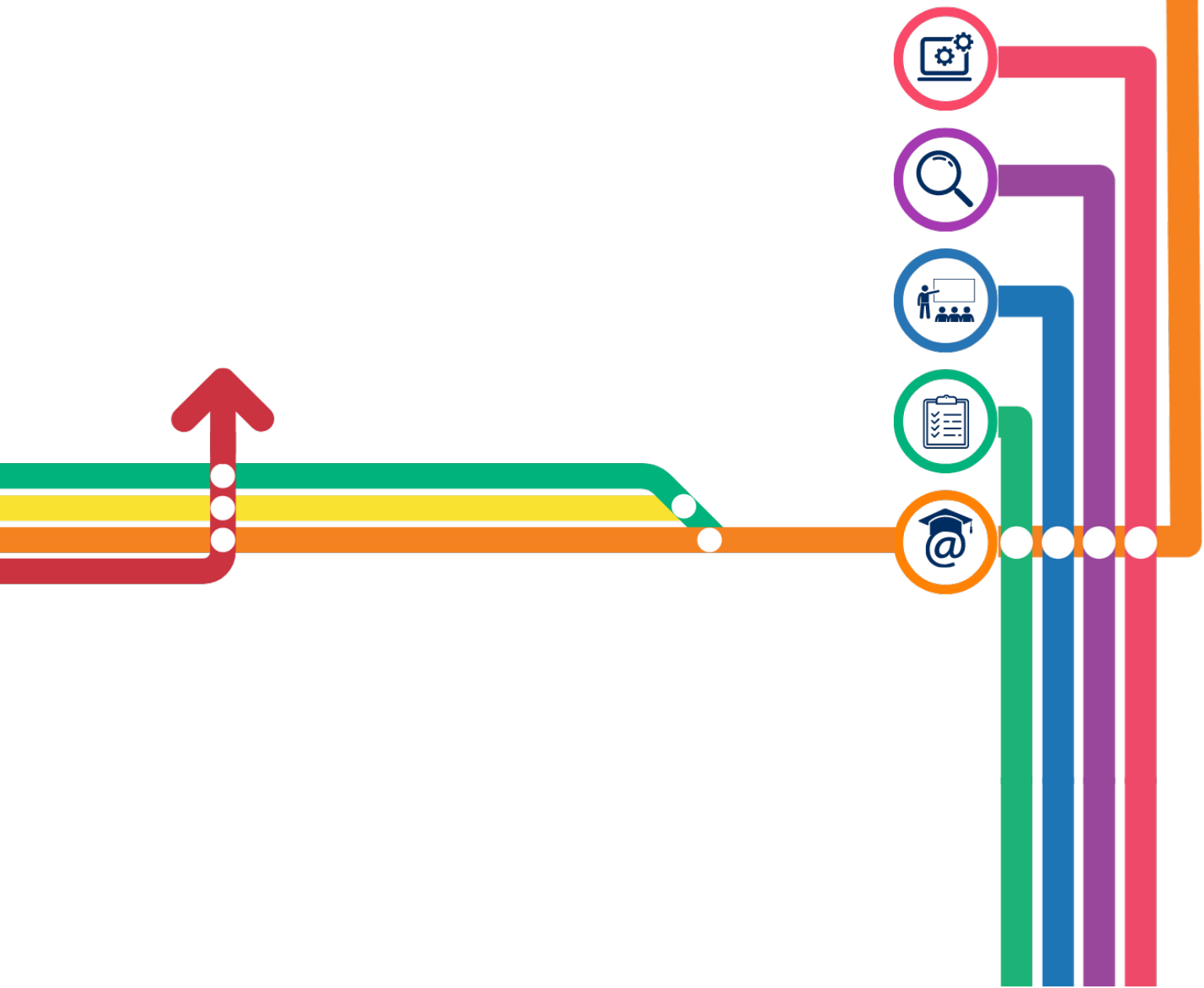
PreACT® 8/9 Technical Bulletin

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.

Table of Contents

List of Tables

List of Figures

Preface

The *PreACT® 8/9 Technical Bulletin* contains technical information about the PreACT® 8/9 test. The principal purpose of the bulletin is to document technical characteristics of the PreACT 8/9 test in light of its intended purposes. The *PreACT 8/9 Technical Bulletin* documents the collection of validity evidence that supports appropriate interpretations of test scores and describes various content and psychometric aspects of PreACT 8/9. Multiple test design and development processes are articulated documenting how ACT builds the assessment in line with the validity argument and how concepts such as 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 bulletin, or on a related topic, to contact ACT.

Please direct comments or inquiries to the address below:

Research Services, ACT Education Corp.

500 ACT Drive

Iowa City, Iowa 52243-0168

Chapter 1:
General Description of PreACT® 8/9

1.1 PreACT 8/9 Overview

PreACT® 8/9, targeted to students in Grades 8 and 9, is designed to predict performance on the PreACT® and ACT® tests. Like all ACT assessment programs, PreACT 8/9 is based on the belief that students—and their parents, teachers, counselors, and school administrators—will make more productive plans and decisions if they have organized, relevant information available when they need it most. While PreACT 8/9 can be used as a stand-alone assessment, it forms a powerful, interrelated sequence of instruments to measure student development when used with the PreACT and ACT tests.

PreACT 8/9 includes four multiple-choice sections—English, mathematics, reading, and science. PreACT 8/9, PreACT, and ACT scores are reported on common scales: the scale score range for PreACT 8/9 is 1–30, for PreACT is 1–35, and for ACT is 1–36. All three assessments provide standards-based interpretations through the ACT® College and Career Readiness Standards—statements that describe the knowledge and skills that students have typically acquired at different score levels. Focused on the integrated, higher-order thinking skills that are important for success both during and after high school, the Standards provide a common language for secondary and postsecondary educators. The Standards also help educators determine the skills students are likely to have and those they are ready to learn next. Teachers can design instruction targeted to specific areas where students need the most support to become college ready.

Because PreACT 8/9 score scales are aligned to PreACT and ACT score scales, the ACT College Readiness Benchmarks—for English, math, reading, science, and STEM—can be used to gauge readiness for college-level coursework. The PreACT 8/9 Readiness Benchmarks indicate whether students are on target for college readiness. Chapter 3 gives details about the ACT College and Career Readiness Standards, the ACT College Readiness Benchmarks, and the PreACT 8/9 Readiness Benchmarks.

PreACT 8/9 also collects information about student interests, needs, plans, and selected background characteristics that can be useful in guidance and planning activities. Schools can use PreACT 8/9 data for academic advising, counseling, and program evaluation. PreACT 8/9, PreACT, and the ACT results give schools a way to get students engaged in planning their futures. Table 1.1 summarizes the components of the ACT assessments.

Table 1.1. Components of ACT College and Career Readiness Assessments

Assessment component		PreACT 8/9	PreACT	ACT
Career and education planning	Interest inventory	√	√	√
	Course taking and grades	√	√	√
	Needs assessment	√	√	√
	Student information	√	√	√
	Predicted PreACT scores	√	—	—
	Predicted ACT scores	√	√	—
	ACT College Readiness Benchmarks	√	√	√
	College Readiness Indicators	√	√	—
Assessments	English, math, reading, & science	√	√	√
	Writing (optional)	—	—	√
Instructional support	ACT College and Career Readiness Standards	√	√	√
Evaluation	Summary reports	√	√	√
	Growth models	√	√	√

1.2 PreACT 8/9 Philosophical Basis

PreACT 8/9 shares a common philosophical basis with PreACT and the ACT. These three testing programs measure student development in the same curriculum areas of English, math, reading, and science. In simplest terms, the principal difference between the three programs is that they focus on knowledge and skills typically attained at different times in students' secondary school experience. The ACT, for 11th and 12th grades, focuses on knowledge and skills attained as the cumulative effect of the school experience. PreACT, targeted for 10th grade, focuses on knowledge and skills typically attained early in students' secondary school experience (by the end of Grade 10). PreACT 8/9 focuses on skills typically learned in middle school. Each test emphasizes what students have learned, provides the chance for students to use the knowledge and skills they currently are learning, and helps them plan for college and careers.

Because the content of PreACT 8/9 is linked to the framework of the ACT test, to understand the philosophical basis of PreACT 8/9, it is best to be knowledgeable about the philosophical basis of the ACT. The ACT is designed to measure how prepared students are to achieve the general academic goals of college. 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. Complexity is a characteristic of such skills. Thus, the ACT is designed to determine how skillful students are in solving problems, grasping implied meanings, drawing inferences, evaluating ideas, and making judgments.

Furthermore, 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.

1.3 Purposes, Claims, Interpretations, and Uses of PreACT 8/9

A theory of action (TOA) that integrates content validity (academic research, curriculum information, and standards) with predictive validity (empirical data) was employed when creating PreACT 8/9, thus following similar methodologies used to build the ACT test. The TOA begins by answering fundamental questions about the purpose of the assessment, such as these: 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 as a result of rigorous research and data collection that inform and allow for the identification of high-value skill targets in each test section, providing focal points for the development of tasks and test forms. The process set forth by the TOA further gives rise to hypothesized mechanisms or processes for 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 improve the components of PreACT 8/9 continuously.

1.3.1 Intended Users

Students in Grades 8 or 9 are the target population and primary users of the assessment. While the PreACT 8/9 can be taken by students in other grade levels, testing in 8th or 9th grade is recommended to optimize the benefits of testing. Additional users include parents interested in their child's performance, teachers interested in identifying areas for improvement, high school guidance counselors and academic advisors responsible for helping students explore and plan their future, and school administrators responsible for evaluation of educational programs. PreACT 8/9 users could also include other organizations promoting college and career programs and talent identification programs.

1.3.2 Intended Uses

There are three primary uses of PreACT 8/9:

- Use 1: Monitor progress toward college and career readiness.
- Use 2: Predict performance on the PreACT and ACT tests.
- Use 3: Identify academic gaps and areas for improvement.

The PreACT 8/9 Readiness Benchmarks and the PreACT 8/9 Readiness Levels support Use 1. Students who score at or above the benchmarks are on target for success in college-level courses in the related test section. The PreACT 8/9 Readiness Levels categorize performance

into one of three readiness levels: On Target, Close to Target, and In Need of Intervention. For details on how the benchmarks and levels are derived, see Chapter 3. Use 1 is also supported through the Indicator of Progress Toward the ACT® WorkKeys® National Career Readiness Certificate™ (NCRC).

The PreACT 8/9 is shorter than the corresponding ACT test and is designed to predict student performance on the PreACT and ACT (excluding writing), supporting Use 2. Predicted PreACT and ACT score ranges are reported for English, math, reading, science, Composite, and STEM. PreACT 8/9 and PreACT simulate the ACT testing experience and provide students, parents, and educators with valuable insights while there is still time to gain the needed understanding and skills that can be demonstrated later on the ACT.

PreACT 8/9 results can help students and educators identify academic gaps and areas for improvement, supporting Use 3. Percentile ranks can help students identify areas of relative strength or weakness. Within each test section, reporting category scores can help educators identify the topics or skills on each test that students found most challenging. The PreACT 8/9 reporting package includes educator reports, early intervention rosters, and an item-response summary report that can also be used to identify academic gaps and areas for improvement. Further, the ACT College and Career Readiness Standards help teachers understand the skills that students are likely to have and what they are ready to learn next.

Additional intended uses of PreACT 8/9 include the following:

- Gauge readiness for advanced high school courses.
- Evaluate school and program effectiveness.
- Facilitate college and career exploration and planning.

1.3.3 Claims

The principal claims of PreACT 8/9 are closely related to the intended uses and are very similar to the claims of the PreACT. The principal claims include the following:

1. PreACT 8/9 measures student readiness on an empirically derived college and career readiness trajectory.
2. PreACT 8/9 scores are strong predictors of PreACT (and ACT) English, math, reading, science, Composite, and STEM scores.
3. PreACT 8/9 provides instructionally actionable information to students, parents, and educators. PreACT 8/9 data can be used to identify areas of student strength and weakness in content areas at a variety of levels (e.g., student, classroom, and school).

The secondary claims of PreACT 8/9 include the following:

4. PreACT 8/9 scores can be used to more accurately identify students who are ready to succeed in advanced high school courses, including AP and dual enrollment courses.
5. PreACT 8/9 can be used as one component of the evaluation of school, program, and curriculum effectiveness. When used in conjunction with the PreACT and the ACT tests, growth measures can be used to help evaluate educational programs.

6. PreACT 8/9 can improve college and career exploration and planning through students taking the Interest Inventory (ACT, 2009), opting into the ACT Educational Opportunity Service (EOS; Moore & Cruce, 2017), and using other college and career planning components.

1.3.4 Intended Outcomes

PreACT 8/9 has three main intended outcomes:

1. In the short term, the information gleaned from PreACT 8/9 score reports can be leveraged into opportunities to improve students' knowledge and skills.
2. Taking PreACT 8/9 can lead to improved performance on the PreACT and ACT tests.
3. In the long term, taking PreACT 8/9 can facilitate increased educational and occupational preparation opportunities.

More specifically, outcomes include the following:

- Students gain experience with the types of content and the mental tasks required by the PreACT and ACT tests.
- Students, parents, and educators understand relative strengths and weaknesses in the four test sections that are also assessed by the PreACT and the ACT.
- Student readiness improves as students prepare for the PreACT and the ACT (and, more importantly, for college and careers).
- Students and parents become aware of free online learning and test preparation resources.
- Schools and districts gain important insights about curriculum and program effectiveness.
- Educators more accurately identify students who are ready for advanced high school coursework.
- Students become more informed about and engaged in college and career exploration and planning.

Research should be conducted on an ongoing basis to evaluate the extent that PreACT 8/9 is resulting in these intended outcomes.

1.4 PreACT 8/9 Evidence Base

ACT researchers use an evidence-based-research and data-collection process to ensure that items and test forms are eliciting the intended evidence to support the claims made by PreACT 8/9. This process informs the development of PreACT 8/9 artifacts such as content and item specifications and test blueprints, which influence the technical quality and output of test items and forms. These artifacts are further informed by several factors, including the following:

- subject matter experts (SMEs)
- academic research on skill targets, sequencing of skills, and grade placement

- data and evidence of student understanding collected from PreACT 8/9
- survey of standards frameworks, such as state standards, ACT College and Career Readiness Standards, and Next Generation Science Standards
- ACT National Curriculum Survey®
- research relating test scores to performance in high school and college courses

The ACT National Curriculum Survey provides empirical validation evidence related to the content of our tests. The most recent survey was released in 2020 and included responses from thousands of K–12 educators and college instructors in English/writing, math, reading, and science. Workforce supervisors and employees also participated in the survey and provide evidence relating to the skills and knowledge essential for career readiness. Results are reviewed by SMEs and then used to identify the most critical skills and knowledge required for college and career readiness.

The validity of PreACT 8/9 is further supported with criterion-related longitudinal evidence that tracks students who complete ACT assessments and their subsequent performance in colleges (2-year and 4-year, by major) and career training programs. Test development for PreACT 8/9 prioritizes knowledge and skills that are most essential to success and that can be generalized across different institutions, academic programs, and majors.

The first step in building this evidence base is to synthesize research on high-value skill targets—the skill targets that can be shown to offer the most useful evidence for college and career readiness. This evidence is achieved by organizing units of knowledge and skills into levels.

The next step is to use this research to develop content specifications and task models that articulate the evidence needed to monitor student progress. Tasks are then generated from these specifications and assembled into test forms based on test blueprints. Test blueprints specify constraints that serve to control various factors, including, but not limited to, content coverage, item difficulty, cognitive complexity, reading load, and item latency. Test forms are then administered, and student performance data are collected.

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

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

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 (National Council on Measurement in Education [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 found online:

Code of Fair Testing Practices in Education

Code of Professional Responsibilities in Educational Measurement

1.6 Administering the PreACT 8/9 Program

PreACT 8/9 is available for administration from September through May each year. The *PreACT 8/9 Administration Manual* (available at http://success.act.org) provides instructions for ordering materials and administering the tests.

1.6.1 Participation Procedures

PreACT 8/9 can be administered on a date of the school's choosing between September 1 and June 1 of each academic year. Schools should order test materials at least 3 to 4 weeks before their scheduled test date. Ordering at least 3 to 4 weeks in advance will allow materials to be delivered 1 to 2 weeks before testing, giving testing staff time to prepare. Schools may choose to test all students in a given grade or provide the testing as optional.

1.6.2 Special Testing for Students With Accommodations

Special provisions are available for administering PreACT 8/9 to students who have diagnosed disabilities that require extended time or special materials. Special testing materials available include large type and braille test books for visually impaired students, audio recordings of test books on a USB drive or at a URL link, and reader's scripts for oral presentation of the test items. Special format materials can be ordered through the online ordering system. Schools are encouraged to administer tests for students on the same day, including for those testing with extended time and special materials.

1.6.3 Administration Schedule

PreACT 8/9 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 test sections.

PreACT 8/9 procedures and materials have been designed to allow schools the option of dividing the administration over 2 or more days. The non-test sections (student plans and background information, Interest Inventory, and course and grade information) may be administered in a nonsecure, supervised school setting on or before the test day. The four test sections must be administered in a single session on the designated test day. Consult the *PreACT 8/9 Administration Manual* for information about makeup testing.

1.6.4 PreACT Support Materials

PreACT 8/9 includes a coordinated set of support materials to help students, parents, teachers, counselors, and administrators understand the purposes of the program and the information provided.

- The PreACT 8/9 Knowledge Hub (http://success.act.org) includes links to online resources and training webinars to help schools effectively administer tests and use the results.
- The *PreACT 8/9 Administration Manual* is designed to be used by PreACT 8/9 test coordinators and testing staff. The manual provides detailed instructions for planning and administering the non-test sections and the four test sections.
- The test materials package includes the test books, answer folders, and instruction booklets that students will use to test. Customers should order one test materials package for each student testing, including students who are testing with accommodations. The number of students testing (i.e., the number of test material packages ordered) determines how many administration manuals and answer document return envelopes will be included with the shipment. ACT sends a small overage of materials with each order.
- Student and school reports are typically shipped from ACT 1 to 2 weeks from the day ACT receives a school's completed answer folders.
- Each student who participates in PreACT 8/9 will have access to *Using Your PreACT 8/9 Results*, a guide that includes sections on interpreting the Student Report, planning for high school and beyond, career possibilities, and building academic skills.

Chapter 2:
PreACT 8/9 Test Development

2.1 Overview

This chapter describes the PreACT® 8/9 test development process with a focus on item and form development procedures. This chapter also includes brief descriptions of scores and indicators reported for PreACT 8/9, in addition to a high-level description of test scores.

2.2 Description of PreACT 8/9

PreACT 8/9, targeted to students in Grades 8 and 9, gives students practice with the PreACT® test and empowers them, their parents, and educators with valuable insights. The experience of taking PreACT 8/9, combined with the selection of rigorous high school courses, will help students perform their best when they take PreACT and the ACT® test.

PreACT 8/9, PreACT, and the ACT have a common purpose—to support students at key decision points in their academic preparation and planning. PreACT 8/9, PreACT, and the ACT provide information helpful to educators guiding students through these important educational and career decisions.

The English, math, reading, and science tests in PreACT 8/9, PreACT, and the ACT are designed with developmentally articulated test specifications, ensuring that the content measured follows a logical developmental sequence across the high school experience. The programs also share common item formats and follow consistent reporting procedures.

Additionally, PreACT 8/9, PreACT, and the ACT share a common set of noncognitive components:

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

Despite having different score ranges, PreACT 8/9 (with a range of 1–30), PreACT (with a range of 1–35), and the ACT (with a range of 1–36) are on the same reporting scale. This common scale allows monitoring of student growth and performance on the three assessment programs. A score increase from PreACT 8/9 to PreACT or 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, as well as

from 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, math, 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 assessments, 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 publishes the results of each ACT National Curriculum Survey 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 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 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, ACT constructs its assessments 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

- using evidence and research to develop and validate ACT standards, assessments, and benchmarks;
- maintaining 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
- developing assessments, reports, and interventions that will help individuals navigate their personal path to success along a kindergarten-through-career continuum.

ACT uses these principles to drive the development and continuous improvement of ACT's education and workplace solutions and 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, math, 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	405
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*.

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

2.4 English Test

2.4.1 Description of the English Test

The PreACT 8/9 English test is a 40-item, 30-minute test that puts the student in the position of a writer who makes decisions to revise and edit a text. It 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. Passage topics are chosen both for their appropriateness in assessing writing and language skills and for their likeliness to engage 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 include "NO CHANGE" to the designated portion in the passage as one of the possible responses. Some items are identified by a number or numbers in a box. These items ask about a section of the passage or the passage as a whole. The student must decide which choice best answers the question.

Cognitive Complexity and Depth of Knowledge

Depth of Knowledge (DOK; see 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 8/9

English test assesses skills across a range of cognitive complexities using items at DOK Levels 1, 2, and 3. ACT content experts classify all multiple-choice English items according to the level descriptions in Table 2.2.

Table 2.2. DOK Level Descriptions for English

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.

2.4.2 English Scores and Reporting Categories

Four scores are reported: a total test score 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. The test also includes eight items that are used for developmental purposes and not included in any of the scores. A brief description of the reporting categories and the approximate number of operational test items in each reporting category are given below.

Production of Writing

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

- Topic Development
    - Students demonstrate their understanding of and control over the rhetorical aspects of texts by identifying the function 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 through 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 the placement of modifiers, shifts in sentence construction, 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.

2.4.3 English Test Blueprints

Table 2.3 gives the ranges for the number and percentage of items on a PreACT 8/9 English test form for each reporting category. Note that the 40-item form contains 8 unscored items that do not contribute to any reporting category.

Table 2.3. Specification Ranges by Reporting Category for English

Reporting category	Number of items	Percentage of test (%)
Production of writing	9–11	28–34
Knowledge of language	4–6	13–19
Conventions of standard English	16–18	50–56

2.5 Math Test

2.5.1 Description of the Math Test

The PreACT 8/9 math test illuminates the mathematical path from Grades 8 and 9 to the grades served by PreACT and the ACT. The 35-item, 40-minute test emphasizes quantitative reasoning and application over extensive computation or memorization of complex formulas. Items focus on what students can do with the mathematics they have learned, which encompasses not only mathematical content but also mathematical practices.

The mathematics 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 mathematics; and appropriately managing the solution process. Some degree of fluency is required. Most students have sufficient time to complete the test. 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 problems 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 and answer all the questions. The test contains problems ranging from easy to very challenging in order to reliably report on readiness levels for students with different levels of preparation. Extended accessibility supports provide for fair and comparable math scores across a range of circumstances.

Cognitive Complexity and Depth of Knowledge

The PreACT 8/9 math test assesses skills across a range of cognitive complexities using items at DOK Levels 1, 2, and 3. ACT content experts classify all multiple-choice math items according to the following level descriptions (see Table 2.4).

Table 2.4. DOK Level Descriptions for Math

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.

2.5.2 Math Scores and Reporting Categories

Four scores are reported: a total test score and three reporting category scores. The three reporting categories are Preparing for Higher Math (PHM), Integrating Essential Skills (IES), and Modeling. The total score on the math test is also used, with the total science score, to determine the STEM score. The test includes three items that are used for developmental purposes and not included in any of the scores. A brief description of the reporting categories and the approximate number of operational test items in each reporting category are given below.

Preparing for Higher Math (PHM)

This reporting category captures the mathematics that students have learned more recently. This category is divided into the following five subcategories.

1. Number & Quantity

Students move from integer exponents to rational exponents in order to probe deeper into properties of the real number system and manipulate expressions with radicals. They also use units to understand and solve problems with multiple steps.

Content immediately preceding these topics, including using rational numbers to approximate irrational numbers, is also part of this category for PreACT 8/9.

2. Algebra

Students build on 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 types of applications they have for modeling. They continue to use their fluency strategically in order to make sense of expressions in terms of their parts and to solve problems.

Through repeated reasoning, students develop a general understanding of solving equations as a process that ensures that all solutions will be found. Students extend their proficiency to equations such as quadratic, polynomial, rational, and radical, as well as to systems of equations, integrating an understanding of solutions in terms of graphs. Students recognize these relationships in applications and create expressions, equations, and inequalities to represent problems.

This PreACT 8/9 category also encompasses content immediately preceding these topics, including integer exponents, square and cube roots, scientific notation, connections between lines and proportional relationships, solving linear equations, and solving systems of linear equations.

3. Functions

Students work with functions that have no equation, functions that follow the pattern of an equation, and functions based on sequences, which can even be recursive. Students investigate particular families of functions—like linear and exponential—in terms of the general function framework: looking at rates of change, algebraic properties, and connections to graphs and tables, and applying these functions in modeling situations. Students also examine a range of functions like those defined in terms of square roots, polynomials, and exponentials, as well as piecewise-defined functions.

Content immediately preceding these topics, including the concept of functions and representing a linear relationship through a function, is also part of this category for PreACT 8/9.

4. Geometry

Students solve and model problems involving plane figures and solids. They also navigate problems in the coordinate plane, where analytic treatment of distance allows students to derive conditions for parallel and perpendicular lines, to split a line segment into pieces with a given ratio of lengths, and to find areas and perimeters of polygons.

This PreACT 8/9 category also encompasses content immediately preceding these topics, including the Pythagorean theorem; the volume of cones, cylinders, and spheres; congruence and similarity through transformations; and angle relationships when parallel lines are cut by a transversal.

5. Statistics & Probability

Students represent and compare distributions of data, interpreting any differences between them using center, spread, shape, and (if applicable) outliers. They use their maturing judgment of likelihood to determine whether a particular model fits the outcomes of a certain process. They also identify outcomes in the union, intersection, or complement of events in a sample space.

This PreACT category also encompasses content immediately preceding these topics, including patterns of association between two quantities as seen through scatterplots and two-way tables, and modeling appropriate data with linear functions.

Integrating Essential Skills (IES)

This reporting category focuses on whether students can put together 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; statistical variability; probability; and random sampling. In addition to learning more content, students should grow in sophistication, accumulating and applying skills in higher-order contexts. 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.

Modeling

Modeling uses mathematics 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 discussed above. Thus, the Modeling reporting category is an overall measure of how well a student uses modeling skills across mathematical topics.

2.5.3 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 solutions of various types of equations and inequalities. Students must remove certain kinds of programs from their calculators. Some calculator features are not allowed or must be turned off for security reasons or to prevent disruptions during testing. Current details are always available on the ACT website at www.act.org.

2.5.4 Item Sets

The math test may include up to two item sets. An item set first presents information, including text, graphs, or other stimulus material, and then follows that information with a set of 2–5 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.

2.5.5 Mathematical Practices

Mathematical practices highlight cross-cutting mathematical skills and knowledge and the complex and vital ways the skills and knowledge integrate with content. Test items focus on important mathematics, which includes various levels of expertise with mathematical practices. Therefore, scores include mathematical practices. The Modeling score pulls out that particular mathematical practice across a variety of contexts.

2.5.6 Math Test Blueprints

Table 2.5 gives the ranges for the number and percentage of items on a PreACT 8/9 math test form by reporting category. Note that the 35-item form contains 3 unscored items that do not contribute to any reporting category.

Table 2.5. Specification Ranges by Reporting Category for Math

Reporting category	Number of items	Percentage of raw score points (%)
Preparing for Higher Math	27–29	84–91
Integrating Essential Skills	3–5	9–16
Modeling	≥4	25

Note. The items in the Preparing for Higher Math reporting category are divided among five subcategories: Number & Quantity, Algebra, Functions, Geometry, and Statistics & Probability. Items in Modeling are also included in either Preparing for Higher Math or Integrating Essential Skills.

2.6 Reading Test

2.6.1 Description of the Reading Test

The PreACT 8/9 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 four passage units, one of which may contain two shorter prose passages on the same topic. The passages include both literary narratives and informational texts from the humanities, natural sciences, and social sciences. Passages are representative of the kinds of texts commonly encountered by students in Grades 8 and 9. Each passage is preceded by a

heading that identifies the passage type (e.g., “Literary Narrative”) and names the author; the heading may also include a brief note containing important background information that helps in understanding the passage.

Each passage unit includes a set of multiple-choice test items. The test 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

The PreACT 8/9 reading test assesses skills across a range of cognitive complexities using items at DOK Levels 1, 2, and 3. ACT content experts classify all multiple-choice reading items according to the level descriptions in Table 2.6.

Table 2.6. DOK Level Descriptions for Reading

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.

2.6.2 Reading Scores and Reporting Categories

Four scores are reported: a total test score and three reporting category scores based on specific knowledge and skills. The three reporting categories are Key Ideas & Details, Craft & Structure, and Integration of Knowledge & Ideas. The test also includes five items that are used for developmental purposes and not included in any of the scores. A brief description of the reporting categories and the approximate number of operational test items in each reporting category are given below.

Key Ideas & Details

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

Craft & Structure

Students determine word and phrase meanings, determine the rhetorical purpose of an author's word choice, analyze text structure, understand authorial purpose and perspective, and analyze characters' points of view. They analyze authors' rhetorical decisions and differentiate between various perspectives and sources of information.

Integration of Knowledge & Ideas

Students understand the 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 evaluate reasoning and evidence from various sources in order to analyze how authors construct arguments.

2.6.3 Reading Test Blueprints

Table 2.7 gives the ranges for the number and percentage of items on a PreACT 8/9 reading test form for each reporting category. Note that the 25-item form contains 5 unscored items that do not contribute to any reporting category.

Table 2.7. Specification Ranges by Reporting Category for Reading

Reporting category	Number of items	Percentage of test (%)
Key Ideas & Details	10–12	50–60
Craft & Structure	6–7	30–35
Integration of Knowledge & Ideas	2–3	10–15

2.7 Science Test

2.7.1 Description of the Science Test

The PreACT 8/9 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 following content areas, which are all represented on the test: life science, physical science, and Earth/space science.

Students are assumed to be taking or have taken introductory science courses over their middle school years, covering fundamental concepts in these content areas. Through these science courses, students should be familiar with the scientific practices (e.g., inquiry and experimental design; basic data analysis), terminology (e.g., common scientific units of measure), and cross-cutting concepts (e.g., patterns; cause and effect) that span all content areas. The assessment assesses science independent of any specific sequence of courses and instead focuses on assessing the science knowledge, skills, and practices that the ACT National Curriculum Survey has identified as both appropriate for 8th graders and most strongly tied to college and career readiness in science.

The test presents several sets of scientific information, each followed by multiple-choice test items. The scientific information is conveyed in three different formats: Data Representation (scientific graphs, tables, and diagrams), Research Summaries (descriptions of one or more related experiments), and Conflicting Viewpoints (two or more brief theoretical models that address the same scientific phenomenon but are inconsistent with one another).

All items on the PreACT 8/9 science test are based on authentic scientific scenarios that are built around important scientific concepts and designed to mirror the experiences of students and working scientists engaging in real science. The PreACT 8/9 science test focuses on multidimensional assessment (to measure three-dimensional learning in science), with items that require students to apply multiple domains. The PreACT 8/9 science test measures the science skills and knowledge that are empirically tied to college and career readiness.

Cognitive Complexity and Depth of Knowledge

The PreACT 8/9 science test assesses skills across a range of cognitive complexities using items at DOK Levels 1, 2, and 3. ACT content experts classify all multiple-choice science items according to the level descriptions in Table 2.8.

Table 2.8. DOK Level Descriptions for Science

Level	Description
DOK1	Locating/reproducing information
DOK2	Applying skills and concepts
DOK3	Integrating skills and concepts (strategic thinking)

2.7.2 Science Scores and Reporting Categories

Four scores are reported: the overall science test score 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. The total score on the science test is also used, with the total math score, to determine the STEM score. The test includes five items that are used for developmental purposes and not included in any of the scores. A brief description of the reporting categories and the approximate number of operational test items in each reporting category are given below.

Interpretation of Data

Students manipulate and analyze scientific data presented in tables, graphs, and diagrams (e.g., recognize trends in data, translate tabular data into graphs, interpolate and extrapolate, and reason mathematically).

Scientific Investigation

Students understand experimental tools, procedures, and design (e.g., identify variables and controls) and compare, extend, and modify experiments (e.g., predict 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., determine which explanation for a scientific phenomenon is supported by new findings).

2.7.3 Science Test Blueprints

Table 2.9 gives the range for the number and percentage of items on a PreACT 8/9 science test form for each reporting category. Note that the 30-item form contains 5 unscored items that do not contribute to any reporting category.

Table 2.9. Specification Ranges by Reporting Category for Science

Reporting category	Number of items	Percentage of test (%)
Interpretation of Data	9–12	36–48
Scientific Investigation	6–10	24–40
Evaluation of Models, Inferences, & Experimental Results	8–12	32–48

2.8 Test Development Procedures

This section describes the procedures that are used in developing PreACT 8/9 tests. Note that items for PreACT 8/9 and PreACT are developed under the development process for the ACT, which is also described in this section.

2.8.1 Review of Test Specifications

Two types of test specifications are used in developing PreACT 8/9 tests: content specifications and statistical specifications.

Content Specifications

Content specifications for PreACT 8/9 tests were developed through the curricular analysis discussed previously. While care is taken to ensure that the basic structure of PreACT 8/9 remains the same from year to year so that the scale scores are comparable, the specific characteristics of the test items used in each specification 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 meet the content specifications are also reviewed. While the general content of the test remains constant, the particular kinds of items in a specification category may change slightly.

Statistical Specifications

Item statistics from classical test theory and item response theory (IRT) are considered. Statistical specifications for the tests indicate the level of difficulty (i.e., proportion correct and average IRT *b*-parameter estimates) and the minimum acceptable level of discrimination (i.e., point biserial correlation and minimum IRT *α*-parameter estimates) of the test items to be used.

The tests are constructed to have a mean item difficulty that is somewhat easier than a typical PreACT and ACT form in terms of average IRT *b*-parameter estimates and overall test characteristic curves. Items selected to be administered on the PreACT 8/9 have a wide distribution of item difficulties so that the tests can effectively differentiate among students who vary widely in their levels of achievement.

2.8.2 Selection of Item Writers

ACT item writers are content specialists in the disciplines measured by ACT tests and consist of ACT staff members. 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 PreACT 8/9, 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 that is specific to the content area. The guides include examples of items, the test specifications, and ACT's requirements for content and styles. Also included are specifications for fair portrayal of all groups of individuals, which includes avoidance of subject matter that may be unfamiliar to members of certain groups within society, a balanced representation for race/ethnicity, and gender-neutral language.

ACT test development staff evaluate each sample set submitted by a potential item writer. A decision concerning whether to contract with the item writer for that content area is made based on that evaluation.

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

2.8.3 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 that evaluate the knowledge, skills, and abilities measured in each test. A typical assignment includes the evidenced-based item template and focuses on a skill statement that the item needs to assess. Included in each template is a set of evidence statements that the item(s) must elicit.

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

2.8.4 Item Construction

Item writers must create items that address educationally important topics and are Psychometrically sound. A large number of items must be constructed because, even with good writers, many items 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 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 and/or other stimulus material, such as graphs and tables.

2.8.5 Review of Items

Content and Specifications Review

After a unit is accepted, ACT staff review it several times 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 this process, all test materials are also reviewed for fair portrayal and balanced representation of groups within society and for gender-neutral language.

After internal item reviews are completed, ACT invites external reviewers, including practicing teachers from each grade level, to participate in refining questions and verifying that constructs are being sampled 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 learning the assessed content at or around the targeted grade(s). During the external content review, items are evaluated for content accuracy, item classification, item format, and language.

Fairness Reviews for Bias, Sensitivity, and Accessibility

ACT conducts external fairness reviews for all items/tasks prior to pretesting and for forms before they become operational. These reviews verify that items are fair, unbiased, and accessible to all students while being sensitive to their diverse backgrounds and situations.

The external fairness review panel consists of experts in diverse educational areas who represent both genders and a variety of racial and ethnic backgrounds. 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. Because

ACT stakeholders count on national representation to maintain the comparability of test forms and scores, ACT selects reviewers in a manner that ensures no one state is overrepresented.

2.8.6 Assembly of New Forms

Items that are judged acceptable in the review process are placed in an item pool. Preliminary forms of the PreACT 8/9 tests are constructed using items from this pool that match the content and statistical specifications for the tests.

2.8.7 Content and Fairness Review of Test Forms

The preliminary versions of the test forms are subjected to several reviews to ensure fairness and conformity to good test-construction practice. First, ACT staff again check items for content accuracy and conformity to ACT style. The items are also reviewed in the context of the units and the overall form to ensure that they are free of clues that could allow testwise students to answer an item correctly even though they lack the required skills or 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. Drawn from the same populations of curriculum and education specialists, these experts have not seen the items before and perform the same types of reviews for all items and the overall forms.

Chapter 3: ACT® College and Career Readiness Standards and ACT College Readiness Benchmarks

PreACT® 8/9 scores support interpretations related to college and career readiness. These scores can be linked to college readiness performance standards and to descriptions of the knowledge and skills important for college and career readiness. The ACT® College and Career Readiness Standards provide descriptions of the knowledge and skills typical of students at different score levels. The PreACT 8/9 Readiness Levels predict whether students are on target to meet the ACT College Readiness Benchmarks. Together, these two empirically derived tools—the Standards and the Benchmarks—support interpretations of college and career readiness and identify the key knowledge and skill areas needed to increase the likelihood of success.

3.1 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® test 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 area test specialists analyzed the skills and knowledge that students need in order to correctly answer test items that were answered correctly by 80% or more of the examinees who scored within each score range. The specialists then used this analysis to write the Standards. See the *ACT® Technical Manual* (ACT, 2024a) for a full account of the development of the Standards and a description of them for each of the test sections. Because the PreACT 8/9 score scales are aligned to the ACT score scales (see Chapter 4), the Standards also help describe the knowledge and skills that students at different PreACT 8/9 score levels typically have.

3.2 ACT College Readiness Benchmarks

The ACT College Readiness Benchmarks are the minimum ACT test scores required for students to have a reasonable chance of success in first-year credit-bearing college courses. There are Benchmarks for six ACT test scores: English, mathematics, reading, science, STEM (science, technology, engineering, and mathematics), and ELA (English language arts). Each ACT Benchmark is linked to success in a different college course or set of courses, as shown in Table 3.1. Students who meet an ACT Benchmark have a 50% chance of earning a B or higher and about a 75% chance of earning a C or higher in the respective coursework at a typical college.

The Benchmarks are based on credit-bearing courses from core subject areas that are most commonly taken by first-year college students. Each ACT Benchmark was linked to performance in a course or courses in the same academic area. The ACT STEM Benchmark was derived from the first-year college mathematics and science courses most commonly taken

by students in STEM-related majors. The courses include calculus, biology, chemistry, physics, and engineering. The ELA Benchmark was based on the same courses used to develop the English and Reading Benchmarks.

Table 3.1. ACT College Readiness Benchmarks

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

The Benchmarks for English, mathematics, reading, and science were first established in 2005 and then updated in 2013 using data from more recent high school graduates (Allen, 2013; Allen & Sconing, 2005). The STEM Benchmark was established in 2015 (Mattern et al., 2015), and the ELA Benchmark was established in 2017 (Radunzel et al., 2017). More information about the Benchmarks is provided in an ACT research and policy issue brief (Allen & Radunzel, 2017). (PreACT 8/9 does not report an ELA score, so the ELA Benchmark is not relevant to PreACT 8/9.)

The ACT College Readiness Benchmarks can help states, districts, and schools identify the level of academic performance needed for a student to be college ready. The Benchmarks help articulate college expectations not only to students in Grades 11 and 12 but also to students in lower grades.

3.3 PreACT 8/9 Readiness Levels and Benchmarks

The PreACT 8/9 tests can be used to monitor students' progress toward college and career readiness. PreACT 8/9 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 8/9 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 8/9 Readiness Levels are specific to grade level (8 or 9) and season (fall or spring), resulting in four sets of Readiness Levels for each PreACT 8/9 score (English, math, reading, science, and STEM). Table 3.2 lists the scale score ranges for the PreACT 8/9 Readiness Levels that were derived in 2024.

Table 3.2. Scale Score Ranges for PreACT 8/9 Readiness Levels

PreACT 8/9 score	Grade level	Season	In Need of Intervention	Close to Target	On Target
English	8	Fall	1–7	8–9	10–30
	8	Spring	1–7	8–10	11–30
	9	Fall	1–8	9–11	12–30
	9	Spring	1–9	10–12	13–30
Math	8	Fall	1–13	14–15	16–30
	8	Spring	1–14	15–16	17–30
	9	Fall	1–14	15–16	17–30
	9	Spring	1–15	16–17	18–30
Reading	8	Fall	1–12	13–15	16–30
	8	Spring	1–13	14–16	17–30
	9	Fall	1–14	15–17	18–30
	9	Spring	1–15	16–18	19–30
Science	8	Fall	1–13	14–16	17–30
	8	Spring	1–14	15–17	18–30
	9	Fall	1–15	16–18	19–30
	9	Spring	1–16	17–18	19–30
STEM	8	Fall	1–16	17–18	19–30
	8	Spring	1–17	18–19	20–30
	9	Fall	1–18	19–20	21–30
	9	Spring	1–19	20–21	22–30

3.3.1 Derivation of PreACT 8/9 Readiness Levels and Benchmarks

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:

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

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

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

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

5. **Fall Grade 11 PreACT.** 52,399 students who took 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, ACT used logistic regression 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-price lunch, school locale (rural, town, suburban, or urban), geographic region, and school mean ACT Composite score. Data regarding school percentage eligible for free or reduced-price lunch 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 calculated only 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 included 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 3.3 provides the distribution of background variables for the total sample before and after weighting. After weighting, the sample percentages were very close to the population percentages.

Table 3.3. 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-price 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 3.4 provides test score summary statistics for each test section and grade level included in the total sample.

Table 3.4. 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), the 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 the 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 numbers 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 pandemic. Table 3.5 shows the cut score point estimates produced by the logistic regression models, as well as the cut scores that were chosen for the Readiness Levels.

Generally, the cut scores for the On Target Readiness Level were chosen as the scores closest to having a .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 .25 probability of meeting the ACT College Readiness Benchmark. In some cases, cut scores that deviated slightly from those rules 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 (i.e., approaching scores that students could achieve by guessing).

Table 3.5. 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)

Chapter 4:
Technical Characteristics of PreACT® 8/9

This chapter discusses the technical characteristics of PreACT® 8/9, including the development of the PreACT 8/9 scales, the development of the predictive relationships between PreACT 8/9 and the PreACT® and ACT® tests, a set of statistics that quantify the reliability and measurement error of PreACT 8/9 test scores, the norms of PreACT 8/9, and the results of psychometric analyses based on operational test data from students taking PreACT 8/9 between fall 2023 and spring 2024.

4.1 PreACT 8/9 Scale Scores

For PreACT 8/9, scale scores are reported for the English, math, reading, and science tests. Scale scores are also reported for the Composite score and the science, technology, engineering, and math (STEM) score. For each of the four multiple-choice tests, the number of questions answered correctly is counted to obtain a raw score, which is then converted to a scale score. The Composite score represents a student's overall performance on the four tests. It is the average of the four scale scores to the nearest whole number (fractions of 0.5 or greater round up). The STEM score represents a student's overall performance on the math and science tests. It is the rounded average of the Math and Science scale scores, with fractional values of 0.5 or greater rounded up. The PreACT 8/9 scale scores range from 1 to 30.

PreACT 8/9 test scores share a common scale with PreACT and ACT test scores. The common scale enhances score interpretations by making it easier to monitor progress over time, determine if students are on target for college and career readiness,[1] and predict student performance on the PreACT at Grade 10 and the ACT at Grade 11. The ACT® College and Career Readiness Standards describe the knowledge and skills corresponding to different score levels on the common scale.

4.1.1 Fall 2022 Linking Study

In the 2022–2023 administration, a new PreACT8/9 test form was first administered. Pre-equating was not an option because item statistics with these newly developed items were not available. To place PreACT 8/9 items onto the PreACT and ACT scale, ACT psychometricians used the common-item nonequivalent groups (CINEG) linking design. The new PreACT 8/9 form includes some linking items that were already on the PreACT and ACT scale along with PreACT 8/9 items. Those linking items were used as operational items and were carefully selected to meet the PreACT 8/9 specifications from both the content and statistical perspectives, especially ensuring that the selected items were not too difficult for 8th- and 9th-grade students. Because English, reading, and science are passage-based tests, it was

[1] See Chapter 3 for discussion of the ACT College and Career Readiness Standards and the ACT College Readiness Benchmarks.

challenging to add as many linking items as possible and not to make the test too difficult. Each content area included at least 20% linking items, and those were positioned in the middle of the test to eliminate potential position effects.

The new PreACT 8/9 form was administered starting on September 1, 2022. The sample size for the linking study was 3,806. Notably, the distributions of gender and ethnicity groups as well as geographic distribution across states of the sample closely mirrored those observed in the population from the previous year.

The first step was to compute classical item statistics, which were reviewed by psychometricians and content experts. Based on the item review, the final linking set was decided. In the next step, the unidimensional, three-parameter logistic item response theory (3PL IRT) model was used to calibrate operational and linking items via BILOG-MG. In order to place these newly calibrated item parameter estimates onto the same scale as PreACT and the ACT, the characteristic curve method (Stocking & Lord, 1983) was employed. After linking, raw-to-scale score conversion tables were produced through IRT true score equating (e.g., Kolen & Brennan, 2014). One of the ACT forms was used as a base form. After this process, all PreACT 8/9 items were placed onto the same scale as the ACT and PreACT.

4.2 Predicted PreACT and ACT Score Ranges

One of the primary intended uses of PreACT 8/9 is to predict how well students will perform on the PreACT as 10th graders and the ACT as 11th graders. Accordingly, PreACT 8/9 score reports include predicted score ranges for PreACT and the ACT. The score predictions can help users interpret their PreACT 8/9 scores, plan high school coursework, and determine how much academic growth they need in order to meet their goals for college and career readiness. In this section, we document the samples and methods used to derive the predicted score ranges.

4.2.1 Samples Used to Derive the PreACT and ACT Score Predictions

The predictions are updated each year, and here we describe the samples 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.

Two longitudinal samples were used to derive the predictions. Students in Sample 1 took PreACT or PreACT Secure in Grade 10. Sample 1 included 43,793 students who took PreACT 8/9 in Grade 8, 134,246 students who took PreACT 8/9 in Grade 9, and 58,238 students who took PreACT in Grade 9.

Students in Sample 2 took the ACT test in Grade 11. Sample 2 included 29,469 students who took PreACT 8/9 in Grade 8, 142,945 students who took PreACT 8/9 in Grade 9, and 97,983 students who took PreACT in Grade 9.

We used propensity score weighting (Austin, 2011) to weight each sample 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 sample 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-price lunch, and school mean ACT Composite score (for the 2023 high school graduating cohort). Table 4.1 summarizes the demographics of the longitudinal samples, as well as the target population. The table reports both the unweighted and weighted percentages of students in each demographic category. Relative to the unweighted sample percentages, the weighted sample percentages more closely match the target population percentages.

Table 4.1. Demographics of Samples Used to Derive Predicted PreACT and ACT Scores

Characteristic		Sample 1: PreACT		Sample 2: ACT		Target population %
		%	Wt. %	%	Wt. %	
Gender	Female	46.9	47.3	49.5	48.0	48.7
	Male	47.4	47.3	45.8	46.8	46.4
	Another gender	0.5	0.5	0.6	0.6	0.7
	Missing	5.1	5.0	4.1	4.6	4.2
Race/ethnicity	Asian	3.7	4.0	4.2	4.2	4.2
	Black/African American	9.8	11.9	10.4	12.6	12.4
	Hispanic	15.5	15.5	13.2	14.4	16.9
	Native American	0.9	1.1	0.8	0.9	1.0
	Native Hawaiian/OPI	0.3	0.4	0.3	0.4	0.3
	Two or more races	5.7	5.1	5.7	5.4	4.9
	White	56.9	53.8	59.3	54.1	52.2
	Missing	7.3	8.3	6.1	8.3	8.3
Region	Midwest	39.0	29.5	44.3	28.1	27.8
	Northeast	0.5	1.1	0.9	2.8	3.7
	South	51.3	52.0	47.5	51.8	52.2
	West	9.2	17.4	7.3	17.4	16.4
School type	Private	30.6	13.0	25.2	14.3	9.9
	Public	69.4	87.0	74.8	85.7	90.1
School locale	Rural	14.3	18.7	16.3	17.9	17.5
	Town	13.2	16.8	14.2	15.5	13.1
	Suburban	35.4	31.3	32.7	32.5	33.0
	Urban	30.6	25.7	31.6	26.7	28.2
	Missing	6.5	7.6	5.2	7.5	8.1
High school graduation year	2023	0.0	0.0	23.8	25.2	100.0
	2024	17.4	16.9	26.2	25.8	0.0
	2025	36.6	35.2	50.0	49.0	0.0
	2026	46.0	47.9	0.0	0.0	0.0

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

Table 4.2 summarizes the test scores for each weighted sample. The mean and standard deviation of the pretest (Grade 8 and Grade 9 scores) and posttest (Grade 10 PreACT score or Grade 11 ACT score) are presented for each test section. In addition, pretest/posttest correlations (*r*) are presented.

Table 4.2. Test Score Summary Statistics for Samples Used to Derive Predicted PreACT and ACT Scores

Sample	Test Section	Pretest		Posttest		*r*
		Mean	*SD*	Mean	*SD*	
Sample 1: PreACT	English	15.01	5.41	16.24	5.96	.78
	Math	17.13	3.89	17.70	4.36	.79
	Reading	18.61	6.16	19.51	6.85	.73
	Science	17.00	4.55	17.66	5.17	.70
	STEM	17.31	3.90	17.93	4.44	.82
	Composite	17.06	4.40	17.82	5.18	.87
Sample 2: ACT	English	16.10	5.63	19.50	6.90	.78
	Math	18.04	4.36	19.57	5.58	.80
	Reading	19.72	6.51	20.84	6.95	.75
	Science	17.78	4.85	20.32	5.68	.72
	STEM	18.16	4.30	20.20	5.37	.83
	Composite	18.04	4.74	19.97	6.01	.87

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

4.2.2 Statistical Model Used to Derive the PreACT and ACT Score Predictions

The predictions are derived from a linear regression model where the pretest score is used to predict the posttest 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, whether the onset of the COVID-19 pandemic (March 2020) occurred between the pretest and posttest, and whether the pretest was PreACT 8/9 (not PreACT).

With the fitted models, a 50% prediction interval forms the lower and upper bounds 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 occurred between the pretest and posttest, and whether the pretest was PreACT 8/9 or PreACT. The lower and upper bounds were obtained after the prediction interval endpoints were rounded to the nearest integer.

The reported score predictions assume that students will take the PreACT test either one or two years after taking PreACT 8/9 and that they will take the ACT test in the spring of Grade 11. Therefore, the PreACT score predictions are based on the following scenarios for number of months between the PreACT 8/9 and PreACT tests: 24 months for PreACT 8/9 administered in Grade 8 and 12 months for PreACT 8/9 administered in Grade 9. The ACT score predictions are based on the following scenarios for number of months between the PreACT and ACT tests:

- 42 months for PreACT 8/9 administered in fall Grade 8
- 36 months for PreACT 8/9 administered in spring Grade 8
- 30 months for PreACT 8/9 administered in fall Grade 9
- 24 months for PreACT 8/9 administered in spring Grade 9

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 8/9 (not PreACT).

After deriving the predicted score ranges, manual adjustments were made to ensure logical consistency across PreACT 8/9 scores (1–30), grade levels (8–9), and predicted outcomes (PreACT and ACT scores). The logical consistency requirements include the following.

For the section test scores and STEM score:

- For each grade level (8 or 9), season (fall or spring), and Composite score value, PreACT and ACT score range predictions do not decrease as PreACT 8/9 scores increase.
- For each grade level (8 or 9), season (fall or spring), and PreACT 8/9 score value, PreACT and ACT score range predictions do not decrease as Composite scores increase.

For the Composite score:

- For each grade level (8 or 9) and season (fall or spring), PreACT and ACT score range predictions do not decrease as PreACT 8/9 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.
- PreACT and 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.

4.3 Predictions of ACT® WorkKeys® National Career Readiness Certificate® (NCRC®) Level

Another of the primary intended uses of PreACT 8/9 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 8/9 Composite score. More specifically, this indicator predicts the ACT WorkKeys National Career Readiness Certificate (NCRC) level that students are likely to obtain if 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 Assessments and attempting to earn an NCRC.

4.3.1 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 Assessments. The number of months between the PreACT test and the WorkKeys test ranged from 0 to 53, with a mean of 23.7 and a 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 the spring of 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-price lunch, and school mean ACT Composite score (for the 2022 school-day tested cohort). Table 4.3 summarizes the sample's demographics and compares the sample to the target population before and after sample weighting.

Table 4.3. 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% due to rounding.

4.3.2 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 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 occurred between the tests. The logistic regression model estimates are provided in Table 4.4.

Table 4.4. 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 numbers of months between the PreACT Suite test and WorkKeys:

- 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
- 12 for fall Grade 11

These values assume that students will take the ACT WorkKeys Assessments in the fall of 12th grade. The cut score estimates were obtained by rounding to the nearest integer, resulting in the score ranges presented in Table 4.5 for each NCRC level, grade level, and season.

Table 4.5. PreACT Suite Composite Score Ranges Corresponding to Predicted NCRC Levels

NCRC level	Grade level and season						
	Grade 8		Grade 9		Grade 10		Grade 11
	Fall	Spring	Fall	Spring	Fall	Spring	Fall
Non-Qualifier	1–8	1–9	1–9	1–9	1–9	1–9	1–9
Bronze	9–13	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. For more information on the Progress Toward the ACT National Career Readiness Certificate Indicator, visit Progress Indicator Linked to Refreshed WorkKeys.

4.4 PreACT 8/9 Norms

One of the secondary uses of PreACT 8/9 test scores is to understand student performance relative to national norms. To support this use, PreACT 8/9 score reports include percentile ranks for English, math, reading, science, STEM, and Composite scores. The PreACT 8/9 norms are defined as the cumulative percentage of students scoring at or below a given score in the norm sample. The norm sample is a reference sample of students taking PreACT 8/9. A PreACT 8/9 norming study is 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. Separate norms are estimated for the fall of Grade 8, the spring of Grade 8, the fall of Grade 9, and the spring of Grade 9.

Students assessed with PreACT 8/9 are not representative of the national population. To support interpretations of nationally representative norms, the PreACT 8/9–tested samples are statistically weighted to more closely match a national distribution 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). For each combination of the weighting variables, the sample and population percentages are first calculated. Then, the weight for each combination is calculated as the population (i.e., ACT) percentage divided by the sample (i.e., PreACT 8/9) percentage. In the cases where weights were very large (>5) or very small (<0.2), they were truncated to be in the interval of [0.2, 5.0]. The final weights were applied to all students within each combination, and the weighting procedure was conducted separately for each of the four norm samples (i.e., fall Grade 8, spring Grade 8, fall Grade 9, and spring Grade 9).

Through this design, student performance on PreACT 8/9 can be understood for each grade level and season relative to the population of students who go on to take the ACT. More detailed results of the PreACT 8/9 norming are documented in a separate study report that includes in-depth information on the norming samples, weighting methodology, estimation procedures, and the results (including percentile ranks and summary statistics). The most recent norm tables can be found on the ACT Knowledge Hub.

4.5 PreACT 8/9 2023–2024 Operational Test Results

This section discusses the results of the PreACT 8/9 test administered from fall 2023 to spring 2024.

4.5.1 Test Sample

Over 216,000 students from 46 states took the PreACT 8/9 test administered from fall 2023 to spring 2024. Tables 4.6 to 4.8 provide data distributions based on gender, ethnicity, and region of the country, respectively, for Grades 8 and 9; Table 4.9 provides school distributions based on region of the country for Grades 8 and 9.

Table 4.6. PreACT 8/9 2023–2024 Operational Test Data Distribution by Gender and Grade

Gender	Grade 8	Grade 9
Female	29,322	69,889
Male	29,504	73,558
Other	4,665	9,216

Table 4.7. PreACT 8/9 2023–2024 Operational Test Data Distribution by Ethnicity and Grade

Ethnicity	Grade 8	Grade 9
Black/African American	7,117	23,553
American Indian/Alaska Native	900	1,707
White	31,012	76,417
Hispanic/Latino	4,449	10,894
Asian	1,811	3,910
Native Hawaiian/Other Pacific Islander	211	425
Two or more races	9,282	19,936
Prefer not to respond	3,640	7,425

Table 4.8. PreACT 8/9 2023–2024 Operational Test Data Distribution by Region of Country and Grade

Region	Grade 8	Grade 9
Midwest	11,836	62,943
Northeast	409	16
South	734	1,578
West	43,783	78,536
Missing	6,729	9,590

Table 4.9. PreACT 8/9 2023–2024 Operational Test School Distribution by Region of Country and Grade

Region	Grade 8	Grade 9
Midwest	195	625
Northeast	15	19
South	636	758
West	73	104
Missing	4	0

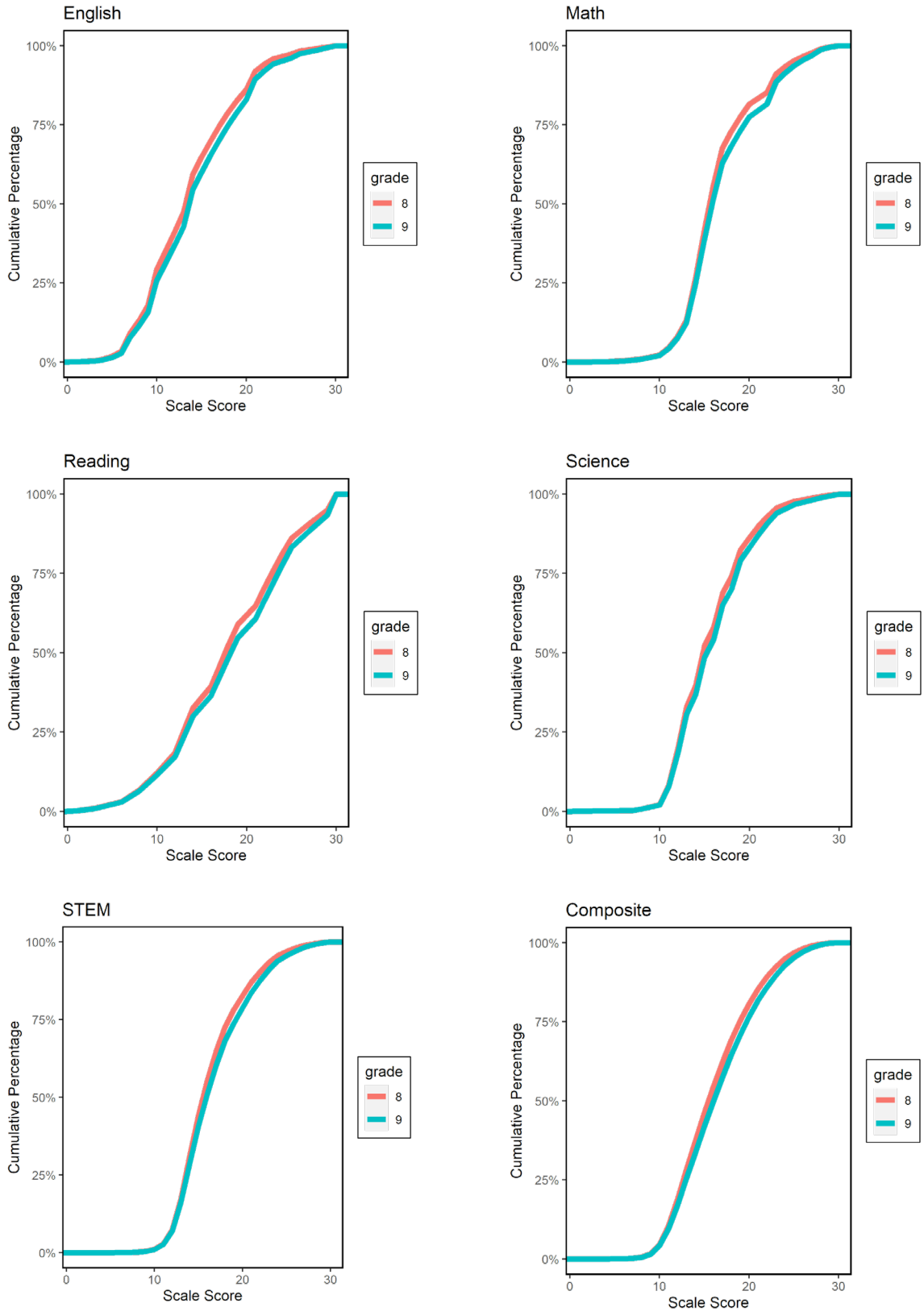
4.5.2 Scale Score Statistics

Scale score summary statistics for the students in the PreACT 8/9 2023–2024 test sample are given in Table 4.10. The table shows that the average scale scores for all test sections are higher for Grade 9 examinees than for Grade 8 examinees. Figure 4.1 shows the comparisons of scale score distributions on different test sections between Grades 8 and 9. When one of the plotted cumulative percentage curves is to the left of the other, it indicates that this group scored lower relative to the group on the right (or, conversely, the group on the right scored higher). For all test sections, the Grade 8 curve was clearly to the left of the Grade 9 curve, showing Grade 9 students obtaining higher scores than Grade 8 students in general.

Table 4.10. Scale Score Summary Statistics for the PreACT 8/9 2023–2024 Operational Test

Grade	Test section	Mean	*SD*	Skewness	Kurtosis
8	English	14.13	5.18	0.51	−0.09
	Math	17.07	4.15	0.79	0.55
	Reading	18.46	6.40	−0.02	−0.69
	Science	16.07	4.05	0.82	0.78
	STEM	16.82	3.79	0.82	0.46
	Composite	16.56	4.33	0.49	−0.31
9	English	14.76	5.39	0.46	−0.22
	Math	17.52	4.40	0.68	0.07
	Reading	19.03	6.57	−0.10	−0.76
	Science	16.48	4.31	0.79	0.53
	STEM	17.25	4.05	0.74	0.13
	Composite	17.07	4.55	0.42	−0.48

Figure 4.1. Scale Score Distributions on Test Sections for Grades 8 and 9



4.5.3 Effective Weights

As with the ACT and PreACT, the PreACT 8/9 Composite and STEM scores are the rounded averages of the scale scores on test sections. Specifically, the English, math, reading, and science scale scores are weighted equally to form the Composite score, and the math and science scale scores are weighted equally to form the STEM score. Forming scores in such a way indicates that for the PreACT 8/9 Composite and STEM scores, the weights used in the calculation are 0.25 and 0.5, respectively, and they are often referred to as *nominal* weights.

Other definitions of the contribution of a test score to a combined score are also available. *Effective* weights, for example, are defined as the proportion of the variability of the combined score that can be attributed to a particular test score (Wang & Stanley, 1970). The effective weights are calculated based on the variance–covariance matrix among the scale scores on test sections using the formula

$$ew_i = \frac{\sigma_i^2 + \sum_{j \neq i} \sigma_{ij}}{\sum_i [\sigma_i^2 + \sum_{j \neq i} \sigma_{ij}]},$$

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

Table 4.11 contains the variance–covariance matrix for the scale scores used to calculate the effective weights based on the 2023–2024 PreACT 8/9 operational data. To serve as a reference, similar information from the most recent PreACT (ACT, 2023c) and ACT (ACT, 2024a) technical manuals is also provided in Tables 4.12 and 4.13, respectively.

For example, the effective weight for the PreACT 8/9 English test was computed by adding the four numbers in the first row of Table 4.11 (28.48, 15.14, 24.63, and 16.00). Then, this sum was divided by the sum of all the elements in the variance–covariance matrix, which resulted in an effective weight of 0.26 (after rounding; see Table 4.14). The effective weights for math, reading, and science were obtained by following similar steps. Since both variance and covariance are included in the numerator, a large variance or large covariances with other test sections could lead to a large effective weight.

Table 4.11. Scale Score Variance–Covariance Matrix for PreACT8/9[2]

Section	English	Math	Reading	Science
English	28.48	15.14	24.63	16.00
Math	15.14	18.79	17.63	13.25
Reading	24.63	17.63	42.57	20.18
Science	16.00	13.25	20.18	17.99

Table 4.12. Scale Score Variance–Covariance Matrix for PreACT

Section	English	Math	Reading	Science
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

Table 4.13. Scale Score Variance–Covariance Matrix for the ACT

Section	English	Math	Reading	Science
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

Tables 4.14 and 4.17 contain the effective weight quantifying the amount of each test section score contributing to the variances of the Composite and STEM scores, respectively, based on the 2023–2024 PreACT 8/9 operational data. The effective weights for the ACT and PreACT from the most recent technical manuals (ACT, 2024a, 2024b) are provided as references in Tables 4.15, 4.16, 4.18, and 4.19.

[2] Note that the diagonal values are the variance of scale score on each test section (e.g., 28.48, 18.79, 42.57, and 17.99 for PreACT 8/9), and the off-diagonal values are the covariance between the scale scores of test sections.

Table 4.14. Effective Weights for the Composite Score for PreACT 8/9

Category	English	Math	Reading	Science
Number of items	32	32	20	25
Proportions of total	0.29	0.29	0.18	0.23
Effective weight	0.26	0.20	0.33	0.21

Table 4.15. Effective Weights for the Composite Score for PreACT

Category	English	Math	Reading	Science
Number of items	45	36	25	30
Proportions of total	0.33	0.26	0.18	0.22
Effective weight	0.27	0.19	0.31	0.23

Table 4.16. Effective Weights for the Composite Score for the ACT

Category	English	Math	Reading	Science
Number of items	75	60	40	40
Proportions of total	0.35	0.28	0.19	0.19
Effective weight	0.27–0.28	0.22–0.23	0.27–0.28	0.21–0.24

Tables 4.14 and 4.15 show that the effective weights for the Composite score for PreACT 8/9 and PreACT are quite close to each other. However, when the PreACT 8/9 effective weights are compared to the ACT results (Table 4.16), the contribution to the Composite score for reading is relatively higher. Table 4.14 shows that the high effective weight for reading is most likely due to the larger score variance (42.57; see Table 4.11). Conversely, the PreACT 8/9 effective weight for math is relatively low when compared to the ACT results because its covariances with the other measures tended to be on the lower side.

Table 4.17. Effective Weights for the STEM Score for PreACT 8/9

Category	Math	Science
Number of items	32	25
Proportion of total	0.56	0.44
Effective weight	0.51	0.49

Table 4.18. Effective Weights for the STEM Score for PreACT

Category	Math	Science
Number of items	36	30
Proportion of total	0.55	0.45
Effective weight	0.46	0.54

Table 4.19. Effective Weights for the STEM Score for the ACT

Category	Math	Science
Number of items	60	40
Proportion of total	0.60	0.40
Effective weight	0.50–0.52	0.48–0.50

Again, Tables 4.17 and 4.18 show that the effective weights for the STEM score are quite similar for the PreACT 8/9 and PreACT. However, when compared to the ACT test (Table 4.19), the pattern of the effective weights is different. Math has a larger effective weight than science for the STEM score in the ACT test, whereas science has a larger effective weight than math in the PreACT 8/9 test. One possible reason could be that in contrast to the ACT, the variance of the science scores (17.99) on the PreACT 8/9 test was larger than the variance of the math scores (13.25), as shown in Table 4.11. Note that some of the proportion sums in Tables 4.14 through 4.19 do not equal one due to rounding error.

4.5.4 Relationship Among Scores

The correlation of scale scores in each test section was computed based on the 2023–2024 PreACT 8/9 operational data and compared with the scale score correlations from the most recent ACT and PreACT technical manuals (ACT, 2024a, 2024b), as shown in Tables 4.20 through 4.22. The correlation values among PreACT 8/9 scale scores of test sections resemble those of PreACT slightly more than those of the ACT. In general, the PreACT 8/9, PreACT, and ACT show patterns of correlations close to each other, reflecting the similar relationships among the test scores on test sections and the Composite and STEM scores for the three tests.

Table 4.20. Correlations Among the Scale Scores of Test Sections for PreACT 8/9

Section	English	Math	Reading	Science	Composite	STEM
English	1.00	.65	.71	.71	.88	.73
Math	—	1.00	.62	.72	.83	.93
Reading	—	—	1.00	.73	.90	.73
Science	—	—	—	1.00	.88	.92
Composite	—	—	—	—	1.00	.92
STEM	—	—	—	—	—	1.00

Table 4.21. Correlations Among the Scale Scores of Test Sections for PreACT

Section	English	Math	Reading	Science	Composite	STEM
English	1.00	.70	.78	.71	.90	.76
Math	—	1.00	.66	.74	.85	.92
Reading	—	—	1.00	.73	.91	.75
Science	—	—	—	1.00	.88	.94
Composite	—	—	—	—	1.00	.93
STEM	—	—	—	—	—	1.00

Table 4.22. Correlations Among the Scale Scores of Test Sections for the ACT

Section	English	Math	Reading	Science	Composite	STEM
English	1.00	.77	.80	.78	.93	.81
Math	—	1.00	.68	.81	.89	.95
Reading	—	—	1.00	.76	.90	.75
Science	—	—	—	1.00	.92	.95
Composite	—	—	—	—	1.00	.95
STEM	—	—	—	—	—	1.00

4.5.5 Differential Item Functioning

Differential item functioning (DIF) is a statistical difference between the probability of a specific population subgroup (the “focal” group) getting the item right and the comparison population subgroup (the “reference” group) getting the item right given that both groups have the same level of expertise with respect to the content being tested. DIF analyses of the PreACT 8/9 tests were conducted based on the 2023–2024 PreACT 8/9 operational data. 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 descriptions 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 4.23.

Table 4.23. The Group Comparison for DIF Analyses

Focal group	Reference group
Female	Male
Asian	White
Black	White
Hispanic	White
American Indian or Alaska Native	White
Pacific Islander	White
Two or more races	White

Using established criteria, ACT flagged the items with STD or MH values exceeding the tolerance level. Per the STD procedure, items are flagged when the absolute value of STD is greater than 0.10. Based on the STD procedure, two math items and one reading item showed DIF. Table 4.24 shows the criteria for flagging DIF in multiple-choice items according to the MH procedure. Table 4.25 presents the number of items in each DIF category: A, B, and C (Zieky, 1993). In English, one item was flagged for the Black/White group. For math, one item each was flagged for the Gender and Black/White groups. For reading, one item was flagged for each DIF group (Gender, Black/White, and Hispanic/White). One item was flagged in science. When we used the STD method, no items were flagged in English or science. For math, one item was flagged in the Gender group. For reading, the same item was flagged for the Gender and Black/White groups. The content experts reviewed the flagged items and did not find bias toward any particular group.

Table 4.24. 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 $\lvert MH\text{-}D \rvert < 1.0$
B	Moderate DIF	Significant MH-CHISQ ($P \leq 0.05$) and $1.0 \leq \lvert MH\text{-}D \rvert < 1.5$
C	Large DIF	Significant MH-CHISQ ($P \leq 0.05$) and $\lvert MH\text{-}D \rvert \geq 1.5$

Table 4.25. PreACT 8/9 Items Flagged for DIF in A, B, and C Categories From MH Procedure

Test section	DIF group	A	B	C	Total number of items
English	Gender	32	0	0	32
	Black/White	31	1	0	32
	Hispanic/White	32	0	0	32
Math	Gender	31	0	1	32
	Black/White	31	1	0	32
	Hispanic/White	32	0	0	32
Reading	Gender	19	1	0	20
	Black/White	19	1	0	20
	Hispanic/White	19	1	0	20
Science	Gender	24	1	0	25
	Black/White	25	0	0	25
	Hispanic/White	25	0	0	25

4.5.6 Reliability and Measurement Precision

Some degree of inconsistency or error is inherent in the measurement of cognitive characteristics. A student who took one test form on one occasion and a second, parallel form on another occasion in close time proximity would likely earn somewhat different scores on the two occasions. The test score variation might be due to student or testing situations, such as different motivations or different levels of distraction. Differences in test scores across testing occasions might also be due to the sample of test items or prompts included in each test form. While procedures are in place to reduce score differences across testing occasions, differences cannot be eliminated.

Reliability coefficients are estimates of the consistency of test scores. They typically range from 0 to 1, with values near 1 indicating greater consistency and those near 0 indicating little or no consistency. The standard error of measurement (SEM) is closely related to test reliability. The SEM summarizes the amount of error or inconsistency in scores on a test. It is possible for the amount of error on a test to vary by student ability level (e.g., true score). At the individual level, for a student with a fixed true score, the conditional SEM (CSEM) is a measure of the anticipated variation in the student's observed scores over repeated parallel measurements. The SEM can then be derived as the average CSEM across the ability levels in a student sample. As the *Standards for Educational and Psychological Testing* (American Educational Research Association et al., 2021) suggests, estimates of relevant indices of reliability/precision should be provided for reported scores. In this section, we describe the methods and statistics that quantify the reliability and measurement error of the PreACT 8/9 test section scores and combined scores.

This section provides information on the reliability estimates using both raw score coefficient alpha reliability and the scale score reliability based on the sample of the 2023–2024 PreACT 8/9 test takers. Since PreACT 8/9 categorizes students by PreACT 8/9 Readiness Level (as shown in the previous chapter), classification consistency is also provided to present the

reliability of categorizing examinees into different readiness levels. For a single test administration, reliability estimates of a test based on the internal structure of the response data can be calculated using the inter-item variance–covariance matrix. The coefficient alpha (Cronbach, 1951) is one of the most widely used indices of internal reliability and was computed for the four PreACT 8/9 test section scores (English, mathematics, reading, and science). Coefficient alpha can be computed using the formula

$$\hat{\alpha} = (\frac{n}{n-1})(1 - \frac{\sum_{i=1}^{n} S_i^2}{S_X^2}),$$

where *n* is the number of test items, S_i^2 is the sample variance of the *i*th item, and S_X^2 is the sample variance of the observed total raw score.

Table 4.26 shows the reliability estimates of raw scores for the PreACT 8/9 test sections using the 2023–2024 operational data. The raw score reliability estimates ranged from .81 to .85.

Table 4.26. Raw Score Reliability for the 2023–2024 PreACT 8/9 Test Sections

Test section	Number of scored items	Raw score reliability
English	32	.84
Math	32	.81
Reading	20	.85
Science	25	.85

Reliability estimates and indices of precision, including SEM and CSEM, are reported for the PreACT 8/9 scale scores for users to judge whether the scores are precise enough for the intended interpretations. In this section, we present the methods and results for the four test section scale scores as well as those for the Composite and STEM scores.

For PreACT 8/9, the development of the score scale involved the unidimensional IRT model, as described in Section 4.1.1. In unidimensional IRT models, the ability parameter, representing an examinee's ability, is commonly denoted as theta (θ). In addition to the ability parameter, the IRT models contain item parameters representing an item's psychometric characteristics (e.g., item difficulty, item discrimination).

Under the IRT framework, the method proposed in Kolen et al. (1996) to compute CSEM and reliability on the reported score scale for PreACT 8/9. Given IRT item and ability parameter estimates, we obtained the distribution of number-correct raw scores conditional on ability levels, which were then transformed to the distribution of scale scores using the raw-to-scale score conversion. The standard deviation of the resulting scale score distribution at a given θ was taken to be the CSEM at that ability level. In addition, to obtain scale score reliability, we used the estimated ability distribution from the 2023–2024 operational data. Together with the scale score reliability estimate, the observed scale score variance was then used to compute the scale score SEM. The detailed procedures employed for computing the reliability, CSEM, and SEM for PreACT 8/9 test scores are described below.

To compute CSEM for PreACT 8/9 test section scale scores, we applied the item parameter estimates (see Section 4.1) to the Lord–Wingersky recursive algorithm (Lord & Wingersky, 1984) and its extension (e.g., Hanson, 1994) to estimate $f(X = x|\theta_i)$, the conditional distribution of the expected raw score *X* given a theta value of θ_i. Based on the raw-to-scale score conversion, we then identified a maximum number of raw score points (*K*) and an observed scale score, *s*(*X*), and computed the CSEM of scale scores conditional on θ_i by the equation

$$CSEM[s(X|\theta_i)] = \{\sum_{x=0}^{K}[s(x) - \xi(\theta_i)]^2 f(X = x|\theta_i)\}^{1/2},$$

where $\xi(\theta_i) = \sum_{x=0}^{K} s(x) f(X = x|\theta_i)$ is the true scale score given θ_i. Up to this point, for each ability estimate that was predefined, we had its corresponding unrounded true scale score and the CSEM. We then applied linear interpolation to find the CSEM for each integer (true) scale score.

The approach to computing CSEM for the PreACT 8/9 Composite and STEM scores is different from that for the individual test sections, but it is methodologically aligned to that for the combined scores for the ACT tests. Under the assumption that measurement errors on the four PreACT 8/9 test sections were independent, the unrounded CSEM for the Composite score was computed as $\left[\sum_i s_i^2(\tau_i)\right]^{1/2}/4$, where $s_i(\tau_i)$ is the CSEM at a true scale score of τ_i for test *i* with *i* = *e*, *m*, *r*, and *s* (indicating English, mathematics, reading, and science, respectively). Since a particular true Composite score can be obtained in various combinations of the true scale scores on the four test sections, each true Composite score value may be associated with several plausible values of the CSEM. Finally, we fit a two-degree polynomial regression to the CSEM values of the true Composite score.

The CSEM for the STEM score was calculated using the same approach as that employed to calculate the CSEM of the Composite score. Under the assumption of independence of measurement errors on the four PreACT 8/9 test sections and using the same notation defined previously, the unrounded CSEM for the STEM score as $\left[\sum_i s_i^2(\tau_i)\right]^{1/2}/2$, where *i* = *m* and *s* for mathematics and science, respectively. The same set of data used to produce the CSEM values for the Composite score was used to obtain the CSEM values for the STEM score. Similarly, we fit a two-degree polynomial regression to the CSEM values of the true STEM score.

Based on the procedure described, the CSEM values were calculated and fitted as needed. The rounded CSEM values of the scale scores for the four test sections and the Composite and STEM scores are presented in Table 4.27. The CSEM values ranged from 1 to 3 for most of the true scale score points for English, mathematics, reading, and science. Across the true score scale of the Composite score, the CSEM value was a constant of 1. Across the true score scale of the STEM score, the rounded CSEM value was also a constant of 1. For the PreACT 8/9 student score reports, the measurement precision is represented by +/–1 CSEM from the student's scale score.

Table 4.27. CSEMs for PreACT 8/9 Scale Scores

Scale score	CSEM					
	English	Mathematics	Reading	Science	Composite	STEM
1	1	1	1	1	1	1
2	1	2	1	2	1	1
3	1	3	2	3	1	1
4	2	3	2	3	1	1
5	2	3	3	3	1	1
6	2	3	3	3	1	1
7	2	3	3	3	1	1
8	2	3	3	2	1	1
9	2	3	3	2	1	1
10	2	3	3	2	1	1
11	2	2	3	2	1	1
12	2	2	3	1	1	1
13	2	2	3	1	1	1
14	2	1	3	2	1	1
15	2	1	3	2	1	1
16	2	1	3	2	1	1
17	2	2	3	2	1	1
18	2	2	3	2	1	1
19	2	2	3	2	1	1
20	2	2	3	2	1	1
21	2	2	2	2	1	1
22	2	2	2	2	1	1
23	2	2	2	2	1	1
24	2	2	2	2	1	1
25	2	2	2	2	1	1
26	2	2	2	2	1	1
27	2	1	2	2	1	1
28	2	1	2	2	1	1
29	1	1	1	2	1	1
30	1	1	1	1	1	1

For the four test sections, we computed reliability for the scale scores using the formula

$$\rho_{s(X)} = 1 - \frac{\sigma^2_{E_{s(X)}}}{\sigma^2[s(X)]},$$

where $\sigma^2_{E_{s(X)}}$ is the aggregate error variance and $\sigma^2[s(X)]$ is the observed variance of scale scores from the operational test data. The aggregate error variance was given by $\sigma^2_{E_{s(X)}} = \int_\theta var[s(X)\theta]g(\theta)d\theta$, where $var[s(X)|\theta]$ is the scale score variance conditional on θ and $g(\theta)$ is the population distribution of θ. For computational purposes, $g(\theta)$ was approximated by a

discrete distribution of a finite number (denoted q) of spaced points on the θ continuum, such as quadrature points (θ_q) and associated weights $w(\theta_q)$. Consequently, the aggregate error variance could be approximated by $\hat{\sigma}^2_{E_{s(X)}} = \sum_{q=1}^{Q} var[s(X)|\theta_q]w(\theta_q)$; the squared root of this quantity was taken as the SEM on the reported score scale. Finally, we applied the estimated SEM to compute an estimate of scale score reliability. Results are presented in the same table. The resulting scale score SEMs and scale score reliability estimates are presented in Tables 4.28 through 4.30. The scale score reliability estimates for the four test sections were all above 0.77. The size of the SEM values mirrored the CSEM values in Table 4.27 since they were aggregated from the conditional error variances.

For the Composite score, we first obtained an estimate of the SEM by adding up all the conditional error variances (i.e., the squared term of the CSEM) using the operational testing sample and taking a square root of the average of the aggregated conditional error variances. We then calculated scale score reliability by assuming observed scale score variance equals true score variance plus error variance and using the definition of reliability given in the equation above. The same method was used to compute the scale score SEM and reliability for the STEM score.

Table 4.28 exhibits the scale score reliability estimates, and the SEMs based on the 2023–2024 operational data for PreACT 8/9. As with the raw score reliability, please refer to section 4.5.6 for more detail on the procedures used to estimate the scale score reliability and SEM. The estimated reliability and SEM ranges for test sections from the most recent ACT and PreACT technical manuals (ACT, 2024a, 2024b) are also provided in Tables 4.29 and 4.30 for comparison.

Table 4.28. Scale Score Reliability and Standard Error of Measurement for PreACT 8/9

Statistic	English	Math	Reading	Science	Composite	STEM
Reliability	.84	.77	.82	.83	.94	.90
SEM	2.13	1.98	2.70	1.64	1.07	1.28

Table 4.29. Scale Score Reliability and Standard Error of Measurement for PreACT

Statistic	English	Math	Reading	Science	Composite	STEM
Reliability	.87	.87	.85	.78	.96	.91
SEM	1.97	1.53	2.37	2.11	1.01	1.31

Table 4.30. Scale Score Reliability and Standard Error of Measurement for the ACT

Statistic	English	Math	Reading	Science	Composite	STEM
Reliability	.92–.94	.92–.93	.85–.89	.83–.89	.96–.97	.93–.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

4.5.7 Classification Consistency

PreACT 8/9 examinees are classified into three college readiness levels based on their scale scores and the PreACT 8/9 Readiness Levels.[3] Classification consistency refers to the extent to which examinees are classified into the same category over replications of a measurement procedure. Because tests are rarely administered twice to the same examinee, classification consistency is typically estimated from a single test administration, with strong assumptions about distributions of measurement errors and true scores (e.g., Hanson & Brennan, 1990; Livingston & Lewis, 1995).

Cohen's (1960) coefficient kappa is another index widely used to assess classification consistency. It estimates the agreement rate after considering the element of chance. In other words, kappa quantifies the classification consistency corrected for the probability of random agreement. As a result, the kappa values are expected to be lower than the agreement rates because of the correction.

Two classification consistency indices, agreement rate (Livingston & Lewis, 1995) and kappa index (Cohen, 1960; Swaminathan et al., 1974), are used to quantify the reliability of categorizing examinees into different readiness levels for PreACT 8/9. Table 4.31 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 of Intervention, Close to Target, and On Target). The agreement rates were high with two levels and moderate with three levels.

Table 4.31. Classification Consistency for the PreACT 8/9 College Readiness Benchmarks

Test section	Two levels		Three levels	
	Agreement	Kappa	Agreement	Kappa
English	.82	.62	.69	.45
Math	.82	.60	.60	.38
Reading	.83	.66	.70	.50
Science	.89	.73	.76	.59
STEM	.95	.79	.88	.69

4.5.8 Dimensionality

Exploratory factor analyses were conducted on data from the PreACT 8/9 tests administered during the 2023–2024 academic year to explore the dimensionality and constructs measured by PreACT 8/9. PreACT 8/9 was developed to measure student development in English, math,

[3] Refer to Chapter 3, "The ACT College and Career Readiness Standards and Benchmarks," for the details of the PreACT 8/9 Readiness Levels.

reading, and science. While reporting category scores are also reported to describe performance in skill areas within each test section, we expect to find one dominant dimension in an empirical analysis of dimensionality. Scree plots of eigenvalues, model fit, and factor loadings were examined to provide evidence of internal structure.

Scree plots display factor analysis eigenvalues against the number of extracted factors, and evaluation of scree plots involves identifying the “elbow” in the plot to indicate the number of dimensions to retain (Cattell, 1966). The scree plots for the English, math, reading, and science tests in Figure 4.2 show the elbow appearing after the first eigenvalue, which is evidence to support the use of a single dimension.

Tables 4.32 through 4.35 show the proportion of accounted variance by the first ten factors for the four test sections. Since the proportions of accounted variance for the factors after the tenth are trivial, the overall proportions for the remaining factors are presented in the tables for conciseness. As shown in Tables 4.32 through 4.35, the percentage of variance accounted for by the second factor for these tests did not exceed 10%. According to Hatcher (1994), factors that account for less than 10% of the variance should not be retained. Hence, it is reasonable to argue that item performance is adequately represented by a unidimensional model.

Figure 4.2. Scree Plots of PreACT 8/9 Test Sections

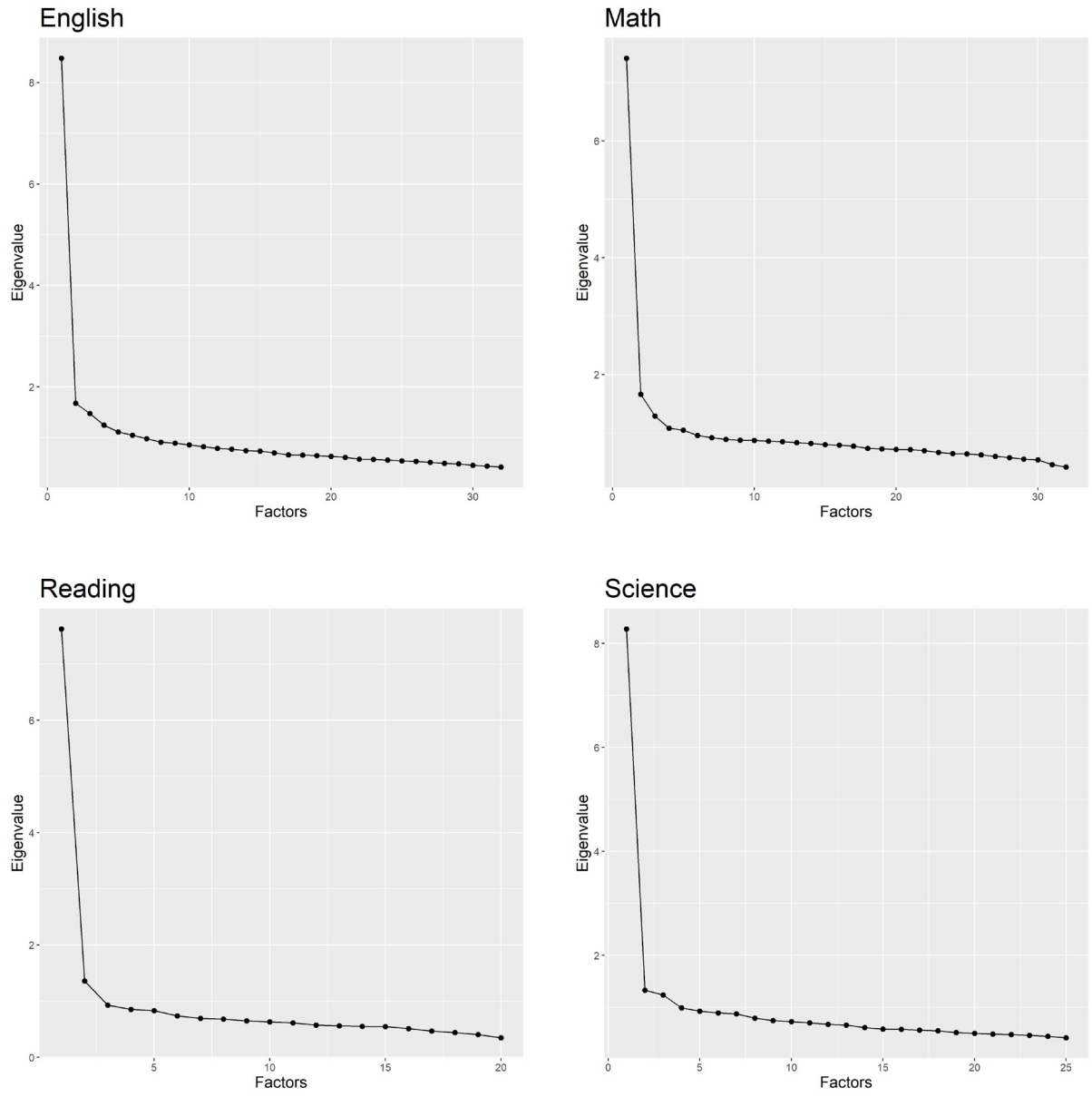


Table 4.32. Percentage of Variance Explained by Factors for PreACT 8/9 English

Factor	%
1	26.5
2	5.2
3	4.6
4	3.9
5	3.5
6	3.3
7	3.1
8	2.8
9	2.8
10	2.7
11–32	41.7

Table 4.33. Percentage of Variance Explained by Factors for PreACT 8/9 Math

Factor	%
1.0	23.2
2.0	5.2
3.0	4.0
4.0	3.4
5.0	3.3
6.0	3.0
7.0	2.9
8.0	2.8
9.0	2.7
10.0	2.7
11–32	46.9

Table 4.34. Percentage of Variance Explained by Factors for PreACT 8/9 Reading

Factor	%
1.0	38.1
2.0	6.8
3.0	4.6
4.0	4.3
5.0	4.1
6.0	3.7
7.0	3.5
8.0	3.4
9.0	3.2
10.0	3.2
11–20	25.1

Table 4.35. Percentage of Variance Explained by Factors for PreACT 8/9 Science

Factor	%
1.0	33.1
2.0	5.3
3.0	5.0
4.0	4.0
5.0	3.7
6.0	3.6
7.0	3.5
8.0	3.2
9.0	3.0
10.0	2.9
11–25	32.8

We evaluated model fit by comparing the model fit index between one- and two-factor models, as shown by the fit statistics in Table 4.36. The fit statistics include the widely used chi-square (χ^2) test and other fit statistics (comparative fit index [CFI], Tucker–Lewis index [TLI], root mean square error of approximation [RMSEA], and standardized root mean square residual [SRMR]) to supplement the chi-square due to its sensitivity to larger sample size (Bollen, 1989; Hu and Bentler, 2009). Fit indices were flagged with an asterisk (*) in Table 4.36 when they indicated inadequate fit. Table 4.36 also shows the chi-square difference test statistics (|DIFF|) between

the one- and two-factor models. The interfactor correlation (CORR) between Factors 1 and 2 in Table 4.36 was used to evaluate how well the two factors could be distinguished from each other in the two-factor model.

Table 4.36. Model Fit Comparison Between the One- and Two-Factor Models for PreACT 8/9

	English			Math			Reading			Science		
	1-Factor	2-Factor	|DIFF|	1-Factor	2-Factor	|DIFF|	1-Factor	2-Factor	|DIFF|	1-Factor	2-Factor	|DIFF|
X^2	26418.4	85255.3	29792.7[a]	66337.9	30467.2	26069.9[a]	54987.7	14575.5	27876.4[a]	72871.4	48205.2	19493.1[a]
df	464	433	31	464	433	31	170	151	19	275	251	24
p	0*	0*	0*	0*	0*	0*	0*	0*	0*	0*	0*	0*
CFI	0.93	0.95	0.02	0.95	0.98	0.03	0.97	0.99	0.03	0.96	0.97	0.01
TLI	0.92	0.94	0.02	0.95	0.97	0.03	0.96	0.99	0.03	0.96	0.97	0.01
RMSEA	0.04	0.03	0.01	0.03	0.02	0.01	0.04	0.02	0.02	0.04	0.03	0.01
SRMR	0.05	0.04	0.01	0.04	0.03	0.01	0.04	0.02	0.02	0.04	0.03	0.01
CORR		0.62			0.33			0.73			0.64	

Note: *df* refers to the degree of freedom; CFI refers to the comparative fit index; TLI refers to the Tucker–Lewis index; RMSEA refers to the root mean square error of approximation; SRMR refers to the standardized root mean square residual; and CORR refers to the correlation between Factors 1 and 2 in the two-factor model.

[a] Note that the chi-square statistic for the chi-square difference testing does not equal the simple difference of the chi-square values for the one- and two-factor models. The weighted least square mean and variance adjusted (WLSMV) estimator was used to estimate the Exploratory Factor Analysis (EFA) models. According to Muthén & Muthén (2015), the chi-square value for WLSMV cannot be used for chi-square difference testing in the regular way because the difference in chi-square values for two nested models using the WLSMV chi-square values is not distributed as chi-square. Instead, the derivatives from the less restrictive model (the one-factor model) are used in the subsequent estimation of the more restrictive model (the two-factor model) to compute a chi-square difference test.

* Flagging criteria include χ2 significant at the $p < .05$ level, CFI < 0.95, TLI < 0.95, RMSEA > 0.06, 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 given the one- and two-factor models.

All statistical indices mentioned were simultaneously evaluated in comparing the goodness of fit of the one- and two-factor models. Fit statistics for the English, math, reading, and science tests showed evidence of the fitness of the one-factor model in most cases. Although the chi-square difference tests are statistically significant for all test sections, it is likely due to the sensitivity of chi-square statistics to large sample sizes. Compared with the one-factor model, the two-factor model did not improve the model fit substantially. The interfactor correlations in the two-factor model were relatively large (>0.5) for all test sections, which indicated a strong relationship between the two factors. Based on the principle of parsimony, the one-factor model was considered adequate for PreACT 8/9. This result is also consistent with findings from PreACT (ACT, 2024) and another study (Li et al., 2016), which found that the one-factor model is adequate for the ACT paper test.

Chapter 5:
Other PreACT Components

5.1 ACT Interest Inventory

The ACT Interest Inventory helps students explore personally relevant career (educational and occupational) options. It is intended for people in the early stages of career planning, such as middle school and high school students; at an early stage, the primary purpose of taking an interest assessment is to stimulate and facilitate exploration of oneself in relation to careers and to provide a focus to one's career exploration. The purpose of the ACT Interest Inventory is not to initiate or complete this developmental process but rather to promote and advance it by providing accurate, personally relevant information. In the exploration process, students may discover aspects of 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 the well-known theory of careers by John L. Holland (e.g., Holland et al., 1969; Holland, 1997). 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 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 and 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; also, the 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 and 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, with activities including designing, building, repairing machinery, and raising crops/animals

5.1.1 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. These content and performance criteria were prioritized to permit the ranking of items meeting an equal number of criteria. 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. The *ACT Interest Inventory Technical Manual* discusses these procedures (ACT, 2009).

5.1.2 Norming Sample

Development of the norming sample was based on interest inventory responses from students who participated in ACT EXPLORE, which was a comprehensive national assessment program designed to help guide Grade 8 students in education and career planning. The target population for the ACT Interest Inventory in PreACT 8/9 consisted of students enrolled in Grade 8 in the United States. Although the ACT EXPLORE program tested a sizable percentage of U.S. 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 273,964 students. The *ACT Interest Inventory Technical Manual* gives additional information on the weighting, precision, and representativeness of this Grade 8 norming sample (ACT, 2009).

5.1.3 Psychometric Support

The *ACT Interest Inventory Technical Manual* provides the full scope of information available on the ACT Interest Inventory, describing its rationale, development, norms, reliability, and validity (ACT, 2009). The following sections present a small portion of the available technical information.

Reliability

Internal consistency reliability was examined for large national samples of students in Grades 8, 10, and 12 (20,000 students per grade). Medians of the internal consistency index (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 (with a median of .84) for Grade 10 females and from .85 to .92 (with a median of .86) for Grade 10 males. Score stability was examined for 786 students in Grades 10 through 11 who completed the inventory twice within a 3- to 9-month interval. Test-retest correlations ranged from .63 to .77 (with a median of .70).

Validity

Construct validity refers to the extent to which assessment scores measure what they are purported to measure, and it 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 (or similar to) measured characteristics of the student completing the inventory. To be useful for this purpose, the characteristics should match those

of people in the career: 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, the results can be used to identify occupational groups that share characteristics compatible with the student.

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, art students would be counted as being a hit if their 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 whether the interest scores of people in a given group would have referred them to that group. Thus, this method is consistent with a primary 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® test in the academic year of 2003–2004, 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 based on occupational choice. The unweighted average hit rate across the six scales was 42%; by chance alone, the hit rate was one out of six, or 17%. This approach to assessing the validity of the ACT Interest Inventory 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% (with a 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.

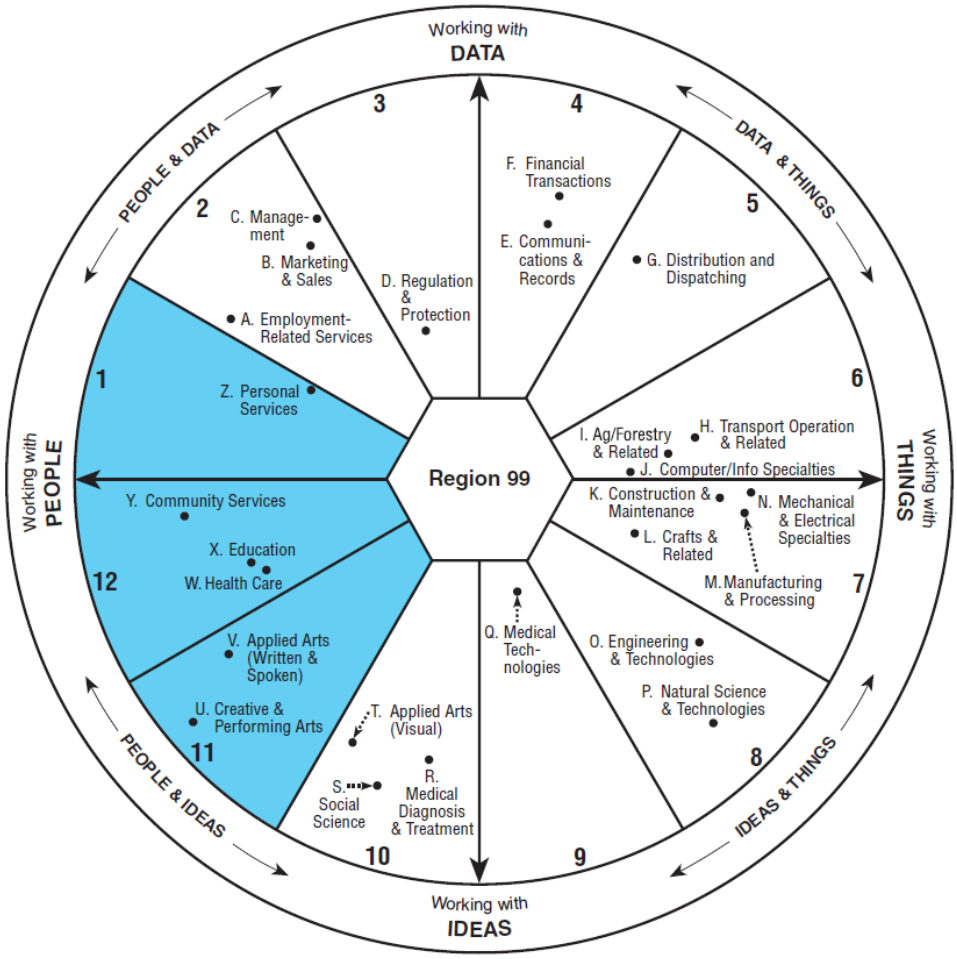
Another type of validity evidence pertains to the structural relationships among the six scales. Holland's (1997) career theory uses a hexagon to visually represent the relationships between the six career types. Thus, if ACT Interest Inventory scales are measuring their intended constructs, we should 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 the Holland hexagon. The coordinates of the six points on a hexagon were used in a principal component analysis to target the expected correlations among the scales and between these two dimensions. Correlations (factor 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 students in Grades 8, 10, and 12. 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. The *ACT Interest Inventory Technical Manual* provides a complete discussion of these analyses and results (ACT, 2009).

5.2 ACT Career Map

The ACT Career Map is an empirically based tool for occupational exploration and interest inventory score interpretation (see Figure 5.1). The map visually displays the similarities and differences among 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—working with data/ideas or people/things—shown to underlie the six Holland types and the work activities of all occupations across the work world (ACT, 2009):

- **data:** facts, numbers, files, accounts, and business procedures
- **ideas:** insights, theories, and new ways of saying or doing something—for example, with words, equations, or music
- **people**: those you help, serve, inform, care for, or sell things to
- **things:** machines, tools, living creatures, and materials such as food, wood, or metal

Figure 5.1. ACT Career Map and Example Results (the Three Shaded Map Regions)



5.2.1 Development

The developers of the current edition of the ACT Career Map used three large databases that provided three diverse perspectives to classify occupations to career areas and determine career area locations on the map. The three areas are (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 database 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, provided good support for the work task dimensions underlying the ACT Career Map. As expected, the data/ideas and people/things scores were essentially independent. Additional details are found in Prediger and Swaney (2004).

5.2.2 Score Reporting

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 that reflect the relation between Holland's types and the two underlying work task dimensions. For example, high-ranking scores for the Arts scale or the Science and Technology scale indicate an interest in ideas-related work tasks.

A student's pattern of ACT Interest Inventory scores is used to obtain scores on the dimensions underlying the ACT Career Map. The PreACT® 8/9 student score report displays ACT Interest Inventory results as two or three shaded regions of the map (see Figure 5.1). The use of map regions facilitates focused exploration for students and is in keeping with the level of precision inherent in the PreACT 8/9 scores.

5.3 Information Sections

5.3.1 Student Information Section

Information about students' future educational and career aspirations, background, and high school activities are collected in the student information section of PreACT 8/9. Students are asked to indicate their 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, 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.

5.3.2 Needs Assessment Section

The needs assessment section allows students to indicate a need for additional help in seven areas:

- 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
- improving my public speaking skills

5.3.3 High School Course and 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 the high school course section. Descriptions of courses that reflect the typical high school core curriculum are provided to help students relate the courses listed to the courses offered in their own schools.

Students are also asked to report grades for their courses in five academic areas: English, math, social studies, natural sciences, and foreign languages.

Chapter 6:
Reporting and Data Services

This chapter describes the reporting and data services of PreACT® 8/9. Additional information on reporting and data services may be found in the PreACT 8/9 Interpretive Guide for Student and Aggregate Reports.

6.1 Student Report

ACT provides two copies of the PreACT 8/9 Student Report to schools. One is intended for the student; the other can be retained for school use.

The Student Report includes the following information:

a. Scale scores for the four test sections (English, math, reading, and science), the Composite score, and the STEM score, each with an associated score range. The Composite score is the arithmetic average of the four test section scores rounded to the nearest whole number (fractions of 0.5 or greater round up); the STEM score is the average of the math and science scores rounded to the nearest whole number (fractions of 0.5 or greater round up). The score range for each reported score incorporates a student's attained score and measurement error estimates, indicating a possible score range of student achievement.

b. Predicted PreACT scale score ranges for the four test sections and the Composite and STEM scores. These are the score ranges within which a student's PreACT reported scores are expected to fall when he or she takes the PreACT in 10th grade. The predicted score ranges are derived using the procedures described in Chapter 4.

c. Predicted ACT scale score ranges for the four test sections and the Composite and STEM scores. These are the score ranges within which a student's ACT reported scores are expected to fall when he or she takes the ACT in 11th grade. The predicted score ranges are derived using the procedures described in Chapter 4.

d. Progress Toward the ACT® WorkKeys® National Career Readiness Certificate® (NCRC®). The predicted ACT NCRC level reveals the certificate that a student is likely to obtain in the 11th grade given his or her Composite score. The ACT NCRC is an assessment-based credential that documents foundational work skills important for job success across industries and occupations.

e. Detailed PreACT 8/9 results. This section shows a student's performance on the reporting categories of the four test sections.

f. Your High School Course Plan Compared to Core. This section shows how students' self-reported plans for high school coursework in core courses compare to the course of study in English, mathematics, social studies, and science recommended by ACT as the minimum needed for students to be prepared for entry-level college courses.

g. Your Education and Career Journey. This information 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.

h. Your Interest-Career Fit. This index shows the level of agreement between a student's interests and the career area (a group of similar occupations) the student selected. For example, high fit means that the student's measured interests are fully aligned with the kinds of occupations they prefer.

i. Item Response Analysis. This section presents a student's response and the correct answer to each item. Also included are Ideas for Progress, which are based on a student's scale score for each test section.

6.2 Student Score Labels

ACT provides schools with two self-adhesive labels for each student taking the PreACT 8/9 test. Each label includes the student's name; the student's ID number (if reported by the student); the date tested; and scale scores for the four test sections, the Composite score, and the STEM score.

6.3 Student List Report

Each participating school receives an alphabetical list of students who took PreACT 8/9, with a summary of each student's test performance, career and educational plans, predicted ACT score ranges, and special status and accommodation codes.

On the student list report, students from the same grade level (as reported on their answer folders) are grouped together. For example, all 8th-grade students are listed alphabetically, followed by all 9th-grade students, etc. Students who did not indicate a grade level are listed separately.

6.4 Educator Reports

ACT will provide schools and districts with an Educator Report, which aggregates and summarizes PreACT 8/9 test results. The results are presented for the grade with the highest number of students tested (regardless of number) and any additional grade with 25 or more students tested.

The PreACT 8/9 Educator Report consists of a series of tables that answer the following questions:

- What is the frequency distribution of our students' PreACT 8/9 scores?
- Do our students' PreACT 8/9 scores differ by ethnic and/or gender groups?
- Do our students' PreACT 8/9 scores differ by the courses they have taken or are currently taking?
- How do our students' PreACT 8/9 Composite scores and coursework plans relate to their educational plans?
- How do our students' PreACT 8/9 Composite scores and coursework plans relate to their expressed needs for help?

- How do our students' PreACT 8/9 Composite scores, coursework plans, and educational plans relate to their career interests?
- How did our students respond to the local items (if applicable)?

The District Educator Report consists of the same tables as those in the Educator Report. These reports summarize designated information concerning the PreACT 8/9 test results of a district's test takers.

6.5 Early Intervention Rosters

Early Intervention Rosters include lists of students in four possible categories:

1. Which of our students reported that they do not plan to finish high school or have no post–high school educational plans?
2. Which of our students earned a PreACT 8/9 Composite score of 16 or higher but reported that they have no plans to attend college?
3. Which of our students reported that they plan to attend college but earned a PreACT 8/9 Composite score of 15 or lower or do not plan to take college core coursework?
4. Which of our students expressed a need for help in one or more areas?

For the first three categories, students are listed alphabetically by name with their PreACT 8/9 scores, coursework plans, and educational plans. For the fourth category, students are listed alphabetically by name with their PreACT 8/9 scores and selected area(s) for which they indicated needing help.

6.6 Item-Response Summary Report

The Item-Response Summary Report provides tables describing the examinees' performance on items in each test section. Item response results are categorized by test (e.g., English) and by reporting category (e.g., Production of Writing).

6.7 Data Service

The Data Service provides schools or districts with PreACT 8/9 student records on a CD. These records can be integrated into a school's database.

References

ACT. (2023). *The ACT interest inventory technical manual*. https://www.act.org/content/dam/act/unsecured/documents/ACT-Interest-Inventory-Technical-Manual.pdf

ACT. (2024a). *ACT technical manual*. https://www.act.org/content/dam/act/unsecured/documents/ACT_Technical_Manual.pdf

ACT. (2024b). *PreACT technical manual*. https://www.act.org/content/dam/act/unsecured/documents/PreACT-Technical-Manual.pdf

Allen, J. (2013). *Updating the ACT College Readiness Benchmarks* (ACT Research Report No. 2013-6). ACT. https://www.act.org/content/dam/act/unsecured/documents/ACT_RR2013-6.pdf

Allen, J., & Radunzel, J. (2017). *What are the ACT College Readiness Benchmarks?* (ACT Issue Brief No. R1670). ACT. https://www.act.org/content/dam/act/unsecured/documents/pdfs/R1670-college-readiness-benchmarks-2017-11.pdf

Allen, J., & Sconing, J. (2005). *Using ACT assessment scores to set benchmarks for college readiness* (ACT Research Report No. 2005-3). ACT. https://www.act.org/content/dam/act/unsecured/documents/ACT_RR2005-3.pdf

American Educational Research Association, American Psychological Association, & National Council on Measurement in Education. (2014). *Standards for educational and psychological testing*. American Educational Research Association. https://www.testingstandards.net/uploads/7/6/6/4/76643089/standards_2014edition.pdf

Austin, P. C. (2011). An introduction to propensity score methods for reducing the effects of confounding in observational studies. *Multivariate Behavioral Research*, *46*(3), 399–424. https://doi.org/10.1080/00273171.2011.568786

Birnbaum, A. (1968). Some latent trait models and their use in inferring an examinee's ability. In F. M. Lord & M. R. Novick (Eds.), *Statistical theories of mental test scores* (pp. 397–472). Addison-Wesley.

Bollen, K. A. (1989). *Structural equations with latent variables*. Wiley & Sons.

Cattell, R. B. (1966). The scree test for the number of factors. *Multivariate Behavioral Research*, *1*(2), 245–276. https://doi.org/10.1207/s15327906mbr0102_10

Cohen, J. (1960). A coefficient of agreement for nominal scales. *Educational and Psychological Measurement*, *20*, 37–46. https://doi.org/10.1177/001316446002000104

Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika*, *16*, 297–334. https://doi.org/10.1007/BF02310555

Hanson, B. A. (1994). *Extension of Lord-Wingersky algorithm to computing test score distributions for polytomous items*. OpenIRT. http://www.openirt.com/b-a-h/papers/note9401.pdf

Hanson, B. A., & Brennan, R. L. (1990). An investigation of classification consistency indexes estimated under alternative strong true score models. *Journal of Educational Measurement*, *27*(4), 345–359. https://doi.org/10.1111/j.1745-3984.1990.tb00753.x

Hatcher, L. (1994). *A step-by-step approach to using the SAS® system for factor analysis and structural equation modeling* (1st ed.). SAS Institute.

Holland, J. L. (1997). *Making vocational choices: A theory of vocational personalities and work environments* (3rd ed.). Psychological Assessment Resources.

Holland, J. L., Whitney, D. R., Cole, N. S., & Richards, J. M. (1969). *An empirical occupational classification derived from a theory of personality and intended for practice and research* (ACT Research Report No. 29). ACT. https://www.act.org/content/dam/act/unsecured/documents/ACT_RR29.pdf

Holland, P. W., & Dorans, N. J. (2006). Linking and equating. In R. L. Brennan (Ed.), *Educational measurement* (4th ed., pp. 187–220). Praeger.

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, *6*(1), 1–55. https://doi.org/10.1080/10705519909540118

Joint Committee on Testing Practices. (2004). *Code of fair testing practices in education*. https://www.apa.org/science/programs/testing/fair-testing.pdf

Kolen, M. J., & Brennan, R. L. (2014). *Test equating, scaling, and linking: Methods and practices* (3rd ed.). Springer-Verlag.

Kolen, M. J., Zeng, L., & Hanson, B. A. (1996). Conditional standard errors of measurement for scale scores using IRT. *Journal of Educational Measurement*, *33*(2), 129–140. https://doi.org/10.1111/j.1745-3984.1996.tb00485.x

Li, D., Yi, Q., & Harris, D. (2016). *Evidence for paper and online ACT comparability: Spring 2014 and 2015 mode comparability studies* (ACT Working Paper No. 2016-02). ACT. https://www.act.org/content/dam/act/unsecured/documents/Working-Paper-2016-02-Evidence-for-Paper-and-Online-ACT-Comparability.pdf

Livingston, S. A., & Lewis, C. (1995). Estimating the consistency and accuracy of classifications based on test scores. *Journal of Educational Measurement*, *32*(2), 179–197. https://doi.org/10.1111/j.1745-3984.1995.tb00462.x

Lord, F. M. (1980). *Applications of item response theory to practical testing problems*. Lawrence Erlbaum.

Lord, F. M., & Wingersky, M. S. (1984). Comparison of IRT true-score and equipercentile observed-score "equatings." *Applied Psychological Measurement*, *8*(4), 453–461. https://doi.org/10.1177/014662168400800409

Mattern, K., Radunzel, J., & Westrick, P. (2015). *Development of STEM Readiness Benchmarks to assist educational and career decision making* (ACT Research Report No. 2015-3). ACT. https://www.act.org/content/dam/act/unsecured/documents/ACT_RR2015-3.pdf

Moore, J. L., & Cruce, T. (2017). *Does opting into a search service provide benefits to students?* (ACT Working Paper No. 2017-3). ACT. https://www.act.org/content/dam/act/unsecured/documents/R1637-opting-into-a-search-service-2017-07.pdf

Muthén, L. K., & Muthén, B. O. (2015). *Mplus user's guide* (7th ed.). Muthén & Muthén. https://www.statmodel.com/download/usersguide/MplusUserGuideVer_7.pdf

NCME Ad Hoc Committee on the Development of a Code of Ethics. (1995). *Code of professional responsibilities in educational measurement*. National Council on Measurement in Education. https://doi.org/10.1891/9780826194893.ap04

Prediger, D. J., & Swaney, K. B. (2004). Work task dimensions underlying the world of work: Research results for diverse occupational databases. *Journal of Career Assessment*, *12*(4), 440–459. https://doi.org/10.1177/1069072704267737

Radunzel, J., & Fang, Y. (2018). *Updating the Progress Toward the ACT National Career Readiness Certificate indicator* (ACT Technical Brief No. R1712). ACT. https://www.act.org/content/dam/act/unsecured/documents/R1712-ACT-progress-toward-NCRC.pdf

Radunzel, J., Westrick, P., Bassiri, D., & Li, D. (2017). *Development and validation of a preliminary ELA Readiness Benchmark based on the ACT ELA score* (ACT Research Report No. 2017-9). ACT. https://www.act.org/content/dam/act/unsecured/documents/R1640-preliminary-ela-benchmark-2017-06.pdf

Spray, J. A. (1989). *Performance of three conditional DIF statistics in detecting differential item functioning on simulated tests* (ACT Research Report No. 89-7). ACT.

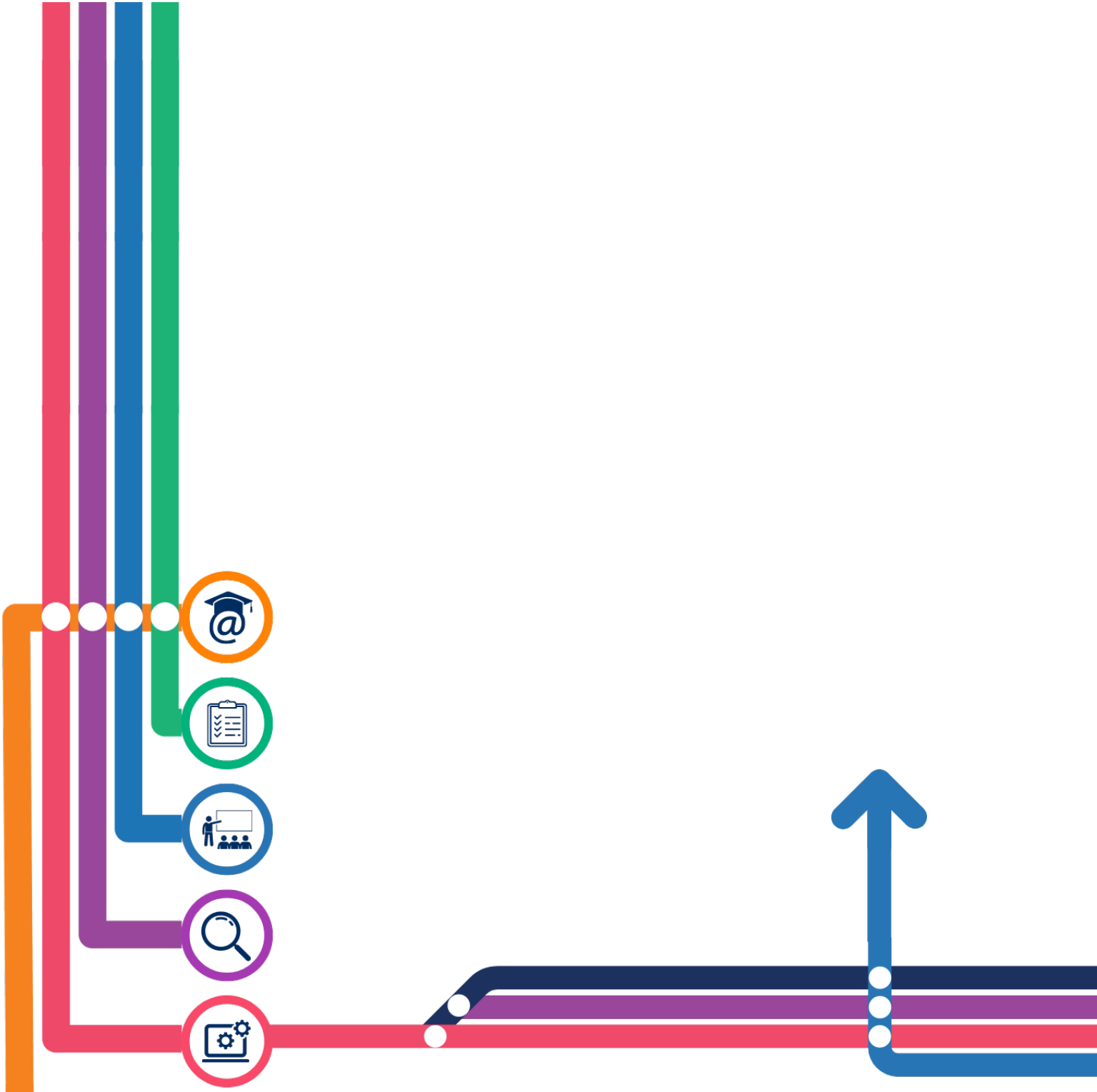
Stocking, M., & Lord, F. M. (1983). Developing a common metric in item response theory. *Applied Psychological Measurement*, *7*(2), 201–210. https://doi.org/10.1177/014662168300700208

Swaminathan, H., Hambleton, R. K., & Algina, J. (1974). Reliability of criterion-referenced tests: A decision-theoretic formulation. *Journal of Educational Measurement*, *11*(4), 263–267. https://doi.org/10.1111/j.1745-3984.1974.tb00998.x

Wang, M., & Stanley, J. (1970). Differential weighting: A review of methods and empirical studies. *Review of Educational Research*, *40*(5), 663–705. https://doi.org/10.3102/00346543040005663

Webb, N. L. (2002, March 28th). *Depth-of-knowledge levels for four content areas*. http://ossucurr.pbworks.com/w/file/fetch/49691156/Norm%20web%20dok%20by%20subject%20area.pdf

Zwick, R. (2012). *A review of ETS differential item functioning assessment procedures: Flagging rules, minimum sample size requirements, and criterion refinement* (ETS Research Report No. RR-12-08). ETS. https://files.eric.ed.gov/fulltext/EJ1109842.pdf



ACT®