X	X	X
Other Scores Reported	Predicted PreACT Scores	X	—	—
	Predicted ACT Scores	X	X	—
	Progress Toward the ACT NCRC	X	X	X
	National Ranks	X	X	X
	Composite Score	X	X	X
	ELA Score	—	—	X
	STEM Score	X	X	X
	Reporting Categories	X	X	X
Standards and Benchmarks	ACT College and Career Readiness Standards	X	X	X
	PreACT Readiness Benchmarks	X	X	—
	ACT College Readiness Benchmarks	—	—	X
Reporting	Individual Student Report	X	X	X
	Item Response Analysis	X	X	—
	Roster Reports	X	X	X
	Summary Reports	X	X	X
	Data Tools	X	X	X

1.2.1 PreACT Score Reports

The PreACT student score report facilitates interpretation of PreACT scores with respect to college readiness, predicted performance on the ACT test, and national norms. Reporting category scores are reported for each test section (English, math, reading, and science), showing how students performed on different topics within each subject. The ACT College and Career Readiness Standards are organized by reporting category.

Each reporting category is based on a subset of items in the test section. For each reporting category, the score report shows the following:

- Total points possible
- Total points achieved
- Percent correct

Additionally, PreACT reports Progress Toward the ACT National Career Readiness Certificate. This indicator represents a prediction of the level students are likely to earn on the ACT® WorkKeys® National Career Readiness Certificate® (NCRC®) if they take WorkKeys in 11th grade.

The report is accompanied by a booklet, Using Your PreACT Results, which provides interpretive information about the test results, describes ACT services and policies, and tells examinees how to contact ACT for further information.

1.3 Purposes, Claims, Interpretations, and Uses of PreACT

In creating PreACT, ACT employed a theory of action (TOA) that integrates content validity (academic research, curriculum information, standards) with predictive validity (empirical data), thus following methodologies similar to those used to build the ACT. The TOA begins by answering fundamental questions about the purpose of the assessment, such as “Who are the intended users? What are the intended uses of the assessment results? What claims should be supported by the assessment? What are the intended benefits that may result from using the assessment? What are measurable outcomes from using the assessment?”

The answers to these questions emerge from rigorous research and data collection that inform and allow for the identification of high-value skill targets in each subject area, providing focal points for the development of tasks and test forms. The process set forth by the TOA further gives rise to possible ways of bringing about the intended goals of the assessment. For example, cognitive labs, piloting, and field testing are used to validate results and iteratively improve the specifications and design of the assessment. Operational results are used to continuously improve the components of the assessment.

1.3.1 Intended Users

High school students are the target population and primary users of the assessment. While PreACT can be taken by students at any grade level, testing in 10th grade is recommended to optimize the benefits of testing. Additional users include parents and guardians interested in their child’s performance, teachers interested in helping students to identify areas of improvement, high school counselors and academic advisors responsible for helping students with postsecondary planning, and school administrators responsible for evaluating educational programs. PreACT users could also include other organizations promoting college and career programs and talent-identification programs.

1.3.2 Intended Uses

The primary uses of PreACT include:

1. monitoring progress toward college and career readiness,
2. predicting performance on the ACT and ACT® WorkKeys® tests, and
3. identifying academic gaps and areas for improvement.

Use 1 is supported by the ACT College Readiness Benchmarks and the PreACT Readiness Levels. Students who score at or above the ACT College Readiness Benchmarks demonstrate that they are ready for first-year college courses in the related subject areas. Student achievement is expected to grow between PreACT (typically given in 10th grade) and the ACT test (typically given in 11th and 12th grade). Therefore, students who score below the ACT College Readiness Benchmarks in 10th grade may still be on target to meet the Benchmarks in 11th or 12th grade. Based on their scores, students are placed at one of three PreACT Readiness Levels: On Target, Close to Target, and In Need of Intervention. Use 1 is also supported through the Progress Toward the ACT National Career Readiness Certificate Indicator.

PreACT tests are shorter than the corresponding ACT tests and are designed to predict student performance on the ACT (excluding writing), supporting Use 2. Predicted ACT score ranges are reported for English, math, reading, science, Composite, and STEM. PreACT simulates the ACT testing experience and provides students, parents, and educators with valuable insights while there is still time to gain needed knowledge and skills, which can later be demonstrated on the ACT.

PreACT results can help students and educators identify academic gaps and areas for improvement (Use 3). Percentile ranks can help students identify subject areas of relative strength or weakness. Within each subject area, reporting category scores let educators see how students performed on each topic aligned to the ACT College and Career Readiness Standards. The PreACT online reporting package includes four early intervention rosters, several summary reports, and data tools to support additional data analysis. Included in the summary reports is the item-response summary report, which can be used to identify academic gaps and areas for improvement.

Additional intended uses of the PreACT include:

4. gauging readiness for advanced high school courses,
5. evaluating school and program effectiveness,
6. facilitating college and career exploration and planning, and
7. understanding performance relative to national norms.

1.3.3 Claims

The claims of PreACT are closely related to the intended uses. The claims are supported by other evidence contained in this technical manual. The primary claims include the following:

1. PreACT measures where students fall on an empirically derived college and career readiness trajectory. See Chapter 5 for more details on the ACT College Readiness Benchmarks, PreACT Readiness Benchmarks, and Progress Toward the ACT National Career Readiness Certificate Indicator.
2. PreACT scores are strong predictors of ACT English, math, reading, science, STEM, and Composite scores. See Chapter 6 for more details on how the predictions are derived, and see Chapter 7 for additional evidence of how well PreACT scores predict ACT scores.
3. PreACT provides instructionally actionable information to students, parents, and educators. PreACT data can be used to identify areas of student strength and weakness in content areas at a variety of levels (student, classroom, school).

The secondary claims of PreACT include the following:

4. PreACT scores can be used to identify students who are ready to succeed in advanced high school courses, including AP and dual enrollment courses. See Chapter 7 for evidence of how well PreACT test scores predict success on AP exams.
5. PreACT can be used as one component of the evaluation of school, program, and curriculum effectiveness. When PreACT is used in conjunction with the ACT test, growth measures can be used to help evaluate educational programs. See Chapter 8 for more information on how PreACT scores can be used to measure student growth.
6. PreACT can improve college and career exploration and planning through the use of the Interest Inventory (ACT, 2009), the ACT Educational Opportunity Service (EOS; Moore & Cruce, 2017), and other college and career planning components.
7. PreACT allows users to understand how students at the same grade level and semester performed relative to the ACT-tested U.S. population. See Lu and Allen (2019) for details on the PreACT norming studies.

1.3.4 Intended Benefits

- Students are exposed to the types of content featured on the ACT and to the ACT testing experience.
- Students get predicted ACT scores, which help them understand how their performance is related to college and career readiness.
- Students, parents, and educators understand relative strengths and weaknesses in four subject areas that are also assessed by the ACT.
- Schools and districts gain important insights about curriculum and program effectiveness.
- Educators gain insights that help them identify students who are ready for advanced high school coursework.
- Students engage in effective college and career exploration and planning.

1.3.5 Intended Outcomes

The measurable outcomes of PreACT include the following:

- Improved performance in academic areas identified as relative weaknesses
- Higher rates of success in advanced high school courses
- Higher ACT scores (and higher rates of success in college and career-training programs)
- Higher enrollment in college and career-training programs
- Improved fit between students' measured interests and their intended college majors and careers

Research is conducted on an ongoing basis to evaluate the extent to which the use of PreACT results in these intended outcomes.

1.4 Code of Fair Testing Practices in Education and Code of Professional Responsibilities in Educational Measurement

Since the publication of the original edition in 1988, ACT has endorsed the *Code of Fair Testing Practices in Education* (Joint Committee on Testing Practices, 2004), a statement of the obligations to test takers of those who develop, administer, or use educational tests and test data. The development of the *Code* was sponsored by a joint committee of the American Association for Counseling and Development, the Association for Measurement and Evaluation in Counseling and Development, the American Educational Research Association, the American Psychological Association, the American Speech-Language-Hearing Association, and the National Council on Measurement in Education to advance, in the public interest, the quality of testing practices.

The *Code* sets forth fairness criteria in four areas: developing and selecting appropriate tests, administering and scoring tests, reporting and interpreting test results, and informing test takers. Separate standards are provided for test developers and test users in each of these four areas.

ACT's endorsement of the *Code* represents a commitment to vigorously safeguard the rights of individuals participating in its testing programs. ACT employs an ongoing review process whereby each of its testing programs is routinely reviewed to ensure that it upholds the standards outlined in the *Code* for appropriate test development practice and test use.

Similarly, ACT endorses and is committed to complying with the *Code of Professional Responsibilities in Educational Measurement* (NCME Ad Hoc Committee on the Development of a Code of Ethics, 1995), a statement of professional responsibilities for those who develop assessments; market and sell assessments; select assessments; administer assessments; interpret, use, and communicate assessment results; educate about assessment; and evaluate programs and conduct research on assessments.

A copy of each code may be obtained free of charge from

ACT Customer Services (68)
P.O. Box 1008
Iowa City, Iowa 52243-1008
319.337.1429

1.5 Test Preparation

Awareness of and exposure to an assessment prior to taking it is important for students to feel comfortable and confident. ACT offers a variety of free and affordable test preparation solutions for students, parents, and educators. Although these resources are designed for the ACT, they are also appropriate for students preparing for the PreACT.

- **ACT Question of the Day.** We post a daily test question to provide students with an opportunity for quick daily practice. Students and teachers can opt to receive a weekly email reviewing the questions posted that week.

- **Preparing for the ACT Test or Preparación Para el Examen ACT.** Includes a full-length practice test, test-taking strategies, and information on what to expect on test day. This publication is available in English and Spanish and is free to download:
    - http://www.act.org/content/dam/act/unsecured/documents/Preparing-for-the-ACT.pdf
    - http://www.act.org/content/dam/act/unsecured/documents/Preparing-for-the-ACT-Spanish.pdf
- **Online Familiarity Assessment.** A full-length ACT practice test available in our simulated online testing environment. Students may also access both timed and untimed practice tests for each ACT subject. Students may sign in to each of the section tests as often as they wish in order to become comfortable with the testing.

- **Alternate Assessment Format Samples.** Students who will test with alternate formats of the assessment can prepare by practicing with one of our alternate format samples. Braille, large print, audio, and reader's scripts are available at no cost to the school and contain a full-length ACT practice test.

Chapter 2
PreACT Test Development

2.1 Overview

This chapter describes the process ACT uses to develop tests (including the National Curriculum Survey®), along with item and form development procedures. Brief overviews of content and bias review processes and of the statistical criteria for form assembly and selection of operational items are included. A high-level description of PreACT® scoring procedures, including descriptions of additional scores and indicators, is also provided.

2.2 Description of PreACT

PreACT, targeted to Grade 10, gives students practice for the ACT and empowers them, their parents, and educators with valuable insights. The experience of taking the PreACT test, combined with rigorous high school coursework, will help students perform their best when they take the ACT.

The ACT and PreACT have a common purpose—to support students at key decision points in their academic preparation and planning. Both tests provide information helpful to educators guiding students through these important educational and career decisions.

The ACT and PreACT English, math, reading, and science tests are designed with developmentally articulated test specifications, ensuring that the content follows a logical developmental sequence across the high school experience. They also share common item formats and follow consistent reporting procedures.

Additionally, the ACT and PreACT share a common set of noncognitive components:

- a career interest inventory
- biographical data
- a student needs assessment
- high school course information

Despite having different score ranges, PreACT, with a range of 1–35, and the ACT, with a range of 1–36, are on approximately the same score scale. This allows comparison of a student's scores on the two assessments. A score increase (either Composite or any section test) from PreACT to the ACT can be interpreted as academic development within the limitations of measurement error.

Content specifications describing the knowledge and skills to be measured by PreACT were determined through a detailed analysis of feedback from current high school and postsecondary teachers, obtained via the ACT® National Curriculum Survey® and educator review, and student data from the ACT and from performance in postsecondary courses. These empirical data are used to continually verify that the PreACT test is measuring the knowledge and skills required for postsecondary and career success.

2.3 The ACT National Curriculum Survey

Every few years, ACT conducts the ACT National Curriculum Survey, which assesses educational practices and college and career readiness expectations. ACT surveys thousands of K–12 teachers and college instructors in English/writing, mathematics, reading, and science, as well as a national cross-section of workforce supervisors and employees, to determine which skills and knowledge in these subjects are being taught at each grade level and which skills and knowledge are considered essential for college and career readiness.

The survey also includes questions about which skills from the ACT Holistic Framework® are essential to college and career success. The Holistic Framework is a research-based framework that integrates behavioral skills, education and career navigation skills, and dimensions such as core academic skills and cross-cutting capabilities.

ACT uses the results of the ACT National Curriculum Survey to guide the development of ACT assessment solutions, including the ACT test, PreACT, and ACT® WorkKeys®. ACT conducts the survey to ensure that its assessments measure the knowledge and skills that instructors of credit-bearing first-year college courses identify as important for success in each content area or that workforce supervisors identify as important for readiness for targeted workforce training and success on the job.

ACT makes the results of each ACT National Curriculum Survey public to help education and workforce stakeholders make more informed decisions about the skills students need to be successful in postsecondary education and the workplace.

2.3.1 The Purpose of the ACT National Curriculum Survey

The ACT National Curriculum Survey directly informs the test blueprint for the assessments. Results from the assessments are used to validate ACT's College and Career Readiness Standards as well as its College and Career Readiness Benchmarks.

Equally important is predictive validity. Does the test accurately and reliably predict performance? Constant monitoring allows ACT to ensure that the answer is "yes."

ACT periodically uses findings from the ACT National Curriculum Survey to monitor the test blueprints. This process ensures that the assessments always measure not only what is being taught in schools around the country, but also what demonstrably matters most for college and career readiness. To maintain relevancy and currency, it is important that assessments are constructed using up-to-date evidence of what matters most.

The science behind ACT assessments—the evidence base and ongoing research—is critical to answering the key question of what matters most in college and career readiness. The ACT National Curriculum Survey represents ACT's commitment to:

- use evidence and research to develop and validate ACT standards, assessments, and benchmarks;
- maintain a robust research agenda to report on key educational metrics (*The Condition of College and Career Readiness*, *Enrollment Management Trends Report*, *The Reality of College Readiness*, and *The Condition of STEM*); and
- develop assessments, reports, and interventions that will help individuals navigate their personal path to success along a kindergarten-through-career continuum.

As a nonprofit educational research organization, ACT uses these principles to drive the development and continuous improvement of ACT's education and workplace solutions, as well as the research agenda associated with them, thereby enabling ACT to fulfill its mission of helping all individuals achieve education and workplace success.

2.3.2 Survey Sample and Process

For the 2020 ACT National Curriculum Survey, ACT made online survey instruments available via various print and electronic methods (e.g., advertisements, email, social media) and invited participation from educators at the early elementary school, late elementary school, middle school, high school, and college levels who teach courses in English and writing, mathematics, reading (including English language arts and social studies), and science (including biology, chemistry, physics, and Earth/space science) in public and private institutions across the United States. ACT also invited participation from supervisors and employees at a large variety of businesses. Table 2.1 gives the numbers of survey respondents in each area.

Table 2.1. ACT National Curriculum Survey 2020 Respondents

Area	Number of Respondents
Early Elementary School	1,214
Late Elementary School	1,213
Middle School	1,623
High School	1,619
K–12 Administrators	405
College Instructors	2,883
Workforce Supervisors	405
Workforce Employees	406
Total	**9,768**

Education participants were asked to rate discrete content knowledge and skills with respect to how important each is to student success in the content area. Specifically, K–12 teachers were asked to rate the importance of each content or skill in a given class they teach, while college instructors were asked to rate the importance of each content or skill as a prerequisite to success in a given class they teach.

ACT also asked the K–12 teachers to indicate whether they teach particular content knowledge or skills and, if so, whether they teach this material as a standard part of their course or as part of a review of material that should have been learned earlier. Some education participants were also asked other content-related questions, depending on the grade level they teach.

Workforce participants were asked to rate discrete skills with respect to how important each is to entry-level success in the workplace. ACT also asked workforce participants to indicate how often employees in their workplace use each of these skills on the job.

Finally, ACT asked all participants questions relevant to current education policy issues (e.g., assessments, technology, standards, student characteristics, and obstacles to success). These results are discussed in the companion report *ACT National Curriculum Survey 2020* (*https://www.act.org/content/dam/act/unsecured/documents/NCS_Report_Web_2020.pdf*).

Because some content areas were surveyed in larger numbers than others, the values displayed in educational-level totals were averaged across English language arts, mathematics, and science. This ensured that, in these results, no one content area would have more influence than another.

2.4 Test Development Procedures

This section describes the procedures used in developing PreACT tests. Note that items for PreACT are developed using the development process for the ACT, which is also described in this section.

2.4.1 Review of Test Specifications

Two major types of test specifications are used in developing PreACT tests: content specifications and statistical specifications.

Content Specifications

Content specifications for PreACT tests were developed through the curricular analysis discussed previously. While care is taken to ensure that the basic structure of PreACT remains the same from year to year so that the scale scores are comparable, the specific characteristics of the test items used in each reporting category are reviewed regularly. Subject-matter experts review the new test forms to verify both their content accuracy and the match between the test content and the content specifications. At this time, the characteristics of the items that fulfill the content specifications are also reviewed. While the general content of the test remains constant, the emphasis of items within a reporting category may change slightly.

Statistical Specifications

Statistical specifications for the tests indicate the level of difficulty (proportion correct, average IRT *b*-parameter value) and minimum acceptable level of discrimination (biserial correlation, minimum IRT *a*-parameter values) of the test items to be used.

The tests are constructed to have a mean item difficulty that is somewhat easier than a typical ACT form in terms of average IRT *b*-parameter value and overall test characteristic curves. Items selected to be administered on the PreACT have a wide distribution of item difficulties so that the tests will effectively differentiate among students who vary widely in their level of achievement.

2.4.2 Selection of Item Writers

ACT contracts with item writers. The item writers are ACT staff and outside contractors who specialize in the disciplines measured by ACT tests. Most have experience in teaching at various levels, from high school to university, and at a variety of institutions, from small private schools to large public institutions. ACT makes every attempt to include item writers who represent the diversity of the population of the United States with respect to ethnic background, gender, and geographic location.

Before being asked to write items for ACT, potential item writer contractors (individuals and groups) are required to submit a sample set of materials for review. Each item writer receives an item writer's guide specific to the content area. The guides include examples of items and provide item writers with the test specifications and ACT's requirements for content and style. They also provide specifications for fair portrayal of all groups of individuals, including use of gender-neutral language, balanced representation of race and ethnicity, and avoidance of subject matter that may be unfamiliar to members of certain groups.

ACT staff evaluate each sample set submitted by a potential item writer and, based on that evaluation, decide whether to contract with the item writer.

Each item writer under contract is given an assignment to produce a small number of items in the content area they are qualified for. The small size of the assignment ensures a diversity of material and maintains the security of the testing program, since any item writer will know only a small proportion of the items produced. Item writers work closely with ACT content specialists, who help them produce items of high quality that meet the test specifications.

2.4.3 Item-Writing Assignments

Item-writing assignments are driven by the test blueprint and item pool analyses with the goal of attaining a wide range of high-quality items for the knowledge, skills, and abilities measured in each test. A typical assignment includes the evidenced-based item template and focuses on a skill statement the item needs to assess. Included in each template is a set of evidence statements the item(s) must elicit.

Assignments are made available to qualified item writers through the ACT item authoring system. This system also contains item metadata, comments from reviewers, and item quality metrics. The information in the system can be connected to the template through the assignment.

2.4.4 Item Construction

Item writers must create items that are psychometrically sounds and meet the test blueprint. Many items must be constructed because many items, even those written by experienced item writers, fail to meet ACT's standards.

Each item writer submits a set of items, called a unit, in a given content area. Most math test items are discrete (not passage based), though some items may belong to a set of several items (e.g., several items based on the same paragraph or chart). All items on the English and reading tests are related to prose passages. All items on the science test are related to passages or other stimulus material, such as graphs and tables.

2.4.5 Review of Items

After an item (or set of items) is written, it is reviewed several times by ACT staff to verify that it meets all of ACT's standards. It is edited to meet ACT's specifications for content accuracy, word count, item classification, item format, and language. During the review and editing process, all test materials are reviewed for fair portrayal and balanced representation of social groups and for gender-neutral language.

After internal item reviews are completed, ACT invites external reviewers with knowledge and experience in those content areas, including practicing teachers from each grade level, to participate in refining items and verifying they are sampling constructs accordingly. Every item is independently reviewed by four to six subject matter experts from across the United States, each of whom has extensive experience with students at or around the grades the items are intended to assess. During the external content review, items are evaluated for content accuracy, item format, and the effectiveness of language in terms of leveling, precision, and fairness.

Bias, Sensitivity, Fairness, Accessibility Reviews

To verify that all items delivered to students are fair, unbiased, and accessible, we conduct external fairness reviews for all items prior to pretesting and for entire test forms before they become operational.

The external fairness review panel consists of experts in diverse educational areas who have experience working with diverse populations. Educators from appropriate grade levels and content areas participate and actively give feedback. The fairness panel reviews items to help verify fairness to all students and to ensure that all items are free of bias or insensitivity. All comments are reviewed, and appropriate changes are made. ACT selects reviewers in such a way that no one state is overrepresented, because stakeholders count on national representation to maintain the comparability of test forms and scores.

2.4.6 Item Tryouts

The items that are judged to be acceptable during the review process are assembled into tryout units for pretesting on samples from the national examinee population. These samples are

carefully selected to be representative of the total examinee population. Each sample is administered a tryout unit from one of the four academic areas covered by ACT tests. The time limits for the tryout units permit most students to respond to all items.

Item Analysis of Tryout Units

Item analyses are then performed on the tryout units. For a given unit, the sample is divided into low-, medium-, and high-performing groups based on the individuals' test scores in the same content area (taken at the same time as the tryout unit). The cutoff scores for the three groups are the 27th and the 73rd percentile points in the distribution of those scores. These percentile points maximize the critical ratio of the difference between the mean scores of the upper and lower groups, assuming that the standard error of measurement in each group is the same and that the scores for the entire examinee population are normally distributed (Millman & Greene, 1989).

Proportions of students in each group who correctly answered each tryout item are tabulated, as well as the proportions in each group selecting each of the incorrect options. Biserial and point-biserial correlation coefficients of each tryout item are also computed.

Item analyses identify statistically effective test items. Items are eliminated or revised for future tryouts if they are too difficult or too easy or if they fail to discriminate between students of high and low educational achievement as measured by their corresponding test scores. The biserial and point-biserial correlation coefficients, as well as the differences between proportions of students answering the item correctly in each of the three groups, are used as indices of the discriminating power of the tryout items.

Additionally, differential item functioning (DIF) analysis procedures are conducted on the tryout data. DIF can be described as a statistically significant difference between the probability of a specific population group (the focal group) answering the item correctly and a comparison population group (the reference group) answering correctly when comparing students in the two groups who have similar levels of achievement with respect to the content being tested. Some items flagged for DIF are reviewed by a diverse panel of external fairness reviewers.

Each item is reviewed following the item analysis. To identify possible problems, ACT staff members scrutinize items flagged for statistical reasons. In some cases, items are revised and undergo further review. The review process also provides feedback that helps to improve the quality of items in the future.

2.4.7 Assembly of New Forms

Items that are judged acceptable during the review process are placed in an item pool. Preliminary forms of the PreACT tests are constructed using items from this pool that match the content and statistical specifications for the tests.

2.4.8 Content and Fairness Review of Test Forms

The preliminary versions of the test forms are subjected to several reviews to ensure that the items are accurate and that the overall test forms are fair and conform to good test-construction practice. The first review is performed by ACT staff. Items are checked for content accuracy and conformity to ACT style. The items are also reviewed to ensure that they are free of clues that could allow test-wise students to answer the item correctly even though they lack the required skills or subject-area knowledge.

The preliminary versions of the test forms are then submitted to content and fairness experts for external review before the operational administration of the test forms. These experts are different individuals from those consulted for the content and fairness reviews of tryout units but are drawn from the same populations of curriculum and education specialists and perform the same types of reviews described in section 2.4.5.

Two panels—a content review panel and a fairness review panel—are provided the test forms for review. The content review panel consists of high school teachers, curriculum specialists, and college and university faculty members. This panel reviews the forms for content accuracy, educational importance, and grade-level appropriateness. The fairness review panel consists of experts in diverse areas of education, with a balanced representation of genders and experience working with diverse populations. This panel reviews the forms to help ensure fairness to all examinees.

After the panels complete their reviews, ACT summarizes the results. All comments from the consultants are reviewed by ACT staff members, and appropriate changes are made to the test forms. Whenever significant changes are made, items and/or passages are replaced and are again reviewed by the appropriate consultants and by ACT staff. If no further changes are needed, the test forms are prepared for printing.

2.5 PreACT Scoring Procedures

The raw score for each of the PreACT tests is equivalent to the number of questions answered correctly. It is converted to a scale score, which is discussed further in Chapter 6.

The Composite score is the average of the four scale scores. The Composite score is rounded to the nearest whole number (0.5 rounds up) and has a minimum score of 1 and a maximum of 35.

2.5.1 Additional Scores and Indicators

In September 2015, ACT began reporting Science, Technology, Engineering, and Math (STEM) scores, a combination of students' math and science scores. Also introduced at that time was the Understanding Complex Texts indicator and the Progress Toward the ACT National Career Readiness Certificate Indicator.

2.5.2 The STEM Score

The STEM score is the average of the math and science scale scores rounded to the nearest integer (fractions of 0.5 or greater round up). Only students who receive scores for both tests receive a STEM score.

2.5.3 Understanding Complex Texts Indicator

PreACT test score reports include an Understanding Complex Texts indicator to show whether students are understanding the central meaning of complex texts at the level needed to succeed in college courses with higher reading demand. This indicator is based on scores from a subset of items on the reading test. These items measure students' global comprehension of the passages instead of sentence- or word-level understanding. Student performance on these items is classified into two performance levels: Below Proficient and Proficient.

2.5.4 Progress Toward the ACT National Career Readiness Certificate Indicator

The Progress Toward the ACT NCRC indicator is based on students' PreACT Composite scores. It provides an estimate of students' likely performance on the ACT NCRC. The ACT NCRC is an assessment-based credential that certifies foundational work skills important for job success across industries and occupations. The ACT NCRC is based on the results of three ACT WorkKeys assessments: applied math, graphic literacy, and workplace documents. Scores on these assessments determine the certificate level—no certificate, Bronze, Silver, Gold, or Platinum—an individual can earn. The ACT NCRC gives individuals evidence that they possess the skills employers deem essential to workplace success. More information about the ACT NCRC can be found at *http://workforce.act.org/credential*. More details on the ACT test scores and indicators can be found in Chapter 7.

2.6 PreACT Score Scales

Scale scores are reported for PreACT English, math, reading, and science tests. Scale scores are also reported for the Composite score (calculated by rounding the unweighted average of the four test scores) and the STEM score (calculated by rounding the unweighted average of the math and science scale scores). Rounding is to the nearest integer, with fractions of 0.5 or greater being rounded up. The range of all PreACT scale scores is 1 to 35.

PreACT scale scores can be compared directly to the ACT's 1-to-36 score scale for each of the corresponding scale scores (PreACT English to ACT English, PreACT STEM to ACT STEM, etc.). The correspondence between the PreACT and ACT score scales is the result of using IRT item parameter values from the ACT item pool to link PreACT scores to the ACT scale through an IRT pre-equating procedure. The IRT true score equating procedure is used to derive raw-to-scale score conversion tables for PreACT. If the assumptions of the IRT pre-equating procedure are met, the mean PreACT and ACT scale scores are expected to be close for any group of examinees taking both tests at the same time. The variance of PreACT and ACT scale scores for any given group of examinees, however, will not be equal, as the ACT tests are longer and more reliable than their PreACT counterparts. Hence, the standard error of measurement is expected to be greater on the PreACT.

PreACT score scales have a maximum of 35. The rationale for setting the maximum scale score on the PreACT tests at 35, rather than at 36 as it is for the ACT tests, is that the PreACT is intended to be a shorter and less difficult version of the ACT. Thus, it is easier to obtain a perfect score (all correct) on the PreACT than it is on the ACT. Consequently, it was decided to cap PreACT scores at a lower value.

Chapter 3
PreACT Test Specifications

3.1 Overview

This chapter describes the content blueprints for each of the four multiple-choice PreACT® tests.

3.2 English Test

3.2.1 Description of the English Test

The PreACT English test is a 45-item, 30-minute test that puts the student in the position of a writer who is revising and editing a text. The test measures a student's understanding of the conventions of standard written English (grammar, usage, and mechanics), production of writing (topic development, organization, unity, and cohesion), and knowledge of language (word choice, style, and tone). The test consists of three passages, each accompanied by a sequence of multiple-choice test items. Different passage types are employed to provide a variety of rhetorical situations. Students must use the rich context of the passage to make editorial choices, demonstrating their understanding of writing strategies and conventions. Passages are chosen not only for their appropriateness in assessing writing and language skills but also to reflect students' interests and experiences. Spelling and the rote recall of the rules of grammar are not tested.

Some items refer to underlined or highlighted portions of the passage and offer several alternatives to the designated portion. These items often include making no change to the designated portion of the passage as one of the possible responses. Some items are identified by a number in a box or by a highlighted asterisk. These items ask about a section of the passage or about the passage as a whole. Some items appear at the end of the item set and are accompanied by instructions noting that the questions are about the passage as a whole. The student must decide which choice best answers each question.

Cognitive Complexity and Depth of Knowledge (DOK)

DOK (Webb, 2002) is a rough-grained, judgment-based measure of a test item's cognitive complexity that is used in many educational contexts. The PreACT English test assesses skills across a range of cognitive complexities using items at DOK Levels 1, 2, and 3. All English items are classified by ACT content experts according to the level descriptions in Table 3.1.

Table 3.1. DOK Level Descriptions for English

Depth of Knowledge Level	Description
DOK1	Requires the recall of information, such as a fact, term, definition, or simple procedure. Requires students to demonstrate a rote response or perform a simple procedure.
DOK2	Requires mental processing that goes beyond recalling or reproducing an answer. Students must make some decisions about how to approach a problem.
DOK3	Requires planning, thinking, explaining, justifying, using evidence, conjecturing, and postulating.

3.2.2 English Scores and Reporting Categories

Four scores are reported: a total test score based on all 45 items and three reporting category scores. The three reporting categories are Production of Writing, Knowledge of Language, and Conventions of Standard English. These reporting categories are subdivided into six elements, each of which targets an aspect of effective writing. A brief description of the reporting categories is given below, followed by a table showing the approximate percentage of test items in each reporting category.

Production of Writing

Students develop a topic effectively by applying their understanding of the rhetorical purpose and focus of a piece of writing. They use various strategies to achieve logical organization, topical unity, and cohesion.

- **Topic Development.** Students demonstrate understanding and control of the rhetorical aspects of texts by identifying the functions of parts of texts, determining whether a text or part of a text has accomplished a purpose, and evaluating the relevance of material in terms of a text's focus.

- **Organization, Unity, and Cohesion.** Students use various strategies to ensure that a text is logically organized, flows smoothly, and has an effective introduction and conclusion.

Knowledge of Language

Students demonstrate effective language use by ensuring precision and concision in word choice and maintaining consistency in style and tone.

Conventions of Standard English

Students apply their understanding of the conventions of Standard English grammar, usage, and mechanics to revise and edit text.

- **Sentence Structure and Formation**
  Students apply an understanding of sentence structure and formation, including understanding the placement of modifiers and relationships between and among clauses.
- **Usage**
  Students edit text to conform to Standard English usage.
- **Punctuation**
  Students edit text to conform to Standard English punctuation.

3.2.3 English Test Blueprints

Table 3.2 shows the current target distribution of test items across reporting categories on each PreACT English test form.

Table 3.2. Specification Ranges by Reporting Category for English

Reporting Category	Number of Items	Percentage of Test
Production of Writing	13–15	29%–33%
Knowledge of Language	6–8	13%–18%
Conventions of Standard English	23–25	51%–56%
Total Number of Items	**45**	**100%**

3.3 Math Test

3.3.1 Description of the Math Test

The PreACT math test is a 36-item, 40-minute test that considers the whole of a student's mathematical development, covering topics typically taught up through the beginning of Grade 12 in U.S. schools and focusing on the prerequisite knowledge and skills that are important for success in college math courses and career training programs. The domain is divided into Preparing for Higher Math (PHM) and Integrating Essential Skills (IES). PreACT weights Grade 8, 9, and 10 skills more heavily than the ACT, but students see a wide range of questions like those on the ACT.

The math construct requires making sense of problems and context, representing relationships mathematically, accessing appropriate mathematical knowledge from memory, incorporating given information, modeling, doing mathematical computations and manipulations, interpreting, applying reasoning skills, justifying, making decisions based on the math, and appropriately managing the solution process. The test emphasizes quantitative reasoning and application over extensive computation or the memorization of complex formulas. Items focus on what

students can do with the math they have learned, which encompasses not only mathematical content but also mathematical practices.

Some degree of computational fluency is required. A calculator is encouraged but not required. Items are designed so that a sophisticated calculator does not provide a significant advantage over a four-function calculator, and so that all items can be done without a calculator in a reasonable amount of time.

Each item has five response options, and students are instructed to choose the correct option. The test contains problems ranging from easy to very challenging in order to reliably report on readiness levels for students with different degrees of preparedness. Extended accessibility supports provide for fair and comparable math scores across a range of circumstances. More information on accessibility can be found in Chapter 4.

Cognitive Complexity and Depth of Knowledge (DOK)

The PreACT math test assesses skills that vary in cognitive complexity using items at DOK Levels 1, 2, and 3. ACT content experts consider how most well-prepared Grade 10 students will approach each item. They then classify each item according to the level descriptions in Table 3.3.

Table 3.3. DOK Level Descriptions for Math

Depth of Knowledge Level	Description
DOK1	Requires the recall of information, such as a fact, term, definition, or simple procedure. Requires students to demonstrate a rote response or perform a simple procedure.
DOK2	Requires mental processing that goes beyond recalling or reproducing an answer. Students must make some decisions about how to approach a problem.
DOK3	Requires planning, thinking, explaining, justifying, using evidence, conjecturing, and postulating. The cognitive demands are complex and abstract.

3.3.2 Math Scores and Reporting Categories

The PreACT math score is an estimate of the score a student would achieve if the student took the ACT math test at the same juncture in the student's education. The predicted ACT math score range given in the PreACT score report provides powerful interpretations based on the successes of similar students over past decades. This predicted score range should be most accurate for students who take PreACT in Grade 10 and take the ACT 12 to 18 months later. It assumes that students continue to learn, just as previous students with that score typically continued to progress.

Comparing a student's predicted ACT math score range with the ACT College Readiness Benchmark for math (currently an ACT score of 22) gives a general idea about the student's likelihood of success in a typical college algebra course, assuming the student progresses at a typical rate.

Nine scores are reported for the PreACT math test: a total test score based on all 36 items and eight reporting category scores. The total test score is reported on the PreACT math scale, which ranges from 1 to 35. Properties of this scale are given in Chapter 6. The math score is averaged with the science score to determine the STEM score, which is related to success in postsecondary science, technology, engineering, and mathematics courses (see Chapter 5 for more information about the derivation of the STEM score). There are also eight math reporting categories designed to give more detail about a student's mathematical achievement. The additional reporting category scores show a pattern of strengths and weaknesses that can differ among students with the same total math test score. The test is first divided into the Preparing for Higher Math (PHM) and Integrating Essential Skills (IES) reporting categories. The PHM score is then divided into separate scores for Number & Quantity, Algebra, Functions, Geometry, and Statistics & Probability. A crosscutting reporting category, Modeling, draws upon items from all the other categories to give a measure of producing, interpreting, understanding, evaluating, and improving models. Descriptions of each reporting category follow, and Table 3.4 shows the number of items that contribute to each reporting category score. PreACT score reports provide the percentage of correctly answered items in each reporting category.

Preparing for Higher Math

This reporting category captures the more recent math that students are learning. This category is divided into the following five subcategories.

Number & Quantity

Students demonstrate an understanding of and fluency with rational numbers and the four basic operations, and they work with irrational numbers, including approximating irrational numbers with rational numbers. They use properties of the real number system. They show their knowledge of complex numbers, compute in this system, and work with the properties of complex numbers. They use vectors and matrices and view them as number systems with properties, operations, and applications.

Algebra

Students manipulate and evaluate expressions involving integer exponents, square and cube roots, and scientific notation. They solve linear equations and make connections between their graphs and proportional relationships. They use their understanding of linear equations to make sense of other kinds of equations and inequalities: what their graphs look like, how to solve them, and what kinds of applications they have for modeling. Students use expressions to solve problems, and they show an understanding of solving equations. They demonstrate extended proficiency with equations by using quadratic, polynomial, rational, and radical equations as well as systems of equations. They create expressions, equations, and inequalities to represent problems and constraints. They see rational expressions as systems analogous to rational numbers, apply the binomial theorem, and solve simple matrix equations that represent systems of linear equations.

Functions

Students demonstrate an understanding of what a function is and what its characteristics are. They can define functions using two variables or function notation. Understanding the general properties of functions equips students to solve problems using new functions they create. Functions provide a framework for modeling real-world phenomena, and students interpret the characteristics of functions in the context of a problem. Students work with functions that have no equation and functions that follow the pattern of an equation. They reason with particular families of functions—like linear, quadratic, and exponential—by looking at rates of change, algebraic properties, and connections to graphs and tables, and by applying these functions in modeling situations. They also work with a range of functions, like those defined in terms of square roots, cube roots, polynomials, exponentials, and logarithms, as well as piecewise-defined functions. They graph rational functions and demonstrate knowledge of asymptotes.

Students have seen shifts in graphs due to parameter changes, but now they demonstrate a unified understanding of translations and scaling through forms such as $f(x - c)$, $f(x) + c$, $af(x)$, and $f(-ax)$. They compose functions and use inverse functions to solve equations with more than one solution. Students connect the trigonometry of right triangles to the unit circle to make trigonometric functions. They use these functions to model periodic behavior. They apply the algebraic properties of trigonometric functions, such as angle addition properties.

Geometry

Students show an understanding of congruence and similarity using transformations like translations and dilations. Students investigate the relationships between the angles formed by parallel lines and a transversal. They model and solve problems with geometric objects. Students find values such as the area of a circle and the volume of cylinders, pyramids, and cones. They demonstrate an understanding of trigonometric ratios as functions of angles, and they solve right-triangle problems using these ratios and the Pythagorean theorem. In the coordinate plane, students derive conditions for parallel and perpendicular lines, split a line segment into pieces with a given ratio of lengths, find areas, and develop equations for circles and parabolas.

Students use trigonometry to compute the area of a triangle, and they apply the law of sines and the law of cosines to answer questions about nonright triangles. They derive equations for ellipses and hyperbolas. Students show an understanding of Cavalieri's principle when using formulas such as the formula for the volume of a sphere.

Statistics & Probability

Students identify patterns of association between two quantities by analyzing scatterplots and two-way tables. They fit linear models to data sets and use the models to solve problems.

Students demonstrate their knowledge of the role of randomness in sample surveys, experiments, and observational studies. They use data to estimate a population mean or proportion and make informal inferences based on their judgment of likelihood. They compare

qualities of research reports based on data and use simulation data to make estimates and judgments.

Students demonstrate an understanding of statistical independence. They relate the sample space to events defined in terms of “and,” “or,” and “not,” and they calculate probabilities using empirical results, independence assumptions, and the ideas of conditional probability. Students understand the multiplicative rule for conditional probability and apply permutations and combinations as tools for counting. They model a sample space with a random variable by giving a numerical value to each event. Students apply expected value and probability to help inform their decisions.

Integrating Essential Skills

This reporting category focuses on whether students can put together their knowledge and skills to solve problems of moderate to high complexity. Topics include rate and percentage; proportional reasoning; units of measure; solving problems with rational numbers; constructing and solving simple equations; scale drawings; cross sections; area, perimeter, circumference, surface area, and volume; simple measures of center and spread; probability; and random sampling.

In addition to learning more content as they progress through their studies, students should also grow in sophistication, accumulating and applying skills in higher-order contexts. Therefore, students should be able to solve problems of increasing complexity, combine skills in longer chains of steps, apply skills in more varied contexts, understand more connections, and increase fluency. In order to assess whether students have had appropriate growth, the items in this reporting category are at DOK Levels 2 and 3.

Modeling

Modeling uses math to represent, through a model, an analysis of an empirical situation. Models often help us predict or understand the actual. However, sometimes knowledge of the actual helps us understand the model, such as when addition is introduced to students as a model of combining two groups. The Modeling reporting category represents all items that involve producing, interpreting, understanding, evaluating, and improving models. Each modeling item is also counted in the other appropriate reporting categories. Thus, the Modeling reporting category is an overall measure of how well a student uses modeling skills across mathematical topics.

3.3.3 Calculator Policy

Students are encouraged to bring a calculator they are familiar with and can use fluently. Most four-function, scientific, or graphing calculators are permitted. Built-in computer algebra systems are not allowed because they could interfere with the construct, specifically understanding and implementing the solutions of various types of equations and inequalities. Students must remove certain kinds of programs from their calculators. In addition, some calculator features must be turned off for security reasons or to prevent disruptions during testing. The ACT calculator policy is available on the ACT website at www.act.org.

3.3.4 Item Sets

The math test may include an item set. An item set first presents information, including text, graphs, or other stimulus material, and then follows that information with a set of two to five items that each draw upon the given information. Items in the set (and across the form in general) are logically independent, meaning that getting the correct answer to one item does not depend upon getting the correct answer to another item.

3.3.5 Math Test Blueprints

Table 3.4 shows the current target distribution of test items across reporting categories on each PreACT math test form. Test construction also takes into account coverage and variety within each of the categories. The test includes PHM items at all three DOK levels (1, 2, and 3). By contrast, it includes IES items only at Levels 2 and 3. This is because IES topics are more practiced and familiar, and because putting these familiar skills to work in higher-complexity tasks is important for college readiness.

Table 3.4. Specification Ranges by Reporting Category for Math

Reporting Category	Number of Items	Percentage of Test
Preparing for Higher Math	21	58%
Number & Quantity	3–5	8%–14%
Algebra	4–6	11%–17%
Functions	4–6	11%–17%
Geometry	3–5	8%–14%
Statistics & Probability	3–5	8%–14%
Integrating Essential Skills	15	42%
Modeling	≥10	≥28%
Total Number of Items	**36**	**100%**

Note. Each item reported in Modeling is also reported in either Preparing for Higher Math (and the appropriate subcategory) or Integrating Essential Skills.

3.4 Reading Test

3.4.1 Description of the Reading Test

The PreACT reading test is a 25-item, 30-minute test that measures a student's ability to read closely, reason about texts using evidence, and integrate information from multiple sources. The test comprises three passage units, one of which may contain two shorter prose passages on the same topic. One of the passages is a literary narrative, and the other two are informational texts from the humanities, natural sciences, and social sciences. Passages are representative of the kinds of texts commonly encountered in high school and first-year college curricula. Each passage is preceded by a heading that identifies the passage type (e.g., literary narrative) and names the author; it may also contain important background information that helps in understanding the passage.

Each passage unit includes a set of multiple-choice test items. The items focus on the mutually supportive skills that readers apply when studying written materials across a range of subject areas. Specifically, items ask students to determine main ideas; locate and interpret significant details; understand sequences of events; make comparisons; comprehend cause-effect relationships; determine the meaning of context-dependent words, phrases, and statements; draw generalizations; analyze the author's or narrator's voice or method; analyze claims and evidence in arguments; and integrate information from multiple related texts. Items do not test the rote recall of facts from outside the passage or the rules of formal logic, nor do they contain questions about vocabulary that can be answered without referring to the passage context.

Cognitive Complexity and Depth of Knowledge (DOK)

The PreACT reading test assesses skills across a range of cognitive complexities using items at DOK Levels 1, 2, and 3. All multiple-choice items are classified by ACT content experts according to the level descriptions in Table 3.5.

Table 3.5. DOK Level Descriptions for Reading

Depth of Knowledge Level	Description
DOK1	Requires the recall of information, such as a fact, term, definition, or simple procedure. Requires students to demonstrate a rote response or perform a simple procedure.
DOK2	Requires mental processing that goes beyond recalling or reproducing an answer. Students must make some decisions about how to approach a problem.
DOK3	Requires planning, thinking, explaining, justifying, using evidence, conjecturing, and postulating.

3.4.2 Reading Scores and Reporting Categories

Five scores are reported: a total test score based on all 25 items, three reporting category scores based on specific knowledge and skills, and an Understanding Complex Texts indicator. The three reporting categories are Key Ideas & Details, Craft & Structure, and Integration of Knowledge & Ideas. A description of each category is given below, followed by a table showing the approximate percentage of the test devoted to each reporting category.

Key Ideas & Details

Students read texts closely to determine central ideas and themes, summarize information and ideas accurately, understand relationships (including sequential, comparative, and cause-effect), and draw logical inferences and conclusions.

Craft & Structure

Students determine word and phrase meanings, analyze how an author uses word choice to achieve a rhetorical effect, analyze text structure, understand authorial purpose and perspective, and analyze points of view. They interpret the rhetorical effects of authorial decisions and differentiate between various perspectives and sources of information.

Integration of Knowledge & Ideas

Students understand authors' claims, differentiate between facts and opinions, and use evidence to make connections between different texts that are related by topic. Some items will require students to analyze how authors construct arguments and to evaluate reasoning and evidence from various sources.

3.4.3 Reading Test Blueprints

Table 3.6 shows the current target distribution of test items across reporting categories on each PreACT reading test form.

Table 3.6. Specification Ranges by Reporting Category for Reading

Reporting Category	Number of Items	Percentage of Test
Key Ideas & Details	13–15	52%–60%
Craft & Structure	7–9	28%–36%
Integration of Knowledge & Ideas	3–4	12%–16%
Total Number of Items	**25**	**100%**

3.5 Science Test

3.5.1 Description of the Science Test

The PreACT science test is a 30-item, 30-minute test that measures the interpretation, analysis, evaluation, reasoning, and problem-solving skills required in the natural sciences. The content of the science test is drawn from the fields of biology, chemistry, physics, and Earth science/space science.

Students are assumed to have, or to be in the process of completing, a minimum of two years of introductory science, which the ACT National Curriculum Survey has identified as typically one year of biology and one year of physical science or Earth science. Thus, it is expected that students have learned the introductory content of biology, physical science, and Earth science, are familiar with the nature of scientific inquiry, and have been exposed to laboratory investigation.

The test presents several passages containing scientific information, each followed by a number of multiple-choice test items. The scientific information is conveyed in one of three different formats: data representation (scientific graphs, tables, and diagrams), research summaries (descriptions and results of one or more related experiments), or conflicting viewpoints (two or more brief theoretical models that address the same scientific phenomenon but are inconsistent with one another).

The Nature of the PreACT Science Test: What Does It Measure?

The PreACT science test assesses science knowledge, skills, and practices across three domains: Interpretation of Data; Scientific Investigation; and Evaluation of Models, Inferences & Experimental Results.

These three domains, and the knowledge and skills encompassed by each domain, were derived from ACT's decades of empirical data and research on college and career readiness in science. The domains and their skills make up the ACT College and Career Readiness Standards for science, which link specific skills and knowledge to quantitatively determined score ranges for the ACT science test and to the College and Career Readiness Benchmark in science, which is predictive of success in science at the postsecondary level. These three domains are also the reporting categories for the PreACT science test (see Table 3.8). ACT also reviews science benchmarks and standards from state, national, and international standards documents (e.g., the Next Generation Science Standards) and monitors the impact of these documents on science curricula to ensure alignment and, when needed, to update the constructs of the test. All items on the ACT science test are based on authentic scientific scenarios that are built around important scientific concepts, and they are designed to mirror the experiences of students and working scientists engaging in real science. The ACT science test focuses on multidimensional assessment (to measure three-dimensional learning in science), with items that require students to apply multiple domains. Some of the items require that students have discipline-specific content knowledge (e.g., knowledge specific to an introductory high school physical science or biology course), but all the items focus on science process skills. Research conducted by ACT on science curricula and instruction at the high school and postsecondary levels shows that while having a fundamental understanding of disciplinary science concepts is important, being able to apply science practices and process skills to science content to solve problems is more strongly tied to college and career readiness in science. The ACT science test focuses on measuring the science skills and knowledge that are empirically tied to college and career readiness.

Cognitive Complexity and Depth of Knowledge (DOK)

The PreACT science test assesses at DOK Levels 1, 2, and 3, with almost all the items being at Levels 2 and 3. Below is an example of how items on the PreACT science test are classified by DOK. All multiple-choice items are classified by ACT content experts according to the level descriptions in Table 3.7.

Table 3.7. DOK Level Descriptions for Science

Depth of Knowledge Level	Description
DOK1	Requires locating, recalling, and/or reproducing information
DOK2	Requires processing presented information and applying skills and concepts. Students typically must process one or two cognitive steps.
DOK3	Requires use of higher-order thinking, such as analysis and evaluation, and often requires using evidence to justify reasoning. Students must typically process multiple cognitive steps, and the overall tasks tend to be complex and abstract.

3.5.2 Science Scores and Reporting Categories

Four scores are reported: a total test score based on all 30 items and three reporting category scores based on different domains of scientific knowledge, skills, and practices. The three

reporting categories are Interpretation of Data; Scientific Investigation; and Evaluation of Models, Inferences & Experimental Results. A description of each reporting category is provided below, and the percentage of the test devoted to each reporting category is provided in Table 3.8. The overall test score is reported on the PreACT science scale, which ranges from 1 to 35. This score is used, with the math score, to determine the STEM score.

Interpretation of Data

Students manipulate and analyze scientific data presented in tables, graphs, and diagrams (e.g., recognizing trends in data, translating tabular data into graphs, interpolating and extrapolating, and reasoning mathematically).

Scientific Investigation

Students understand experimental tools, procedures, and design (e.g., identifying variables and controls) and compare, extend, and modify experiments (e.g., predicting the results of additional trials).

Evaluation of Models, Inferences & Experimental Results

Students judge the validity of scientific information and formulate conclusions and predictions based on that information (e.g., determining which explanation for a scientific phenomenon is supported by new findings).

3.5.3 Science Test Blueprints

Table 3.8. Specification Ranges by Reporting Category for Science

Reporting Category	Number of Items	Percentage of Test
Interpretation of Data	6–12	20%–40%
Scientific Investigation	5–12	17%–40%
Evaluation of Models, Inferences & Experimental Results	6–12	20%–40%
Total Number of Items	**30**	**100%**

Chapter 4
Test Administration, Test Security, Accessibility, Accommodations, and Supports

4.1 Administering PreACT

PreACT® can be administered on a date of the school's choosing between September 1 and June 1 each academic year. PreACT Implementation Webinars and Resources provide instructions for scheduling testing and ordering materials.

4.1.1 Participation Procedures

In June, ACT activates its online ordering system for PreACT test materials for the following academic year. Schools are provided notice of this activation and asked to go online and place orders or contact ACT Customer Care for assistance in placing their order. Customers should order test materials at least four weeks before their scheduled test date. Ordering at least four weeks in advance will allow materials to be delivered two weeks before testing, giving testing staff time to prepare. Customers may choose to census test their students in a given grade or provide the testing as optional.

4.1.2 Administration Schedule

PreACT has been designed to be administered within a half day during school-supervised sessions. It takes about 3 hours and 15 minutes to complete the entire program: approximately 60 minutes for the non-test sections and 2 hours and 10 minutes for the four subject tests. The non-test sections (student plans and background information, Interest Inventory, and course/grade information) may be administered in a non-secure, supervised school setting on or before the test day. The four subject tests must be administered in a single session on the designated test day. Consult the *PreACT Administration Manual* for information about makeup testing.

4.1.3 PreACT Support Materials

PreACT includes a coordinated set of support materials to help students, parents, guardians, teachers, counselors, and administrators understand the purposes of the program and the information provided.

- PreACT Implementation Webinars and Resources include links to online materials that provide information about the PreACT product and help schools begin planning their administration.
- The *PreACT Administration Manual* is designed to be used by test coordinators and testing staff. The manual provides detailed instructions for planning and administering the non-test sections and the subject tests.
- The *Accessibility and Supports Guide for PreACT* was developed to help educational teams select appropriate accessibility supports and accommodations for their students for use during PreACT testing.

- The test materials package includes the test books, answer documents, and instruction booklets students will use to test. The administration manuals and other materials needed by test coordinators to administer PreACT are also included. Schools should order one test material package for each student testing, including students who are testing with accommodations or English learner supports. The number of administration manuals and answer document return envelopes included in each shipment is determined by the number of students testing. ACT sends a small overage of materials with each order.
- Student and school reports are shipped from ACT within ten business days from the day ACT receives a school's completed answer folders. Scores and reports are also available in ACT's Online Reporting system within 10 business days from the day ACT receives a school's completed answer folders.
- Each student who participates in PreACT will have access to *Using Your PreACT Results*, which includes information about interpreting the student report, planning for high school and beyond, career possibilities, and building academic skills.
- Educators will have access to the *Interpretive Guide for Student and Aggregate Reports*, which includes information for helping students understand their student report and interpreting the school aggregate reports (Student List Report, Educator Report, Item-Response Summary Report, and Student Data File).
- The *ACT Online Reporting User Guide* is available to assist testing staff in using the Online Reporting system to retrieve score reports, analyze data, and create school, district, and state level reports.

4.2 Test Security

To ensure the validity of PreACT test score interpretations, the examinees, any individuals who have a role in administering the tests, and those who are otherwise involved in facilitating the testing process must strictly observe ACT's standardized testing policies and procedures, which may be supplemented by ACT from time to time with additional communications to testing staff.

Testing staff must protect the confidentiality of PreACT test items and responses prior to testing. Testing staff should be aware of their responsibilities and be competent to undertake their roles, including understanding ACT's test administration policies and procedures as well as acknowledging and avoiding conflicts of interest in their roles as test administrators for PreACT.

Testing staff must be alert to activities that can compromise the fairness of the test and the validity of score interpretations. Such activities include, but are not limited to:

- Prohibited test-taking behavior such as copying answers or using prohibited electronic devices during testing
- Accessing questions prior to the test, taking photos, or making copies of test questions or test materials
- Posting test questions on the Internet
- Test proctor or test administrator misconduct such as providing questions or answers to examinees or permitting them to engage in prohibited conduct during testing

In addition to these security-related protocols, ACT may engage, at its discretion, additional test security practices designed to protect ACT test content and the validity of score interpretations.

4.3 Information Security

The ACT Information Security framework is based on the widely recognized ISO/IEC 27000 standard (International Organization for Standardization, 2017). This framework was selected because it covers a range of information security categories that comprehensively reflect the broad perspective that ACT takes in safeguarding information assets. The following are categories covered by the framework and brief statements of their importance to ACT:

1. **Information Security Program Management.** This is overseen by the information security officer at ACT. The information security officer provides guidance and direction to the organization to ensure compliance with all relevant security-related regulations and requirements.
2. **Information Security Risk Management.** ACT uses the CIS Risk Assessment Method (CIS RAM) to identify, manage, and mitigate information security risks.
3. **Information Security and Data Privacy Policy.** ACT's Information Security and Data Privacy Policy, together with the supporting standards, emphasizes the importance of safeguarding information and data assets and sets a direction for doing so.
4. **Information and Technology Compliance.** The systems that store, maintain, and process information are designed to protect data security at all stages. The security considerations surrounding ACT's systems include encryption, system security requirements, and logging and monitoring to verify that systems are operating within expected parameters.
5. **Business Continuity and Disaster Recovery.** ACT maintains a business continuity program designed to ensure that critical business operations will be maintained in the event of a disruption.
6. **Security Training and Awareness.** At ACT, information security is everyone's responsibility. All employees take annual information security awareness training on topics covered in the Information Security and Data Privacy Policy; additional training is received by the individuals within the organization who manage, coordinate, and implement specific information security objectives.

4.4 Accessibility, Accommodations, and Supports

4.4.1 Testing Students with Accommodations and English Learner Supports

Administration of PreACT with accommodations and English learner (EL) supports is entirely at the discretion of school personnel. Accommodations and EL supports on PreACT are limited.

ACT recommends accommodation selection be based on the student's current diagnosis or EL status and documented needs. Generally, a current Individual Educational Program (IEP) or 504 plan is evidence of a need for accommodations as documented by the student's educational team. A limited English proficient (LEP) designation, based on state requirements, is evidence of the need for EL supports.

4.4.2 Accessibility

Accessibility supports apply to all students. Different levels of support are needed by individual students to demonstrate what they know and can do. PreACT permits the use of supports that will honor the skills and knowledge that the tests measure, while removing construct-irrelevant barriers to student performance.

Although ACT designs the standardized testing experience to be the same for all students, ACT does afford accommodations for students with diagnosed, documented disabilities and language supports for EL examinees to provide equitable access during the test without compromising the validity of test results. Accessibility supports emphasize an individualized approach to implementing assessment practices for students with diverse needs who participate in large-scale standardized testing.

The four available types of accessibility supports for use in PreACT are as follows:

1. Universal supports
2. Designated supports
3. EL supports
4. Accommodations

4.4.3 Universal Supports

Universal supports are accessibility aids made available to all students to foster greater inclusion in the standardized test. Universal supports are embedded into testing practices.

Universal supports embedded into PreACT testing practices include:

- Test booklet used as scratch paper
- Standard calculator for mathematics section
- General administration directions repeated if requested
- Asking for clarification of verbal instructions

4.4.4 Designated Supports

Designated supports are adjustments to PreACT that change the way a student accesses the test without changing the content being assessed. Typically, designated supports are adjustments to the testing environment which require advance planning to deliver. As with universal supports, designated supports are available to all students.

Designated supports on PreACT include:

- Assistive devices/technology
- Food, drink, or medication for examinees with a medical need in the test room (does not include medical devices)
- Frequent breaks that do not stop the testing clock
- Noise buffers/ear plugs
- Permission to stand during testing
- Personalized notification of time remaining
- Service animal
- Small group/one-to-one testing

4.4.5 Accommodations

Accommodations are accessibility supports needed by relatively few students. Students who receive accommodations should have a documented disability with their individual needs documented in a formal educational plan. It is recommended this plan be developed by an educational team which includes relevant school personnel, parents/guardians, and the student. Accommodation decisions are usually based on a formal evaluation of a student and what they need to access instruction and assessments.

Successful and secure delivery of accommodations on a standardized assessment often requires additional local resources with specialized skills and knowledge. ACT recommends that students who use this level of support have developed familiarity and expertise through regular use of the same supports in the educational setting.

Examples of accommodations include, but are not limited to, the following:

- Timing/scheduling supports (e.g., extra testing time, breaks as needed)
- Presentation supports (e.g., alternate formats, assistive technology, auditory presentation)
- Response supports (e.g., assistive technology, scribe)

Additional examples are available in the *PreACT Accessibility Supports Guide* (https://content.act.org/resources/r/Accessibility_Supports_Guide_for_PreACT).

4.4.6 English Learner Supports

English learner (EL) supports are appropriate for students who are not proficient in English and who receive similar supports during instructions. Designation as a student with limited English proficiency (LEP) follows the guidelines set by each individual State Department of Education. Generally, English language proficiency is measured using an English Language Proficiency (ELP) assessment.

Only the following EL supports are available for use on the PreACT:

- ACT-authorized bilingual dictionary
- Translated test directions, provided by ACT
- Extended time (one-and-one-half)
- Small-group testing

Chapter 5: Scoring and Reporting

This chapter describes the scoring and reporting services of the PreACT®. Additional information on reporting and data services may be found in the PreACT Interpretative Guide for Student and Aggregate Reports, available in PDF at https://www.act.org/content/dam/act/secured/documents/preact-interpretive-guide.pdf.

PreACT scores support interpretations related to college and career readiness. The scores can be linked to descriptions of the knowledge and skills important for college and career readiness and are also linked to college readiness performance standards. The ACT® College and Career Readiness Standards provide descriptions of the knowledge and skills students at different score levels typically have. The PreACT Readiness Levels indicate whether students are on target to meet the ACT College Readiness Benchmarks. In addition, PreACT scores support "college-ready now" interpretations through their alignment to the ACT score scale (and ACT College Readiness Benchmarks). Together, the empirically derived Standards and Benchmarks support interpretations of college and career readiness and the identification of the knowledge and skills that are key to student success.

5.1 Reporting and Data Services

5.1.1 Student Report

Two PreACT student reports are provided to the school. One is intended for the student, and the other can be retained for school use. Additional student reports can also be downloaded and printed from the online reporting portal.

The student reports include the following information:

- **PreACT test scores**, including scores for the four section tests (English, math, reading, and science), the Composite score, and the STEM score. The Composite score is the average of the four section test scores, and the STEM score is the average of the math and science scores (with fractions of 0.5 and higher rounding up).

- **Predicted ACT Composite Score Range** is the range within which the student's ACT Composite score is expected to fall when the student takes the ACT® in the spring of 11th grade. Predictions are also provided for the four section tests and the STEM score. The predicted score ranges were derived using procedures described in Chapter 6.

- **U.S. Ranks (National Norms)** is the approximate percentage of recent testers, at the same grade level, who took the PreACT and received scores that are the same as or lower than the student's. For example, a rank of 56 for the student's Composite score indicates that 56% of other tested students earned that Composite score or below.

- **Progress Toward the ACT National Career Readiness Certificate (NCRC)** provides an estimate of students' most likely performance on the ACT® WorkKeys® Assessments given their Composite scores. These assessments lead to the ACT® WorkKeys®

National Career Readiness Certificate® (NCRC®), an assessment-based credential that documents foundational work skills important for job success across industries and occupations.

- **Detailed PreACT Results** describe students' performance on the reporting categories of the four section tests and provide a proficiency indicator for Understanding Complex Texts.

- **High School Course Plan Compared to Core** compares students' self-reported plans for high school coursework in a set of core courses to the courses of study in English, math, social studies, and science recommended by ACT as the minimum necessary for students to be prepared for entry-level college courses.

- **Education and Career Journey** helps students identify their career-related interests and encourages follow-up with career-exploration activities. In addition, this section reports information that can help students evaluate whether they are on track to meet their self-reported educational goals.

- **Item Response Analysis** shows the student's answer to each item and the correct response to that item. Ideas for Progress is also provided for each section test and is based on the scale score the student earned on each section test.

5.1.2 Student Score Label

ACT provides schools with two self-adhesive labels for each student participating in the PreACT program. Each label includes the student's name, the student's ID number (if reported by the student), the date tested, the scale scores for each of the four section tests, the PreACT Composite score, and the STEM score.

5.1.3 Roster Reports

Roster reports present data for individual students.

- **The Student Scores Report** lists each student along with their career choice, PreACT test scores, and predicted ACT scores.

- **Early Intervention Rosters** list students and their PreACT test scores. Different rosters are provided for different intervention uses. Rosters 1, 2, and 3 also report students' educational aspirations and planned years of coursework in each core subject area.

    - **Roster 1** lists students who reported that they do not plan to finish high school or have no post–high school educational plans. This roster is designed for interventions aimed at keeping students in school and exploring options for after high school.

    - **Roster 2** lists students who have no college plans but are close to or on target for college readiness. This roster is designed for interventions encouraging

students who would be likely to succeed in college to explore postsecondary opportunities.

- **Roster 3** lists students who plan to attend college but need intervention or do not plan to take college core coursework. This roster is designed for interventions for college-bound students who may need additional academic support or academic advising.

- **Roster 4** lists students who expressed a need for help in one or more areas and reports their areas of need. This roster helps educators provide targeted assistance to students who are requesting help in specific areas.

5.1.4 Summary Reports

Summary reports provide aggregated data for different groups of students. Results are aggregated by testing year, season (fall or spring), and grade level.

- **My Summary Results** summarizes performance on each section of the test. It reports mean scores (including the Composite and STEM scores) and the percentage of students scoring at each readiness level.

- **How did our students respond to local items?** summarizes responses to each locally administered survey question, providing the number and percentage of students with each response.

- **Item Response Summary** lists the reporting category for each question on the test, provides the correct response, and reports the percentage of students who selected each item response option.

- **Average Scores by Ethnicity and Gender** reports mean PreACT test scores by gender and race/ethnicity. It also reports the percentage of students who have taken or are taking core coursework.

- **Average Scores by English Course Pattern** reports the number of students taking each English coursework pattern, as well as the mean PreACT English score and mean PreACT Composite score for each English coursework pattern.

- **Average Scores by Mathematics Course Pattern** reports the number of students taking each math coursework pattern, as well as the mean PreACT math score and mean PreACT Composite score for each math coursework pattern.

- **Average Scores by Social Studies Course Pattern** reports the number of students taking each social studies coursework pattern, as well as the mean PreACT reading score and mean PreACT Composite score for each social studies coursework pattern.

- **Average Scores by Science Course Pattern** reports the number of students taking each science coursework pattern, as well as the mean PreACT science score and mean PreACT Composite score for each science coursework pattern.

- **Average Scores by On Track for Core Coursework Status** reports the number of students by core coursework status (across all subject areas), mean PreACT test scores for each section of the test, and mean Composite and STEM scores.

- **Average Composite Score and Coursework Plans by Educational Aspirations** reports the number of students in each educational aspirations category. For each category, it also presents the percentage of students planning to take core coursework and the mean PreACT Composite score.

- **Average Composite Score and Coursework Plans by Expressed Need for Help** reports the number of students who expressed a need for help in different areas. For each area, it provides the percentage of students planning to take core coursework and the mean PreACT Composite score.

- **Students' Scores, Coursework Plans, and Educational Aspirations by Career Interest** reports the number of students (male, female, and total) with interests aligning to each career interest type. For each type, it provides the percentage of students planning to take core coursework, the percentage of students with each type of educational aspiration, and the mean PreACT Composite score.

- **Local Quartile** reports the percentage of students scoring within each national quartile (first quartile: national percentile ranks of 1–24; second quartile: national percentile ranks of 25–49; third quartile: national percentile ranks of 50–74; fourth quartile: national percentile ranks of 75–100). It also provides the range of PreACT test scores for each quartile.

5.1.5 Additional Online Reporting Tools

Data Tools provides summary statistics, frequency distributions, cross-tabulations, and scatterplots to support additional data analysis. The **Download Hub** allows users to download the complete student-level data file for additional analysis or integration with other data systems.

5.2 Progress Toward the ACT National Career Readiness Certificate Indicator

The Progress Toward the ACT National Career Readiness Certificate indicator provides students with information about their level of career readiness based on their PreACT Composite score. More specifically, this indicator predicts the NCRC level that students are likely to obtain in 12th grade. Using a large sample of students who took a PreACT assessment before taking the ACT WorkKeys assessment, this prediction was established by linking students' Composite scores from Grades 8–11 with the NCRC level they earned. Table 5.1 shows the PreACT Composite score ranges that correspond to different predicted NCRC levels.

The values are subject to change as updates are made to the predictions. More details on how the predictions were derived are provided in Section 6.3.

Table 5.1. PreACT Composite Score Ranges Corresponding to Predicted NCRC Levels

NCRC Level	Grade Level and Season					ACT Composite Score Range
	Grade 9		Grade 10		Grade 11	
	Fall	Spring	Fall	Spring	Fall	
Below Bronze	1–9	1–9	1–9	1–9	1–9	1–12
Bronze	10–13	10–13	10–14	10–14	10–14	13–16
Silver	14–18	14–18	15–18	15–19	15–19	17–21
Gold	19–22	19–22	19–23	20–23	20–24	22–26
Platinum	23–35	23–35	24–35	24–35	25–35	27–36

For more information on the Progress Toward the ACT National Career Readiness Certificate indicator, visit www.act.org/NCRC-indicator.

5.3 ACT College and Career Readiness Standards

The ACT College and Career Readiness Standards are statements that describe what students who score in various score ranges on the ACT section tests are *likely* to know and be able to do. ACT began developing the Standards in 1997 and continues to refine them as new data become available. The Standards are based on empirical data that include normative data, college admissions criteria, and information obtained through ACT's Course Placement Service. Content specialists wrote the Standards based on their analysis of the skills and knowledge students need to respond successfully to test items that were answered correctly by 80% or more of the examinees who scored within each score range.

A full account of the development of the Standards and a description of the Standards for each test section are given in the *ACT Technical Manual* (ACT, 2024).

5.4 ACT College Readiness Benchmarks

The ACT College Readiness Benchmarks are scores on the ACT section tests that represent the level of achievement required for a student to have a 50% chance of obtaining a B or higher (or about a 75% chance of obtaining a C or higher) in corresponding credit-bearing first-year college courses at a typical 2-year or 4-year postsecondary institution. These college courses or course areas and the current Benchmarks are given in Table 5.2.

Table 5.2. ACT College Readiness Benchmarks

College courses and course areas	ACT test score	ACT Benchmark
English Composition I	English	18
College Algebra	Mathematics	22
American history, other history, psychology, sociology, political science, and economics	Reading	22
Biology	Science	23
Calculus I, biology, chemistry, physics, and engineering	STEM	26
English Composition I, American history, other history, psychology, sociology, political science, and economics	ELA	20

The Benchmarks are empirically derived and based on the actual performance of students in college. Through ACT's postsecondary research services and other research partnerships, ACT has assembled an extensive database consisting of course grades and test score data from a large number of first-year students and a wide range of postsecondary institutions. These data provide an overall measure of what it takes to be successful in selected first-year college courses.

The Benchmarks are subject to change over time. Some of the possible reasons for updating the Benchmarks include changes in college grading standards and changes in college student performance. The Benchmarks for English, math, reading, and science were updated in 2013 with more recent data from 214 institutions and over 230,000 students. The STEM and ELA Benchmarks were established more recently.

Students, parents, and counselors can use the Benchmarks to determine the academic areas in which students are ready for college coursework, as well as areas in which they may need more work. Although the Benchmarks are useful predictors of success in first-year college courses, ACT scores above the cutoffs do not guarantee success. Factors other than academic preparedness, such as motivation and good study habits, are also important to success in college (Robbins et al., 2004).

A description of the development of the ACT College Readiness Benchmarks is provided in the *ACT Technical Manual* (ACT, 2022) and various ACT research reports (Allen & Sconing, 2005; Allen, 2013; Mattern et al., 2015; Radunzel et al., 2015, 2017).

5.5 PreACT Readiness Levels and Benchmarks

The PreACT tests can be used to monitor students' progress toward college and career readiness. PreACT scores are classified into one of three Readiness Levels:

1. **On Target:** Students scoring in this range are predicted to meet or exceed the ACT College Readiness Benchmark in 11th or 12th grade. The PreACT Readiness Benchmark is the score associated with a 50% chance of meeting the ACT College

Readiness Benchmark in 11th or 12th grade and is the minimum score of the On Target range.

2. **Close to Target:** Students scoring in this range have less than a 50% chance, but greater than a 25% chance, of meeting the ACT College Readiness Benchmark.

3. **In Need of Intervention:** Students scoring in this range have less than a 25% chance of meeting the ACT College Readiness Benchmark.

PreACT Readiness Levels are specific to grade level (9, 10, or 11) and season (fall or spring), and PreACT score (English, math, reading, science, and STEM). For Grade 11, Readiness Levels are only available for fall. Table 5.3 lists the scale score ranges for the PreACT Readiness Levels that were derived in 2024, along with the PreACT Readiness Benchmark and corresponding ACT College Readiness Benchmark.

Table 5.3. Scale Score Ranges for PreACT Readiness Levels

Score	Grade level / season	PreACT Readiness Level			PreACT Readiness Benchmark	ACT Benchmark
		In need of intervention	Close to target	On target		
English	9, fall	1–8	9–11	12–35	12	18
	9, spring	1–9	10–12	13–35	13	18
	10, fall	1–10	11–13	14–35	14	18
	10, spring	1–11	12–14	15–35	15	18
	11, fall	1–12	13–15	16–35	16	18
Math	9, fall	1–14	15–16	17–35	17	22
	9, spring	1–15	16–17	18–35	18	22
	10, fall	1–16	17–18	19–35	19	22
	10, spring	1–16	17–18	19–35	19	22
	11, fall	1–17	18–19	20–35	20	22
Reading	9, fall	1–14	15–17	18–35	18	22
	9, spring	1–15	16–18	19–35	19	22
	10, fall	1–16	17–19	20–35	20	22
	10, spring	1–17	18–20	21–35	21	22
	11, fall	1–18	19–21	22–35	22	22
Science	9, fall	1–15	16–18	19–35	19	23
	9, spring	1–16	17–18	19–35	19	23
	10, fall	1–17	18–19	20–35	20	23
	10, spring	1–18	19–20	21–35	21	23
	11, fall	1–19	20–21	22–35	22	23
STEM	9, fall	1–18	19–20	21–35	21	26
	9, spring	1–19	20–21	22–35	22	26
	10, fall	1–20	21–22	23–35	23	26
	10, spring	1–20	21–22	23–35	23	26
	11, fall	1–21	22–23	24–35	24	26

For more details on how the PreACT Readiness Levels were derived, please see Section 6.4.

Chapter 6: Scaling, Equating, and Technical Characteristics

Scale scores are reported for PreACT® English, math, reading, and science tests. Scale scores are also reported for the Composite score and the STEM score. The range of all PreACT scale scores is 1 to 35. More background information on the PreACT scale is available in Section 2.6. This chapter discusses the construction of the score scales and equating methods, along with documentation of predictions and PreACT Readiness Levels, and other characteristics of the PreACT tests. Section 6.1 focuses on the development of the PreACT scales and timing conditions through a special pilot study conducted in Spring 2016. Section 6.2 documents how the predicted ACT® score ranges are derived. Section 6.3 documents how predicted ACT® WorkKeys® National Career Readiness Certificate® (NCRC®) levels are derived. Section 6.4 documents the derivation of the PreACT Readiness Levels. Section 6.5 describes the PreACT score ranges. Section 6.6 presents the summary of the operational test data from students taking the PreACT tests between Fall 2024 and Spring 2025. Section 6.7 describes the PreACT norms. Sections 6.8 to 6.10 present the results of psychometric analyses, including differential item functioning, reliability and measurement error, and classification consistency based on the 2024–2025 operational data. Section 6.11 describes the mode comparability study conducted using PreACT 8/9 online pilot data.

6.1 Spring 2016 Pilot Study

In May 2016, ACT conducted a pilot study of the PreACT testing program by administering two paper PreACT forms under a number of timing conditions. The intention of the pilot study was to try out PreACT forms on samples of 10th and 11th graders and investigate psychometric properties of the test. Analyses of the pilot study data are presented in this chapter. Results of the study were used to inform testing time and estimate the reliability of PreACT raw scores.

6.1.1 Study Samples and Conditions

High schools across the country were invited to participate in the study, testing either 10th graders, 11th graders, or both. Over 140 schools from 25 states agreed to participate. Students were administered one of four test forms: A1, B1, A2, or B2. Forms A1 and A2 had identical test items but were administered under different timing conditions. Likewise, forms B1 and B2 had identical items but different time limits. Time limits in minutes for the forms by test section are shown in Table 6.1. Forms A1 and B1, which had different test questions but the same time limits, were spiraled so that each form was administered to a random sample of students such that randomly equivalent groups of students were obtained. Because of the practical difficulty of administering tests with different time limits within a school, Forms A2 and B2 were administered separately, and all the students in a school were administered one of these forms. An attempt was made during the school selection to balance the samples of students taking the different forms based on prior school performance on the ACT, but the balancing was impacted by school attrition from the study. Therefore, performance of students who took forms A1 and B1 can be directly compared, as the other forms were administered to students with likely differing sample characteristics. Characteristics of study data based on gender, ethnicity, and region of country are given in Tables 6.2–6.5, respectively.

Table 6.1. Time Limit Conditions by Form and Test Section in Pilot Study (in minutes)

Test Section	Form		
	A1/B1	A2	B2
English	30	25	35
Math	40	45	35
Reading	25	30	30
Science	30	25	35

Table 6.2. Pilot Data Distribution by Gender, Grade, and Form

Gender	Grade	Form			
		A1	B1	A2	B2
Female	Grade 10	1,152	1,156	1,180	1,089
	Grade 11	235	257	503	507
Male	Grade 10	984	926	1,086	938
	Grade 11	166	166	461	450
Missing	Grade 10	36	32	33	29
	Grade 11	17	15	8	13

Table 6.3. Pilot Data Distribution by Ethnicity, Grade, and Form

Race/Ethnicity	Grade	Form			
		A1	B1	A2	B2
Black/African American	Grade 10	240	241	334	143
	Grade 11	33	32	118	63
American Indian/ Alaskan Native	Grade 10	7	10	11	8
	Grade 11	3	2	12	4
White	Grade 10	1,109	1,062	773	811
	Grade 11	171	203	409	240
Hispanic/Latino	Grade 10	463	461	870	892
	Grade 11	150	149	284	579
Asian	Grade 10	67	63	133	33
	Grade 11	14	10	35	9
Native Hawaiian/ Other Pacific Islander	Grade 10	3	6	3	2
	Grade 11	1	1	4	5
Two or more races	Grade 10	113	96	76	64
	Grade 11	22	18	42	33
Prefer not to respond	Grade 10	55	50	51	64
	Grade 11	12	11	31	33
Missing	Grade 10	115	125	48	39
	Grade 11	12	12	37	4

Table 6.4. Pilot Data Distribution by Region of Country, Grade, and Form

Region	Grade	Form			
		A1	B1	A2	B2
East	Grade 10	1,102	1,094	351	705
	Grade 11	124	144	193	149
Midwest	Grade 10	176	143	245	242
	Grade 11	0	0	113	0
Southwest	Grade 10	649	633	1,278	943
	Grade 11	135	139	519	655
West	Grade 10	245	244	425	166
	Grade 11	159	155	147	166

Table 6.5. Pilot Data School Distribution by Region of Country

Region	Grade 10	Grade 11
East	38	18
Midwest	23	1
Southwest	29	23
West	21	13

6.1.2 Examining Pre-Equating with Item Parameters from the ACT Pool

One of the goals of the pilot study was to examine whether item parameter estimates from the ACT item pool would be appropriate for pre-equating the PreACT taken by Grade 10 students. Conversion tables obtained from IRT pre-equating and post-equating were compared, as well as the Test Characteristic Curves (TCCs) based on item parameter estimates from the ACT item pool and from new calibrations. Subsequent sections describe the pre-equating and post-equating procedures in detail.

IRT pre-equating was conducted using the existing item parameter estimates from the ACT item pool. Forms A1 and B1 were then equated to the same base form with a pre-existing raw-to-scale score conversion table. The equating procedure involves generating the TCCs for the new forms and the base form, obtaining the equated raw scores, and using the equated raw scores with the base form raw-to-scale score conversion table to get the conversion tables for the new forms.

Post-equating was conducted for forms A1 and B1 separately through the following procedure. First, based on the responses of Grade 10 students provided for the items on forms A1 and B1 in the pilot study, items on forms A1 and B1 were calibrated separately using the three-parameter logistic (3PL) IRT model (Birnbaum, 1968) with priors for *c*-parameters selected to closely approximate the *c*-parameters in the ACT item pool. Next, calibrated item parameters were aligned to the ACT item pool scale using the Stocking-Lord method (Stocking & Lord, 1983). IRT true-score equating was then conducted to create conversion tables for both forms A1 and B1 using the form administered in the first year as the base form.

The conversion tables and TCCs from post-equating were compared to those derived from pre-equating for both forms A1 and B1. Figures 6.1–6.8 depict the comparisons of TCCs for forms A1 and B1 after the scale transformation for all four test sections. TCCs comparing pre- and post-equating for both forms A1 and B1 are very close to each other and overlapped for most of the ability ranges. The comparison of conversion tables showed that, for all test sections and test forms (except for math form B1), the post-equated and pre-equated conversions generally differed by no more than one scale score point for the same raw score. For math form B1, a scale score difference of two was observed only once at the raw score of 32, which is at the high end of the distribution. The similarities of TCCs and conversion tables support the use of pre-equating with the item parameters from the ACT pool for English, math, reading, and science.

Figure 6.1. English TCCs Comparing Pre- and Post-Equating for A1

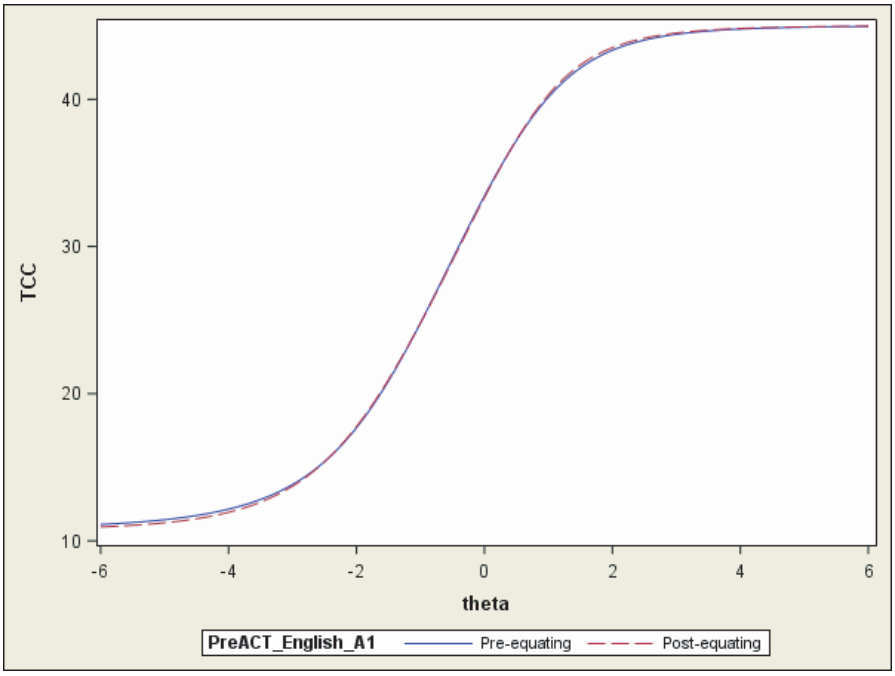


Figure 6.2. English TCCs Comparing Pre- and Post-Equating for B1

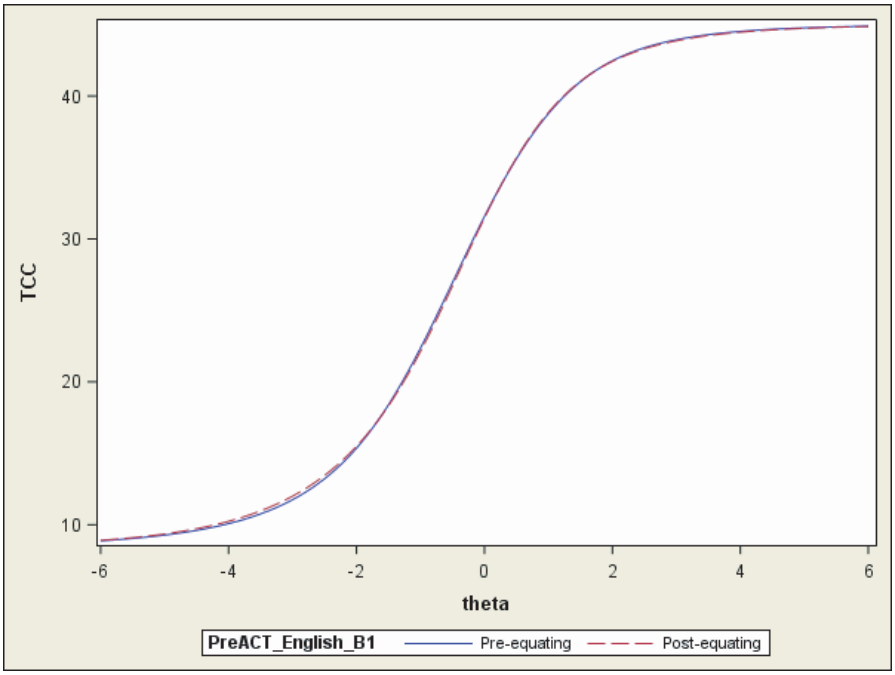


Figure 6.3. Math TCCs Comparing Pre- and Post-Equating for A1

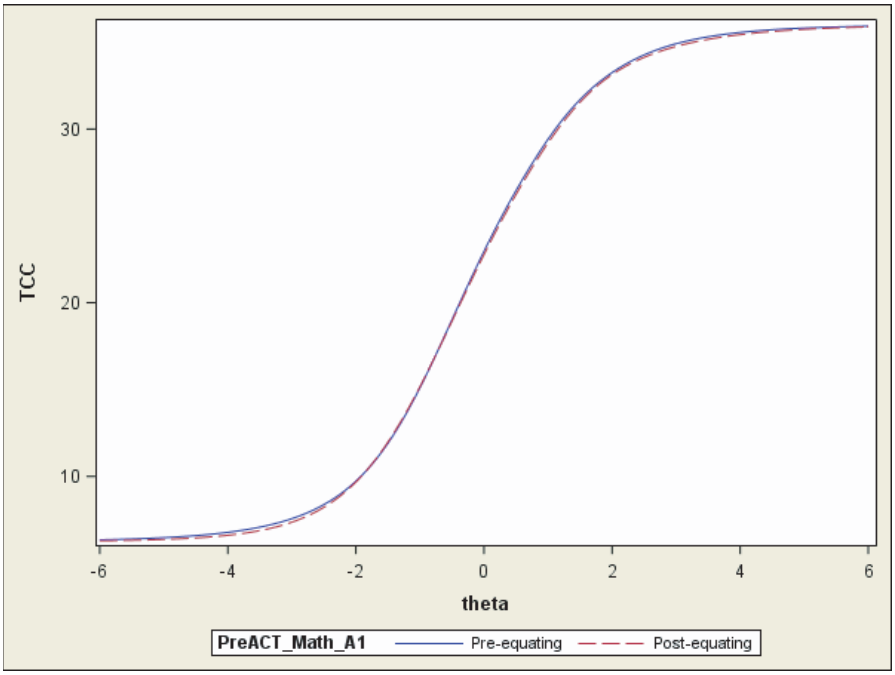


Figure 6.4. Math TCCs Comparing Pre- and Post-Equating for B1

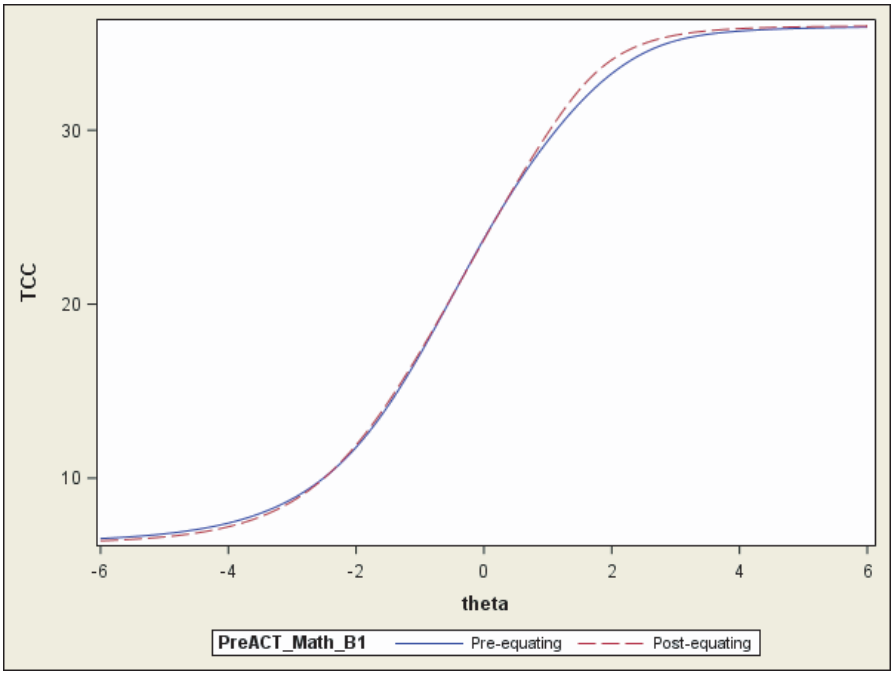


Figure 6.5. Reading TCCs Comparing Pre- and Post-Equating for A1

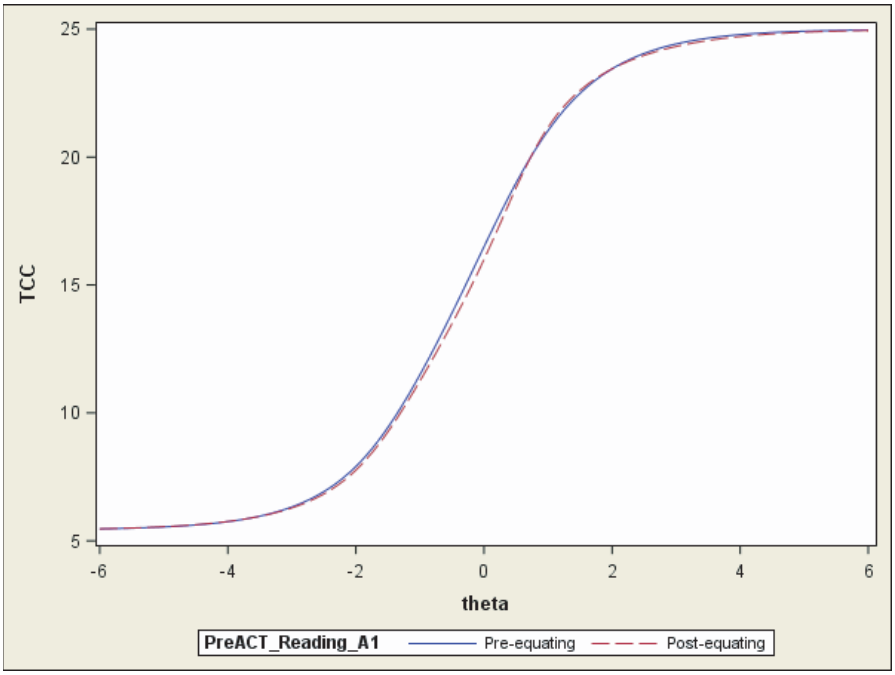


Figure 6.6. Reading TCCs Comparing Pre- and Post-Equating for B1

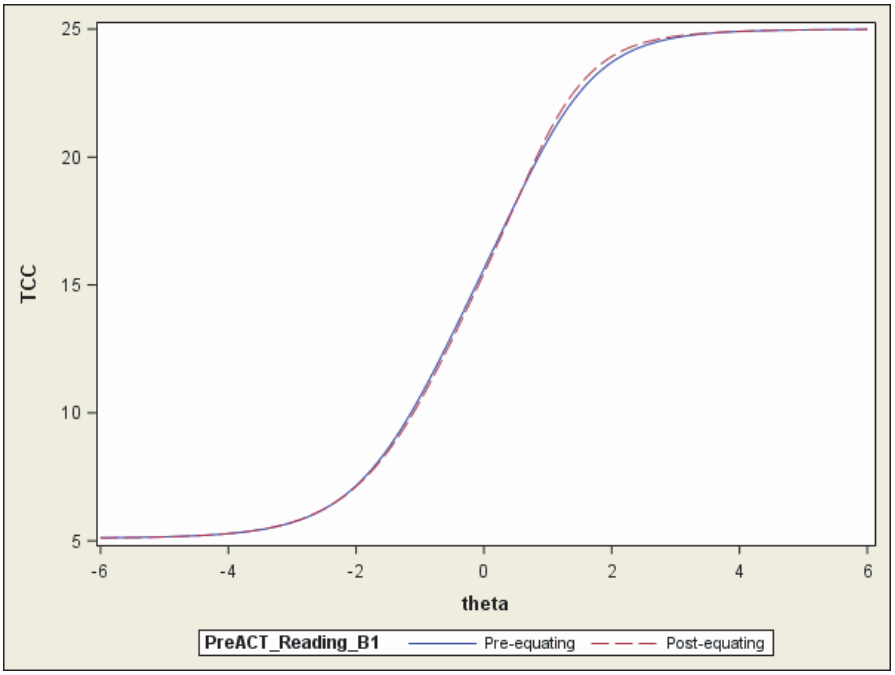


Figure 6.7. Science TCCs Comparing Pre- and Post-Equating for A1

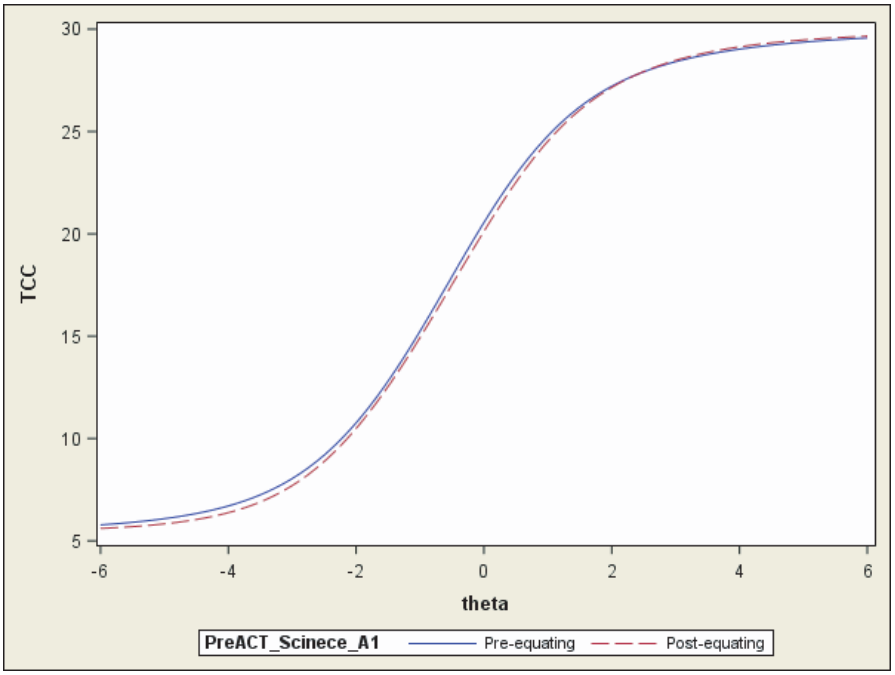
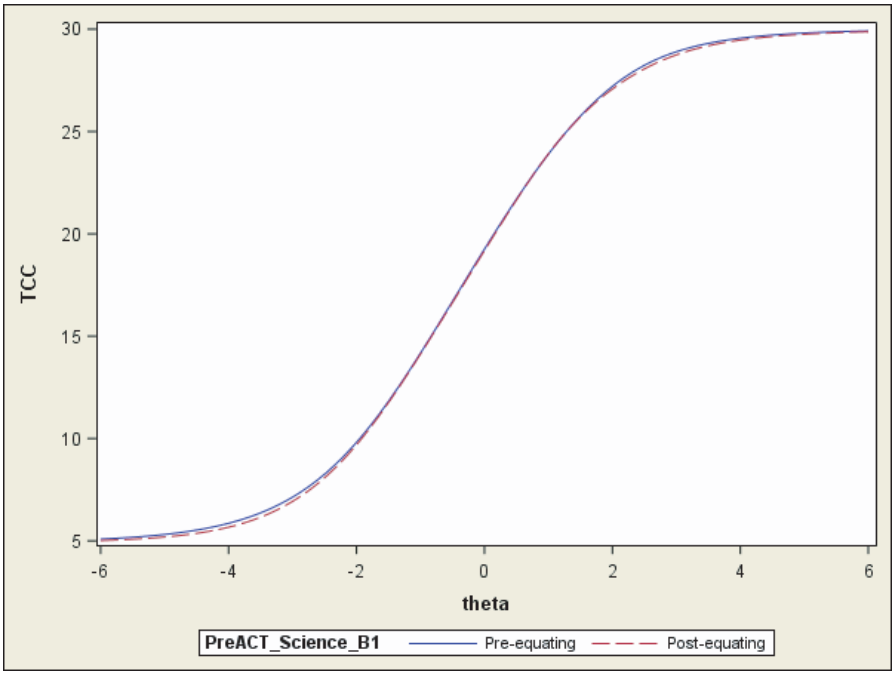


Figure 6.8. Science TCCs Comparing Pre- and Post-Equating for B1



6.1.3 Setting PreACT Timing Conditions

In the pilot study, each test section was administered under two or three different timing conditions (refer to Table 6.1). The timing conditions for forms A1 and B1, i.e., the baseline timing conditions, were set by giving the same approximate time per item as is given on the ACT. The other timing conditions for each test were set by adding or subtracting five minutes from these baseline timing conditions. Prior to the study, the expectation was that the groups with more time would score higher. However, because the A2 and B2 groups were not necessarily equivalent to each other or to the A1/B1 group, the sample characteristics of the groups taking each form were confounding factors, and thus it cannot be concluded that the different performances, represented by scores earned, were because of different timing conditions.

Timing decisions were based on the results from various analyses, including the examining of *p*-values, mean scale scores, item omit rates, comparisons of PreACT and ACT scores on the matched samples, and matched sample omit rates. However, analysis results did not strongly indicate any single set of the timing conditions would be the most appropriate for the PreACT. There were specific cases, however, that the results shown would not be appropriate. For example, omit rates results from the matched samples for the form A1 reading test section and the form B2 math test section suggested that the shortest timing condition should be avoided. There were less obvious differences between the baseline or greatest time allotment conditions. With the considerations that (a) the baseline timing conditions were best aligned with time allotments on the ACT relative to the number of items on the PreACT, and (b) the results from the pilot study did not show consistent evidence to the contrary, it was decided that the baseline

timing conditions should be used in operational administrations for the English, math, and science sections. For reading, where only two timing conditions were evaluated, the results showed that the shorter timing condition should be avoided. Thus, the timing condition with five extra minutes was chosen for operational administrations. The final timing for each test section is presented in Table 6.6.

Table 6.6. Operational Time Limits for Each Test Section (in minutes)

Test section	Operational time limit
English	30
Math	40
Reading	30
Science	30
Total	130

6.1.4 Score Distributions

The score distribution for each test section was obtained using the data of Grade 10 students who took the test section with the same timing condition as the operational timing condition given in Table 6.6. The score distributions are presented in Table 6.7. It should be noted that the distributions likely differ from operational data because of differences in potential student motivation, population characteristics, and the time of year when the test was administered.

Table 6.7. Scale Score Distributions for Grade 10

Scale score	English cumulative percent	Math cumulative percent	Reading cumulative percent	Science cumulative percent
1	0.00	0.05	0.17	0.18
2	0.00	0.05	0.17	0.18
3	0.09	0.05	0.91	0.18
4	0.09	0.05	0.91	0.28
5	1.06	0.05	0.91	0.28
6	3.55	0.23	2.52	0.74
7	7.18	0.23	2.52	0.74
8	12.48	0.23	5.05	1.47
9	15.38	0.37	5.05	2.90
10	21.36	0.37	6.83	2.90
11	28.18	1.06	14.70	10.04
12	32.32	2.21	22.44	22.88
13	35.68	5.06	26.49	28.50
14	42.40	18.00	36.84	34.16
15	46.13	36.19	44.06	41.02
16	52.90	51.52	55.81	45.90
17	60.22	63.81	62.51	57.00
18	63.67	71.36	67.59	61.19
19	66.76	74.95	71.25	66.11
20	73.48	77.85	75.21	73.25
21	78.82	80.85	78.95	80.99
22	81.58	86.10	82.43	85.08
23	87.34	88.63	86.34	88.44
24	86.50	90.38	86.34	91.02
25	91.30	93.78	86.82	93.28
26	92.86	95.49	92.30	95.63
27	95.07	96.64	92.30	95.63
28	96.87	97.74	94.61	96.96
29	96.87	97.74	94.61	96.96
30	98.25	98.76	96.61	98.48
31	98.25	98.76	96.61	98.48
32	96.03	96.17	98.22	98.48
33	96.03	96.17	98.22	96.40
34	96.77	96.59	96.39	96.40
35	100.00	100.00	100.00	100.00

6.1.5 Reliability and Validity Evidence

In classical test theory, the reliability of a test can be described as the measurement consistency of the observed test scores, which is calculated by the correlation between two parallel tests or the squared correlation between the observed score and the true score. However, the first estimation of reliability is hard to achieve within a single test administration. In the second method, the reliability is defined as the ratio of the true score variance to the observed score variance. Many indices of reliability coefficients have been developed, among which the coefficient alpha (Cronbach, 1951) is commonly used to estimate the internal consistency of the number of correct scores (raw score) from a single administration of a test. The coefficient alpha is calculated using the following formula:

$$\alpha = \left(\frac{k}{k-1}\right)\left(1 - \frac{\sum_{i=1}^{k} s_i^2}{s_x^2}\right)$$

where *k* is the number of test items, s_x^2 is the sample variance of the observed total test scores, and s_i^2 is the sample variance of the i^{th} item.

Table 6.8 presents the coefficient alpha estimates of raw scores from the pilot study for different forms and timing conditions.

Table 6.8. Raw Score Coefficient Alpha Reliability

Grade	Form	Reliability			
		English	Math	Reading	Science
10	A1	.90	.88	.83	.85
	B1	.90	.88	.85	.85
	A2	.90	.87	.85	.82
	B2	.88	.86	.84	.85
11	A1	.92	.88	.83	.87
	B1	.90	.88	.84	.84
	A2	.91	.90	.87	.86
	B2	.87	.85	.82	.82

Some validity evidence can be gleaned from the pilot study. Students in the pilot study were examined for matching ACT score records. Across all conditions and forms, a total of 1,100 students in the pilot study had ACT scores. Based on these matching data, the correlations between PreACT pilot and ACT scale scores are computed and shown in Table 6.9. Table 6.10 presents disattenuated correlations.

The observed correlations between corresponding test sections range from .66 to .82, and disattenuated correlations range from .80 to .93. Because of potentially lower motivation effects and other population differences, it is expected that correlations between ACT scale scores and PreACT operational scale scores will be larger than those given in the table.

Table 6.9. Observed Correlations Between PreACT Pilot and ACT Scores

Test	Test section	PreACT					
		English	Math	Reading	Science	Composite	STEM
ACT	English	.81	.66	.67	.61	.80	.69
	Math	.63	.82	.57	.65	.76	.80
	Reading	.69	.58	.68	.60	.74	.64
	Science	.64	.68	.58	.66	.73	.73
	Composite	.79	.76	.70	.70	.84	.79
	STEM	.68	.80	.61	.70	.79	.81

Table 6.10. Disattenuated Correlations Between PreACT Pilot and ACT Scores

Test Section	English	Math	Reading	Science	Composite	STEM
Disattenuated Correlations	.90	.93	.80	.80	.93	.95

6.2 Predicted ACT Score Ranges

One of the primary intended uses of PreACT scores is to predict how well students will perform on the ACT. Accordingly, PreACT score reports include predicted ACT score ranges. The score predictions can help users interpret their PreACT scores, facilitate high school coursework planning, and give students an indication of how much academic growth is needed to meet their goals for college and career readiness. In this section, we document the samples and methods used to derive the predicted ACT score ranges.

6.2.1 Samples Used to Derive the ACT Score Predictions

The predictions are updated each year, and here we describe the sample used to derive the predictions that were reported during the 2024–2025 academic year. We used longitudinal data, including PreACT® 8/9, PreACT, PreACT® Secure™, and ACT test scores for students tested through spring 2024.

Included in the sample were students who took the ACT test in the spring of Grade 11 from 2022 to 2024 and at least one test from the PreACT Suite prior to taking the ACT. The sample included six groups:

- 29,469 students who took PreACT 8/9 in Grade 8
- 142,945 students who took PreACT 8/9 in Grade 9
- 97,983 students who took PreACT in Grade 9
- 878,993 students who took PreACT in Grade 10
- 70,449 students who took PreACT Secure in Grade 10
- 51,191 students who took PreACT in Grade 11

We used propensity score weighting (Austin, 2011) to weight each group to be demographically similar to the target population of students who took the ACT and were projected to complete

high school in 2023. The procedure used logistic regression to estimate each student's probability of being in each group based on gender, race/ethnicity, geographic region, school type (public or private), school locale (rural, town, suburban, or urban), school percentage of students eligible for free or reduced lunch, and school mean ACT Composite score (for the 2023 high school graduating cohort). After weighting, the six groups were combined to form one longitudinal sample.

Table 6.11 summarizes the demographics of the longitudinal sample, as well as the target population. The table reports both the unweighted and weighted percentage of students in each demographic category. Relative to the unweighted sample percentages, the weighted sample percentages more closely match the target population percentages.

Table 6.11. Demographics of Sample Used to Derive Predicted ACT Scores

Characteristic		Sample %	Sample Weighted %	Target Population %
Gender	Female	44.0	48.5	48.7
	Male	42.4	46.6	46.4
	Another Gender	0.6	0.3	0.7
	Missing	13.0	4.6	4.2
Race/ethnicity	Asian	3.1	3.9	4.2
	Black/African American	11.0	11.7	12.4
	Hispanic	12.5	16.3	16.9
	Native American	1.0	1.1	1.0
	Native Hawaiian/OPI	0.2	0.3	0.3
	Two or more races	5.2	5.0	4.9
	White	52.6	53.7	52.2
	Missing	14.4	8.0	8.3
Region	Midwest	32.8	30.7	27.8
	Northeast	1.2	3.5	3.7
	South	57.9	47.7	52.2
	West	8.1	18.1	16.4
School type	Private	13.9	13.1	9.9
	Public	86.1	86.9	90.1
School locale	Rural	21.3	17.6	17.5
	Town	14.0	14.4	13.1
	Suburban	29.8	32.5	33.0
	Urban	28.2	28.4	28.2
	Missing	6.7	7.0	8.1

Note. OPI = Other Pacific Islander. The percentages of each characteristic may not add up to 100% because of rounding.

Table 6.12 summarizes the test scores for the weighted sample. The mean and standard deviation of the PreACT and ACT scores are presented for each subject. In addition, pretest/posttest correlations (r) are presented.

Table 6.12. Test Score Summary Statistics for Samples Used to Derive Predicted ACT Scores

Subject	PreACT		ACT		*r*
	Mean	SD	Mean	SD	
English	16.18	6.16	19.09	6.95	.82
Math	18.19	4.63	19.47	5.62	.84
Reading	20.22	6.84	20.54	7.00	.78
Science	18.30	5.32	20.13	5.76	.75
STEM	18.49	4.64	20.05	5.43	.86
Composite	18.35	5.14	19.70	6.07	.89

Note. r = Pearson correlation of pretest and posttest scores; SD = standard deviation.

6.2.2 Statistical Model Used to Derive the ACT Score Predictions

The predictions are derived from a linear regression model where the pretest score (PreACT score) is used to predict the posttest score (ACT score). For each section test score and each combined score (STEM and Composite), the regression model uses linear and quadratic terms of the pretest score to predict the posttest score. For the section test scores and STEM score, the PreACT Composite score is included as an additional predictor variable to improve prediction accuracy. For the section test scores and STEM score, models are also fit without the Composite score so that predictions can still be reported for examinees who do not have a Composite score. Each regression model includes additional variables so that predictions can be derived under different scenarios of number of months between pretest and posttest, the interaction between the number of months between the pretest and posttest and pretest score, whether the onset of the COVID-19 pandemic occurred between the pretest and posttest, and whether the pretest was PreACT or PreACT Secure (not PreACT 8/9).

Separate models were fit for two grade level categories: Grades 8–9, and Grades 10–11. Using the fitted models, a 50% prediction interval forms the lower and upper bound of the predicted score range for each possible combination of pretest score, Composite score, number of months between pretest and posttest, whether the onset of the COVID-19 pandemic (March 2020) occurred between the pretest and posttest, and whether the pretest was PreACT or PreACT Secure. The lower and upper bounds are obtained after rounding the prediction interval endpoints to the nearest integer.

The reported score predictions assume that students will take the ACT test in the spring of Grade 11. Therefore, the ACT score predictions are based on the following scenarios for number months between the PreACT and ACT tests: 30 months for PreACT administered in fall Grade 9, 24 months for PreACT administered in spring Grade 9, 18 months for PreACT administered in fall Grade 10, 12 months for PreACT administered in spring Grade 10, and 6 months for PreACT administered in fall Grade 11. The score predictions also assume that the onset of the pandemic did not occur between the pretest and posttest, and that the pretest was

PreACT or PreACT Secure (not PreACT 8/9).

After deriving the predicted score ranges, manual adjustments were made to ensure logical consistency across PreACT scores (1–35) and grade levels (9–11). The logical consistency requirements include:

For the section test scores and STEM score:

- For each grade level (9, 10, or 11), season (fall or spring), and Composite score value, ACT score range predictions do not decrease as PreACT scores increase.
- For each grade level (9, 10, or 11), season (fall or spring), and PreACT score value, ACT score range predictions do not decrease as Composite scores increase.

For the Composite score:

- For each grade level (9, 10, or 11) and season (fall or spring), ACT score range predictions do not decrease as PreACT scores increase.

For the section test scores, STEM score, and Composite score:

- For Grades 8 and 9, Grade 11 ACT score predictions are not lower than Grade 10 PreACT score predictions.
- ACT score range predictions do not decrease with grade level and season. For example, the ACT score predictions for fall Grade 10 should be greater than or equal to the ACT score predictions for spring Grade 9.

6.3 Predictions of ACT WorkKeys National Career Readiness Certificate Level

Another of the primary intended uses of PreACT is to monitor progress toward college and career readiness. To support this use, the Progress Toward Career Readiness Indicator provides students with information about their level of career readiness based on their PreACT Composite score. More specifically, this indicator predicts the NCRC level that students are likely to obtain, assuming they take the ACT® WorkKeys® Assessments in 12th grade. This prediction was established using a longitudinal sample of students who took a PreACT assessment (PreACT 8/9, PreACT, or PreACT Secure) before taking the ACT WorkKeys assessment and attempting to earn an NCRC.

6.3.1 Sample Used to Derive the NCRC Predictions

The sample used to derive the NCRC predictions included 161,303 examinees who took the ACT WorkKeys Assessments through March 2024. The sample included 16,319 students who took PreACT 8/9, 144,781 students who took PreACT, and 203 students who took PreACT Secure before taking the ACT WorkKeys assessment. The number of months between the PreACT test and the WorkKeys test ranged from 0 to 53, with a mean of 23.7 and standard deviation of 5.3.

The sample was weighted to represent the target population of all public high school students in the South and Midwest regions of the United States. The target population was derived as

students from public high schools that administered the ACT test during the school day to at least 50% of their 11th-grade students in spring 2022. We used propensity score weighting (Austin, 2011) to weight the sample to be like the target population. The procedure used logistic regression to estimate each student's probability of being in the sample based on gender, race/ethnicity, geographic region (South or Midwest only), school locale (rural, town, suburban, or urban), school percentage of students eligible for free or reduced lunch, and school mean ACT Composite score (for the 2022 school-day tested cohort). Table 6.13 summarizes the sample's demographics and compares the sample to the target population before and after sample weighting.

Table 6.13. Demographics of Sample Used to Derive Predicted NCRC Levels

Characteristic		Sample		Target population %
		%	Wt. %	
Gender	Female	45.3	48.0	47.5
	Male	46.8	47.3	46.3
	Another gender	1.3	1.1	0.8
	Missing	6.6	3.6	5.4
Race/ethnicity	Asian	2.5	2.4	2.9
	Black/African American	23.0	15.5	15.8
	Hispanic	14.2	16.1	14.9
	Native American	1.1	1.1	1.0
	Native Hawaiian/OPI	0.1	0.2	0.2
	Two or more races	4.9	5.6	5.1
	White	50.3	49.5	50.9
	Missing	3.9	9.8	9.2
Region	Midwest	9.0	29.3	31.0
	Northeast	0.0	0.0	0.0
	South	91.0	70.7	69.0
	West	0.0	0.0	0.0
School type	Public	100.0	100.0	100.0
School locale	Rural	32.2	26.4	24.3
	Town	12.7	18.9	16.4
	Suburban	21.5	24.1	28.5
	Urban	24.8	24.9	25.1
	Missing	8.9	5.7	5.8
High school graduation year	2021	<0.1	<0.1	0.0
	2022	23.6	19.2	0.0
	2023	40.8	37.6	100.0
	2024	29.6	32.6	0.0
	2025	5.9	10.5	0.0
	2026	0.1	0.1	0.0

Note. OPI = Other Pacific Islander. The percentages of each characteristic may not add up to 100% because of rounding.

6.3.2 Statistical Model Used to Derive the NCRC Level Predictions

Among students in the sample, 12.3% earned a Platinum NCRC, 19.2% earned a Gold NCRC, 30.4% earned a Silver NCRC, 25.6% earned a Bronze NCRC, and 12.5% were Below Bronze. Using the weighted sample, logistic regression was used to find the PreACT Suite Composite scores associated with a 50% chance of obtaining each NCRC level or higher. The model included the number of months between pretest and posttest as a covariate, as well as an indicator for whether the onset of the COVID-19 pandemic (March 2020) occurred between the tests. The logistic regression model estimates are provided in Table 6.14.

Table 6.14. Logistic Regression Parameter Estimates Used to Derive Progress Toward Career Readiness Cut Scores

NCRC level	Predictor	Estimate	SE
Bronze	Intercept	−4.172	0.059
	Composite score	0.413	0.003
	Number of months between tests	0.006	0.002
	Pandemic disruption	−0.398	0.021
Silver	Intercept	−6.664	0.047
	Composite score	0.447	0.002
	Number of months between tests	0.007	0.001
	Pandemic disruption	−0.330	0.017
Gold	Intercept	−9.400	0.056
	Composite score	0.456	0.002
	Number of months between tests	0.026	0.001
	Pandemic disruption	−0.288	0.019
Platinum	Intercept	−11.806	0.083
	Composite score	0.456	0.003
	Number of months between tests	0.041	0.002
	Pandemic disruption	−0.288	0.026

Note. SE = standard error.

The logistic regression results were then used to find the PreACT Suite Composite scores associated with a 50% chance of scoring at or above each NCRC level, under the assumption that the onset of the COVID-19 pandemic did not occur between the tests. Estimates were obtained for different values of the number of months between the PreACT Suite test and WorkKeys test: 48 (for fall Grade 8), 42 (for spring Grade 8), 36 (for fall Grade 9), 30 (for spring Grade 9), 24 (for fall Grade 10), 18 (for spring Grade 10), and 12 (for fall Grade 11). These values assume that students will take the ACT WorkKeys test in fall of 12th grade. The cut score estimates were obtained by rounding to the nearest integer, resulting in the score ranges presented in Table 6.15 for each NCRC level, grade level, and season.

Table 6.15. PreACT Suite Composite Score Ranges Corresponding to Predicted NCRC Levels

NCRC level	PreACT Suite grade level and season						
	Grade 8		Grade 9		Grade 10		Grade 11
	Fall	Spring	Fall	Spring	Fall	Spring	Fall
Below Bronze	1–8	1–9	1–9	1–9	1–9	1–9	1–9
Bronze	9–14	10–13	10–13	10–13	10–14	10–14	10–14
Silver	14–17	14–17	14–18	14–18	15–18	15–19	15–19
Gold	18–21	18–21	19–22	19–22	19–23	20–23	20–24
Platinum	22–35	22–35	23–35	23–35	24–35	24–35	25–35

Note. The maximum possible scale score for Platinum level is 30 for PreACT 8/9, 32 for PreACT 9 Secure, and 35 for PreACT and PreACT Secure.

6.4 Derivation of PreACT Readiness Levels

A study was conducted in 2024 to update the Readiness Levels for PreACT 8/9, PreACT, and PreACT Secure. We used longitudinal data, including PreACT 8/9, PreACT, and ACT test scores for students tested through February 2024. Students' PreACT 8/9 and PreACT records were linked to their ACT scores obtained in spring or summer of 11th grade and/or fall, spring, or summer of 12th grade. Five samples were created:

Grade 8 PreACT 8/9: 11,397 students who took the PreACT 8/9 in 8th grade during the 2019–2020 academic year and took the ACT in 11th and/or 12th grade

Grade 9 PreACT 8/9: 58,870 students who took the PreACT 8/9 in 9th grade during the 2019–2020 or 2020–2021 academic years and took the ACT in 11th and/or 12th grade

Grade 9 PreACT: 119,060 students who took the PreACT in 9th grade during the 2016–2017 through 2020–2021 academic years and took the ACT in 11th and/or 12th grade

Grade 10 PreACT: 768,071 students who took the PreACT in 10th grade during the 2019–2020 through 2021–2022 academic years and took the ACT in 11th and/or 12th grade

Fall Grade 11 PreACT: 52,399 students who took the PreACT in the fall of 11th grade during the 2020–2021 through 2022–2023 academic years and took the ACT in 11th and/or 12th grade

Each sample was weighted to approximately match a target population: the 2023 cohort of ACT-tested high school graduates. To determine the weights, logistic regression was used to estimate propensity score weights (Austin, 2011). The weighting variables included gender, race/ethnicity, school type (public or private), school percentage eligible for free or reduced lunch, school locale (rural, town, suburban, or urban), geographic region, and school mean ACT Composite score. School percentage eligible for free or reduced lunch data were available for most public schools. For schools that did not have these data available, a missing data indicator was used in the logistic regression model used to estimate propensity score weights. School mean ACT Composite score was only calculated for schools with state or district ACT testing programs. For schools that did not participate in state or district ACT testing programs, a missing data indicator was used in the logistic regression model used to estimate propensity score weights.

After weighting, each sample approximately matched the target population. The five samples were then combined to form the total sample. Some students were included in multiple samples because they took multiple PreACT 8/9 and/or PreACT tests; the total sample included 927,647 students. Table 6.16 provides the distribution of background variables for the total sample, before and after weighting. After weighting, the sample percentages are very close to the population percentages.

Table 6.16. Background Characteristics of Total Sample

Characteristic		Sample %		Population (%)
		Raw	Weighted	
Gender	Female	46.5	48.7	48.7
	Male	44.8	46.7	46.4
	Another gender	0.6	0.5	0.7
	Prefer not to respond	1.8	1.3	1.9
	Missing	6.3	2.8	2.3
Race/ ethnicity	Asian	3.2	4.0	4.2
	Black/African American	11.7	11.7	12.4
	Hispanic	12.5	15.9	16.9
	Native American	1.1	1.0	1.0
	Native Hawaiian/OPI	0.3	0.3	0.3
	Two or more races	5.4	5.0	4.9
	White	53.3	54.3	52.2
	Prefer not to respond	2.7	2.4	3.3
	Missing	9.9	5.4	4.9
Grade level last ACT	11	76.0	71.7	68.6
	12	24.0	28.3	30.3
	Other	0.0	0.0	1.1
School type	Nonpublic	15.3	13.0	10.1
	Public	84.7	87.0	89.9
School locale	Rural	22.3	17.9	17.6
	Town	13.6	13.7	13.2
	Suburban	29.5	33.5	33.1
	Urban	28.3	28.5	28.4
	Missing	6.3	6.3	7.8
Region	Midwest	29.4	30.2	27.8
	Northeast	1.4	3.5	3.6
	South	60.9	47.6	52.2
	West	8.4	18.7	16.4
School FRL %	% Missing	25.2	36.7	32.2
	Mean	39.2	42.1	42.0
School mean ACT	% Missing	8.0	20.9	23.8
	Mean	18.8	18.7	18.5

Note. OPI = Other Pacific Islander; FRL = free or reduced lunch.

Students' best ACT test scores in each section were used to determine whether students met the ACT College Readiness Benchmark. (When students tested more than once, their highest math and science scores were used to calculate their STEM score, also known as an ACT Superscore.) Table 6.17 provides test score summary statistics for each test section and grade level included in the total sample.

Table 6.17. Weighted Summary Statistics for PreACT 8/9 or PreACT Scores and Best ACT Scores

Test section	Grade level	*N*	PreACT 8/9 or PreACT		ACT		
			Mean	SD	Mean	SD	% Meeting Benchmark
English	8	11,397	15.6	4.7	19.4	6.4	55.2
	9	177,930	15.9	5.5	19.8	6.8	58.4
	10	768,071	16.2	6.2	19.4	7.0	55.9
	11	52,399	17.2	6.5	19.4	7.0	55.8
Math	8	11,397	17.5	3.9	19.6	5.2	32.3
	9	177,930	17.8	4.0	19.9	5.4	35.4
	10	768,071	18.3	4.5	19.8	5.6	34.8
	11	52,399	18.7	4.8	19.5	5.4	33.3
Reading	8	11,397	18.4	5.7	21.3	6.6	44.9
	9	177,930	19.3	6.2	21.3	6.9	46.3
	10	768,071	20.5	6.7	21.1	7.1	45.1
	11	52,399	21.0	6.9	20.9	7.1	44.1
Science	8	11,397	16.8	4.2	20.6	5.5	35.5
	9	177,930	17.5	4.6	20.7	5.6	37.0
	10	768,071	18.6	5.2	20.5	5.8	36.2
	11	52,399	19.0	5.5	20.4	5.8	36.2
STEM	8	11,397	17.4	3.8	20.3	5.2	18.8
	9	177,930	17.9	4.0	20.5	5.3	18.9
	10	768,071	18.7	4.5	20.4	5.5	18.9
	11	52,399	19.1	4.8	20.2	5.3	18.3

Note. SD = standard deviation.

For each test section, logistic regression was used to model the probability of meeting the ACT College Readiness Benchmark as a function of PreACT 8/9 or PreACT test score (linear and quadratic effects), number of months between PreACT 8/9 or PreACT test and last ACT test, the interactions of PreACT 8/9 or PreACT test score effects and number of months between tests, and an indicator variable for whether the onset of the COVID-19 pandemic (March 2020) occurred between the tests.

The logistic regression models produced estimated probabilities of meeting the ACT Benchmark for each combination of test section, PreACT 8/9 or PreACT score, number of months between

tests, and whether the onset of the pandemic occurred between the tests. To derive the Readiness Level cut scores, we used estimates obtained for specific values of number of months between tests, including the following:

- 45 months between tests for the fall Grade 8 Readiness Levels
- 39 months between tests for the spring Grade 8 Readiness Levels
- 33 months between tests for the fall Grade 9 Readiness Levels
- 27 months between tests for the spring Grade 9 Readiness Levels
- 21 months between tests for the fall Grade 10 Readiness Levels
- 15 months between tests for the spring Grade 10 Readiness Levels
- 9 months between tests for the fall Grade 11 Readiness Levels

Note that the estimates also assume that the onset of the pandemic did not occur between tests; therefore, the Readiness Levels assume that student growth was not disrupted by the onset of the pandemic. Table 6.18 shows the cut score point estimates produced by the logistic regression models, as well as the cut scores chosen for the Readiness Levels.

Generally, the cut scores for the On Target Readiness Level were chosen as the scores closest to having a 0.50 probability of meeting the ACT College Readiness Benchmark. Similarly, the cut scores for the Close to Target Readiness Level were chosen as the scores closest to having a 0.25 probability of meeting the ACT College Readiness Benchmark. In some cases, cut scores that deviated slightly from those rules were selected to achieve greater continuity across grade levels. Further, some of the cut scores for the Close to Target Readiness Level were modified to ensure that the cut score was at least 2 score points below the cut score for the On Target Readiness Level. For Grade 8 English, the cut scores for Close to Target were set at 8, despite the estimates being lower. This was done to ensure that the cut scores were not set too low (e.g., approaching scores that students could achieve by guessing).

Table 6.18. Cut Score Point Estimates (and Selected Cut Score) for Readiness Levels

Readiness level	Grade level	Season	Cut score				
			English	Math	Reading	Science	STEM
Close to target	8	Fall	4.91 (8)	14.91 (14)	11.04 (13)	13.84 (14)	17.70 (17)
	8	Spring	7.21 (8)	15.39 (15)	12.92 (14)	14.95 (15)	18.53 (18)
	9	Fall	8.73 (9)	15.91 (15)	14.49 (15)	15.99 (16)	19.37 (19)
	9	Spring	9.95 (10)	16.47 (16)	15.87 (16)	16.99 (17)	20.21 (20)
	10	Fall	11.01 (11)	17.05 (17)	17.14 (17)	17.95 (18)	21.04 (21)
	10	Spring	11.98 (12)	17.67 (17)	18.35 (18)	18.89 (19)	21.85 (21)
	11	Fall	12.91 (13)	18.30 (18)	19.53 (19)	19.81 (20)	22.63 (22)
On target (Readiness Benchmarks)	8	Fall	9.56 (10)	16.16 (16)	15.58 (16)	16.67 (17)	19.19 (19)
	8	Spring	10.77 (11)	16.71 (17)	16.94 (17)	17.61 (18)	20.06 (20)
	9	Fall	11.82 (12)	17.31 (17)	18.19 (18)	18.52 (19)	20.93 (21)
	9	Spring	12.77 (13)	17.93 (18)	19.38 (19)	19.41 (19)	21.78 (22)
	10	Fall	13.67 (14)	18.59 (19)	20.52 (20)	20.29 (20)	22.61 (23)
	10	Spring	14.55 (15)	19.26 (19)	21.66 (21)	21.15 (21)	23.41 (23)
	11	Fall	15.43 (16)	19.93 (20)	22.81 (22)	22.01 (22)	24.16 (24)

6.5 PreACT Score Ranges

Measurement precision on the PreACT student score reports is represented by +/−1 CSEM (conditional standard error of measurement) from the student's scale score. CSEM values were computed for each form following the IRT-based procedure described by Kolen and Brennan (2004, pp.301–302) with simulated θ values from −8 to 8. The specific steps and formula of computing the CSEM values are as follows:

Step 1. For a given specific θ_i point, the recursive formula by Lord and Wingersky (1984) was used to find the conditional distribution of observed raw scores, which is symbolized as $f(X|\theta_i)$. Based on the raw-to-scale conversion table obtained using the IRT true score equating method, $f(X|\theta_i)$ was transformed to the conditional distribution of possible scale score points for a certain examinee with a specific ability of θ_i.

Step 2. The expected mean of the conditional distribution of scale scores given θ_i is

$$\xi(\theta_i) = \sum_{j=0}^{K} sc(j) f(X = j|\,\theta_i)$$

where $sc(j)$ represents the corresponding scale score for a raw score point j based on the raw-to-scale score conversion on a test with *K* items.

Step 3. Conditional measurement error variance of scale scores given θ_i is

$$var[sc(j)|\theta_i] = \sum_{j=0}^{K}[sc(j) - \xi(\theta_i)]^2 f(X = j|\theta_i)$$

The square root of the above error variance represents the CSEM of scale scores at a given θ_i. For each scale score from 1 to 35, the corresponding raw score and θ were located. The CSEM values were calculated through the formula above and were rounded to integers. Considering the values across forms were very close, it was decided, for simplicity, to use the scale score CSEM values on the form administered in Fall 2016. The scale score CSEM values are continuously monitored and will be updated if significant deviations are found. CSEM values for all PreACT scale scores can be found in Table 6.19.

Table 6.19. PreACT CSEM Values

PreACT Scale Score	English CSEM	Math CSEM	Reading CSEM	Science CSEM	Composite CSEM	STEM CSEM
1	2	1	2	2	1	1
2	2	1	2	2	1	1
3	2	1	2	2	1	1
4	2	1	2	2	1	1
5	2	1	2	2	1	1
6	2	1	2	2	1	1
7	2	1	2	2	1	1
8	2	1	2	2	1	1
9	2	1	2	2	1	1
10	2	1	2	2	1	1
11	2	1	2	2	1	1
12	2	1	2	2	1	1
13	2	1	2	2	1	1
14	2	1	2	2	1	1
15	2	1	2	2	1	1
16	2	1	2	2	1	1
17	2	1	2	2	1	1
18	2	2	2	2	1	1
19	2	2	2	2	1	1
20	2	2	2	2	1	1
21	2	2	3	2	1	1
22	2	2	3	2	1	1
23	2	2	3	2	1	1
24	2	2	3	2	1	1
25	2	2	3	3	1	2
26	2	2	3	3	1	2
27	3	2	3	3	1	2
28	3	3	3	3	2	2
29	3	3	3	3	2	2
30	3	3	3	3	2	2
31	3	3	3	3	2	2
32	3	3	3	3	2	2
33	3	3	3	3	2	2
34	2	2	2	2	1	1
35	1	1	1	1	1	1

6.6 PreACT 2023–2024 Operational Test Data

Over 450,000 examinees from 50 states took the PreACT tests during the 2023–2024 academic year. Tables 6.20 to 6.23 present the data distributions for grades 9, 10, and 11 based on gender, ethnicity, and region of country, respectively.

Table 6.20. PreACT 2023–2024 Operational Test Data Distribution by Gender and Grade

Gender	Grade 9	Grade 10	Grade 11
Female	19,905	148,233	9,713
Male	19,520	155,160	10,373
Other	2,303	85,671	2,041

Note. "Other" category includes 'Another gender,' 'Prefer not to respond,' and missing.

Table 6.21. PreACT 2023–2024 Operational Test Data Distribution by Ethnicity and Grade

Race/Ethnicity	Grade 9	Grade 10	Grade 11
Black/African American	4,990	29,618	1,573
American Indian/Alaskan Native	289	4,386	217
White	21,058	169,985	12,669
Hispanic/Latino	2,184	21,550	1,187
Asian	2,024	14,358	785
Native Hawaiian/Other Pacific Islander	316	1,192	68
Two or more races	6,435	49,247	2,563
Prefer not to respond	1,878	16,904	1,079
Missing	2,554	81,824	1,986

Table 6.22. PreACT 2023–2024 Operational Test Data Distribution by Region of Country and Grade

Region	Grade 9	Grade 10	Grade 11
Midwest	17,006	117,505	14,638
Missing	6	172	2
Northeast	1,491	18,766	1,314
South	19,195	195,858	3,895
West	4,030	56,763	2,278

Table 6.23. PreACT 2023–2024 Operational Test School Distribution by Region of Country and Grade

Region	Grade 9	Grade 10	Grade 11
Midwest	415	1,108	281
Northeast	49	227	70
South	444	1,918	298
West	176	509	115
Missing	1	5	1

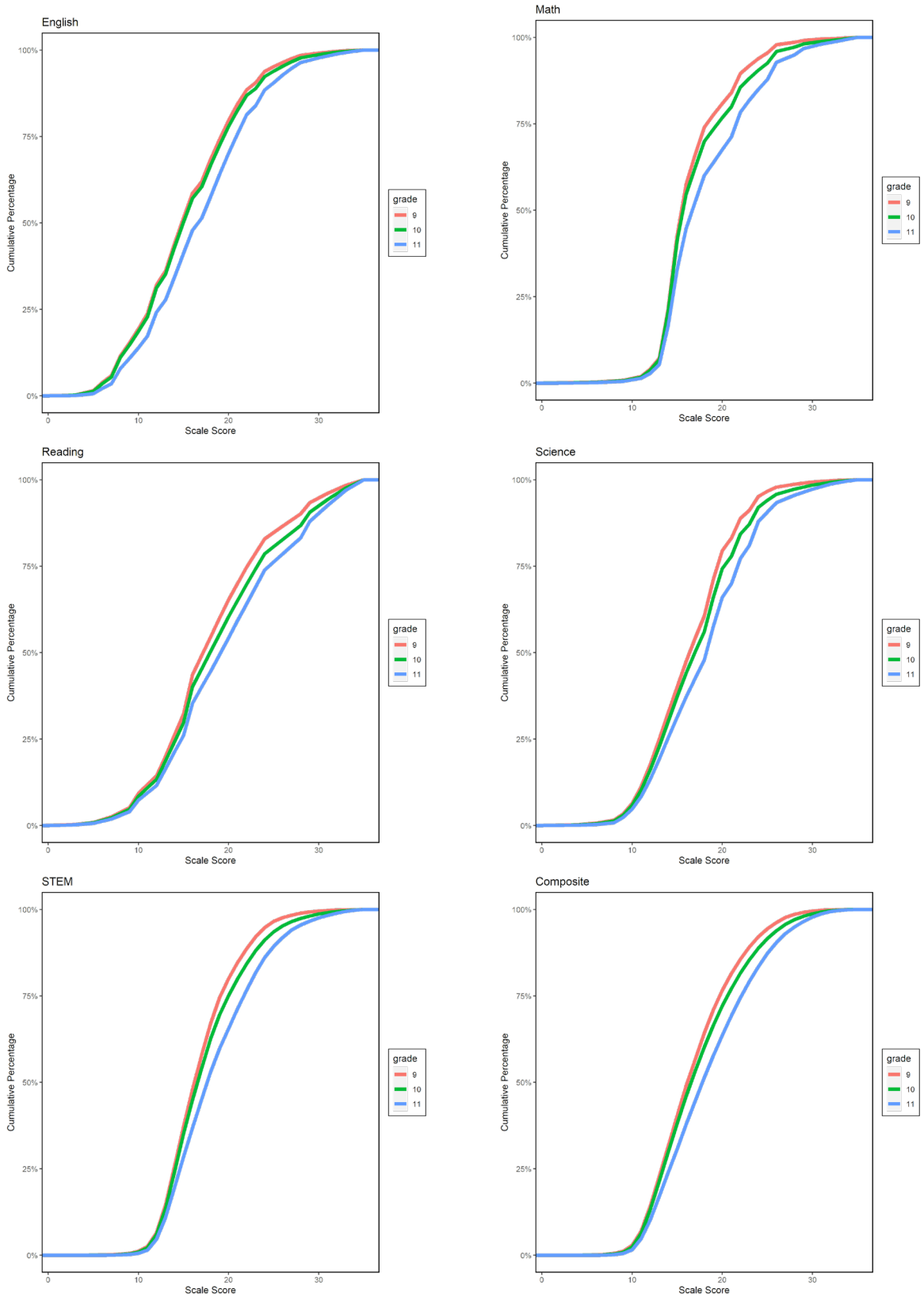
6.6.1 Scale Score Statistics for the PreACT 2023–2024 Test Sample

Scale score summary statistics for the students in Grades 9, 10, and 11 in the PreACT 2023–2024 samples are given in Table 6.24. Figure 6.9 shows the comparisons of scale score distributions among three grades.

Table 6.24. Scale Score Summary Statistics for 9th, 10th, and 11th Graders

Grade	Test section	Mean	SD	Skewness	Kurtosis
Grade 9	English	15.70	5.70	0.33	–0.14
	Math	17.17	3.93	1.18	2.03
	Reading	18.74	6.43	0.48	–0.15
	Science	17.01	4.65	0.35	0.28
	STEM	17.34	3.95	0.77	0.75
	Composite	17.28	4.57	0.58	–0.06
Grade 10	English	15.99	5.89	0.39	–0.08
	Math	17.67	4.46	1.21	1.61
	Reading	19.50	6.81	0.40	–0.45
	Science	17.64	5.08	0.47	0.31
	STEM	17.90	4.46	0.87	0.72
	Composite	17.82	4.97	0.61	–0.13
Grade 11	English	17.32	6.09	0.30	–0.21
	Math	18.77	5.00	0.94	0.43
	Reading	20.41	7.02	0.27	–0.68
	Science	18.66	5.44	0.40	0.03
	STEM	18.96	4.90	0.69	0.06
	Composite	18.91	5.29	0.45	–0.48

Figure 6.9. Scale Score Distribution Comparisons for Grades



6.6.2 Effective Weights

As with the ACT, the PreACT Composite score is the rounded average of the scale scores of the English, math, reading, and science test sections. This score evaluates students' general educational development over the four areas. Therefore, it is necessary to report the contributions of individual test section scores to a combined score, which is represented by effective weight. According to Wang and Stanley (1970), effective weight is defined as the statistical contribution of the test to the variance of the composite. The effective weights are calculated based on the variance-covariance matrix between the scale scores. Since the scale scores from the four test sections were equally weighted to compute the Composite score, effective weights, ew_i, were calculated as

$$ew_i = \frac{\sigma_i^2 + \sum_{j \neq 1} \sigma_{ij}}{\sum_i \left[\sigma_i^2 + \sum_{j \neq 1} \sigma_{ij}\right]}$$

where σ_i^2 is the variance of scale scores on test section *i*, and σ_{ij} is the covariance between scale scores on test sections *i* and *j*.

Table 6.25 contains the variance-covariance matrix of the scale scores for effective weights calculation based on 2023–2024 operational data. For example, the effective weight for English was computed by adding the four numbers in the first row (34.72, 18.37, 31.26, and 21.22). This sum was then divided by the sum of all the elements in the variance-covariance matrix. Since both variance and covariance are included in the numerator, a greater variance or covariance with other test sections could lead to a greater effective weight.

Tables 6.26 and 6.27 contain the effective weight for each test section score contributing to the variances of the Composite and STEM scores separately based on the 2023–2024 PreACT operational data. The effective weights for typical ACT forms from the most recent ACT technical manual (ACT, 2024) are provided as references. From Table 6.27, it should be noted that, compared with the science score, the mathematics score has a larger effective weight in STEM for the ACT test. By contrast, for the PreACT, the science score has a larger effective weight to STEM. One possible explanation could be that, compared with the ACT, the science score on the PreACT tests has larger variance values than the mathematics score, as shown in Table 6.25. The summation of some proportions in Table 6.20 does not equal one because of rounding.

Table 6.25. Scale Score Variance-Covariance Matrix for the PreACT and ACT Tests

Test	Test section	English	Math	Reading	Science
PreACT	English	34.72	18.37	31.26	21.22
	Math	18.37	19.85	20.09	16.65
	Reading	31.26	20.09	46.11	25.18
	Science	21.22	16.65	25.18	25.73
ACT	English	43.03	27.53	35.12	28.11
	Math	27.53	30.19	24.91	24.29
	Reading	35.12	24.91	46.64	27.52
	Science	28.11	24.29	27.52	29.67

Table 6.26. Effective Weights of Composite Score for the PreACT and ACT Tests

Test	Test section	Number of items	Proportion of total	Effective weight
PreACT	English	45	0.33	0.27
	Math	36	0.26	0.19
	Reading	25	0.18	0.31
	Science	30	0.22	0.23
ACT	English	75	0.35	0.27–0.28
	Math	60	0.28	0.22–0.23
	Reading	40	0.19	0.27–0.28
	Science	40	0.19	0.21–0.24

Table 6.27. Effective Weights of STEM Score for the PreACT and ACT Tests

Test	Test section	Number of items	Proportion of total	Effective weight
PreACT	Math	36	0.55	0.46
	Science	30	0.45	0.54
ACT	Math	60	0.60	0.50–0.52
	Science	40	0.40	0.48–0.50

6.6.3 Correlations

The correlations of scale scores were computed based on the 2023–2024 PreACT operational data and compared with the scale score correlations from the most recent ACT technical manual (ACT, 2024), as shown in Table 6.28. Correlations among PreACT scale scores are similar to those of the ACT.

Table 6.28. Correlations Among the PreACT and ACT Test Scores

Test	Test section	English	Math	Reading	Science	Composite	STEM
PreACT	English	1.00	0.70	0.78	0.71	0.90	0.76
	Math	—	1.00	0.66	0.74	0.85	0.92
	Reading	—	—	1.00	0.73	0.91	0.75
	Science	—	—	—	1.00	0.88	0.94
	Composite	—	—	—	—	1.00	0.93
	STEM	—	—	—	—	—	1.00
ACT	English	1.00	0.77	0.80	0.78	0.93	0.81
	Math	—	1.00	0.68	0.81	0.89	0.95
	Reading	—	—	1.00	0.76	0.90	0.75
	Science	—	—	—	1.00	0.92	0.95
	Composite	—	—	—	—	1.00	0.95
	STEM	—	—	—	—	—	1.00

6.7 PreACT Norms

One of the intended uses of PreACT test scores is to understand student performance relative to national norms. PreACT score reports provide percentile ranks for English, mathematics, reading, science, STEM, and Composite scores. A PreACT norming study is typically conducted each year, and the results are used to assign percentile ranks to scores. The goal of the norming study is to estimate norms (including percentile ranks) that are representative of examinees across the country who take the ACT test. Norms are estimated for Fall grade 9, Spring grade 9, Fall grade 10, Spring grade 10, and Fall grade 11, respectively. Sample selection and weighting procedures are used to ensure that each sample is representative of the ACT-tested population with respect to gender, race/ethnicity, geographic region, and school category (defined by public/nonpublic status and percentage of students eligible for free and reduced-price lunch). Through this design, student performance on the PreACT can be understood for each grade level and season, relative to the population of students who go on to take the ACT test. Detailed description of the PreACT norming studies, including norming samples, weighting methodology, estimation procedures, and analyses results, is documented in separate reports (Lu & Allen, 2018). The most recent norm tables can be found at https://success.act.org/s/article/PreACT-and-PreACT-89-US-Ranks.

6.8 Differential Item Functioning

Differential item functioning (DIF) can be described as a statistical difference between the probability of the specific population subgroup (the “focal” group) answering the item correctly and the comparison population subgroup (the “base” group) answering the item correctly given that both groups have the same level of expertise with respect to the content being tested. DIF analyses of the PreACT tests were conducted separately for grades 9, 10, and 11. The procedures currently used for the PreACT DIF analyses include the standardized difference in proportion correct (STD) procedure and the Mantel-Haenszel common odds-ratio (MH) procedure (Holland & Thayer, 1988). Detailed description of these statistics and their performance in detecting DIF is documented in the ACT Research Report entitled *Performance of Three Conditional DIF Statistics in Detecting Differential Item Functioning on Simulated Tests* (Spray, 1989).

Both the STD and MH techniques are designed for use with multiple-choice items, and both require data from a significant number of students to provide reliable results. Testing industry standards require a minimum of 300 students for the focal group and 700 students overall (Zwick, 2012). As a result, DIF analyses of PreACT tests were conducted on each multiple-choice item for the seven group comparisons, as shown in Table 6.29 below.

Table 6.29. The Group Comparison for DIF Analyses

Focal group	Reference group
Female	Male
Asian	White
Black/African American	White
Hispanic	White
American Indian or Alaska Native	White
Pacific Islander	White
Two or More Races	White

Using pre-established criteria, the items with STD or MH values exceeding the tolerance level were flagged. The flagging criteria for the STD procedure is to flag items when the absolute value of STD is greater than 0.10. Based on the STD procedure, one English item and one math item show DIF. Table 6.30 shows the criteria for flagging DIF in multiple-choice items related to the MH procedure. Table 6.31 presents the number of items in each DIF category: A, B, and C (Zieky, 1993). In English, one item was flagged for DIF in gender and in Black/White. For math, one item had DIF B in gender and Black/White. No item was flagged for DIF in reading. In science, two items were flagged for DIF in gender. The content experts reviewed the flagged items and did not find they were biased to any particular group.

Table 6.30. Criteria for the A, B, and C DIF Categories on MH Procedure

Category	Description	Criterion
A	Negligible DIF	Nonsignificant MH-CHISQ (P > 0.05) or |MH-D| < 1.0
B	Moderate DIF	Significant MH-CHISQ (P ≤ 0.05) and 1.0 ≤ |MH-D| < 1.5
C	Large DIF	Significant MH-CHISQ (P ≤ 0.05) and |MH-D| ≥ 1.5

Table 6.31. Summary of DIF Analysis

Test section	DIF group	A	B	C	Total number of items
English	Gender	44	1	0	45
	Black/White	44	1	0	45
	Hispanic/White	45	0	0	45
Math	Gender	35	1	0	36
	Black/White	35	1	0	36
	Hispanic/White	36	0	0	36
Reading	Gender	25	0	0	25
	Black/White	25	0	0	25
	Hispanic/White	25	0	0	25
Science	Gender	28	2	0	30
	Black/White	30	0	0	30
	Hispanic/White	30	0	0	30

6.9 Reliability and Measurement Error

Reliability quantifies the level of consistency in test scores across repeated test administrations and is usually estimated based on a single test administration. Coefficient alpha is one of the most widely used measures of reliability, and it provides reliability estimates for number-correct scores. Table 6.32 shows the coefficient alpha reliability estimates for the raw scores of the 2023–2024 PreACT operational test.

Table 6.32. Coefficient Alpha Reliability Estimates for Raw Scores

English	Math	Reading	Science
.90	.88	.87	.84

Under the framework of item-response theory, scale score reliability estimates were calculated using the formula by Kolen, Zeng, and Hanson (1996). The specific formula for scale score reliability is

$$SEM_t^2 = \int_\theta var[sc(j)|\theta]g(\theta)d\theta$$

$$REL_t = 1 - \frac{SEM_t^2}{s_t^2}$$

where SEM_t^2 is the estimated error variance of the measurement for test section *t*, and s_t^2 is the sample variance of the observed scale score for the section. $var[sc(j)|\theta]$ is the conditional measurement error variance of scale scores for a given θ. $g(\theta)$ is the posterior distribution of θ obtained from the empirical data.

The SEM values for each test section (English, math, reading, and science) were then used to calculate the reliabilities of the STEM and Composite scale scores. The estimated standard error of measurement for the Composite score (SEM_c) is calculated as

$$SEM_c = \frac{\sqrt{\sum_{t=1}^{4} SEM_t^2}}{4}$$

where the summation is over SEM^2 of the four test sections. The estimated reliability of the Composite (REL_c) is calculated as

$$REL_c = 1 - \frac{SEM_c^2}{s_c^2}$$

where s_c^2 is the observed scale score variance for the Composite score.

Similarly, the estimated standard error of measurement for STEM (SEM_{stem}) is calculated based on the summation over the SEM^2 values from the math and science scale scores:

$$SEM_{stem} = \frac{\sqrt{SEM_{math}^2 + SEM_{science}^2}}{2}$$

The estimated reliability of the STEM (REL_{stem}) is calculated as

$$REL_{stem} = 1 - \frac{SEM_{stem}^2}{s_{stem}^2}$$

where s_{stem}^2 is the observed scale score variance for the STEM.

Table 6.33 exhibits the scale score reliability estimates and the standard error of measurement (SEM) based on 2023–2024 operational data. The estimated reliability and SEM ranges for the recent ACT forms (ACT, 2023) are provided as well for the purpose of comparison.

Table 6.33. Estimated Scale Score Reliabilities and Standard Error of Measurement

Grade	Statistic	English	Math	Reading	Science	Composite	STEM
PreACT	Reliability	0.87	0.87	0.85	0.78	0.96	0.91
	SEM	1.97	1.53	2.37	2.11	1.01	1.31
ACT	Reliability	0.92–0.94	0.92–0.93	0.85–0.89	0.83–0.89	0.96–0.97	0.93–0.95
	SEM	1.64–1.82	1.51–1.65	2.28–2.62	1.90–2.13	0.94–1.02	1.22–1.31

6.10 Classification Consistency

PreACT examinees are classified into three college readiness levels based on their scale scores and PreACT Readiness Levels.[1] The classification consistency reflects the percentages of examinees who would be consistently classified into the same achievement levels on two equivalent administrations of the test. However, since the test (or parallel forms of the test) is not often administered twice to the sample, it is necessary to estimate classification consistency with a single test administration using psychometric methods. Two classification consistency indices, agreement rate (Livingston and Lewis, 1995) and Kappa index (Cohen, 1960; Swaminathan, Hambleton, & Algina, 1974), are used to quantify the reliability of categorizing examinees into different readiness levels.

Table 6.34 presents a summary of classification consistency indices—the agreement rate (percentage consistently classified) and Kappa index. Two Levels refers to On Target/Not on Target decisions, and Three Levels refers to classification using all three Readiness Levels (i.e., In Need, Close to Target, and On Target). As can be observed from this table, agreement rates were high with two levels and moderate with three levels for all scores.

Table 6.34. Classification Consistency

Test section	Two levels		Three levels	
	Agreement	Kappa	Agreement	Kappa
English	0.84	0.68	0.73	0.54
Math	0.89	0.74	0.74	0.56
Reading	0.87	0.72	0.74	0.58
Science	0.86	0.62	0.70	0.48
STEM	0.95	0.80	0.88	0.70

6.11 Mode Comparability for Online Pilot Study

In preparation for administering PreACT and PreACT 8/9 online starting from fall 2024, PreACT online pilot test was administered in spring 2024. Students who participated in online pilot test took the online form, while other students took a standard paper form. Both forms have the same content. To report test scores from online pilot test, the mode comparability study was planned and conducted to ensure that the scores from different modes were comparable.

[1] Refer to Section 6.3 for the details on the PreACT Readiness Levels.

To provide evidence that the mode effect is negligible, a bootstrap approach was considered. The hypothesis to be evaluated in this study is that if the item parameter estimates and raw-to-scale score conversion tables based on the students who take the online pilot test are comparable with those based on random samples of the students who take the paper test.

For the online condition, the sample was collected based on about 3,000 students who participated in the online pilot test. For the paper condition, students who took the standard paper form with the same content of the online form between the first day of the test window and the last day of the online pilot test window were included. In total, around 334,000 students were included in the analysis. Raw score means of the online group are slightly higher than those of the paper group. The difference between the mean raw score of online and paper groups was more than 1 score point in English and reading, and less than 1 score point in math and science. The mean raw score difference in science was the smallest, .07. Using the same *N* count from the online group, 3,347 students were randomly sampled from the paper group for 500 times.

Based on the item review including item statistics, differential item functioning (DIF), content expert review, mode-independent items—common items—were identified. Content experts reviewed all items and made comments whether students could perform differently depending on the mode. Based on the DIF results, flagged items were removed from the common items set. The final number of common items included in the analysis was presented in Table 1. They were all above 30% of the total number of items.

Table 6.35. Number of Identified Common Items (Mode-Independent Items)

Subject	Total number of items	Common items (%)*
English	45	22 (49%)
Math	36	14 (39%)
Reading	25	8 (32%)
Science	30	13 (43%)

*All items had the same content between online and paper forms. Common items were identified based on the statistics and content review.

Item parameters were estimated using 3PL in BILOG. Item calibration was done with the online and paper samples, and 500 bootstrapped datasets. Item parameters estimated using the 500 bootstrapped datasets and online samples were placed on the PreACT bank scale. The acceptable range was set with minimum and maximum of each item. Table 6.36 presents the percentage of items falling in the criteria range. The acceptance rate is at least 84% for *a*-parameters, 64% for *b*-parameters, and 70% for *c*-parameters.

Table 6.36. Number of Items Within the Acceptance Range – Scaled Item Parameters

Subjects	*a*-parameter (%)	*b*-parameter (%)	*c*-parameter (%)
English	43 (96%)	29 (64%)	37 (82%)
Math	34 (94%)	25 (69%)	30 (83%)
Reading	21 (84%)	17 (68%)	22 (88%)
Science	27 (90%)	24 (80%)	21 (70%)

After scale transformation using the Stocking and Lord method, IRT equating was conducted to obtain raw-to-scale score conversion tables. If the scale score from the online pilot conversion table fell in the range based on 500 replications—i.e., within the minimum and maximum of scale scores across 500 replications—we can assume the converted score for that score point is within the acceptable range. In English, 7 score points did not fall within the criteria range; 4 score points in math, 2 score points in reading, and 1 score point in science were out of the criteria range. However, all the difference was within 1 scale score point. Considering the conditional standard error of measurement, the difference is not statistically significant. Results of the study provide adequate evidence that the mode effect in online pilot was negligible. Thus, the same conversion tables were be applied when producing score reports for all students regardless of the mode.

Chapter 7: Validity Evidence

According to the *Standards for Educational and Psychological Testing*, "validity refers to the degree to which evidence and theory support the interpretations of test scores for proposed uses of tests" (American Educational Research Association [AERA] et al., 2014, p.11). Validation is the process of justifying intended interpretations and uses and may involve logical, empirical, or theoretical components.

This chapter describes evidence of the validity of PreACT® scores. Validity evidence is provided with respect to five areas: (a) test content, (b) response process, (c) internal structure, (d) relations to other variables, and (e) consequences of testing.

As discussed in Chapter 1, the primary uses of PreACT include

- monitoring progress toward college and career readiness,
- predicting performance on the ACT® test and ACT® WorkKeys® Assessments, and
- identifying academic gaps and areas for improvement.

Secondary uses of PreACT include

- gauging readiness for advanced high school courses,
- evaluating school and program effectiveness,
- facilitating college and career exploration and planning, and
- understanding performance relative to national norms.

The collection of evidence presented in this technical manual (and other PreACT test documentation) supports the intended uses of PreACT. Test users may develop particular interpretations and additional uses that are not covered in this chapter or this technical manual. Each use needs to be justified by a validity argument, and evidence will continue to be gathered and evaluated as the uses of PreACT evolve.

7.1 Evidence Based on Test Content

PreACT helps students prepare for the ACT and lets students and educators monitor progress toward college and career readiness. One of the intended uses of PreACT is to predict student performance on the ACT, which helps facilitate educational and career planning. To support this intended use, ACT provides content-related evidence by evaluating the connections between PreACT and the ACT with respect to the content domain, the knowledge and skills implied by the PreACT specifications, the characteristics of the items, and the development of test forms.

As described in Chapters 2 and 3, PreACT contains four content domains (English, math, reading, and science). PreACT is designed with developmentally articulated test specifications, ensuring that the content measured follows a logical developmental sequence across the high school experience. PreACT 8/9, PreACT, and the ACT share a set of cognitive and noncognitive components. The programs also share item formats and follow consistent reporting procedures.

PreACT is reviewed every year by subject matter experts to ensure that its basic structure matches that of the ACT test and that the two tests' scale scores are comparable.

In addition, ACT periodically conducts academic research and surveys, including the ACT National Curriculum Survey®, to ensure the continued appropriateness of the content on PreACT and the ACT. The ACT® College and Career Readiness Standards are statements of what students should know and be able to do in order to be college and career ready (or on the way to becoming so) in English, math, reading, and science at each grade level. The knowledge and skills a student currently has (and areas for improvement) can be identified by examining the student's PreACT or ACT test scores with respect to the Standards. These Standards are consistent with many states' standards focusing on college and career readiness.

In light of the National Curriculum Survey results, ACT subject matter experts determined the PreACT test content specifications (the number and types of items to be included in each test section and the depth of knowledge [DOK] level of each item). The specific characteristics of the test items in each specification category were reviewed to determine the accuracy and appropriateness of the collection of items. Subject matter experts review new test forms to verify their content accuracy and confirm that the test content matches the content specifications. The items that fulfill the content specifications are also reviewed for content accuracy, word count, item classification, item format, and language.

Items selected to be administered on PreACT have a wide distribution of item difficulties so that the tests will effectively differentiate among students whose achievement levels vary widely. However, since PreACT is designed to be administered before the ACT, its statistical specifications are carefully reviewed to ensure that it has an overall mean item difficulty that is somewhat easier than that of a typical ACT form.

7.2 Evidence Based on Response Process

According to the *Standards*, some intended interpretations of test scores are based on the assumption that a particular psychological process or cognitive operation is used by test takers. "Theoretical and empirical analyses of the response processes of test takers can provide evidence concerning the fit between the construct and the detailed nature of the performance or response actually engaged in by test takers" (AERA et al., 2014, p. 15). Procedures like think-alouds and cognitive labs are commonly used to provide this type of validity evidence.

As mentioned previously, PreACT, like the ACT, was developed using a theory of action. The theory of action helps answer questions related to the purpose of the assessment—intended users, uses, benefits, interpretations, and assessment outcomes. The answers to these questions provide information needed to identify high-value skill targets in each subject area, providing focal points for the development of tasks and test forms. The process set forth by the theory of action further gives rise to potential ways of bringing about the intended goals of the assessment. For example, cognitive labs, piloting, and field-testing are used to evaluate student response processes on items and to iteratively improve the specifications and design of the assessment. The related analyses can provide evidence related to the fit between the

constructs and the cognitive processes engaged in by test takers. The collection and evaluation of all validity evidence is ongoing, and additional evidence based on response processes may be provided in the future.

7.3 Evidence Based on Internal Structure

As indicated by the *Standards* (AERA et al., 2014), analyzing internal structure includes evaluating intended score interpretations from the perspective of expected relationships between test items or parts of the test. Hence the internal structure of PreACT is evaluated via an analysis of dimensionality.

Exploratory factor analyses were conducted on data from PreACT tests administered during the 2023–2024 academic year to explore the dimensionality of the constructs measured by PreACT. PreACT measures student development in English, math, reading, and science. While reporting category scores are also reported to describe performance on skill areas within each subject, we expect to find one dominant dimension in an empirical analysis of dimensionality. In the exploratory factor analyses, scree plots of eigenvalues, model fit, and factor loadings were examined to provide validity evidence of internal structure.

A scree plot shows the relationship between eigenvalues and the number of extracted factors and is typically evaluated by identifying the “elbow” in the plot, which indicates the number of dimensions to retain (Cattell, 1966). Figure 7.1 shows the scree plots for the English, math, reading, and science tests. As can be seen from this figure, the elbow appears after the first eigenvalue, which is evidence for a single dimension. Tables 7.1 through 7.4 show the proportion of variance accounted for by the first 10 factors for the English, math, reading, and science tests, respectively. Since the proportions of variance accounted for by the factors after the 10th are trivial, the table presents overall proportions for the remaining factors. As shown in this table, for each test section, the percentage of variance accounted for by the second factor was smaller than 10%. According to Hatcher (1994), factors that account for less than 10% of the variance should not be retained. Hence it is reasonable to believe that PreACT should be represented by a unidimensional model.

Model fit was evaluated by comparing the model fit index between one- and two-factor models, as shown by the fit statistics given in Table 7.5. The fit statistics include the widely used chi-square test, plus other fit statistics—the comparative fit index (CFI), the Tucker–Lewis index (TLI), the root mean square error of approximation (RMSEA), and the standardized root mean square residual (SRMR)—to supplement the chi-square index due to its sensitivity to large sample sizes (Bollen, 1989; Hu & Bentler, 2009). Fit indices were flagged with an asterisk in Table 7.5 if they showed inadequate fit. Table 7.5 also shows the differences in the fit statistics (DIFF) between the one- and two-factor models. The interfactor correlation (CORR) between Factors 1 and 2 in Table 7.5 was used to evaluate how easily the two factors could be distinguished from each other in the model. All these statistical indices were simultaneously evaluated to compare the goodness of fit of the one- and two-factor models. Fit statistics for the English, math, reading, and science tests showed evidence supporting the one-factor model in most cases. Although the chi-square tests were statistically significant for all tests, this was

likely due to the sensitivity of chi-square statistics to large sample sizes. Compared with the use of the one-factor model, the use of the two-factor model did not substantially improve the model fit. The interfactor correlations in the two-factor model were relatively large (>0.5) for all tests, which indicates a strong relationship between the two factors. Based on the principle of parsimony, the one-factor model was considered adequate for PreACT.

Figure 7.1. Scree Plots of PreACT Tests for English, Math, Reading, and Science

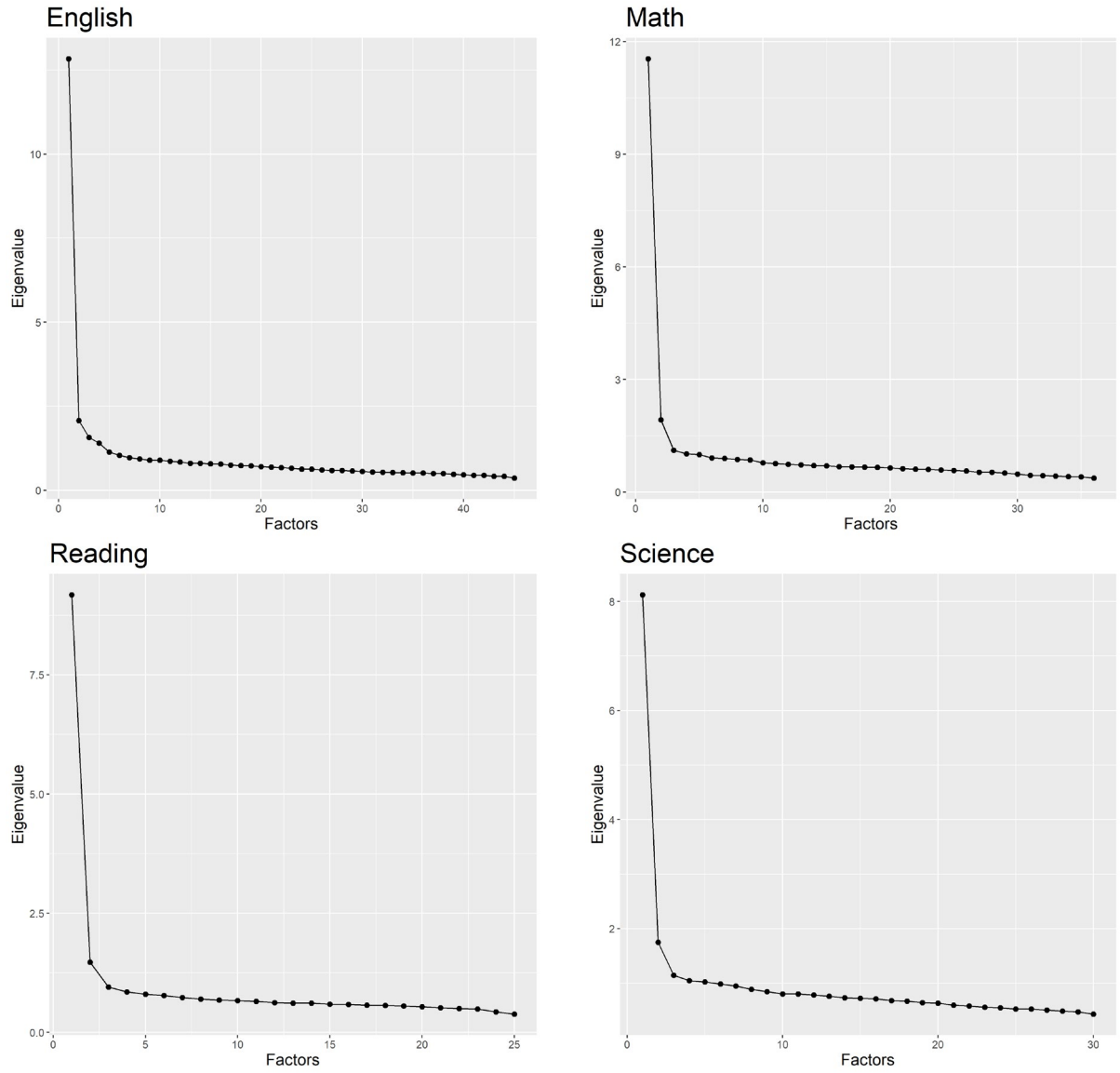


Table 7.1. Percentage of Variance Explained by Factors for PreACT English

English	
Factor	**%**
1	28.5
2	4.6
3	3.5
4	3.1
5	2.5
6	2.3
7	2.2
8	2.1
9	2.0
10	2.0
11−45	47.2

Table 7.2. Percentage of Variance Explained by Factors for PreACT Math

Math	
Factor	**%**
1	32.1
2	5.4
3	3.1
4	2.8
5	2.8
6	2.5
7	2.5
8	2.4
9	2.4
10	2.2
11−36	41.9

Table 7.3. Percentage of Variance Explained by Factors for PreACT Reading

Reading	
Factor	**%**
1	36.7
2	5.9
3	3.8
4	3.4
5	3.2
6	3.1
7	2.9
8	2.8
9	2.7
10	2.7
11−25	32.8

Table 7.4. Percentage of Variance Explained by Factors for PreACT Science

Science	
Factor	**%**
1	27.1
2	5.8
3	3.8
4	3.5
5	3.4
6	3.3
7	3.2
8	3.0
9	2.8
10	2.7
11−30	41.4

Table 7.5. Model Fit Comparison Between One- and Two-Factor Models

Statistic	English			Math			Reading			Science		
	1	2	DIFF	1	2	DIFF	1	2	DIFF	1	2	DIFF
χ^2	528768.9	301762.9	129762.0	216609.1	70215.3	89386.1	145475.7	34135.9	70613.6	226961.2	90575.9	87273.2
DF	945	901	44	594	559	35	275	251	24	405	376	29
***p*-value**	0*	0*	0*	0*	0*	0*	0*	0*	0*	0*	0*	0*
CFI	0.930	0.960	0.030	0.967	0.989	0.022	0.968	0.992	0.024	0.932	0.973	0.041
TLI	0.927	0.956	0.029	0.965	0.988	0.023	0.965	0.991	0.026	0.927	0.969	0.042
RMSEA	0.035	0.027	0.008	0.028	0.017	0.011	0.034	0.017	0.017	0.035	0.023	0.012
SRMR	0.045	0.032	0.013	0.038	0.020	0.018	0.038	0.018	0.020	0.044	0.027	0.017
CORR	—	0.637	—	—	0.465	—	—	0.722	—	—	0.600	—

Note. DF is the degree of freedom; CFI is the comparative fit index; TLI is the Tucker–Lewis index; RMSEA is the root mean square error of approximation; SRMR is the standardized root mean square residual; and CORR is the correlation between Factor 1 and Factor 2 loadings. Flag criteria included CFI < 0.95, TLI < 0.95, RMSEA > 0, SRMR > 0.08, |DIFF CFI| > 0.1, |DIFF TLI| > 0.1, |DIFF RMSEA| > 0.05, and |DIFF SRMR| > 0.05. |DIFF| represents the absolute difference for an index (Hu & Bentler, 2009).

7.4 Evidence Based on Relationships to Other Variables

Intended uses of PreACT include monitoring progress toward college and career readiness and predicting performance on the ACT. PreACT measures academic achievement related to major curriculum areas. These intended interpretations and uses of PreACT test scores imply that PreACT scores should be both predictive of ACT test scores and related to academic performance in high school. Studies were conducted to evaluate the relationships between PreACT test scores and ACT test scores, high school coursework and grades, success in advanced high school courses, and success on Advanced Placement (AP) exams. The results are summarized below.

7.4.1 Relationship With ACT Test Scores

Using PreACT and 11th-grade ACT scores collected through the spring of 2022, correlations of PreACT and ACT scores were examined. This analysis was based on two groups of students:

- 9th-grade PreACT sample: 81,531 students who took PreACT (n = 74,862) or PreACT 8/9 (n = 6,669) in 9th grade and took the ACT in 11th grade, 24 to 30 months after taking PreACT or PreACT 8/9
- 10th-grade PreACT sample: 879,588 students who took PreACT in 10th grade and took the ACT in 11th grade, 12 to 18 months after taking PreACT

Table 7.6 presents summary statistics and correlations of PreACT and ACT scores. In addition to Pearson correlations (r), disattenuated correlations (r_{dis}) are also presented. Disattenuated correlations are estimates of what the correlations would be if the PreACT and ACT tests measured achievement without error (i.e., had reliabilities of 1.0).

The correlation ranged from .72 (Grade 9 science) to .90 (Grade 10 Composite). Most of the disattenuated correlations are greater than .90, suggesting that the PreACT and ACT tests measure similar constructs. Because the correlation coefficients are very large, the findings indicate that PreACT scores are very strong predictors of ACT scores, supporting the use of PreACT scores as predictors of ACT scores.

Table 7.6. Correlations of PreACT and 11th-Grade ACT Scores

PreACT grade	Test Section	PreACT		ACT		*r*	r_{dis}
		Mean	*SD*	Mean	*SD*		
9	English	16.7	5.7	20.5	7.1	.80	.90
	Math	18.0	4.1	20.3	5.5	.80	.92
	Reading	19.5	6.3	21.4	6.9	.74	.87
	Science	18.1	4.9	20.8	5.7	.72	.83
	STEM	18.3	4.1	20.8	5.4	.83	.89
	Composite	18.2	4.6	20.9	5.8	.87	.91
10	English	16.5	6.0	18.8	6.7	.83	.92
	Math	18.4	4.6	19.5	5.3	.85	.94
	Reading	19.9	6.6	20.2	6.7	.78	.90
	Science	18.5	5.2	19.9	5.6	.75	.90
	STEM	18.7	4.6	19.9	5.2	.86	.93
	Composite	18.4	5.0	19.7	5.6	.90	.93

7.4.2 Relationship With High School Coursework and Grades

Because PreACT measures skills that are taught in school and related to major curriculum areas, students who perform better in high school courses should generally perform better on PreACT. Further, performance on PreACT should be an indicator of readiness for advanced high school coursework. To test these propositions, students who took PreACT in 10th grade and who reported their high school grades and coursework when they took the ACT in 11th grade were included.

Table 7.7 presents correlations between PreACT test scores and high school grade averages. The correlations are based on data collected through the spring of 2022 for students who took PreACT in the fall of 10th grade and the ACT in the spring of 11th grade. Overall high school grade point average (HSGPA) was calculated based on students' self-reported grades in core subject areas (English, math, social studies, and natural science). Subject-area GPAs were calculated using the courses within each of the four core subject areas. Correlations between GPAs and test scores from the same subject area were examined (PreACT reading scores were used for social studies courses).

The correlations are presented for the total group ("All students") and for student groups defined by gender, race/ethnicity, English language learner status, special education status, and eligibility for free and reduced-price lunch. The information in Table 7.7 is summarized as follows:

- PreACT Composite score and overall HSGPA as of Grade 11 are highly correlated (r = .57).
- Correlations between PreACT Composite scores and overall HSGPA are similar across gender and racial/ethnic groups and also similar for English language learners and students eligible for free and reduced-price lunch.

- Correlations between PreACT scores and high school grade averages are smaller for students in special education.
- Correlations between PreACT scores and high school grade averages are the highest in math and English.

Table 7.7. Correlations of PreACT Scores With High School Grade Averages (HSGPA and Subject-Specific GPAs), by Student Group

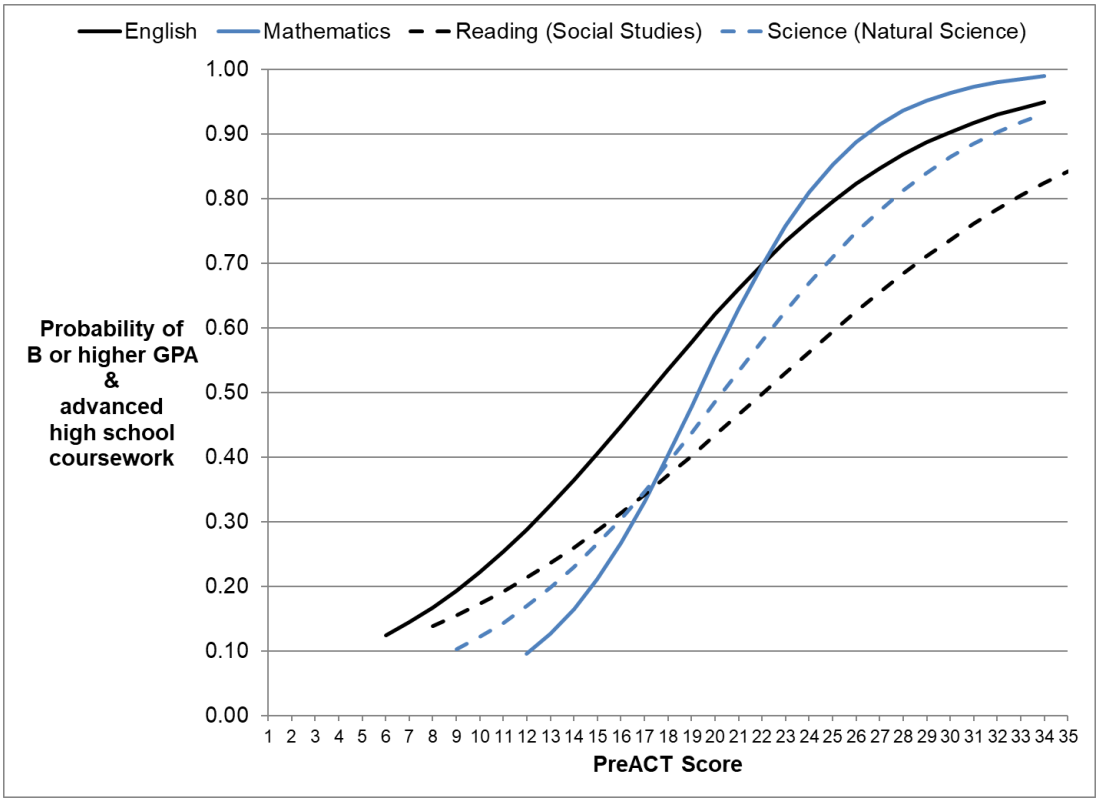
Student group		*N*	High school subject area/PreACT test score				
			Overall/ Composite	English/ English	Math/ math	Social studies/ reading	Natural science/ science
All students		244,116	.57	.48	.49	.42	.45
Gender	**Female**	130,487	.57	.46	.48	.41	.44
	Male	111,179	.59	.48	.52	.43	.47
Race/ ethnicity	**African American**	27,742	.50	.40	.39	.36	.33
	Asian	8,446	.55	.43	.48	.39	.44
	Hispanic	27,742	.55	.45	.45	.41	.42
	Other	21,242	.53	.44	.45	.38	.41
	White	157,359	.55	.45	.48	.40	.43
English language learner		28,436	.51	.41	.42	.36	.37
Special education		3,415	.34	.25	.26	.25	.23
Free/reduced lunch eligible		4,652	.50	.42	.40	.35	.39

When students register for the ACT, they are asked whether they are enrolled in advanced placement, accelerated, or honors courses in each core subject area. Students who perform well in advanced high school courses tend to perform better on the ACT and in college. We examined the relationship between PreACT test scores and success in advanced high school courses. For this analysis, the criterion variable was conjunctive: Students who earned a B or higher subject-area GPA (3.00 or higher) and were enrolled in at least one advanced course in the same subject area achieved “successful advanced course-taking.”

The probabilities of successful advanced course-taking are graphed in Figure 7.2. The probabilities were estimated using logistic regression and are provided for each core subject area (English, math, social studies, and natural science). Successful advanced course-taking and test scores from the same subject area were examined (PreACT reading scores were used for social studies courses). The probabilities were estimated using data collected through the spring of 2022 for a sample of approximately 185,000 students who took PreACT in the fall of 10th grade and the ACT in the spring of 11th grade.

From Figure 7.2, we see that the probability of successful advanced course-taking increases sharply as PreACT scores increase. The relationship is strongest in math, followed by natural science, English, and social studies. The PreACT test scores associated with a 50% chance of successful advanced course-taking are 17 (English), 19 (math), 22 (reading), and 20 (science). This evidence supports the use of PreACT scores to gauge readiness for advanced high school courses.

Figure 7.2. Relationship of Grade 10 PreACT Scores and Successful Advanced Course-Taking



Note. Values are plotted for PreACT scores between the 1st and 99th percentiles in the sample.

7.4.3 Relationship With AP Exam Success

Radunzel and Allen (2020) found that PreACT scores are good predictors of success on AP exams and estimated the PreACT cut scores associated with AP exam success. Data for the study were available for 49,220 students from 318 high schools who had taken at least one AP exam between May of 2015 and May of 2019 and had previously taken ACT® Aspire®, PreACT, or the ACT. A concordance of PreACT/ACT scores with ACT Aspire scores was used to combine data across assessments. Full details of the study are documented in an ACT research report (see Radunzel & Allen, 2020).

The study defined success in AP courses in two ways—receiving an exam score of 3 or higher and receiving an exam score of 4 or higher—and found that PreACT, ACT, and ACT Aspire scores are positively related to AP exam scores and are good predictors of success in future AP

courses. The prediction was strengthened by using combined PreACT scores that were aligned to the content of the AP courses. The sum of the English and reading scores (denoted E+R) was used for ELA-related AP courses, and the STEM score (the average of the math and science scores) was used for STEM-related courses. As a result, the recommended links to AP exam success were developed in relation to content-relevant scores for most courses (shown in Table 7.8).

For each course and outcome, two cut scores are provided—one for fall testing and one for spring testing—depending on when students take PreACT. For example, the first row of results within the table indicates that students who test in the fall and achieve a PreACT E+R score of 42 or higher are likely academically ready to take AP English Language and Composition in the subsequent academic year, as they have a 50% or greater chance of earning a 3 or higher on the corresponding AP exam. Those with a PreACT E+R score of 54 or higher have a 50% or greater chance of earning a score of 4 or higher. The AP-ready cut scores derived from spring testing are slightly higher at 45 (for 3 or higher) and 56 (for 4 or higher) to account for the reduced time between PreACT testing and taking the AP exam. Table 7.8 also reports the correlations (*r*) between test scores (PreACT, ACT, or ACT Aspire) and AP exam scores.

For a holistic view of student readiness for AP courses, we recommend using PreACT scores in combination with other readiness measures (e.g., high school coursework taken, high school grades, motivation, and interest).

Table 7.8. PreACT Scores Associated With Approximately a 50% Chance of Success on AP Exams

AP course		*N*	PreACT Score	*r*	3 or higher		4 or higher	
					Fall	Spring	Fall	Spring
ELA-related	English Lang. and Composition	22,044	E+R	.71	42	45	54	56
	English Lit. and Composition	21,227	E+R	.73	49	51	61	62
	European History	1,025	E+R	.66	45	49	57	60
	Human Geography	3,245	E+R	.57	41	41	52	52
	Psychology	6,813	E+R	.65	39	42	46	49
	U.S. Government and Politics	5,050	E+R	.60	47	50	59	61
	U.S. History	15,669	E+R	.61	44	47	55	57
	World History	8,675	E+R	.62	39	43	51	55
STEM-related	Biology	8,478	STEM	.73	22	23	26	27
	Calculus AB*	3,983	STEM	.61	25	25	28	28
	Chemistry	5,157	STEM	.66	24	25	28	29
	Computer Science A	1,091	STEM	.67	24	24	28	28
	Environmental Science	3,643	STEM	.71	23	24	—	25
	Macroeconomics	978	STEM	.60	24	26	—	27
	Microeconomics	911	STEM	.61	23	25	—	25
	Physics 1**	3,628	STEM	.69	27	27	—	30
	Physics C: E and M	100	STEM	.62	26	28	—	28
	Physics C: Mechanics	413	STEM	.59	25	25	—	28
	Statistics	6,002	STEM	.72	23	24	—	27
Other	Art History	734	Comp.	.50	22	22	—	28
	Music Theory	1,078	Comp.	.56	21	22	—	25
PSAT/SAT-derived	Comparative Government and Politics	—	Comp.	—	22	22	—	25
	Computer Science Principles	—	Comp.	—	18	18	—	25

Note. E+R = English + Reading score. Comp. = Composite score

*Cut scores are not reported for AP Calculus BC. According to College Board's AP Potential tool, students who meet the AP Calculus AB cut scores and perform well in courses leading up to Calculus may consider taking AP Calculus BC.

**Cut scores are not reported for AP Physics 2. According to College Board's AP Potential tool, students who meet the AP Physics 1 cut scores and perform well in prerequisite courses for AP Physics 2 may consider taking AP Physics 2.

7.5 Evidence Related to Consequences of Testing

Consequences of testing include (a) interpretations and uses of test scores intended by the test developer, (b) claims made about the test that are not directly based on test score, and (c)

unintended consequences (AERA et al., 2014). ACT continually seeks evidence of both positive and negative consequences. In this section, we discuss intended consequences of PreACT testing and discuss research that examined the effects of PreACT adoption on college readiness outcomes.

7.5.1 Intended Consequences of PreACT Testing

As described in Chapter 1, the intended benefits of PreACT are closely related to its intended uses and include the following:

- Students gain exposure to the types of content featured on the ACT and to the ACT testing experience.
- Predicted ACT scores improve understanding of student performance relative to college and career readiness.
- Students, parents, and educators understand relative strengths and weaknesses in four subjects that are also assessed by the ACT.
- Schools and districts gain important insights about curriculum and program effectiveness.
- Educators can identify students who are ready for advanced high school coursework.
- Students engage in effective college and career exploration and planning.
- Students can better prepare for the ACT (and, more generally, for college and careers).

7.5.2 Effects of PreACT Adoption on College Readiness Outcomes

A study conducted in 2018 used quasi-experimental methods to examine the effects of schoolwide PreACT adoption on ACT test scores, participation in challenging high school courses, interest–major fit, and college score sending behavior (Allen, 2018). The study found that schoolwide adoption of PreACT led to an increase in ACT Composite score of 0.23 score points, which is comparable to one month of instruction. This effect could be due to exposure to test content and items that mimic those on the ACT (benefit #1), feedback students receive from taking PreACT (benefit #3), changes in instruction or school programming (benefit #4), or improvements in ACT test preparation (benefit #7).

The study also provided evidence of small effects of PreACT adoption on interest–major fit and out-of-state college score sending (benefit #6). Schools that adopted PreACT had students with greater fit between their planned college major and their vocational interests, as well as more students sending their ACT scores to out-of-state colleges.

Further, within schools that adopted PreACT, students who participated in the PreACT Educational Opportunity Service (now called ACT Recruit Me) were more likely to send their ACT scores to at least four colleges and at least one out-of-state college. Students who completed the PreACT Interest Inventory had slightly higher fit between their interests and planned major when they took the ACT. The study did not provide evidence of PreACT effects on outcomes related to taking challenging high school courses. Students from schools that adopted PreACT were no more likely to take accelerated/AP/honors courses or upper-level elective courses in math or science.

Chapter 8: Growth Interpretations

When administered with other ACT® assessments, the PreACT® can be used to generate measures of student growth. Scenarios where growth measures using PreACT scores are of interest include:

- Measuring growth from the PreACT test to the ACT test. A common scenario is when the PreACT test is administered in Grade 10 and the ACT test is administered in Grade 11.

- Measuring growth from the PreACT® 8/9 test to the PreACT test. A common scenario is when PreACT 8/9 is administered in Grade 8 or 9 and the PreACT test is administered in Grade 10. Note that some schools also administer the PreACT in both Grade 9 and 10.

In this chapter, we describe two types of growth models: the gain score model and the Student Growth Percentile (SGP) model. Both models can be applied to describe growth across ACT's suite of college and career readiness assessments.

8.1 Gain Scores

PreACT 8/9, PreACT 9 Secure, PreACT, PreACT® Secure™, and ACT test scores share common scales, making it easier to monitor progress over time. A gain score is the arithmetical difference in scores from one test to the next. Gain scores are an attractive growth measure because of their simplicity and intuitive appeal. Gain scores address the question, "How much has a student learned on an absolute scale?" (Castellano & Ho, 2013)

Gain scores generally have a high degree of measurement error. The standard error of measurement (SEM) of a gain score is equal to $\sqrt{SEM_x^2 + SEM_y^2}$, where SEM_x and SEM_y are the SEMs of the component test scores. For example, if the SEM of the PreACT English score is 2.0 and the SEM of the ACT English score is 1.7, then the SEM of the English gain score is 2.6. Because gain scores have relatively large SEMs, it is not uncommon for students to have negative gain scores. Because the SEM of gain scores is large relative to the average gain, gain scores should not be used to make strong inferences about learning for individual students.

8.1.1 Gain Score Statistics

For all subject areas, positive mean gain scores are anticipated because students are expected to increase their knowledge and skills in the tested areas with more schooling. In this section, we examine gain score summary statistics. Using data collected through spring 2024, summary statistics are provided for 14 groups of students (Table 8.1). The groups are defined by which assessments they took, the grade levels and seasons during which they tested, and the time elapsed between the tests.

We classified student records as having been disrupted by the onset of the pandemic if the first test occurred before April 1, 2020, and the second test occurred after June 1, 2020 (Across the

United States, most in-person schooling was suspended during this period.). For each group listed in Table 8.1, we provide the number of students and the mean Composite score gain by pandemic disruption status. For Groups 1 and 2, there were very few cases where growth was disrupted by the pandemic. For all groups other than Group 2, we find that mean Composite score gains were lower for students whose gains were disrupted by the onset of the pandemic.

For the remainder of the statistics presented in this chapter, we summarize data for students whose gains were not disrupted by the pandemic. By doing so, we describe the growth statistics that result under normal schooling scenarios.

Table 8.1. Comparison of Mean Composite Score Gains by COVID-19 Pandemic Disruption Status

Group	Number of students		Mean Composite gain		
	Not disrupted	Disrupted	Not disrupted	Disrupted	Difference
1. PreACT 8/9 to PreACT 8/9, fall Grade 8 to fall Grade 9, 10–14-month span	12,641	97	1.23	1.02	–0.21
2. PreACT 8/9 to PreACT 8/9, spring Grade 8 to spring Grade 9, 10–14-month span	21,918	391	1.14	1.51	0.36
3. PreACT 8/9 to PreACT, fall Grade 9 to fall Grade 10, 10–14 month-span	58,345	3,851	0.62	0.01	–0.60
4. PreACT 8/9 to PreACT, spring Grade 9 to spring Grade 10, 10–14-month span	67,805	1,937	0.59	–0.02	–0.61
5. PreACT to PreACT, fall Grade 9 to fall Grade 10, 10–14-month span	56,561	5,852	1.45	1.27	–0.18
6. PreACT to PreACT, spring Grade 9 to spring Grade 10, 10–14-month span	65,088	3,182	1.53	1.06	–0.47
7. PreACT to ACT, spring Grade 10 to spring Grade 11, 10–14-month span	558,472	29,507	1.17	0.50	–0.67
8. PreACT to ACT, fall Grade 10 to spring Grade 11, 15–19-month span	1,029,816	214,171	1.52	0.66	–0.85

Group	Number of students	Mean Composite gain	Group	Number of students	Mean Composite gain
9. PreACT to ACT, spring Grade 9 to spring Grade 11, 22–26-month span	51,514	31,670	2.72	1.76	–0.96
10. PreACT to ACT, fall Grade 9 to spring Grade 11, 27–31-month span	42,216	40,330	3.74	2.75	–1.00
11. PreACT 8/9 to ACT, spring Grade 9 to spring Grade 11, 22–26-month span	57,295	5,205	1.40	0.98	–0.42
12. PreACT 8/9 to ACT, fall Grade 9 to spring Grade 11, 27–31-month span	55,523	24,069	1.72	1.15	–0.57
13. PreACT 8/9 to ACT, spring Grade 8 to spring Grade 11, 34–38-month span	6,738	1,584	2.34	1.80	–0.54
14. PreACT 8/9 to ACT, fall Grade 8 to spring Grade 11, 39–43-month span	8,435	10,118	2.86	2.44	–0.42

The summary statistics presented in Table 8.2 include the mean Test 1 (PreACT 8/9® or PreACT) and Test 2 (PreACT 8/9, PreACT, or ACT) scores, correlations of Test 1 scores and Test 2 scores, the mean gain scores, and the standard deviations of the gain score. The mean gains per month are also presented to allow comparisons of growth rates across the different groups. The samples include students who tested through spring 2024, excluding cases where growth was disrupted by the onset of the pandemic.

Table 8.2. Gain Score Summary Statistics

Group	Subject	Mean scores		*r*	Mean gain	SD gain	Mean gain per month
1. PreACT 8/9 to PreACT 8/9, fall Grade 8 to fall Grade 9, 10–14 months apart	Composite	15.71	16.94	0.84	1.23	2.35	0.10
	English	13.66	14.93	0.74	1.27	3.79	0.11
	Math	15.85	17.14	0.67	1.29	2.92	0.11
	Reading	17.01	18.52	0.67	1.51	4.78	0.13
	Science	15.82	16.66	0.66	0.84	3.48	0.07
2. PreACT 8/9 to PreACT 8/9, spring Grade 8 to spring Grade 9, 10–14 months apart	Composite	17.07	18.21	0.86	1.14	2.29	0.10
	English	15.51	16.80	0.76	1.29	3.87	0.11
	Math	16.75	17.72	0.72	0.98	2.88	0.08
	Reading	18.65	20.10	0.70	1.44	4.62	0.12
	Science	16.84	17.72	0.69	0.88	3.44	0.07
3. PreACT 8/9 to PreACT, fall Grade 9 to fall Grade 10, 10–14 months apart	Composite	17.36	17.97	0.88	0.62	2.24	0.05
	English	15.39	16.38	0.78	0.99	3.61	0.08
	Math	17.37	17.65	0.79	0.28	2.58	0.02
	Reading	18.88	19.61	0.73	0.72	4.64	0.06
	Science	17.28	17.76	0.70	0.47	3.67	0.04
4. PreACT 8/9 to PreACT, spring Grade 9 to spring Grade 10, 10–14 months apart	Composite	18.41	18.99	0.88	0.59	2.35	0.05
	English	16.69	17.58	0.80	0.88	3.69	0.07
	Math	18.15	18.52	0.80	0.37	2.76	0.03
	Reading	20.12	20.79	0.74	0.67	4.75	0.06
	Science	18.17	18.59	0.71	0.42	3.78	0.04
5. PreACT to PreACT, fall Grade 9 to fall Grade 10, 10–14 months apart	Composite	17.06	18.51	0.89	1.45	2.33	0.12
	English	15.25	17.07	0.81	1.82	3.68	0.15
	Math	17.04	18.24	0.81	1.20	2.60	0.10
	Reading	18.38	20.02	0.75	1.65	4.64	0.14
	Science	17.07	18.20	0.71	1.13	3.79	0.09
6. PreACT to PreACT, spring Grade 9 to spring Grade 10, 10–14 months apart	Composite	18.16	19.69	0.89	1.53	2.35	0.13
	English	16.59	18.45	0.81	1.86	3.69	0.16
	Math	17.86	19.33	0.83	1.47	2.76	0.12
	Reading	19.63	21.38	0.76	1.75	4.66	0.15
	Science	18.07	19.10	0.72	1.03	3.84	0.09
7. PreACT to ACT, spring Grade 10 to spring Grade 11, 10–14 months apart	Composite	19.02	20.20	0.91	1.17	2.38	0.10
	English	17.07	19.51	0.84	2.43	3.76	0.20
	Math	18.69	19.72	0.86	1.03	2.79	0.09
	Reading	20.77	20.75	0.78	-0.02	4.44	0.00
	Science	19.07	20.31	0.75	1.25	3.85	0.10
8. PreACT to ACT, fall Grade 10 to spring Grade 11, 15–19 months apart	Composite	17.74	19.25	0.89	1.52	2.49	0.09
	English	15.53	18.20	0.82	2.67	3.84	0.16
	Math	17.75	19.05	0.83	1.30	2.90	0.08
	Reading	19.38	19.80	0.77	0.41	4.54	0.02
	Science	17.78	19.46	0.73	1.68	3.95	0.10

9. PreACT to ACT, spring Grade 9 to spring Grade 11, 22–26 months apart	Composite	18.08	20.80	0.88	2.72	2.69	0.11
	English	16.32	20.46	0.81	4.15	3.97	0.17
	Math	17.71	20.16	0.81	2.45	3.19	0.10
	Reading	19.53	21.35	0.74	1.81	4.68	0.08
	Science	18.27	20.74	0.71	2.47	4.01	0.10
10. PreACT to ACT, fall Grade 9 to spring Grade 11, 27–31 months apart	Composite	17.83	21.57	0.87	3.74	2.95	0.13
	English	15.87	21.19	0.80	5.31	4.28	0.18
	Math	17.64	21.05	0.80	3.41	3.55	0.12
	Reading	19.19	22.09	0.74	2.90	4.77	0.10
	Science	18.10	21.45	0.71	3.35	4.14	0.12
11. PreACT 8/9 to ACT, spring Grade 9 to spring Grade 11, 22–26 months apart	Composite	18.58	19.98	0.87	1.40	2.65	0.06
	English	16.95	19.37	0.79	2.41	4.00	0.10
	Math	18.53	19.36	0.80	0.83	3.16	0.04
	Reading	20.27	20.52	0.72	0.25	4.83	0.01
	Science	18.07	20.17	0.72	2.10	3.80	0.09
12. PreACT 8/9 to ACT, fall Grade 9 to spring Grade 11, 27–31 months apart	Composite	17.80	19.53	0.87	1.72	2.66	0.06
	English	15.94	18.61	0.77	2.68	4.10	0.09
	Math	18.00	19.05	0.79	1.05	3.14	0.04
	Reading	19.37	20.18	0.72	0.81	4.77	0.03
	Science	17.40	19.77	0.72	2.37	3.76	0.08
13. PreACT 8/9 to ACT, spring Grade 8 to spring Grade 11, 34–38 months apart	Composite	17.12	19.46	0.85	2.34	2.85	0.06
	English	15.17	19.01	0.76	3.84	4.24	0.11
	Math	16.96	18.76	0.75	1.80	3.41	0.05
	Reading	19.40	19.93	0.70	0.53	4.90	0.01
	Science	16.47	19.66	0.68	3.19	3.83	0.09
14. PreACT 8/9 to ACT, fall Grade 8 to spring Grade 11, 39–43 months apart	Composite	16.98	19.84	0.84	2.86	2.96	0.07
	English	14.77	19.54	0.73	4.76	4.47	0.12
	Math	17.13	19.12	0.75	1.99	3.56	0.05
	Reading	19.25	20.24	0.71	0.99	4.83	0.02
	Science	16.24	19.96	0.69	3.72	3.89	0.09

Note. r = Pearson correlation of Test 1 scores and Test 2 scores; SD = standard deviation.

The PreACT-to-ACT gain score results from Table 8.2 (Groups 7–10) can be summarized as follows:

- Gain scores tend to be highest in English relative to the other subject areas.
- Average gain scores increase with more time between the PreACT and ACT tests.
- The average gains per month are similar across the four PreACT-to-ACT groups, except for reading. Average monthly gains range from 0.09 to 0.13 for the Composite, 0.16 to 0.20 for English, 0.08 to 0.12 for math, 0.00 to 0.10 for reading, and 0.10 to 0.12 for science.

- The mean gain in Composite score ranges from 1.17 (for spring Grade 10 to spring Grade 11) to 3.74 (for fall Grade 9 to spring Grade 11).
- Correlations between PreACT and ACT test scores are highest for the Composite, followed by English and math. Correlations are lowest for reading and science, which is expected because the reading and science tests are shorter (and have lower reliability) than the English and math tests.
- The standard deviations of gain scores suggest that there is considerable variability in gain scores. Some of this variability is because of the measurement error inherent in PreACT and ACT test scores.

The results from Table 8.2 also show that average gains from PreACT 8/9 to PreACT (Groups 3 and 4) are smaller than the average gains from PreACT to PreACT (Groups 5 and 6).

Average PreACT-to-PreACT gain scores (Groups 5 and 6) can also be compared to the average PreACT-to-ACT gain scores for students who tested approximately one year apart (Group 7). For reading, the mean PreACT-to-PreACT gain scores (1.65 and 1.75) are notably higher than the mean PreACT-to-ACT gain score (−0.02). Conversely, the mean PreACT-to-PreACT gain scores for English (1.82 and 1.86) are lower than the mean PreACT-to-ACT gain score for English (2.43).

Group 8 includes students who took the ACT test in the spring of Grade 11, 15–19 months after having taken the PreACT test in the fall of Grade 10. For this group, mean gain scores are presented for student groups defined by gender, race/ethnicity, English learner status, special education status, and eligibility for free or reduced-price lunch (Table 8.3). For the latter three student groups, data linking students to special groups were not available for most schools that administered the PreACT. Therefore, the sample sizes are relatively small.

Table 8.3. Fall Grade 10 PreACT to Spring Grade 11 ACT Mean Gain Scores by Student Group

Student group		*N*	Test section/score				
			English	Math	Reading	Science	Composite
All students		1,029,816	2.67	1.30	0.41	1.68	1.52
Gender	**Another gender**	2,624	2.77	1.24	-0.06	1.54	1.37
	Female	455,834	2.69	1.23	0.31	1.54	1.44
	Male	435,218	2.66	1.39	0.66	1.80	1.63
Race/ethnicity	**Black**	158,307	2.19	0.58	0.15	1.31	1.06
	Asian	31,061	4.11	2.23	1.00	2.36	2.43
	Hispanic	149,603	2.51	0.98	0.24	1.47	1.30
	Native American	14,961	2.15	0.61	0.24	1.28	1.07
	Native Hawaiian/OPI	1,967	2.52	0.95	0.21	1.63	1.35
	Two or more races	62,275	2.54	1.20	0.35	1.57	1.42
	White	553,957	2.83	1.57	0.54	1.79	1.68
English learner		42,148	2.43	0.86	0.40	1.27	1.24
Special education		19,027	1.97	0.27	0.43	1.12	0.95
Free/reduced-price lunch eligible		12,931	2.11	0.60	0.22	1.15	1.01

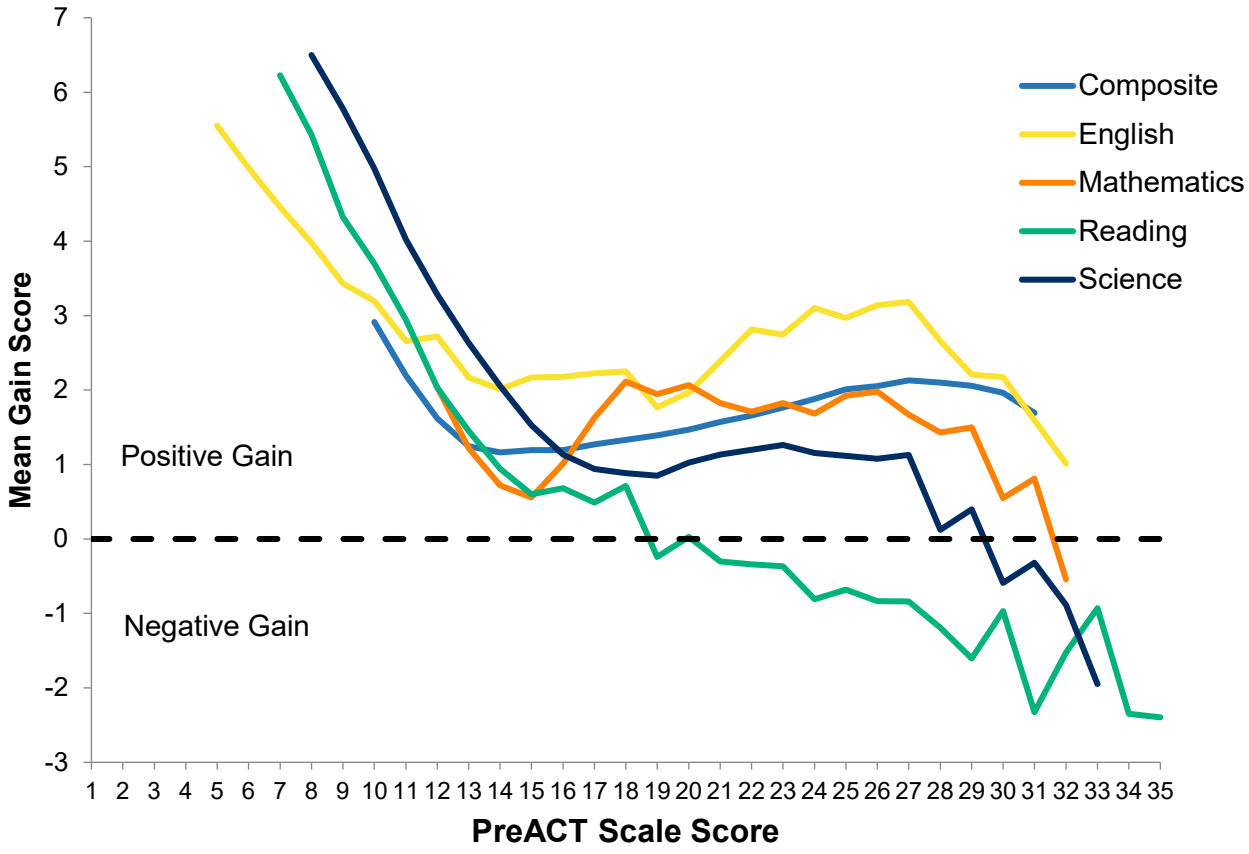
Note. OPI = Other Pacific Islander

The results from Table 8.3 can be summarized as follows:

- Mean gain scores in reading and science are higher for males relative to females and students of another gender.
- Mean Composite gain scores are highest for students who are Asian, followed by those who are White, two or more races, Native Hawaiian or other Pacific Islander, Hispanic, Native American, and Black/African American.
- Students who are in special education or who are eligible for free or reduced-price lunch tend to have below-average gain scores.

PreACT-to-ACT gain scores tend to be high for students with very low PreACT scores and low for students with very high PreACT scores (Figure 8.1). For example, students with a PreACT Composite score of 10 had a mean gain of 2.9, while students with a PreACT Composite score of 31 had a mean gain of 1.7. This phenomenon is known as *regression to the mean* and is related to the gain score measurement error issue described earlier. In the middle of the PreACT test score distributions, the average gain scores are more consistent. When determining how much gain should be expected from the PreACT test to the ACT test, one should consider the mean gain, conditional on PreACT score.

Figure 8.1. Fall Grade 10 PreACT to Spring Grade 11 ACT Mean Gain Scores by PreACT Score



Note. Values are plotted for PreACT scores between the 1st and 99th percentile in the sample.

8.2 Student Growth Percentiles

Student Growth Percentiles (SGPs) represent a student's current achievement compared to others with similar prior achievement. SGPs answer the question, "What is the percentile rank of a student's score compared to students with similar score histories?" (Castellano & Ho, 2013)

The SGPs discussed here are estimated using quantile regression methods (Koenker, 2005) by the SGP R package (Betebenner et al., 2017). When SGPs are interpreted, the reference group used to estimate the model should always be considered. The SGPs range from 1 to 100, and an SGP value of 50 represents typical growth relative to students in the reference group with the same prior achievement score.

8.2.1 ACT Growth Modeling Resources

An SGP table is available on the ACT growth modeling resources website (https://www.act.org/content/act/en/research/services-and-resources/act-growth-modeling-resources.html). The SGP table covers the following assessment scenarios:

- PreACT 8/9 to PreACT 8/9, Grade 8 to Grade 9
- PreACT 8/9 to PreACT, Grade 9 to Grade 10
- PreACT 8/9 to PreACT Secure, Grade 9 to Grade 10
- PreACT to ACT, Fall Grade 9 to Spring Grade 11
- PreACT to ACT, Spring Grade 9 to Spring Grade 11
- PreACT to ACT, Fall Grade 10 to Spring Grade 11
- PreACT to ACT, Spring Grade 10 to Spring Grade 11
- PreACT Secure to ACT, Spring Grade 10 to Spring Grade 11

The SGPs represent growth norms for approximately one year (12 months). The SGPs are based on large samples of students from across the country who tested in the most recent three years through school-day testing programs. The samples are weighted to be more representative of the population of students who take the ACT with respect to student demographics (race/ethnicity and gender), school poverty level, school type (public or private), and school mean ACT score. The weighting procedure ensures that each of the samples is similar to a common population (the most recent ACT-tested graduating class).

For students tested in Spring Grade 10 and Spring Grade 11, Table 8.4 presents SGP estimates for combinations of PreACT and ACT Composite scores. For example, the SGP for a student who earned a PreACT Composite score of 18 and an PreACT Composite score of 20 is 65. Yellow highlighting indicates score combinations with SGP values of at least 25 but no greater than 75. These are cases where growth can be considered average. Score combinations to the left of the yellow highlighting indicate below-average growth (SGP < 25), and score combinations to the right indicate above-average growth (SGP > 75). Table 8.4 includes only scores of 10 and higher; the growth modeling resources provide SGPs for all subjects and all score combinations.

Table 8.4. Spring Grade 10 PreACT to Spring Grade 11 ACT Composite Score SGPs

PreACT Composite score	ACT Composite score																											
	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
10	8	14	36*	64*	86	94	98	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
11	5	11	26*	51*	75*	88	95	98	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
12	4	7	18	41*	64*	80	90	96	99	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
13	1	5	13	28*	48*	68*	83	92	97	99	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
14	1	4	7	17	35*	54*	74*	85	91	95	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
15	1	1	5	11	23	40*	60*	74*	80	90	96	99	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
16	1	1	3	5	13	25*	39*	56*	67*	85	93	98	99	100	100	100	100	100	100	100	100	100	100	100	100	100	100
17	1	1	3	4	7	10	20	34*	51*	67*	83	91	97	100	100	100	100	100	100	100	100	100	100	100	100	100	100
18	1	1	3	3	4	8	10	19	32*	48*	65*	79	89	96	100	100	100	100	100	100	100	100	100	100	100	100	100
19	1	1	3	3	3	4	7	12	17	31*	47*	65*	79	90	96	99	100	100	100	100	100	100	100	100	100	100	100
20	1	1	1	1	1	1	4	6	13	24	39*	54*	66*	83	93	98	100	100	100	100	100	100	100	100	100	100	100
21	1	1	1	1	1	1	3	5	6	12	23	38*	56*	66*	85	94	98	100	100	100	100	100	100	100	100	100	100
22	1	1	1	1	1	1	1	1	1	5	12	20	34*	52*	66*	84	93	98	99	100	100	100	100	100	100	100	100
23	1	1	1	1	1	1	1	1	1	1	5	10	18	30*	47*	67*	82	91	97	99	100	100	100	100	100	100	100
24	1	1	1	1	1	1	1	1	1	1	4	7	10	17	30*	46*	65*	80	90	96	99	100	100	100	100	100	100
25	1	1	1	1	1	1	1	1	1	1	3	4	7	9	16	30*	46*	64*	78	89	95	100	100	100	100	100	100
26	1	1	1	1	1	1	1	1	1	1	3	3	4	6	9	17	29*	45*	61*	77	88	95	100	100	100	100	100
27	1	1	1	1	1	1	1	1	1	1	3	3	3	4	6	10	16	27*	43*	60*	76	88	95	100	100	100	100
28	1	1	1	1	1	1	1	1	1	1	3	3	3	3	3	5	10	18	27*	42*	60*	75*	88	97	100	100	100
29	1	1	1	1	1	1	1	1	1	1	1	3	3	3	3	3	5	10	17	31*	43*	59*	77	92	98	100	100
30	1	1	1	1	1	1	1	1	1	1	1	3	3	3	3	3	3	5	9	16	30*	45*	63*	82	94	99	100
31	1	1	1	1	1	1	1	1	1	1	1	1	1	3	3	3	3	3	4	9	16	26*	49*	67*	85	95	100
32	1	1	1	1	1	1	1	1	1	1	1	1	1	3	3	3	3	3	3	4	7	14	27*	52*	67*	87	100
33	1	1	1	1	1	1	1	1	1	1	1	1	1	3	3	3	3	3	3	4	5	7	14	29*	46*	70*	97
34	1	1	1	1	1	1	1	1	1	1	1	1	1	3	3	3	3	3	3	3	4	6	8	14	28*	48*	80
35	1	1	1	1	1	1	1	1	1	1	1	1	1	3	3	3	3	3	3	3	3	4	6	7	14	26*	54*

Note. Yellow highlighting with an asterisk (*) indicates score combinations of average growth (25 ≤ SGP ≤ 75).

8.2.2 Aggregating SGPs

While all test scores have measurement error, it is more pronounced for gain scores and SGPs because the measurement error of multiple test scores is compounded. For this reason, we do not recommend using SGPs or gain scores as the primary measure of how much an individual student learned. Instead, we recommend using aggregate forms of gain scores and SGPs for describing growth for groups of students (e.g., by student demographic group, school, or district). The mean SGP and median SGP are common measures of group-level growth. Research suggests that the mean SGP may have advantages over the median SGP in terms of efficiency, greater alignment with expected values, and greater robustness to scale transformations (Castellano & Ho, 2015).

Table 8.5 shows mean SGPs by subject area and student group for students who took the PreACT in the fall of Grade 10 and the ACT in the spring of Grade 11 (Group 8). The overall mean SGP values ranged from 49.1 in English to 52.4 for reading. Because an SGP of 50 represents typical growth, we might have expected the overall means to be closer to 50. Whereas the sample included data collected across several years, the SGPs are based on a reference group of students who took the ACT test between 2021 and 2023, and the SGP reference group was weighted to be more representative of the ACT-tested population.

Table 8.5. Fall Grade 10 PreACT to Spring Grade 11 ACT Mean SGPs by Student Group

Student group		*N*	Test section/score				
			English	Math	Reading	Science	Composite
All students		1,029,816	48.1	49.8	52.4	50.3	49.9
Gender	**Another gender**	2,624	50.4	49.2	53.0	50.6	47.4
	Female	455,834	48.7	49.4	53.1	49.9	49.3
	Male	435,218	47.6	50.5	52.6	50.7	50.9
Race/ethnicity	**Black**	158,307	41.6	43.9	44.9	42.5	44.3
	Asian	31,061	59.8	58.1	60.1	59.0	59.3
	Hispanic	149,603	45.2	47.9	48.2	46.4	47.7
	Native American	14,961	42.9	44.3	47.9	44.6	45.4
	Native Hawaiian/OPI	1,967	45.5	46.9	48.1	47.6	48.1
	Two or more races	62,275	47.7	49.3	52.5	49.7	49.4
	White	553,957	50.5	51.8	55.5	53.1	51.8
English learner		42,148	44.7	46.5	48.3	44.8	47.0
Special education		19,027	37.7	39.6	43.1	38.8	41.1
Free/reduced-price lunch eligible		12,931	42.6	44.0	47.3	43.4	44.5

Note. OPI = Other Pacific Islander

From Table 8.5, we learn that mean SGP varies by student subgroup. Males have slightly higher growth in math and science, whereas females have slightly higher growth in English and reading. SGP differences are more pronounced across racial/ethnic groups, with students who

are Asian showing the highest growth (Composite mean SGP = 59.3) and students who are Black showing the lowest growth (Composite mean SGP = 44.3). Students in the other groups (English learner, special education, and free/reduced-price lunch eligible) have lower growth than the total group in all subject areas.

Chapter 9
Other PreACT Components

9.1 The ACT Interest Inventory

9.1.1 Overview

The ACT Interest Inventory helps students explore personally relevant career (educational and occupational) options. The inventory is intended for people in the early stages of college and career planning, such as high school students, where the primary purpose of interest assessment is to stimulate and facilitate exploration of self in relation to education and career options and to provide a focus for this exploration. The purpose of the ACT Interest Inventory is not to initiate or complete this developmental process, but rather to promote and advance this process by providing accurate, personally relevant information. In the process of exploration, students may confirm personal preferences or discover things about educational and occupational options (as well as themselves) that they had not previously considered.

The ACT Interest Inventory assesses six types of interests paralleling the six career types in Holland's (1997) well-known theory of careers (Holland, Whitney, Cole, & Richards, 1969). The inventory contains 12 items per scale and uses a three-choice response format (like, indifferent, dislike). Items emphasize work-relevant activities (e.g., build a picture frame, conduct a meeting, help settle an argument between friends) that are likely to be familiar to individuals, either through participation or observation. The reliability across its six scales, and validity of the inventory for its intended uses is well established (ACT, 2009). The six scale titles, parallel Holland types (in parentheses), and example activities are as follows:

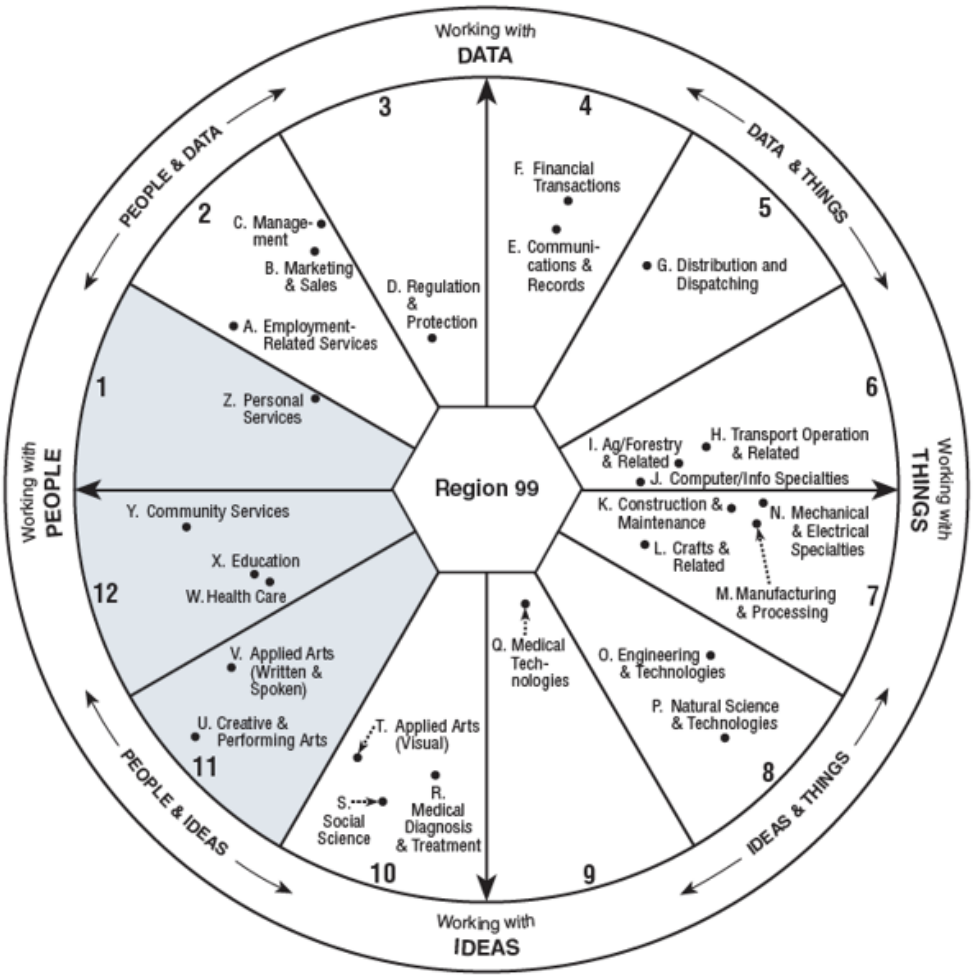
- **Science & Technology (Investigative):** Investigating and attempting to understand phenomena in the natural sciences through reading, research, and discussion.
- **Arts (Artistic):** Expressing oneself through activities such as painting, designing, singing, dancing, and writing; artistic appreciation of such activities (e.g., listening to music).
- **Social Service (Social):** Helping, enlightening, or serving others through activities such as teaching, counseling, and working in service-oriented organizations.
- **Administration & Sales (Enterprising):** Persuading, influencing, directing, or motivating others through activities such as sales, supervision, and aspects of business management.
- **Business Operations (Conventional):** Developing and/or maintaining accurate and orderly files, records, etc.; designing and/or following systematic procedures for performing business activities.

- **Technical (Realistic):** Working with tools, instruments, and mechanical or electrical equipment. Activities include designing, building, repairing machinery, and raising crops/animals.

9.1.2 Reporting Procedures

The PreACT® student score report displays ACT Interest Inventory results using a student's pattern of interest inventory scores to identify two or three shaded regions of the Career Map based on the dimensions underlying the map (see Figure 9.1). The use of map regions facilitates focused exploration and is in keeping with the level of precision inherent in the scores.

Figure 9.1. The ACT Career Map and Example Results (three shaded map regions)



The ACT Career Map is an empirically-based tool for occupational exploration and interest inventory score interpretation. The map visually displays the similarities and differences between occupations by showing the locations of 26 career areas (groups of similar occupations) with respect to four compass points. The compass points are based on two orthogonal work-task dimensions shown to underlie the six Holland types and the work activities

of all occupations across the work world (ACT, 2009): working with data/ideas and people/things.

- Data: Facts, numbers, files, accounts, business procedures.
- Ideas: Insights, theories, new ways of saying or doing something—for example, with words, equations, or music.
- People: People you help, serve, inform, care for, or sell things to.
- Things: Machines, tools, living things, and materials such as food, wood, or metal.

Development of the current edition of the Career Map involved the use of three large databases that provide three diverse perspectives for classifying occupations to career areas and determining career area locations on the map: (a) general nature of work (expert ratings); (b) detailed nature of work (job analysis data); and (c) interests of workers (mean interest scores). Data/ideas and people/things scores based on each data source were obtained for hundreds of O*NET occupations. For the data/ideas scores, correlations for the three sets of database pairs ranged from .75 to .78. For the people/things scores, the correlations ranged from .74 to .81. These correlations, which are unusually high for scores based on diverse data sources, provide good support for the work task dimensions underlying the Career Map. As expected, the data/ideas and people/things scores were essentially independent. Additional details are found in Prediger & Swaney (2004).

The ACT Career Map provides a simple yet comprehensive overview of the world of work and a visual means for linking scores to career options. The 26 career areas are located in 12 map regions, reflecting the relation between measured interests and the two underlying work task dimensions. For example, high-ranking scores for the Arts or the Science & Technology scales indicate an interest in ideas-related work tasks.

9.1.3 Psychometric Support

The ACT Interest Inventory Technical Manual (ACT, 2009) describes the rationale, development, norms, reliability, and validity of the instrument. Please refer to this manual for a complete discussion of the technical information available on the ACT Interest Inventory. The following is a brief description of this information.

Development. Item selection for the current edition of the ACT Interest Inventory involved evaluating tryout items with respect to four item content criteria and five rigorous item performance criteria. Performance and content criteria were prioritized to permit the ranking of items based on quality of functioning. Based on data from 9,000 students in grades 8, 10, and 12, the best 72 items (12 per scale) were selected. Item/scale functioning was subsequently evaluated on 60,000 students in grades 8, 10, and 12.

Norms. Development of the norming sample was based on interest inventory responses from students who participated in ACT PLAN, a comprehensive national assessment program

designed to help guide 10th graders in education and career planning. The target population consisted of students enrolled in grade 10 in the United States. Although the ACT PLAN program tested a sizable percentage of U.S. high school students, some sample bias was inevitable. To improve the national representativeness of the sample, individual records were weighted to more closely match the characteristics of the target population with respect to gender, ethnicity, school enrollment, school affiliation (public/private), and region of the country. The sample consisted of 407,325 students from 4,030 schools.

Reliability. Internal consistency reliability was examined for large national samples of students in grades 8, 10, and 12 (20,000 students per grade). Median internal consistency estimates (coefficient alpha) across the six scales were .84 for grade 8, .86 for Grade 10, and .87 for grade 12. Estimates were very similar across gender. For example, estimates ranged from .81 to .91 (median of .84) for Grade 10 females, and from .85 to .92 (median of .86) for Grade 10 males. Score stability was examined for 786 students in grades 10–11 who completed the inventory twice within a three to nine-month interval. Test-retest correlations ranged from .63 to .77 (median of .70).

Validity. Construct validity refers to the extent to which assessment scores measure what they are purported to measure and is evaluated in light of the purpose of the assessment. ACT Interest Inventory results are primarily used for career exploration, that is, to identify occupations that are compatible with (similar to) measured characteristics of the user. To be used for this purpose, scientific interests should predominate among scientists (e.g., biology majors, employed chemists), artistic interests should predominate among artists (e.g., musicians, writers), and so on (Holland, 1997). If ACT Interest Inventory results differentiate career groups in theory-consistent ways, they can be used to identify occupational groups sharing characteristics compatible with the user.

A common method of determining accurate group membership is to classify people by Holland-type group membership (e.g., by occupational choice, college major, or occupation incumbency) and count them as a “hit” if their highest interest score matches their group. Thus, an art student would be counted as a hit if his or her highest score was on the Arts scale. The percentage of people who are hits (the “hit rate”) is then computed for each Holland-type group, and the average of the six hit rates (the unweighted average) is obtained. In effect, this approach to validation asks whether people in a given group would have been referred to that group by their interest scores. Thus, this method is consistent with the primary counseling use of the ACT Interest Inventory and most other interest inventories: to identify personally relevant career options.

ACT Interest Inventory item responses were obtained for a random sample of 10,992 high school seniors who registered for the ACT, completed all 72 items, and reported that they were “very sure” of their future occupational choice. Students were assigned to one of six career groups on the basis of occupational choice. The unweighted average hit rate across the six scales was 42%. (By chance alone the hit rate is one out of six, or 17%). This approach to assessing ACT Interest Inventory validity has been used in many earlier studies, involving over 68,000 people and 23 sets of criterion groups. Across these studies, unweighted average hit

rates have ranged from 31% to 55% (median of 42%). These hit rates meet or exceed the hit rates reported for comparable inventories, supporting the use of the ACT Interest Inventory in career exploration and counseling.

Another type of validity pertains to the structural relationships among the scales. Holland's (1997) career theory uses a hexagon to visually represent the relationships between the six career types. Thus, if ACT Interest Inventory scales are measuring their intended constructs, we should expect to see a pattern of scale relationships that, when displayed visually, reveal an approximately hexagonal shape. As noted earlier, research suggests that the data/ideas and people/things work task dimensions underlie Holland's (1997) hexagon. The coordinates of the six points on a hexagon were used in a principal components analysis to target the expected correlations between the scales and these two dimensions. Correlations (loadings) between ACT Interest Inventory scales and the work task dimensions, as determined by the targeted principal components analysis, were obtained for large national samples of 8th, 10th, and 12th grade students. Factor loadings were plotted for males and females in all three grades. The obtained structures were in accord with theory: plots were approximately hexagonal for all grades and quite similar across gender. The observed relationships support the structural validity of the scales and the generalizability of the work task dimensions.

9.2 Information Sections

9.2.1 Student Information Section

Information about students' future educational and career aspirations, background, and high school activities are collected in this section. Students are asked to indicate educational plans after high school, and to select one career area (group of occupations) they like best from 26 options. Students also have the option to provide information about the education levels of their parents/guardians, their religious affiliation, language they know best, and time spent working in a paid job. Students can indicate their participation in extracurricular high school activities and programs. For students planning to go to college, this information is valuable for developing appropriate programs to meet student interests and needs, and for determining what financial aid/scholarships might be available for students given their backgrounds. Information about educational plans and career interests are useful in evaluating the extent to which students' current choices are realistic, and how well students understand the level of education needed to achieve their career goals.

9.2.2 Needs Assessment Section

In this section, students can indicate a need for additional help in seven skill areas. These areas include: making plans for my education, career, and work after high school, improving my writing skills, improving my reading speed or comprehension, improving my study skills, improving my mathematical skills, improving my computer skills, and improving my public speaking skills. Information about needs is important for identifying the skills students can focus on developing during high school, and for determining the resources that can be used to assist students.

9.2.3 High School Course/Grade Information Section

Information about the courses students have taken, are taking, and plan to take during high school (Grades 9–12) are collected in this section. Students are also asked to report grades for their courses in five academic areas: English, Math, Social Studies, Natural Sciences, and Foreign Languages. Descriptors of courses that reflect the typical high school core curriculum are provided to help students relate the courses listed to courses offered in their own schools. The course/grade information is useful for understanding the relationship between students' coursework and academic achievement, their current and anticipated preparedness for college, and whether students' coursework is aligned with their future educational and career goals.

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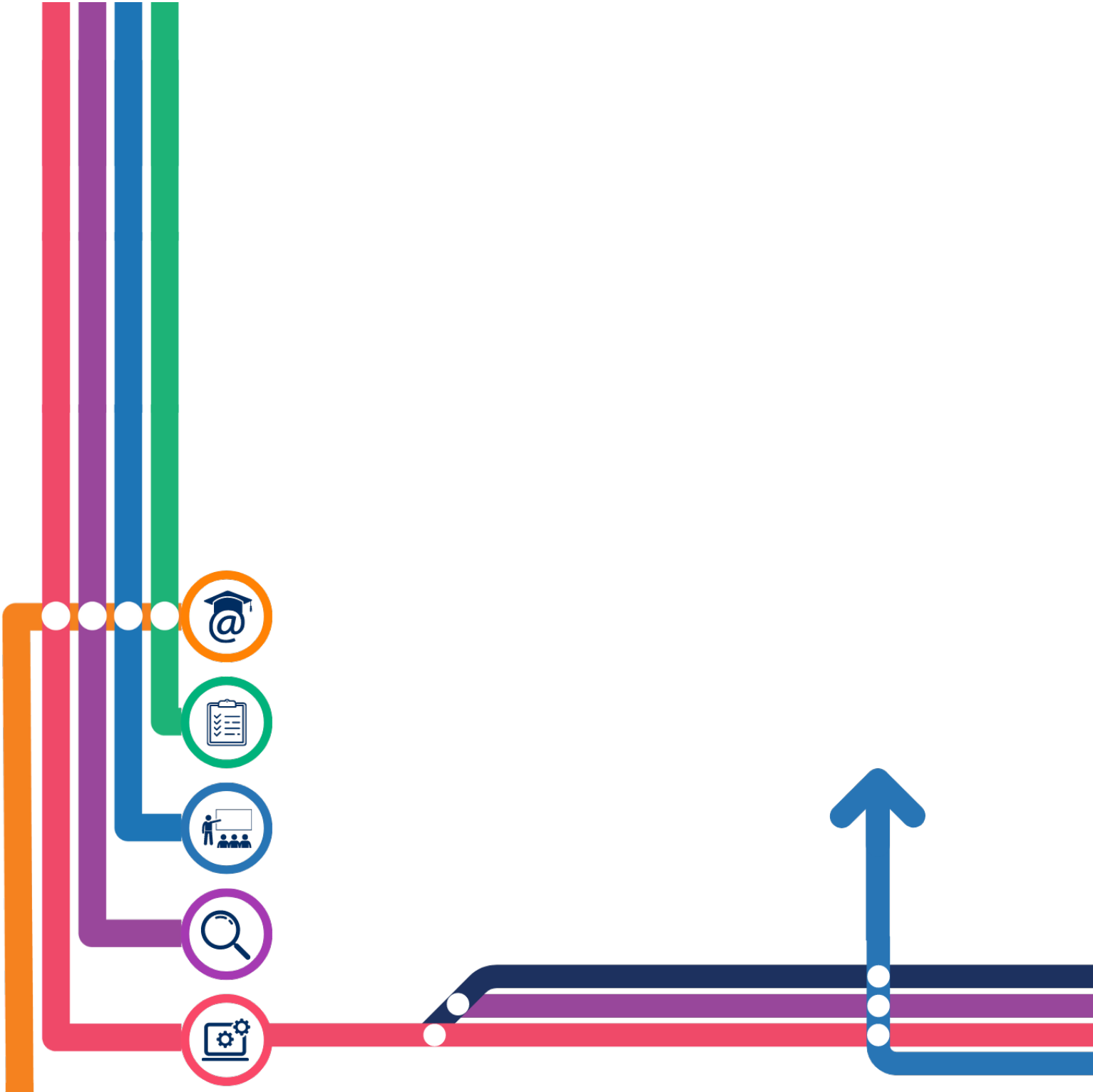

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