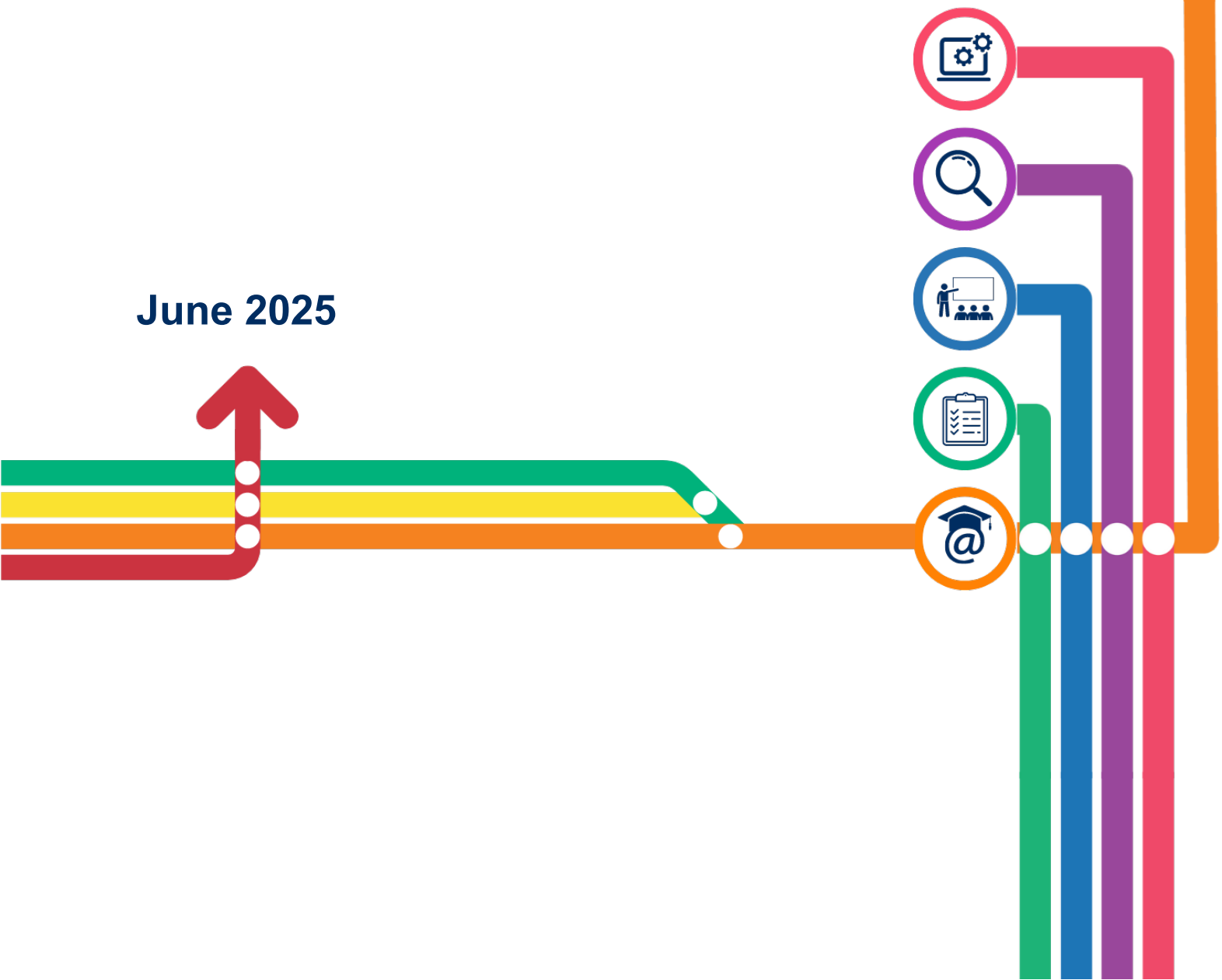
PreACT® Secure™ Technical Manual

June 2025



Commitment to Fair Testing

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

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

Table of Contents

List of Tables

List of Figures

Preface

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

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

Please direct comments or inquiries to the address below:

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

Chapter 1
PreACT® Secure™

ACT's Mission

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

1.1 Philosophical Basis for ACT Tests

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

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

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

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

1.2 Overview of PreACT Secure

PreACT Secure is very similar to PreACT. The primary difference is that PreACT Secure is designed to offer greater security through shorter testing windows and secure control of test content. We expect PreACT Secure scores to support the same interpretations that have been

established for PreACT scores. However, PreACT Secure may offer advantages over PreACT for uses and interpretations involving higher-stakes decisions. In this technical manual, much of the information provided for PreACT Secure is the same as what is provided for PreACT. Reporting features supporting the interpretations of PreACT Secure test scores, such as readiness benchmarks and national norms, are based on studies of PreACT test scores. As more data are collected for PreACT Secure, we will evaluate whether different score interpretations are needed for PreACT Secure and PreACT.

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

Like all ACT assessment programs, PreACT Secure is based on the belief that students—and their parents or guardians, teachers, counselors, and school administrators—will make more productive plans and decisions if they have organized, relevant information available when they need it most.

PreACT Secure is vertically aligned to measure educational progress in the context of preparing for the ACT and planning for college and careers. PreACT Secure includes four multiple-choice test sections—English, math, reading, and science. The results from PreACT Secure can be used to help students plan their coursework and other learning opportunities to help ensure that they are prepared for the ACT and their postsecondary goals. High schools can use PreACT Secure data for academic advising, counseling, and program evaluation. The secure nature of the assessment also lends itself to evaluating readiness for college courses and advanced high school courses, identification for talented and gifted programs, and eligibility for scholarships. PreACT Secure may be used for local, state, or federal accountability, where accepted.

ACT provides customers with administration materials, including interpretive guides for score reports. The PreACT Secure individual student report, which each PreACT Secure examinee receives, contains sections about the student's scores, predicted ACT and ACT® WorkKeys® National Career Readiness Certificate® (NCRC®) scores, and ideas for progress. The interpretive guide called Using Your PreACT Secure Results, along with the PreACT Secure individual student report, can help students get a better sense of where they are, where they might want to go, and how to get there.

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

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

PreACT Secure also provides standards-based interpretations through the ACT College and Career Readiness Standards—statements that describe the knowledge and skills students have

demonstrated through their performance on the test. Because the Standards focus on the integrated higher-order thinking skills that students develop in Grades K–12 and that are important for success both during and after high school, the Standards provide a common language for secondary and postsecondary educators.

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

The Standards also offer teachers guidance for improving instruction to help correct student deficiencies in specific areas. PreACT Secure and ACT results can be used to identify students who are college ready or on target for college readiness. The ACT College Readiness Benchmarks—for English, math, reading, science, and STEM—were developed to help identify examinees who would likely be ready for college-level work in these subject areas. The PreACT Readiness Benchmarks are the scores indicating that students are on target for meeting or exceeding the ACT College Readiness Benchmarks. Chapter 5 provides details about the College and Career Readiness Standards and the College Readiness Benchmarks.

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

Table 1.1. Components of ACT College and Career Readiness Assessments

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

1.2.1 PreACT Secure Individual Student Reports

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

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

- Total points possible
- Total points achieved
- Percent correct

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

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

1.3 Purposes, Claims, Interpretations, and Uses of PreACT Secure

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

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

1.3.1 Intended Users

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

1.3.2 Intended Uses

The primary uses of PreACT Secure include:

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

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

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

PreACT Secure results can help students and educators identify academic gaps and areas for improvement (Use 3). Percentile ranks can help students identify relative strengths or weaknesses in certain subject areas. Within each subject area, reporting category scores let educators see how students performed on each topic aligned to the ACT College and Career Readiness Standards. The PreACT Secure online reporting package includes four early intervention rosters, several summary reports, and data tools to support additional data analysis.

Additional intended uses of PreACT Secure include:

4. gauging readiness for advanced high school and college courses,
5. evaluating school and program effectiveness,
6. understanding performance relative to national norms, and
7. satisfying accountability testing and reporting requirements.

Because it is a secure assessment, PreACT Secure may offer advantages over PreACT for uses and interpretations involving higher stakes decisions, such as determinations of readiness for college courses (Use 4) and as an accountability assessment (Use 7). PreACT Secure can also be used to determine eligibility for scholarships and for talent search programs.

1.3.3 Claims

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

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

The secondary claims of PreACT Secure include the following:

4. PreACT Secure scores can be used to identify students who are ready to succeed in advanced high school courses, including AP and dual enrollment courses. See Chapter 7 for evidence of how well PreACT test scores have predicted success on AP exams.
5. PreACT Secure can be used as one component of the evaluation of school, program, and curriculum effectiveness. When PreACT Secure is used in conjunction with the ACT test, growth measures can be used to help evaluate educational programs. See Chapter 8 for more information on how PreACT Secure scores can be used to measure student growth.
6. PreACT Secure allows users to understand how students at the same grade level and semester performed relative to the ACT-tested U.S. population. See Lu and Allen (2019) for details on the PreACT norming studies.
7. PreACT Secure improves test security through shorter testing windows and secure control of test content.

1.3.4 Intended Benefits

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

1.3.5 Intended Outcomes

The measurable outcomes of PreACT Secure include the following:

- Improved performance in academic areas identified as relative weaknesses
- Higher rates of success in advanced high school courses
- Higher ACT scores
- Higher enrollment and rates of success in college and career-training programs

Research is conducted on an ongoing basis to evaluate the extent to which the use of PreACT results in these intended outcomes and future research will include PreACT Secure.

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

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

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

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

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

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

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

1.5 Test Preparation

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

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

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

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

Chapter 2
PreACT® Secure™ Test Development

2.1 Overview

This chapter describes the process ACT uses to develop tests (including the National Curriculum Survey), along with item and form development procedures. It includes brief overviews of the content and fairness review processes and of the statistical criteria for form assembly and the selection of operational items. This chapter also provides a high-level description of PreACT® Secure™ scoring procedures, including descriptions of additional scores and indicators.

2.2 Description of PreACT Secure

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

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

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

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

Content specifications describing the knowledge and skills to be measured by PreACT Secure were determined through a detailed analysis of feedback from current high school and postsecondary teachers via the ACT National Curriculum Survey®, as well as student data from the ACT and performance in postsecondary courses. We use these empirical data to continually verify that PreACT Secure is measuring the knowledge and skills required for postsecondary and career success.

2.3 The ACT National Curriculum Survey

Every few years, ACT conducts the ACT National Curriculum Survey, which assesses educational practices and college and career readiness expectations. ACT surveys thousands of K–12 teachers and college instructors in English/writing, mathematics, reading, and science, as well as a national cross-section of workforce supervisors and employees, to determine which

skills and knowledge in these subjects are being taught at each grade level and which skills and knowledge are considered essential for college and career readiness.

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

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

ACT makes the results of each ACT National Curriculum Survey public to help education and workforce stakeholders make more informed decisions about the skills students need in order 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 ACT's assessment blueprints. 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."

To maintain relevancy and currency, it is important that assessments are constructed using up-to-date evidence of what matters most. To that end, 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.

The science behind ACT's 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 the following:

- using evidence and research to develop and validate ACT standards, assessments, and benchmarks
- maintaining a robust research agenda to report on key educational metrics (see, for example, ACT reports such as *The Condition of College and Career Readiness*, *Enrollment Management Trends Report*, *The Reality of College Readiness*, and *The Condition of STEM*)

- developing assessments, reports, and interventions that will help individuals navigate their personal path to success along a kindergarten-through-career continuum

As an educational research organization, ACT uses these principles to drive the development and continuous improvement of our education and workplace solutions, as well as the research agenda associated with them, thereby enabling us to fulfill our 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 sent out online surveys via various electronic methods (e.g., advertisements, email, social media) and invited participation from educators at all levels (early elementary school through college) who teach courses in English, writing, mathematics, reading, social studies, and science (including biology, chemistry, physics, and Earth/space science) in public and private institutions across the United States. ACT also invited participation from supervisors and employees at a large variety of businesses. Table 2.1 gives the numbers of survey respondents in each area.

Table 2.1. ACT National Curriculum Survey 2020 Respondents

Area	Number of respondents
Early elementary school	1,214
Late elementary school	1,213
Middle school	1,623
High school	1,619
K–12 administrators	405
College instructors	2,883
Workforce supervisors	405
Workforce employees	406
Total	**9,768**

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

ACT also asked the K–12 teachers to indicate whether they taught particular content knowledge or skills and, if so, whether they taught 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 taught.

Workforce participants were asked to rate discrete skills with respect to how important each was to entry-level success in the workplace. ACT also asked workforce participants to indicate how often employees in their workplace used 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, mathematics, and science. This ensured that, in these results, no one content area would have more influence than another.

2.4 Test Development Procedures

2.4.1 Review of Test Specifications

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

2.4.1.1 Content Specifications

Content specifications for PreACT Secure were informed by the curricular analysis discussed previously. While ACT is careful to ensure that the basic structure of PreACT Secure tests remains the same from year to year so that the scale scores are comparable, the specific characteristics of the test items used in each reporting category are reviewed regularly. Subject matter experts review new test forms to verify both their content accuracy and the match between the test content and the content specifications.

2.4.1.2 Statistical Specifications

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

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

2.4.2 Selection of Item Writers

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

Before being asked to write items for ACT, potential contractors (individuals and groups) are required to submit a sample set of materials for review. Each item writer receives an item writer's guide specific to the content area. The guide includes examples of items and provides

the test specifications and ACT's requirements for content and style. It also provides specifications for fair portrayal of all groups of individuals, including use of gender-neutral language, balanced representation of race and ethnicity, and avoidance of subject matter that may be unfamiliar to members of certain groups.

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

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

2.4.3 Item-Writing Assignments

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

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

2.4.4 Item Construction

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

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

2.4.5 Review of Items

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

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

2.4.5.1 Sensitivity, Fairness, and Accessibility Reviews

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

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

2.4.6 Embedded Field Tests

Sets of items judged acceptable during the review process are embedded in test forms and field-tested with representative samples of students. Each test section in a test form contains a set of embedded field-test (EFT) items. Different sets of EFT items are spiraled into each test form.

EFT items do not contribute to a student's total reported test section score, but they are designed to be indistinguishable from scored items (that is, the items that contribute to the reported score). By juxtaposing EFT items with scored items, ACT expects that students will invest the same level of effort when answering both types of items. The time limit for each test section permits most students to answer all scored and EFT items.

EFT Item Analysis

EFT items are analyzed using classical test theory (CTT) and item response theory (IRT).

When CTT is used, for a given set of EFT items, the test-taker sample is divided into low-, medium-, and high-performing groups based on students' total scores in the same test section. The cutoff scores for the three groups are the 27th and the 73rd percentile points in the distribution of those scores. These percentile points maximize the critical ratio of the difference between the mean scores of the upper and lower groups, assuming that the standard error of measurement in each group is the same and that the scores for the entire examinee population are normally distributed (Millman & Greene, 1989). For each group, the proportion of students

who chose the correct answer to each EFT item is computed, as well as the proportion of students who chose each of the incorrect answers. Biserial and point-biserial correlation coefficients of each EFT item are also computed.

When IRT is used, EFT items are calibrated using the three-parameter logistic (3PL) IRT model (Birnbaum, 1968). Three parameters are estimated for each item: the discrimination parameter, the difficulty parameter, and the pseudo-chance parameter. The estimated parameters are then transformed to the same scale as all previously calibrated items using the Stocking–Lord method (Stocking & Lord, 1983).

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

Differential item functioning (DIF) analysis procedures are also conducted on the EFT items. DIF is a statistically significant difference between the probability of a specific population group (the focal group) answering the item correctly and a comparison population group (the reference group) answering correctly when students in the two groups have similar levels of achievement with respect to the content being tested. Items flagged for DIF are reviewed by a panel of external fairness reviewers.

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

2.4.7 Assembly of New Forms

EFT items that are judged acceptable during the item analysis and subsequent review are placed in an item pool. Preliminary PreACT Secure test forms are constructed using items from this pool that match the content and statistical specifications for the tests.

2.4.8 Content and Fairness Review of Test Forms

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

The preliminary forms are then submitted to content and fairness experts for external review before the operational administration of the test forms. These experts are different individuals

from those consulted for the content and fairness reviews of EFT items, but they are drawn from the same populations of curriculum and education specialists and perform the same types of reviews described in section 2.4.5.1.

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

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

2.5 PreACT Secure Scoring Procedures

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

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

2.5.1 Additional Scores and Indicators

Beginning with the September 2015 ACT test, ACT began reporting a science, technology, engineering, and math (STEM) score, a combination of students' math and science scores. Also introduced at that time was the Progress Toward the ACT National Career Readiness Certificate Indicator. These scores are also reported for PreACT 8/9 and PreACT.

2.5.2 The STEM Score

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

2.5.3 Progress Toward the ACT National Career Readiness Certificate (NCRC) Indicator

The Progress Toward the ACT NCRC Indicator is based on students' PreACT Secure Composite scores. It provides an estimate of students' likely performance on the ACT® WorkKeys® National Career Readiness Certificate® (NCRC®). The NCRC is an assessment-based credential that certifies foundational work skills important for job success across

industries and occupations. The NCRC is based on the results of three ACT WorkKeys Assessments: Applied Math, Graphic Literacy, and Workplace Documents. Scores on these assessments determine an individual's certificate level—no certificate, Bronze, Silver, Gold, or Platinum. The NCRC gives individuals evidence that they possess the skills employers deem essential to workplace success; see ACT's webpage about the NCRC for more information. More details on the ACT test scores and indicators can be found in Chapter 7.

2.6 PreACT Secure Score Scales

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

PreACT Secure scale scores can be compared directly to the ACT's 1-to-36 score scale for each of the corresponding scale scores (PreACT Secure English to ACT English, PreACT Secure STEM to ACT STEM, etc.). The correspondence between the PreACT Secure and ACT score scales is the result of a common scale for the two assessments. PreACT Secure items are calibrated and placed onto the ACT item pool scale, and an IRT post-equating procedure is used to obtain PreACT Secure scale scores so that those scores are on the same scale as ACT scale scores. The IRT equating procedure is used to derive raw-to-scale score conversion tables for PreACT Secure. The mean PreACT Secure and ACT scale scores are expected to be close for any group of examinees taking both tests at the same time. The variance of PreACT Secure and ACT scale scores for any given group of examinees, however, will not be equal, as the ACT is longer and more reliable than its PreACT Secure counterpart. Hence, the standard error of measurement is expected to be greater on PreACT Secure.

The PreACT Secure score scale has a maximum of 35 rather than 36 as it is for the ACT. The reason for this is that PreACT Secure is intended to be a shorter and less difficult version of the ACT. Thus, it is easier to obtain a perfect score on PreACT Secure than it is on the ACT. Consequently, we decided to cap PreACT Secure scores at a lower value.

Chapter 3
PreACT Secure Test Specifications

3.1 Overview

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

3.2 English Test

3.2.1 Description of the English Test

The PreACT Secure English test has 48 items (36 scored items and 12 field-test items) and a 35-minute time limit. The test places the student in the position of a writer who is revising and editing a text and measures a student's understanding of the following: 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 items. Different passage types are employed to provide a variety of rhetorical situations. Students must use the rich context of the passage to make editorial choices, demonstrating their understanding of writing strategies and conventions. Passages are chosen not only for their appropriateness in assessing writing and language skills, but also to reflect students' interests and experiences. Spelling and the rote recall of the rules of grammar are not tested.

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

Cognitive Complexity and Depth of Knowledge (DOK)

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

Table 3.1. DOK Level Descriptions for English

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

3.2.2 English Scores and Reporting Categories

Four scores are reported: a total test score based on the 36 scored items, and three reporting category scores based on specific knowledge and skills. The three reporting categories are Production of Writing, Knowledge of Language, and Conventions of Standard English. These reporting categories are subdivided into six elements, each of which targets an aspect of effective writing. A brief description of the reporting categories is given below, followed by a table showing the approximate percentage of test items in each reporting category.

Production of Writing

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

- *Topic Development*

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

- *Organization, Unity, and Cohesion*

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

Knowledge of Language

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

Conventions of Standard English

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

- *Sentence Structure and Formation*

  Students apply an understanding of sentence structure and formation, including understanding the placement of modifiers and relationships between and among clauses.

- *Usage*

  Students edit text to conform to standard English usage.

- *Punctuation*

  Students edit text to conform to standard English punctuation.

3.2.3 English Test Blueprints

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

Table 3.2. Specification Ranges by Reporting Category for English

Reporting Category	Number of Items	Percentage of Test
Production of Writing	10–12	28%–33%
Knowledge of Language	5–7	14%–19%
Conventions of Standard English	18–20	50%–56%
Scored Total	**36**	**100%**

3.3 Math Test

3.3.1 Description of the Math Test

The PreACT Secure math test has 38 items (33 scored items and five field-test items) and a 45-minute time limit. The test considers the whole of a student's mathematical development, covering topics typically taught up through the beginning of Grade 12 in U.S. schools and focusing on the prerequisite knowledge and skills that are important for success in college math courses and career training programs. The domain is divided into Preparing for Higher Math (PHM) and Integrating Essential Skills (IES). The PreACT Secure math test weights Grade 8, 9, and 10 skills more heavily than the ACT math test, but students see a wide range of questions like those on the ACT math test.

The math construct requires making sense of problems and context, representing relationships mathematically, accessing appropriate mathematical knowledge from memory, incorporating given information, modeling, performing mathematical computations and manipulations, interpreting, applying reasoning skills, justifying, making decisions based on the math, and

appropriately managing the solution process. The test emphasizes quantitative reasoning and application over extensive computation or the memorization of complex formulas. Items focus on what students can do with the math they have learned, which encompasses not only mathematical content but also mathematical practices.

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

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

Cognitive Complexity and Depth of Knowledge (DOK)

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

Table 3.3. DOK Level Descriptions for Math

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

3.3.2 Math Scores and Reporting Categories

Nine scores are reported for the PreACT Secure math test: a total test score based on the 33 scored items, and eight reporting category scores based on different domains of mathematical knowledge, skills, and practices. The test is first divided into the Preparing for Higher Math (PHM) and Integrating Essential Skills (IES) reporting categories. The PHM score is then divided into separate scores for Number & Quantity, Algebra, Functions, Geometry, and Statistics & Probability. A crosscutting reporting category, Modeling, draws upon items from all the other categories to give a measure of producing, interpreting, understanding, evaluating, and improving models. PreACT Secure score reports provide the percentage of correctly answered items in each reporting category.

The total test score is reported on the PreACT Secure math scale, which ranges from 1 to 35. Properties of this scale are given in Chapter 6. The total math score is averaged with the total

science score to determine the STEM (science, technology, engineering, and mathematics) score, which is related to success in postsecondary STEM courses.

Preparing for Higher Math

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

Number & Quantity

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

Algebra

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

Functions

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

Students have seen shifts in graphs due to parameter changes, but now they demonstrate a unified understanding of translations and scaling through forms such as $f(x - c)$, $f(x) + c$, $af(x)$,

and $f(-ax)$. They compose functions and use inverse functions to solve equations with more than one solution. Students connect the trigonometry of right triangles to the unit circle to make trigonometric functions. They use these functions to model periodic behavior. They apply the algebraic properties of trigonometric functions, such as angle addition properties.

Geometry

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

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

Statistics & Probability

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

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

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

Integrating Essential Skills

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

surface area, and volume; simple measures of center and spread; probability; and random sampling.

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

Modeling

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

3.3.3 Calculator Policy

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

3.3.4 Item Sets

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

3.3.5 Math Test Blueprints

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

Table 3.4. Specification Ranges by Reporting Category for Math

Reporting Category	Number of Items	Percentage of Test
Preparing for Higher Math	21	64%
Number & Quantity	3–5	9%–15%
Algebra	4–6	12%–18%
Functions	4–6	12%–18%
Geometry	3–5	9%–15%
Statistics & Probability	3–5	9%–15%
Integrating Essential Skills	12	36%
Modeling	≥8	≥24%
Scored Total	**33**	**100%**

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

3.4 Reading Test

3.4.1 Description of the Reading Test

The PreACT Secure reading test has 33 items (25 scored items and 8 field-test items) and a 40-minute time limit. The test measures a student's ability to read closely, reason about texts using evidence, and integrate information from multiple sources. It comprises three passage units, one of which may contain two shorter prose passages on the same topic. One of the passages is a literary narrative, and the other two are informational texts from the humanities, natural sciences, or social sciences. Passages are representative of the kinds of texts commonly encountered in high school and first-year college curricula. Each passage is preceded by a heading that identifies the passage type (e.g., literary narrative) and names the author; it may also contain important background information that helps in understanding the passage.

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

Cognitive Complexity and Depth of Knowledge (DOK)

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

Table 3.5. DOK Level Descriptions for Reading

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

3.4.2 Reading Scores and Reporting Categories

Four scores are reported: a total test score based on the 25 scored items, 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. A description of each category is given below, followed by a table showing the approximate percentage of the test devoted to each reporting category.

Key Ideas & Details

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

Craft & Structure

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

Integration of Knowledge & Ideas

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

3.4.3 Reading Test Blueprints

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

Table 3.6. Specification Ranges by Reporting Category for Reading

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

3.5 Science Test

3.5.1 Description of the Science Test

The PreACT Secure science test has 36 items (30 scored items and six field-test items) and a 35-minute time limit. The test measures the interpretation, analysis, evaluation, reasoning, and problem-solving skills required in the natural sciences. The content of the science test is drawn from the fields of biology, chemistry, physics, and Earth science/space science.

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

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

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

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

These three domains, and the knowledge and skills encompassed by each domain, were derived from ACT's decades of empirical data and research on college and career readiness in science. The domains and their skills make up the ACT College and Career Readiness Standards for science, which link specific skills and knowledge to quantitatively determined score ranges for the ACT science test and to the College and Career Readiness Benchmark in science, which is predictive of success in science at the postsecondary level. These three

domains are also the reporting categories for the PreACT Secure science test (see Table 3.8). ACT also reviews science benchmarks and standards from state, national, and international standards documents (e.g., the Next Generation Science Standards) and monitors the impact of these documents on science curricula to ensure alignment and, when needed, to update the constructs of the test.

All items on the ACT science test are based on authentic scientific scenarios that are built around important scientific concepts, and they are designed to mirror the experiences of students and working scientists engaging in real science. The ACT science test focuses on multidimensional assessment (to measure three-dimensional learning in science) with items that require students to apply multiple domains. Some of the items require that students have discipline-specific content knowledge (e.g., knowledge specific to an introductory high school physical science or biology course), but all the items focus on science process skills. Research conducted by ACT on science curricula and instruction at the high school and postsecondary levels shows that, while having a fundamental understanding of disciplinary science concepts is important, being able to apply science practices and process skills to science content to solve problems is more strongly tied to college and career readiness in science. The ACT science test focuses on measuring the science skills and knowledge that are empirically tied to college and career readiness.

Cognitive Complexity and Depth of Knowledge (DOK)

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

Table 3.7. DOK Level Descriptions for Science

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

3.5.2 Science Scores and Reporting Categories

Four scores are reported: a total test score based on the 30 scored items, and three reporting category scores based on different domains of scientific knowledge, skills, and practices. The three reporting categories are Interpretation of Data; Scientific Investigation; and Evaluation of Models, Inferences & Experimental Results. A description of each reporting category is provided below, and the percentage of the test devoted to each reporting category is provided in Table 3.8. The overall test score is reported on the PreACT Secure science scale, which ranges from 1 to 35. This total science score is averaged with the total math score to determine the STEM score.

Interpretation of Data

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

Scientific Investigation

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

Evaluation of Models, Inferences & Experimental Results

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

3.5.3 Science Test Blueprints

Table 3.8 shows the current target distribution of scored items across reporting categories on each PreACT Secure science test form.

Table 3.8. Specification Ranges by Reporting Category for Science

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

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

4.1 Administering PreACT Secure

PreACT® Secure™ can be administered during certain limited windows during the testing year. PreACT Secure implementation webinars and resources provide instruction for scheduling testing and ordering materials.

4.1.1 Participation Procedures

In June, the registration portal opens to allow districts to enroll for the next school year. Districts enroll between June and January, and then in January, they receive guidance on importing students, setting up online or paper testing, and assigning accommodations and English learner (EL) supports. Spring testing occurs in March and April. Fall testing occurs in October.

4.1.2 Administration Schedule

PreACT Secure is designed to be administered within a half day during school-supervised sessions. It takes about 3 hours 5 minutes to complete the entire program: approximately 30 minutes for the non-test section and 2 hours 35 minutes for the four test sections. The non-test section 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 unless a student is approved for multiday testing in their accommodations plan. Consult the *PreACT Secure Administration Manual* for information about makeup testing.

4.1.3 PreACT Secure Support Materials

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

- Implementation webinars and resources include links to online materials that provide information about PreACT Secure and help schools begin planning their administration.
- The *PreACT Secure Administration Manual* is designed for test coordinators and testing staff. The manual provides detailed instructions for planning and administering the non-test section and the test sections.
- The *Accessibility and Supports Guide for PreACT Secure* helps educational teams select appropriate accessibility supports and accommodations for their students to use during testing.
- Before testing, the test coordinator will designate each student as testing either online or on paper and as testing with standard time, with accommodations, or with EL supports. Paper testing is only available for a limited number of accommodations (braille, large print, and reader's script).

- For online testing, all required test materials and tools are included in the TestNav portal. For students testing with accommodations or EL supports, additional tools will be available in the TestNav portal or at the test site to support the students.
- For paper testing, schools should order one package of test materials for each student testing with accommodations. Each package includes one standard test booklet, one alternate-format test (braille, large print, or reader's script), answer documents, and instruction booklets. Each shipment will also include necessary return materials.
- Student and school reports are available in ACT's Online Reporting system.
- Each student who takes PreACT Secure will have access to *Using Your PreACT Secure Results*, which includes information about interpreting the student report, planning for high school and beyond, exploring career possibilities, and building academic skills.
- Educators will have access to the *PreACT Secure Interpretive Guide for Student and Aggregate Reports*, which includes information for helping students understand their student reports and for interpreting the school aggregate reports (Student List Report, Educator Report, and Student Data File).
- The *ACT Online Reporting User Guide* is available to help testing staff use the Online Reporting system to retrieve score reports, analyze data, and create school-, district-, and state-level reports.

4.2 Test Security

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

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

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

- prohibited test-taking behavior, such as copying answers or using prohibited electronic devices during testing
- accessing questions before or after the test, taking photos, or making copies of test questions or test materials
- posting test questions on the internet
- test proctor or test administrator misconduct, such as providing questions or answers to examinees or permitting them to engage in prohibited conduct during testing

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

4.3 Information Security

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

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

4.4 Accessibility, Accommodations, and Supports

Accessibility supports apply to all students and emphasize an individualized approach to implementing assessment practices for students with diverse needs. Different levels of support are needed by individual students so they can demonstrate what they know and can do. PreACT Secure permits the use of supports that will honor the skills and knowledge that the tests measure while removing construct-irrelevant barriers to student performance.

Although ACT designs the standardized testing experience to be the same for all students, ACT does afford language supports for English learners and accommodations for students with

diagnosed, documented disabilities in order to provide equitable access to the test without compromising the validity of the test results.

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

- universal supports
- designated supports
- accommodations
- English learner supports

4.4.1 Universal Supports

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

Universal supports embedded into PreACT Secure include the following:

- ability to use log-in tickets as scratch paper
- embedded calculator for the math test
- section directions available on demand
- ability to ask for clarification or repetition of verbal instructions
- ability to mark items for review
- highlighter
- ability to adjust color contrast
- magnification device/zoom
- answer eliminator
- answer masking tool

4.4.2 Designated Supports

Designated supports are adjustments to a test that are available to any student with an identified need. Typically, designated supports are adjustments to the testing environment that require advance planning to deliver. It is recommended that a consistent process be used to determine the supports each student needs. Designated supports for PreACT Secure include the following:

- assistive devices/technology
- food, drink, or medication for examinees with a medical need in the test room (does not include cell phones or other smart devices used to monitor medical conditions)
- frequent breaks that do not stop the testing clock
- noise buffers/earplugs
- permission to stand during testing
- personal aide
- service animal
- small group or one-to-one testing

4.4.3 Accommodations

Accommodations are accessibility supports needed by relatively few students. Students who receive accommodations should have a documented disability and a formal educational plan—generally a current Individualized Education Program (IEP) or 504 plan—that indicates their individual needs. It is recommended that this plan be developed by an educational team that includes relevant school personnel, parents/guardians, and the student. Accommodations decisions are usually based on a formal evaluation of a student and of what the student needs to access instruction and assessments.

Successful and secure delivery of an accommodated standardized assessment often requires additional local individuals with specialized skills and knowledge. ACT recommends that students who will use accommodations on an assessment regularly use those same accommodations in an educational setting in order to become proficient with them.

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

- timing (e.g., extra testing time, breaks as needed, multiday administration)
- presentation and formats (e.g., braille, text-to-speech, screen reader software, sign language interpreter)
- response and navigation (e.g., accessible calculator for math, brailled response, speech-to-text, scribe)
- setting and location (e.g., medical monitoring devices, background music, fidget device, personalized notification of time remaining)

A complete list of available accommodations is in the *Accessibility Supports Guide for PreACT Secure*.

4.4.4 English Learner Supports

English learner (EL) supports are available for students who are not proficient in English. Designation as a student with limited English proficiency (LEP) follows the guidelines set by each individual state department of education. Such a designation is evidence of a need for EL supports. Generally, English language proficiency is measured using an English language proficiency (ELP) assessment.

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

- ACT-authorized bilingual dictionary
- translated test directions, provided by ACT
- one-and-one-half time, single day
- small-group testing

4.4.5 Testing Students With Accommodations and English Learner Supports

Accommodations and EL supports on PreACT Secure are limited to those that do not invalidate the test construct. Not all accommodations or EL supports provided in the classroom fall into this category.

A student's eligibility to take PreACT Secure with accommodations or EL supports is entirely at the discretion of school personnel. ACT recommends accommodations and EL supports selection be based on the student's current educational plan, medical plan, or EL status.

Chapter 5
Scoring and Reporting

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

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

5.1 Reporting and Data Services

5.1.1 Student Report

The student reports include the following information:

- **PreACT Secure test scores**, including scores for the four section tests (English, math, reading, and science), the Composite score, and the STEM score. The Composite score is the rounded unweighted average of the four test section scale scores, and the STEM score is the rounded unweighted average of the math and science scale scores (with fractions of 0.5 and higher rounding up).
- **Predicted ACT Composite Score Range** is the range within which the student's ACT Composite score is expected to fall when the student takes the ACT in the spring of 11th grade. Predictions are also provided for the four test section scores and the STEM score. The predicted score ranges were derived using historical PreACT and ACT data, as described in Chapter 6.
- **U.S. Ranks (National Norms)**, which are adopted from PreACT national norms, are the approximate percentages of recent testers, at the same grade level and season (fall or spring), whose PreACT scores are less than or equal to the student's scores. For example, a rank of 56 for the student's Composite score indicates that 56% of other tested students earned that Composite score or below.
- **Progress Toward the ACT® WorkKeys® National Career Readiness Certificate® (NCRC®)** indicator provides an estimate of students' most likely level on the ACT NCRC given their Composite scores. The NCRC is an assessment-based credential that documents foundational work skills important for job success across industries and occupations.

- **Detailed PreACT Secure Results** describe students' performance on the reporting categories of the four section tests.

5.1.2 Summary Reports

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

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

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

- **Average Scores by Ethnicity and Gender** reports mean PreACT Secure test scores by gender and race/ethnicity.

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

5.1.3 Additional Online Reporting Tools

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

5.2 Progress Toward the ACT NCRC Indicator

The Progress Toward the ACT NCRC indicator provides students with information about their level of career readiness based on their PreACT Secure Composite scores. More specifically, this indicator predicts the ACT NCRC level that students are likely to obtain if they take the ACT test in the spring of 11th grade and the WorkKeys test during the same academic year. To make this prediction possible, ACT linked the PreACT Composite score to the ACT Composite score and linked the ACT Composite score to the appropriate ACT NCRC level. The link between ACT Composite scores and ACT NCRC levels was established using the data of nearly 79,000 11th and 12th graders who took the ACT and all three ACT NCRC assessments during the 2017–2018 academic year (Radunzel & Fang, 2018). Subsequent parts of this section describe the links between PreACT Composite scores, ACT Composite scores, and ACT NCRC levels.

PreACT and 11th-grade ACT test scores collected through the spring of 2022 were used to derive the predicted ACT NCRC levels for two groups of students:

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

- 10th-grade PreACT sample: 879,588 students who took PreACT in 10th grade and took the ACT test in 11th grade, 12 to 18 months after taking PreACT.

Test score summary statistics and correlations for the two groups are presented later in this technical manual (see Table 7.3).

Logistic regression was used to find the PreACT Composite scores associated with a 50% chance of obtaining each ACT NCRC level or higher. Note that the 50% cut score was calculated from the logistic regression coefficients as −1×Intercept/Slope. Table 5.1 provides the logistic regression parameter estimates, the standard errors for those estimates, and the cut scores associated with meeting each ACT NCRC level. The final cut scores were obtained by rounding the cut score estimates to the nearest whole number.

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

PreACT Grade Level	ACT NCRC Level	Intercept		Slope		50% Cut Score	
		Beta	SE	Beta	SE	Estimate	Rounded
9	Bronze	−5.769	0.112	0.616	0.008	9.37	9
	Silver	−10.307	0.086	0.736	0.006	14.00	14
	Gold	−12.987	0.092	0.717	0.005	18.10	18
	Platinum	−15.610	0.128	0.695	0.006	22.45	22
10	Bronze	−6.153	0.032	0.604	0.002	10.19	10
	Silver	−11.604	0.027	0.752	0.002	15.43	15
	Gold	−15.306	0.034	0.761	0.002	20.12	20
	Platinum	−18.695	0.054	0.754	0.002	24.80	25

Table 5.2 shows the Composite scale score ranges for both PreACT or PreACT Secure (Grades 9 and 10) and the ACT score ranges that correspond to different predicted ACT NCRC levels. The PreACT scale score ranges may be subject to change as more data are collected.

Table 5.2. Composite Score Ranges Corresponding to Predicted ACT NCRC Levels

Predicted ACT NCRC Level	PreACT or PreACT Secure Composite Score Range		ACT Composite Score Range
	Grade 9	Grade 10	
Below Bronze	1–8	1–9	1–12
Bronze	9–13	10–14	13–16
Silver	14–17	15–19	17–21
Gold	18–21	20–24	22–26
Platinum	22–35	25–35	27–36

Note. For more information on the Progress Toward the ACT NCRC Indicator, visit *www.act.org/NCRC-indicator*.

5.3 ACT College and Career Readiness Standards

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

A full account of the development of the Standards and a description of the Standards for each test section are given in the *ACT Technical Manual* (ACT, 2022).

5.4 ACT College Readiness Benchmarks

The ACT College Readiness Benchmarks are ACT scores that represent the level of achievement required for a student to have a 50% chance of obtaining a B or higher (or about a 75% chance of obtaining a C or higher) in corresponding credit-bearing first-year college courses at a typical 2-year or 4-year postsecondary institution. These college courses or course areas and the current Benchmarks are given in Table 5.3.

Table 5.3. ACT College Readiness Benchmarks

College Courses and Course Areas	ACT Test Score	ACT Benchmark
English Composition I	English/Writing	18
College Algebra	Math	22
American history, other history, psychology, sociology, political science, and economics	Reading	22
Biology	Science	23
Calculus I, biology, chemistry, physics, and engineering	STEM	26
English Composition I, American history, other history, psychology, sociology, political science, and economics	ELA	20

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

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

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

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

5.5 PreACT Readiness Levels and Benchmarks

PreACT Secure tests can be used to monitor students' progress toward college and career readiness. Based on research using scores from the PreACT assessment, PreACT Secure scores are classified into one of three readiness levels:

1. **On Target**. Students scoring in this range are predicted to meet or exceed the ACT College Readiness Benchmark in 11th or 12th grade. The PreACT Readiness Benchmark is the score associated with a 50% chance of meeting the ACT College Readiness Benchmark in 11th or 12th grade and is the minimum score for the On Target range.
2. **Close to Target**. Students scoring in this range have less than a 50% chance, but greater than a 25% chance, of meeting the ACT College Readiness Benchmark.
3. **In Need of Intervention**. Students scoring in this range have less than a 25% chance of meeting the ACT College Readiness Benchmark.

PreACT Readiness Levels are specific to grade level (8, 9, 10, or 11), resulting in five sets of readiness levels for each score (English, math, reading, science, and STEM). The scale score ranges for the PreACT Readiness Levels that were derived in the spring of 2020 are listed in Table 5.4.

Table 5.4. Scale Score Ranges for PreACT Readiness Levels

Test Section	Grade Level and Season	In Need of Intervention	Close to Target	On Target
English	Grade 8, Fall	1–7	8–10	11–35
	Grade 8, Spring	1–7	8–10	11–35
	Grade 9, Fall	1–8	9–11	12–35
	Grade 9, Spring	1–9	10–12	13–35
	Grade 10, Fall	1–10	11–13	14–35
	Grade 10, Spring	1–11	12–14	15–35
	Grade 11, Fall	1–12	13–15	16–35
Math	Grade 8, Fall	1–12	13–14	15–35
	Grade 8, Spring	1–13	14–15	16–35
	Grade 9, Fall	1–14	15–16	17–35
	Grade 9, Spring	1–15	16–17	18–35
	Grade 10, Fall	1–16	17–18	19–35
	Grade 10, Spring	1–16	17–18	19–35
	Grade 11, Fall	1–17	18–19	20–35
Reading	Grade 8, Fall	1–11	12–14	15–35
	Grade 8, Spring	1–12	13–15	16–35
	Grade 9, Fall	1–13	14–16	17–35
	Grade 9, Spring	1–14	15–17	18–35
	Grade 10, Fall	1–15	16–18	19–35
	Grade 10, Spring	1–16	17–19	20–35
	Grade 11, Fall	1–17	18–20	21–35
Science	Grade 8, Fall	1–13	14–16	17–35
	Grade 8, Spring	1–14	15–17	18–35
	Grade 9, Fall	1–15	16–17	18–35
	Grade 9, Spring	1–15	16–18	19–35
	Grade 10, Fall	1–16	17–19	20–35
	Grade 10, Spring	1–17	18–19	20–35
	Grade 11, Fall	1–17	18–20	21–35
STEM	Grade 8, Fall	1–16	17–18	19–35
	Grade 8, Spring	1–17	18–19	20–35
	Grade 9, Fall	1–18	19–20	21–35
	Grade 9, Spring	1–19	20–21	22–35
	Grade 10, Fall	1–20	21–22	23–35
	Grade 10, Spring	1–21	22–23	24–35
	Grade 11, Fall	1–21	22–23	24–35

5.5.1 Derivation of PreACT Readiness Levels and Benchmarks

PreACT and ACT test scores collected through the spring of 2020 were used to derive the PreACT Readiness Levels and Benchmarks. PreACT records were linked to ACT records from the spring or summer of 11th grade and the fall, spring, or summer of 12th grade. Five samples were created:

- Fall Grade 9: 10,673 students who took the PreACT between September and December of 9th grade prior to taking the ACT in 11th and/or 12th grade
- Spring Grade 9: 11,425 students who took the PreACT between February and June of 9th grade prior to taking the ACT in 11th and/or 12th grade
- Fall Grade 10: 193,425 students who took the PreACT between September and December of 10th grade prior to taking the ACT in 11th and/or 12th grade
- Spring Grade 10: 158,611 students who took the PreACT between February and June of 10th grade prior to taking the ACT in 11th and/or 12th grade
- Fall Grade 11: 40,654 students who took the PreACT between September and December of 11th grade prior to taking the ACT in 11th and/or 12th grade

Each sample was weighted to approximately match a target population—the 2019 cohort of ACT-tested high school graduates. After weighting, each sample approximately matched the target population. For example, Table 5.5 provides the distribution of background variables for the Fall Grade 10 sample before and after weighting.

Table 5.5. Characteristics of the Fall Grade 10 Sample

Characteristic		Sample %		Population %
		Raw	Weighted	
	Other/Missing	0.6	1.6	1.6
Gender	Female	53.7	52.0	52.0
	Male	45.7	46.4	46.4
	Black/African American	8.8	12.2	12.5
	White	57.5	51.7	51.6
Race/Ethnicity	Hispanic	12.2	16.4	16.4
	Asian	3.9	4.6	4.6
	Other	9.2	5.7	5.6
	Missing	8.5	9.4	9.3
Grade level at last ACT test	11	49.7	55.0	54.8
	12	50.3	45.0	45.2
	Missing	21.5	27.7	27.9
	High school or less	12.9	15.2	15.2
Parent education level	Some college	17.2	17.1	17.1
	Bachelor's	26.0	21.5	21.4
	More than bachelor's	22.5	18.5	18.4
	Missing	35.0	38.7	38.8
	<36K	13.8	17.0	17.0
Family income	36K–60K	11.8	11.6	11.5
	60K–100K	15.3	13.7	13.7
	>100K	24.1	19.1	19.0
	Missing	23.4	28.0	28.3
	<2.50	5.6	7.2	7.2
High school GPA	2.50–3.00	8.6	9.7	9.7
	3.00–3.50	18.8	18.9	18.9
	3.50–3.75	13.6	12.2	12.1
	3.75–4.00	30.0	23.9	23.9
	Missing	1.0	2.0	1.9
School type	Public	83.7	88.1	88.3
	Non-public	15.3	10.0	9.8
	With accommodations	6.5	7.2	7.2
ACT test type	State and District	27.7	35.9	36.3
	National	65.8	56.8	56.5

Note. Other = Native American + Native Hawaiian/Other Pacific Islander + Two or more races; Missing = No response + Prefer not to respond

Students' best ACT test score in each section was used to determine whether they met the ACT College Readiness Benchmark. Table 5.6 provides test score summary statistics for each weighted sample, including the percentage meeting the ACT College Readiness Benchmark.

Table 5.6. Weighted Summary Statistics

Test Section	Grade Level and Season	*N*	PreACT Score		ACT Score		
			Mean	SD	Mean	SD	% Meeting Benchmark
English	Grade 9, Fall	10,673	15.4	6.0	21.1	7.1	65.4%
	Grade 9, Spring	11,425	16.5	6.1	21.4	7.1	66.7%
	Grade 10, Fall	193,425	16.8	5.9	20.7	7.0	63.1%
	Grade 10, Spring	158,611	17.7	6.2	21.1	7.2	64.7%
	Grade 11, Fall	40,654	18.5	6.3	21.0	6.9	65.2%
Math	Grade 9, Fall	10,673	17.2	3.7	21.2	5.6	45.5%
	Grade 9, Spring	11,425	17.9	4.0	21.1	5.5	45.2%
	Grade 10, Fall	193,425	18.5	4.4	20.8	5.6	41.5%
	Grade 10, Spring	158,611	19.0	4.9	20.8	5.6	41.5%
	Grade 11, Fall	40,654	19.8	5.1	21.0	5.5	43.5%
Reading	Grade 9, Fall	10,673	17.4	5.8	22.2	6.9	50.6%
	Grade 9, Spring	11,425	18.4	6.0	22.3	6.9	51.1%
	Grade 10, Fall	193,425	19.6	6.3	22.1	6.8	49.9%
	Grade 10, Spring	158,611	20.3	6.5	22.2	7.0	50.3%
	Grade 11, Fall	40,654	21.3	6.7	22.1	6.9	50.5%
Science	Grade 9, Fall	10,673	17.5	4.9	21.6	5.7	42.6%
	Grade 9, Spring	11,425	18.2	5.2	21.6	5.8	42.7%
	Grade 10, Fall	193,425	18.8	5.2	21.4	5.7	40.7%
	Grade 10, Spring	158,611	19.3	5.4	21.5	5.9	42.3%
	Grade 11, Fall	40,654	19.8	5.5	21.6	5.7	42.8%
STEM	Grade 9, Fall	10,673	17.6	4.0	21.5	5.4	23.8%
	Grade 9, Spring	11,425	18.3	4.3	21.5	5.4	23.4%
	Grade 10, Fall	193,425	18.9	4.5	21.2	5.3	21.9%
	Grade 10, Spring	158,611	19.4	4.8	21.2	5.5	22.6%
	Grade 11, Fall	40,654	20.1	5.0	21.4	5.3	22.8%

For each sample and each PreACT section, logistic regression was used to model the probability of meeting the ACT College Readiness Benchmark as a function of PreACT test score. The PreACT Readiness Benchmark (cut score for the On Target readiness level) was chosen as the score that most accurately reflected a .50 probability of meeting the ACT College Readiness Benchmark. Similarly, the cut score for the Close to Target readiness level was chosen as the score that most accurately reflected a .25 probability of meeting the ACT College Readiness Benchmark. In a few cases (Fall Grade 9 math and Spring Grade 10 math), the cut score for Close to Target was lowered by one point to ensure that the Close to Target cut score was at least two points lower than the On Target cut score. Table 5.4 shows the resulting PreACT Readiness Levels.

The PreACT Readiness Levels will be used to help stakeholders interpret PreACT Secure scores. Future research will examine whether different readiness levels are needed for PreACT and PreACT Secure.

5.5.2 College and Career Readiness Rates by PreACT Readiness Level

After taking PreACT Secure, students still have time to grow academically before taking the ACT test in 11th or 12th grade. Students who score below the On Target level may still meet the ACT College Readiness Benchmark later in high school.

By design, most students who meet the PreACT Readiness Benchmark (and hence score in the On Target range) should go on to meet the ACT College Readiness Benchmark. Similarly, around 25% of students who score in the Close to Target range should meet the ACT College Readiness Benchmark, and fewer than 25% who score in the In Need of Intervention range should meet the ACT College Readiness Benchmark.

Informed by the same data sets used to derive the PreACT Readiness Levels, Table 5.7 shows the percentage of students who met the ACT College Readiness Benchmark by test section, grade level and season, and PreACT Readiness Level. Among students who scored in the On Target range, the percentage meeting the ACT College Readiness Benchmark ranged from 73% to 87%; among those in the Close to Target range, the percentage ranged from 22% to 38%; and among those in the In Need of Intervention range, the percentage ranged from 3% to 16%. The percentages show that the PreACT Readiness Levels are accurate predictors of college and career readiness, and that many students who are not on target when they take PreACT are able to grow enough academically to meet the ACT College Readiness Benchmarks.

Table 5.7. Percentage Meeting ACT College Readiness Benchmark, by PreACT Readiness Level

Test Section	Grade Level and Season	PreACT Readiness Level		
		In Need of Intervention	Close to Target	On Target
English	Grade 9, Fall	16.3%	32.5%	84.0%
	Grade 9, Spring	11.5%	30.7%	84.5%
	Grade 10, Fall	11.9%	30.4%	82.2%
	Grade 10, Spring	11.5%	31.5%	85.4%
	Grade 11, Fall	11.2%	35.1%	87.1%
Math	Grade 9, Fall	4.5%	22.4%	80.4%
	Grade 9, Spring	5.2%	33.1%	86.8%
	Grade 10, Fall	6.7%	38.0%	85.9%
	Grade 10, Spring	4.6%	31.2%	84.3%
	Grade 11, Fall	6.8%	34.9%	83.4%
Reading	Grade 9, Fall	13.1%	32.3%	80.5%
	Grade 9, Spring	13.0%	34.1%	81.0%
	Grade 10, Fall	10.8%	30.7%	79.0%
	Grade 10, Spring	11.8%	35.9%	81.5%
	Grade 11, Fall	11.5%	35.1%	80.0%
Science	Grade 9, Fall	11.1%	29.2%	72.8%
	Grade 9, Spring	9.6%	27.5%	73.0%
	Grade 10, Fall	7.8%	27.0%	74.1%
	Grade 10, Spring	9.2%	30.1%	74.2%
	Grade 11, Fall	8.1%	31.1%	78.0%
STEM	Grade 9, Fall	4.8%	32.1%	77.5%
	Grade 9, Spring	4.0%	34.2%	77.8%
	Grade 10, Fall	3.3%	31.7%	77.6%
	Grade 10, Spring	3.5%	36.7%	82.0%
	Grade 11, Fall	2.7%	25.8%	75.1%

Chapter 6

Scaling, Equating, and Technical Characteristics

Scale scores are reported for PreACT® Secure™ English, math, reading, and science tests. Scale scores are also reported for the Composite score and the STEM score. The range of all PreACT Secure scale scores is 1 to 35. More background information on the PreACT Secure scale is available in Section 2.6. This chapter discusses equating methods and characteristics of PreACT Secure tests. Section 6.1 describes the equating procedure of PreACT Secure. Section 6.2 documents how the predicted ACT® score ranges are derived. Section 6.3 describes the PreACT Secure score ranges. Section 6.4 presents the summary of the operational test data from students taking PreACT Secure tests in Fall 2023 and Spring 2024. Section 6.5 describes the PreACT Secure norms. Sections 6.6 to 6.8 present the results of psychometric analyses, including differential item functioning, reliability, measurement error, and classification consistency based on the Fall 2023 and Spring 2024 operational data.

6.1 Equating of PreACT Secure Tests

Post-equating was conducted to create raw-to-scale score conversion tables for each test section of the PreACT Secure tests administered in Spring 2024. It was performed through the following procedure. First, based on the responses of Grade 10 students in the equating sample, operational items on the two main forms were calibrated separately with the Item Response Theory (IRT) Three-Parameter Logistic model. Next, the calibrated item parameters were aligned to the ACT item pool scale with the Stocking-Lord linking procedure. Finally, the IRT true score equating was conducted to establish conversion tables. These derived conversion tables are used to transform raw scores on the new forms to scale scores.

The Composite and STEM scores, which constitute combinations of individual test section scores, are not directly equated. Instead, they are derived from the rounded arithmetic mean of scale scores originating from two or four test sections.

6.2 Predicted ACT Score Ranges

One of the intended uses of PreACT Secure is to predict performance on the ACT test. PreACT Secure score reports provide predicted ACT score ranges, and separate predictions are reported for Grades 9 and 10 with the assumption that students will take the ACT test in 11th grade. PreACT and 11th-grade ACT test scores collected through Spring 2022 were used to derive the predictions using two groups of students:

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

These samples were used to estimate the predicted ACT score ranges that are used for PreACT Secure reporting for Fall 2023 and Spring 2024. Test score summary statistics and correlations for the two groups are presented in Table 7.3.

For each section test score, Composite score, and STEM score, the predicted ACT score ranges are based on a regression model where the PreACT test score (9th or 10th grade) is used to predict the 11th-grade ACT test score. The regression model uses linear and quadratic effects of the PreACT score to predict the ACT score, and a 50% prediction interval forms the endpoints of the predicted score range.

Research has shown that ACT test scores declined during the COVID-19 pandemic (Allen, 2022). For purposes of deriving the predictions, we classified student records as having been disrupted by the onset of the COVID-19 pandemic if the PreACT test occurred before March 1, 2020 and the ACT test occurred after June 1, 2020 (Across the United States, most in-person schooling was suspended during this period.). For the 9th-grade PreACT sample, 38,588 records were disrupted by the pandemic and 42,943 records were not disrupted by the pandemic. For the 10th-grade PreACT sample, 143,930 records were disrupted by the pandemic and 735,658 records were not disrupted by the pandemic.

We included an indicator variable for pandemic disruption in the regression models for predicting ACT scores. By doing so, disruption-adjusted and regular score predictions (which assume that students' ACT scores are not subject to the disruption) can be obtained. The disruption-adjusted predictions are generally lower than the regular score predictions. Because the predictions will be applied to students who will take the PreACT Secure and ACT tests after the pandemic onset, we will use the regular score predictions for reporting predicted ACT score ranges.

Using the same data that was used to derive the predictions, we examine the accuracy of the predicted ACT score ranges. For records not disrupted by the pandemic, Table 6.1 provides the percentage of students scoring below, within, and above their predicted ACT score range. By design, the percentage of students scoring below their prediction is about the same as the percentage of students scoring above their prediction. Note that the 50% prediction interval results in a coverage rate of about 60% because the test scores are integers and scores that equal the interval endpoints are considered in the interval.

Table 6.2 provides the prediction accuracy rates for records that were disrupted by the pandemic. While the prediction intervals still included at least 50% of the actual test scores, we are shown that students' ACT scores tended to fall below their predicted range. This is evidence that students whose education was disrupted by the onset of the pandemic experienced less academic growth.

Table 6.1. Percent Scoring Below, Within, and Above Predicted ACT Score Ranges Among Records Not Disrupted by the Onset of the COVID-19 Pandemic

PreACT grade	Test section	Actual ACT score relative to predicted score range		
		% Below	% Within	% Above
9	English	23.1	55.7	21.2
	Math	19.9	59.9	20.2
	Reading	22.3	56.8	20.9
	Science	20.5	60.6	18.9
	Composite	19.7	62.4	17.9
	STEM	20.4	60.1	19.5
10	English	19.5	60.8	19.7
	Math	16.9	64.1	19.1
	Reading	20.7	58.8	20.5
	Science	20.1	60.2	19.7
	Composite	20.1	62.5	17.4
	STEM	20.6	60.3	19.2

Table 6.2. Percent Scoring Below, Within, and Above Predicted ACT Score Ranges Among Records Disrupted by the Onset of the COVID-19 Pandemic

PreACT grade	Test section	Actual ACT score relative to predicted score range		
		% Below	% Within	% Above
9	English	37.9	50.2	11.8
	Math	32.7	57.4	9.8
	Reading	38.0	51.6	10.4
	Science	27.1	59.2	13.7
	Composite	37.5	54.8	7.7
	STEM	31.0	57.6	11.4
10	English	29.2	59.2	11.6
	Math	23.6	65.1	11.4
	Reading	31.4	56.2	12.4
	Science	24.8	59.6	15.5
	Composite	32.8	58.4	8.8
	STEM	27.7	59.4	12.9

6.3 PreACT Secure Score Ranges

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

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

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

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

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

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

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

The square root of the above error variance represents the CSEM of scale scores at a given θ_i. For each scale score from 1 to 35, the corresponding raw score and θ were located. The CSEM values were calculated through the formula above and were rounded to integers. Considering the values across forms were very close, it was decided, for simplicity, to use the final scale-score CSEM values obtained based on the forms administered in Spring 2023. The scale-score CSEM values are continuously monitored and will be updated if significant deviations are found. CSEM values for all PreACT Secure scale scores can be found in Table 6.3.

Table 6.3. PreACT Secure CSEM Values

PreACT Secure scale score	English CSEM	Math CSEM	Reading CSEM	Science CSEM	Composite CSEM	STEM CSEM
1	2	2	3	2	1	1
2	2	2	3	2	1	1
3	2	2	3	2	1	1
4	2	2	3	2	1	1
5	2	2	3	2	1	1
6	2	2	3	2	1	1
7	2	2	3	2	1	1
8	1	2	3	2	1	1
9	1	2	3	2	1	1
10	2	2	3	2	1	1
11	2	2	3	2	1	1
12	2	2	3	2	1	1
13	2	2	2	2	1	1
14	2	1	2	2	1	1
15	2	1	2	2	1	1
16	2	1	2	2	1	1
17	2	1	2	2	1	1
18	2	2	2	2	1	1
19	2	2	2	2	1	1
20	2	2	3	2	1	1
21	2	2	3	2	1	1
22	2	2	3	2	1	1
23	3	2	3	2	1	1
24	3	2	3	2	1	1
25	3	2	3	2	1	2
26	3	2	3	3	1	2

PreACT Secure scale score	English CSEM	Math CSEM	Reading CSEM	Science CSEM	Composite CSEM	STEM CSEM
27	3	2	3	3	1	2
28	3	3	3	3	2	2
29	3	3	3	3	2	2
30	3	3	3	3	2	2
31	3	3	3	3	1	2
32	3	3	2	3	1	2
33	3	3	2	3	1	2
34	2	2	2	2	1	2
35	1	1	1	1	1	1

6.4 PreACT Secure Fall 2023 and Spring 2024 Operational Test Data

Over 190,000 examinees took the PreACT Secure tests in Fall 2023 and Spring 2024. Tables 6.4 and 6.5 show the distributions of data for students in 9th grade and 10th grade, respectively, based on gender and ethnicity. Considering the relatively small sample size and concerns over privacy, data for other grades are not included in the report.

Table 6.4. PreACT Secure Fall 2023 and Spring 2024 Operational Test Data Distribution by Gender and Grade

Gender	Grade 9	Grade 10
Female	63,583	29,961
Male	65,292	31,114
Other*	4,179	1,687

* Other category includes ‘Another gender,’ ‘Prefer not to respond,’ and missing.

Table 6.5. PreACT Secure Fall 2023 and Spring 2024 Operational Test Data Distribution by Ethnicity and Grade

Race/Ethnicity	Grade 9	Grade 10
Black/African American	20,494	4,580
American Indian/Alaskan Native	1,187	546
White	66,394	37,402
Hispanic/Latino	2,580	797
Asian	3,407	2,200
Native Hawaiian/Other Pacific Islander	158	48
Two or more races	15,540	6,788
Prefer not to respond	16,027	5,852
Missing	7,267	4,549

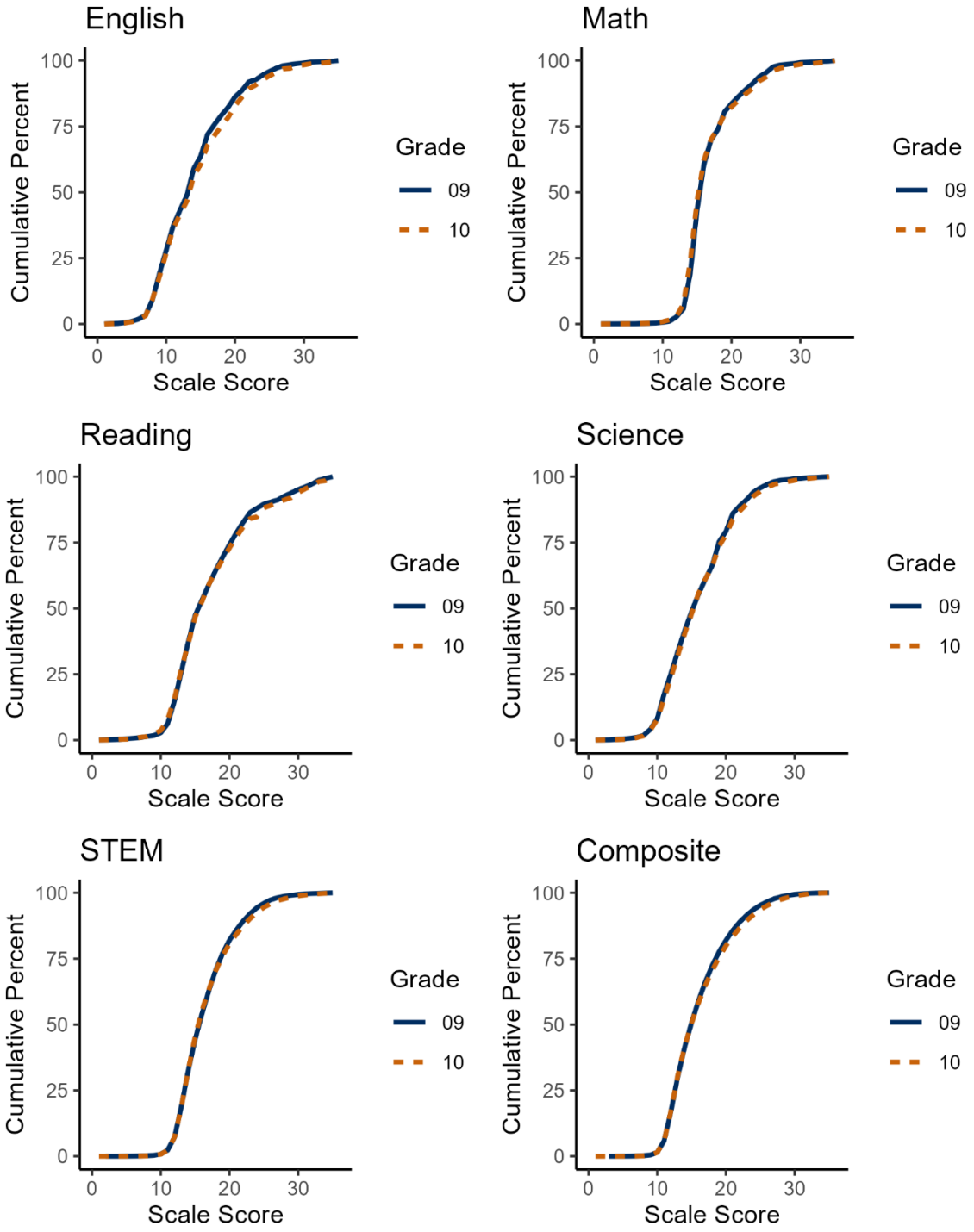
Scale Score Statistics for the PreACT Secure Fall 2023 and Spring 2024 Test Sample

Table 6.6 shows the scale-score summary statistics for students in 9th and 10th grade in the PreACT Secure Fall 2023 and Spring 2024 sample. Figure 6.1 shows how the scale scores are distributed for the two grades.

Table 6.6. Scale Score Summary Statistics for 9th and 10th Graders

Grade	Test section	Mean	SD	Skewness	Kurtosis
9	English	14.37	5.41	0.90	0.75
	Math	17.12	3.84	1.47	2.93
	Reading	17.65	5.85	1.04	0.7
	Science	16.33	4.91	0.57	0.19
	STEM	16.97	4.06	1.02	1.14
	Composite	16.49	4.42	0.99	0.69
10	English	14.88	5.86	0.9	0.59
	Math	17.15	4.26	1.55	2.83
	Reading	17.8	6.15	0.97	0.44
	Science	16.57	5.13	0.69	0.39
	STEM	17.11	4.38	1.17	1.38
	Composite	16.73	4.77	1.05	0.69

Figure 6.1. Scale Score Distribution Comparisons for Grades



Effective Weights

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

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

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

Table 6.7 contains the variance-covariance matrix of the scale scores of one operational form for effective weights calculation based on Fall 2023 and Spring 2024 operational data. For example, the effective weight for English was computed by adding the four numbers in the first row (32.81, 16.41, 26.8, and 20.75). This sum was then divided by the sum of all the elements in the variance-covariance matrix. Since both variance and covariance are included in the numerator, a greater variance or covariance with other test sections could lead to a greater effective weight.

Tables 6.8 and 6.9 contain the effective weight for each test section score contributing to the variances of the Composite and STEM scores separately based on the four operational forms. Regarding these scores, the effective weights remain consistent across forms. The effective weights for typical ACT forms from the most recent ACT technical manual (ACT, 2024) are provided as references. From Table 6.9, it should be noted that, compared with the science score, the math score has a slightly larger effective weight in STEM for the ACT test. By contrast, for PreACT Secure, the science score has a slightly greater effective weight in STEM. One possible explanation could be that, compared with the ACT, the science score on the PreACT Secure test has larger variance values than the math score, as shown in Table 6.7. Note that the summation of some proportions in Table 6.9 does not equal one because of rounding errors.

Table 6.7. Scale Score Variance-Covariances from one PreACT Secure Test Form

Test	Test section	English	Math	Reading	Science
PreACT Secure	English	32.81	16.41	26.80	20.75
	Math	16.41	17.07	16.13	15.10
	Reading	26.80	16.13	36.68	22.01
	Science	20.75	15.10	22.01	25.62

Table 6.8. Effective Weights of Composite Score for the PreACT Secure and ACT Tests

Test	Test section	Number of items	Proportion of total	Effective weight
PreACT Secure	English	36	0.29	0.27–0.29
	Math	33	0.27	0.17–0.19
	Reading	25	0.20	0.28–0.31
	Science	30	0.24	0.23–0.25
ACT	English	75	0.35	0.27–0.29
	Math	60	0.28	0.22–0.23
	Reading	40	0.19	0.26–0.28
	Science	40	0.19	0.21–0.24

Table 6.9. Effective Weights of STEM Score for the PreACT Secure and ACT Tests

Test	Test section	Number of items	Proportion of total	Effective weight
PreACT Secure	Math	33	0.52	0.42–0.45
	Science	30	0.48	0.55–0.58
ACT	Math	60	0.60	0.49–0.52
	Science	40	0.40	0.48–0.51

Correlations

The correlations of scale scores were computed based on the Fall 2023 and Spring 2024 PreACT Secure data and compared with the scale-score correlations from the most recent ACT technical manual (ACT, 2024), as shown in Table 6.10. Correlations among PreACT Secure scale scores are slightly lower than those of the ACT.

Table 6.10. Correlations Among the PreACT Secure Scores and ACT Test Scores

Test	Test section	English	Math	Reading	Science	Composite	STEM
PreACT Secure	English	1.00	0.69	0.77	0.72	0.91	0.76
	Math	—	1.00	0.64	0.72	0.84	0.91
	Reading	—	—	1.00	0.72	0.90	0.74
	Science	—	—	—	1.00	0.88	0.94
	Composite	—	—	—	—	1.00	0.93
	STEM	—	—	—	—	—	1.00
ACT	English	1.00	0.77	0.81	0.79	0.93	0.82
	Math	—	1.00	0.70	0.82	0.89	0.95
	Reading	—	—	1.00	0.77	0.90	0.77
	Science	—	—	—	1.00	0.92	0.95
	Composite	—	—	—	—	1.00	0.95
	STEM	—	—	—	—	—	1.00

6.5 PreACT Secure Norms

One of the intended uses of PreACT Secure test scores is to understand student performance relative to national norms. PreACT Secure score reports provide percentile ranks for English, math, reading, science, STEM, and Composite scores. A PreACT norming study is typically conducted each year, and the results are used to assign percentile ranks to scores. The goal of the norming study is to estimate norms (including percentile ranks) that are representative of examinees across the country who take the ACT test. Norms are estimated for Fall Grade 9, Spring Grade 9, Fall Grade 10, Spring Grade 10, and Fall Grade 11, respectively. Sample selection and weighting procedures are used to ensure that each sample is representative of the ACT-tested population with respect to gender, race/ethnicity, geographic region, and school category (defined by public/nonpublic status and percentage of students eligible for free and reduced-price lunch). Through this design, student performance on the PreACT can be

understood for each grade level and season, relative to the population of students who go on to take the ACT test. Detailed descriptions of the PreACT norming studies, including norming samples, weighting methodology, estimation procedures, and analyses results, is documented in separate reports (Lu & Allen, 2019). The most recent norm tables can be found at https://success.act.org/s/article/PreACT-and-PreACT-89-US-Ranks.

The percentile ranks reported for PreACT Secure are based on the most recent PreACT norming study. However, future studies will examine whether different norms are needed for PreACT and PreACT Secure.

6.6 Differential Item Functioning

Differential item functioning (DIF) can be described as a statistical difference between the probability of the specific population subgroup (the “focal” group) getting the item right and the comparison population subgroup (the “base” 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 Secure tests were conducted separately for Grades 9 and 10 and each operational form. The procedures currently used for the PreACT Secure 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 Secure tests were conducted on each multiple-choice item for the seven group comparisons, as shown in Table 6.11 below.

Table 6.11. Group Comparison for DIF Analyses

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

Using pre-established criteria, any items in the four operational forms administered during Fall 2023 and Spring 2024 with STD or MH values exceeding the tolerance level were flagged. The flagging criteria for the STD procedure is to flag items when the absolute value of STD is greater than 0.10. Based on the STD procedure, for English, DIF was observed across various comparison groups: one item for female/male comparison, three items for Black/White comparison, six items for Hispanic comparison, and eight items for Asian/White comparison; for Math, DIF was also observed across various comparison groups: one item for the Hispanic/White comparison; four items for the Asian/White comparison, two items for the female/male comparison, and two items for Black/White comparison; for Reading, one item demonstrated DIF in the Hispanic/White comparison and two items in the Asian/White comparison; no item manifested DIF for Science. Table 6.12 shows the criteria for flagging DIF in multiple-choice items related to the MH procedure. In this table, MH-CHISQ denotes the *p*-value of the MH Chi-square statistic and MH-D signifies the delta-scaled MH alpha. Table 6.13 presents the items flagged according to the MH procedure. The comparison groups with no DIF B or DIF C across all test sections are not included in the table. Following the STD procedure, English has a relatively higher count of item flagged with DIF, while reading and science have fewer. The content experts reviewed all the flagged items and found no evidence of bias towards any specific group.

Table 6.12. Criteria for the A, B, and C DIF Categories on MH Procedure

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

Table 6.13. Summary of DIF Analysis according to MH Procedure

Test section	DIF group	A	B	C	Total number of items
English	Female/Male	138	6	0	144
	Black/White	139	2	3	144
	Hispanic/White	133	8	3	144
	Asian/White	124	16	4	144
Math	Female/Male	125	5	2	132
	Black/White	129	2	1	132
	Hispanic/White	127	5	0	132
	Asian/White	115	13	4	132
Reading	Female/Male	100	0	0	100
	Black/White	99	1	0	100
	Hispanic/White	94	6	0	100
	Asian/White	98	1	1	100
Science	Female/Male	120	0	0	120
	Black/White	119	1	0	120
	Hispanic/White	117	3	0	120
	Asian/White	117	3	0	120

6.7 Reliability and Measurement Error

Reliability quantifies the level of consistency in test scores across repeated test administrations and is usually estimated based on a single test administration. Coefficient alpha is one of the most widely used measures of reliability, and it provides reliability estimates for number correct scores. Table 6.14 shows the coefficient alpha reliability estimates for the raw scores of the four PreACT Secure operational forms administered in Fall 2023 and Spring 2024.

Table 6.14. Coefficient Alpha Reliability Estimates for Raw Scores

Form	English	Math	Reading	Science
A	0.83	0.83	0.82	0.79
B	0.87	0.85	0.83	0.77
C	0.87	0.88	0.84	0.84
D	0.85	0.86	0.84	0.81

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Table 6.15 exhibits the ranges of scale-score reliability estimates and the standard error of measurement (SEM) for the four operational forms based on Fall 2023 and Spring 2024 operational data. The estimated reliability and SEM ranges for the recent ACT forms (ACT, 2024) are provided as well for the purpose of comparison.

Table 6.15. Estimated Scale Score Reliabilities and Standard Error of Measurement

Test	Form	Statistic	English	Math	Reading	Science	Composite	STEM
PreACT Secure	A	Reliability	0.84	0.83	0.81	0.75	0.94	0.88
		SEM	2.16	1.39	2.27	2.09	1.00	1.25
	B	Reliability	0.86	0.86	0.80	0.72	0.94	0.88
		SEM	2.09	1.39	2.38	2.26	1.03	1.33
	C	Reliability	0.86	0.88	0.82	0.80	0.95	0.92
		SEM	2.14	1.45	2.39	2.20	1.04	1.32
	D	Reliability	0.84	0.87	0.81	0.75	0.95	0.9
		SEM	2.17	1.49	2.55	2.19	1.07	1.32
ACT	—	Reliability	0.93–0.94	0.91–0.93	0.86–0.90	0.86–0.89	0.97–0.97	0.94–0.95
		SEM	1.61–1.76	1.50–1.63	2.08–2.57	1.79–2.25	0.89–1.01	1.20–1.36

6.8 Classification Consistency

PreACT Secure examinees are classified into three college readiness levels based on their scale scores and PreACT Readiness Levels.[1] The classification consistency reflects the percentages of examinees who would be consistently classified into the same achievement levels on two equivalent administrations of the test. However, since the test (or parallel forms of the test) is not often administered twice to the same sample, it is necessary to estimate classification consistency with a single test administration using psychometric methods. Two classification consistency indices, agreement rate (Livingston & Lewis, 1993) and Kappa index (Cohen, 1960; Swaminathan et al., 1974), are used to quantify the reliability of categorizing examinees into different readiness levels.

Table 6.16 presents a summary of classification consistency indices—the agreement rate (percentage consistently classified) and Kappa index. “Two levels” refers to On Target/Not on Target decisions, and “Three levels” refers to classification using all three Readiness Levels (i.e., In Need, Close to Target, and On Target). As can be observed from this table, agreement rates were high with two levels and moderate with three levels for all scores.

[1] Refer to Chapter 5, “ACT College and Career Readiness Standards and College Readiness Benchmarks,” for the details of the PreACT Readiness Levels.

Table 6.16. Classification Consistency

Form	Test section	Two levels		Three levels	
		Agreement	Kappa	Agreement	Kappa
A	English	0.84	0.67	0.65	0.46
	Math	0.94	0.75	0.82	0.57
	Reading	0.89	0.71	0.69	0.48
	Science	0.88	0.65	0.80	0.55
	STEM	0.98	0.78	0.95	0.70
B	English	0.86	0.71	0.70	0.53
	Math	0.93	0.77	0.79	0.56
	Reading	0.89	0.71	0.73	0.52
	Science	0.87	0.60	0.72	0.46
	STEM	0.97	0.79	0.94	0.70
C	English	0.85	0.69	0.69	0.51
	Math	0.92	0.80	0.78	0.61
	Reading	0.88	0.72	0.71	0.52
	Science	0.85	0.65	0.74	0.53
	STEM	0.96	0.81	0.91	0.72
D	English	0.84	0.67	0.66	0.48
	Math	0.90	0.75	0.75	0.57
	Reading	0.87	0.70	0.69	0.49
	Science	0.86	0.63	0.74	0.50
	STEM	0.97	0.79	0.92	0.70

Chapter 7
Validity Evidence

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

This chapter describes evidence of the validity of PreACT® Secure™ scores with respect to five areas: 1) test content, 2) response processes, 3) internal structure, 4) relationships to other variables, and 5) consequences of testing.

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

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

Secondary uses of PreACT Secure include

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

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

7.1 Evidence Based on Test Content

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

As described in Chapters 2 and 3, PreACT Secure contains four content domains (English, math, reading, and science). PreACT Secure is designed with developmentally articulated test specifications, ensuring that the content measured follows a logical developmental sequence across the high school experience from Grades 8 and 9 (PreACT 8/9) to Grade 10 (PreACT or

PreACT Secure) to Grades 11 and 12 (the ACT test). The programs also share item formats and follow consistent reporting procedures. PreACT Secure is reviewed every year by subject matter experts to ensure that its basic structure matches that of the ACT test and that the two tests' scale scores are comparable.

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

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

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

7.2 Evidence Based on Response Processes

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

As mentioned previously, PreACT Secure, like the ACT, was developed using a theory of action. The theory of action helps answer questions related to the purpose of the assessment—intended users, uses, benefits, interpretations, and assessment outcomes. The answers to these questions provide information needed to identify high-value skill targets in each subject area, providing focal points for the development of test items and forms. The process set forth by the theory of action also gives rise to potential ways of bringing about the intended goals of

the assessment. For example, cognitive labs, piloting, and field-testing are used to evaluate student response processes on items and iteratively improve the specifications and design of the assessment. The related analyses can provide evidence about the fit between the constructs and the cognitive processes engaged in by test takers. The collection and evaluation of all validity evidence is ongoing, and additional evidence based on response processes may be provided in the future.

7.3 Evidence Based on Internal Structure

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

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

A scree plot shows the relationship between eigenvalues and the number of extracted factors and is typically evaluated by identifying the “elbow” in the plot, which indicates the number of dimensions to retain (Cattell, 1966). Figure 7.1 shows the scree plots of one operational form for the English, math, reading, and science tests. (The scree plots for the other operational forms closely mirror these, so only one set of plots is presented.) As shown in this figure, the elbow appears after the first eigenvalue, which is evidence for a single dimension. Tables 7.1 through 7.4 show the proportion of variance accounted for by the first 10 factors for the English, math, reading, and science tests (respectively) for the four operational forms. Since the proportions of variance accounted for by the factors after the tenth are trivial, the tables present overall proportions for the remaining factors. As shown in these tables, for each test section, the percentage of variance accounted for by the second factor was smaller than 10%. According to Hatcher (1994), factors that account for less than 10% of the variance should not be retained. As a result of that, it is reasonable to believe that PreACT Secure should be represented by a unidimensional model.

Model fit was evaluated by comparing the model fit index between one- and two-factor models, as shown by the fit statistics given in Tables 7.5 through 7.8. The fit statistics include the widely used chi-square test, plus other fit statistics—the comparative fit index (CFI), the Tucker–Lewis index (TLI), the root mean square error of approximation (RMSEA), and the standardized root mean square residual (SRMR)—to supplement the chi-square index due to its sensitivity to large sample sizes (Bollen, 1989; Hu & Bentler, 2009). Fit indices were flagged with an asterisk in these four tables if they showed inadequate fit. Tables 7.5 through 7.8 also show the differences in the fit statistics (DIFF) between the one- and two-factor models. The interfactor

correlation (CORR) between Factors 1 and 2 in the tables was used to evaluate how well the two factors could be distinguished from each other in the model. All these statistical indices were simultaneously evaluated to compare the goodness of fit of the one- and two-factor models. Fit statistics for the English, math, reading, and science tests showed evidence supporting the one-factor model in most cases. Although the chi-square tests were statistically significant for all tests, this was likely due to the sensitivity of chi-square statistics to large sample sizes. Compared with the use of the one-factor model, the use of the two-factor model did not substantially improve the model fit. The interfactor correlations in the two-factor model were relatively large (>0.5) for all tests, which indicates a strong relationship between the two factors. Based on the principle of parsimony, the one-factor model was considered adequate for PreACT Secure.

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

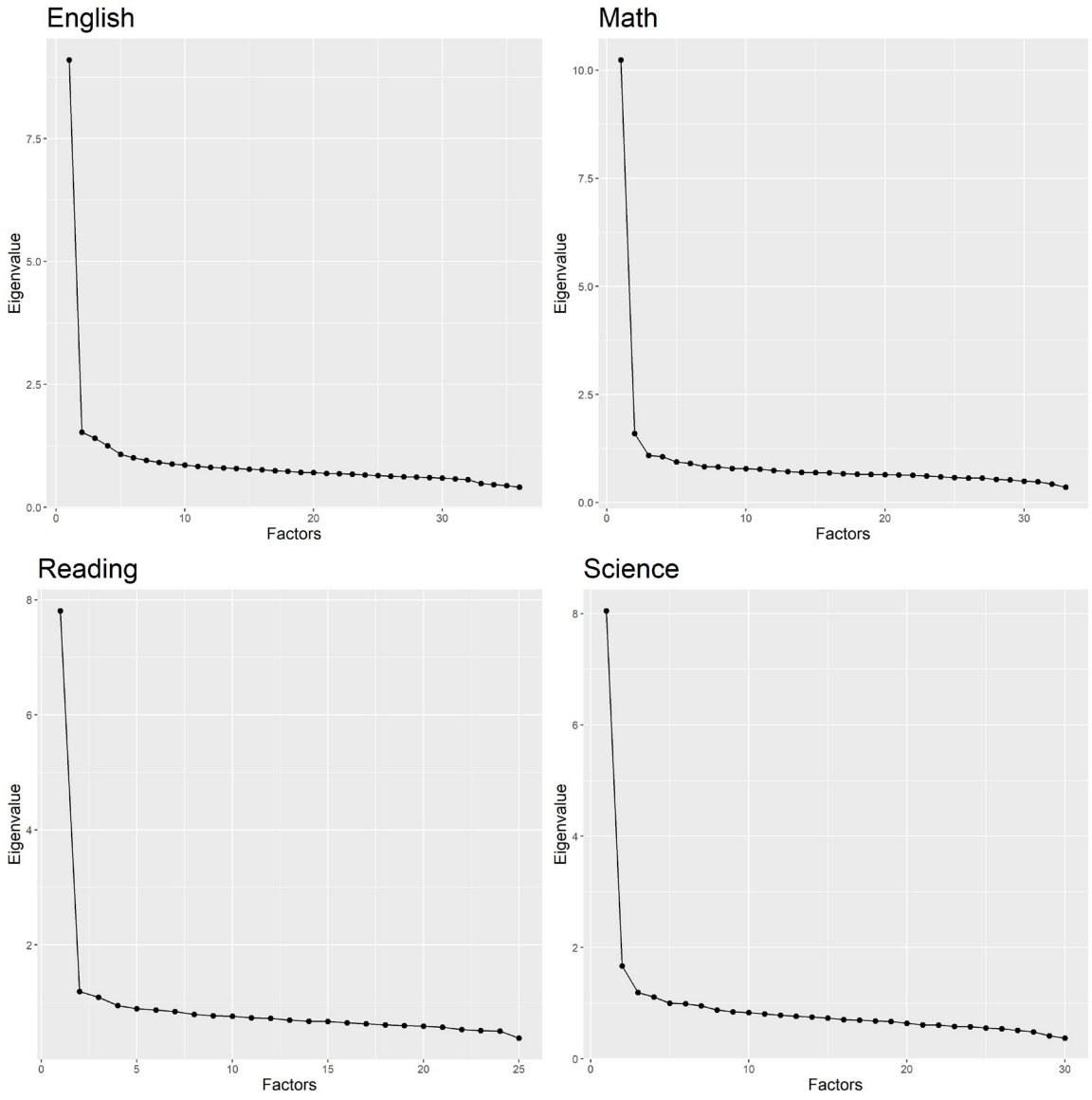


Table 7.1. Percentage of Variance Explained by Factors for the Four PreACT Secure Operational Forms: English

Factor	Form A %	Form B %	Form C %	Form D %
1	23.6	28.5	27.9	26.1
2	4.5	4.6	4.2	5.4
3	4.0	4.0	3.8	3.6
4	3.6	3.3	3.3	3.1
5	3.0	2.9	2.8	3.1
6	2.9	2.7	2.7	2.9
7	2.8	2.6	2.7	2.8
8	2.6	2.5	2.5	2.6
9	2.5	2.4	2.4	2.5
10	2.4	2.3	2.3	2.5
11–45	48.1	44.2	45.2	45.5

Table 7.2. Percentage of Variance Explained by Factors for the Four PreACT Secure Operational Forms: Math

Factor	Form A %	Form B %	Form C %	Form D %
1	25.7	29.7	33.9	29.5
2	4.4	5.9	5.4	5.2
3	4.1	3.6	3.3	3.3
4	3.6	3.4	3.1	3.3
5	3.2	3.2	2.8	3.1
6	2.9	3.2	2.7	2.9
7	2.7	2.8	2.6	2.8
8	2.6	2.7	2.5	2.6
9	2.6	2.6	2.5	2.6
10	2.5	2.5	2.4	2.4
11–36	45.7	40.3	38.9	42.4

Table 7.3. Percentage of Variance Explained by Factors for the Four PreACT Secure Operational Forms: Reading

Factor	Form A %	Form B %	Form C %	Form D %
1	29.4	29.1	31.9	31.3
2	4.9	4.7	4.8	4.4
3	4.3	4.6	4.2	3.9
4	3.9	4.3	3.6	3.6
5	3.7	3.6	3.5	3.6
6	3.5	3.4	3.3	3.5
7	3.5	3.3	3.3	3.4
8	3.4	3.2	3.2	3.3
9	3.2	3.1	3.0	3.2
10	3.1	3.1	3.0	3.1
11–25	37.1	37.7	36.1	36.6

Table 7.4. Percentage of Variance Explained by Factors for the Four PreACT Secure Operational Forms: Science

Factor	Form A %	Form B %	Form C %	Form D %
1	22.6	20.4	28.4	24.2
2	5.6	4.9	5.6	4.8
3	4.4	4.2	4.3	3.8
4	4.1	4.0	3.4	3.5
5	3.5	3.3	3.3	3.4
6	3.4	3.2	3.2	3.4
7	3.2	3.2	3.0	3.2
8	3.0	3.1	2.9	3.1
9	2.9	3.0	2.9	3.0
10	2.9	2.9	2.8	2.9
11–30	44.3	47.7	40.2	44.8

Table 7.5. Model Fit Comparison Between One- and Two-Factor Models for PreACT Secure Operational Form A

Statistic	English			Math			Reading			Science		
	1	2	DIFF	1	2	DIFF	1	2	DIFF	1	2	DIFF
Chi-square	13267.47	9238.90	2969.94	6640.40	4156.28	1929.97	4480.51	2696.81	1444.72	10122.62	5923.72	3017.46
DF	594	559	35	495	463	32	275	251	24	405	376	29
p-value	0*	0*	0*	0*	0*	0*	0*	0*	0*	0*	0*	0*
CFI	0.94	0.96	0.02	0.97	0.98	0.01	0.97	0.99	0.01	0.93	0.96	0.03
TLI	0.94	0.96	0.02	0.96	0.98	0.01	0.97	0.98	0.01	0.92	0.95	0.03
RMSEA	0.03	0.02	0.00	0.02	0.02	0.00	0.02	0.02	0.01	0.03	0.02	0.01
SRMR	0.04	0.03	0.01	0.03	0.02	0.01	0.03	0.02	0.01	0.04	0.03	0.01
CORR	—	0.24	—	—	0.67	—	—	0.12	—	—	0.48	—

Table 7.6. Model Fit Comparison Between One- and Two-Factor Models for PreACT Secure Operational Form B

Statistic	English			Math			Reading			Science		
	1	2	DIFF	1	2	DIFF	1	2	DIFF	1	2	DIFF
Chi-square	14238.94	8698.18	3783.48	12321.82	4854.58	4755.24	4083.67	2811.29	1072.18	6073.60	4043.11	1591.62
DF	594	559	35	495	463	32	275	251	24	405	376	29
p-value	0*	0*	0*	0*	0*	0*	0*	0*	0*	0*	0*	0*
CFI	0.95	0.97	0.02	0.95	0.98	0.03	0.98	0.98	0.01	0.95	0.97	0.02
TLI	0.95	0.97	0.02	0.95	0.98	0.03	0.97	0.98	0.01	0.94	0.96	0.02
RMSEA	0.03	0.02	0.01	0.03	0.02	0.01	0.02	0.02	0.00	0.02	0.02	0.00
SRMR	0.04	0.03	0.01	0.04	0.03	0.02	0.03	0.02	0.01	0.03	0.03	0.01
CORR	—	0.58	—	—	0.34	—	—	0.74	—	—	0.60	—

Table 7.7. Model Fit Comparison Between One- and Two-Factor Models for PreACT Secure Operational Form C

Statistic	English			Math			Reading			Science		
	1	2	DIFF	1	2	DIFF	1	2	DIFF	1	2	DIFF
Chi-square	29698.52	20477.60	6929.17	27244.84	9709.87	11130.56	8981.93	5274.16	3059.78	29201.95	14153.41	10512.79
DF	594	559	35	495	463	32	275	251	24	405	376	29
p-value	0*	0*	0*	0*	0*	0*	0*	0*	0*	0*	0*	0*
CFI	0.96	0.98	0.01	0.97	0.99	0.02	0.98	0.99	0.01	0.95	0.98	0.02
TLI	0.96	0.97	0.01	0.97	0.99	0.02	0.98	0.99	0.01	0.95	0.98	0.02
RMSEA	0.03	0.02	0.00	0.03	0.02	0.01	0.02	0.02	0.00	0.03	0.02	0.01
SRMR	0.04	0.03	0.01	0.04	0.02	0.02	0.03	0.02	0.01	0.04	0.03	0.01
CORR	—	0.74	—	—	0.57	—	—	0.82	—	—	0.54	—

Table 7.8. Model Fit Comparison Between One- and Two-Factor Models for PreACT Secure Operational Form D

Statistic	English			Math			Reading			Science		
	1	2	DIFF	1	2	DIFF	1	2	DIFF	1	2	DIFF
Chi-square	47506.82	22573.62	15218.30	24004.62	9035.51	9948.07	6346.05	3833.70	2146.50	16747.67	10132.66	5192.66
DF	594	559	35	495	463	32	275	251	24	405	376	29
p-value	0*	0*	0*	0*	0*	0*	0*	0*	0*	0*	0*	0*
CFI	0.93	0.97	0.04	0.97	0.99	0.02	0.99	0.99	0.01	0.96	0.98	0.02
TLI	0.93	0.96	0.04	0.96	0.99	0.02	0.99	0.99	0.01	0.96	0.97	0.02
RMSEA	0.03	0.02	0.01	0.03	0.02	0.01	0.02	0.01	0.00	0.02	0.02	0.01
SRMR	0.04	0.03	0.01	0.03	0.02	0.01	0.02	0.02	0.01	0.03	0.02	0.01
CORR	—	0.40	—	—	0.44	—	—	0.85	—	—	0.65	—

Note. DF is the degree of freedom; CFI is the comparative fit index; TLI is the Tucker–Lewis index; RMSEA is the root mean square error of approximation; SRMR is the standardized root mean square residual; and CORR is the correlation between Factor 1 and Factor 2 loadings. Flag criteria included CFI < 0.95, TLI < 0.95, RMSEA > 0.06, 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 (Hu & Bentler, 2009).

7.4 Evidence Based on Relationships to Other Variables

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

7.4.1 Relationship With ACT Test Scores

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

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

Table 7.9 presents summary statistics and correlations of PreACT and ACT scores. In addition to Pearson correlations (r), disattenuated correlations (r_{dis}) are also presented. Disattenuated correlations are estimates of what the correlations would be if the PreACT and ACT tests measured achievement without error (e.g., had reliabilities of 1.0).

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

Table 7.9. Correlations of PreACT and 11th-Grade ACT Scores

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

7.4.2 Relationship With High School Coursework and Grades

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

Table 7.10 presents correlations between PreACT test scores and high school grade averages. The correlations are based on data collected through the spring of 2022 for students who took PreACT in the fall of 10th grade and the ACT in the spring of 11th grade. Overall high school grade point average (GPA) was calculated based on students' self-reported grades in core subject areas (English, math, social studies, and natural science). Subject-area GPAs were calculated using the courses within each of the four core subject areas. Correlations between GPAs and test scores from the same subject area were examined (PreACT reading scores were used for social studies courses).

The correlations are presented for the total group ("All students") and for student groups defined by gender, race/ethnicity, English language learner status, special education status, and free/reduced-price lunch eligibility. The information in Table 7.10 is summarized as follows:

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

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

Table 7.10. Correlations of PreACT Scores with High School Grade Averages (HSGPA and Subject-Specific GPAs), by Student Group

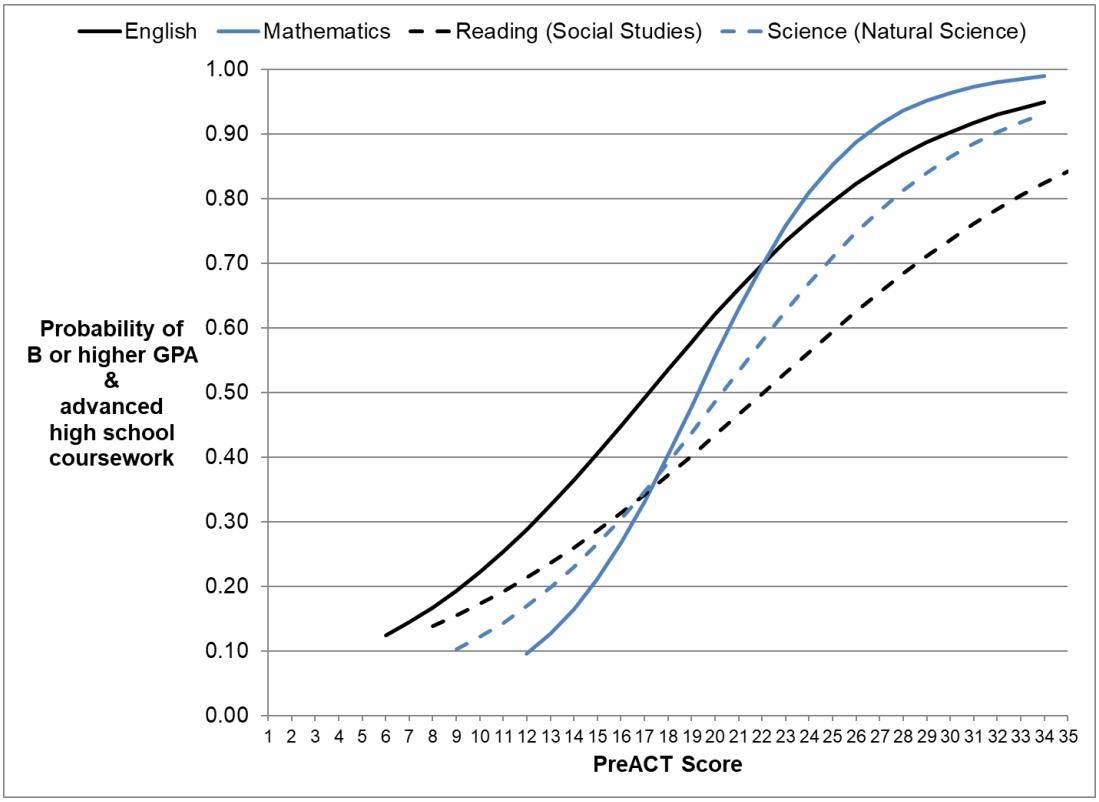
Student group		*N*	High school subject area / PreACT test score				
			Overall/ Composite	English/ English	Math/ math	Social studies/ reading	Natural science/ science
All students		244,116	.57	.48	.49	.42	.45
Gender	Female	130,487	.57	.46	.48	.41	.44
	Male	111,179	.59	.48	.52	.43	.47
Race/ ethnicity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

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

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

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

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



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

7.4.3 Relationship With AP Exam Success

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

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

courses. The researchers strengthened the prediction by using combined PreACT scores that were aligned to the content of the AP courses. The sum of the English and reading scores (denoted E+R) was used for ELA-related AP courses, and the STEM score (the average of the math and science scores) was used for STEM-related courses. As a result, the recommended links to AP exam success were developed in relation to content-relevant scores for most courses (shown in Table 7.11).

For each course and outcome, two cut scores are provided—one for fall testing and one for spring—depending on when students take PreACT or PreACT Secure. For example, the first row of results within the table indicates that students who test in the fall and achieve a PreACT or PreACT Secure E+R score of 42 or higher are likely academically ready to take AP English Language and Composition in the subsequent academic year, as they have a 50% or greater chance of earning a 3 or higher on the corresponding AP exam. Those with a PreACT or PreACT Secure E+R score of 54 or higher have a 50% or greater chance of earning a 4 or higher. The AP-ready cut scores derived from spring testing are slightly higher at 45 (for 3 or higher) and 56 (for 4 or higher) to account for the reduced time between PreACT testing and taking the AP exam. Table 7.11 also reports the correlations (*r*) between test scores (PreACT, ACT, or ACT Aspire) and AP exam scores.

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

Table 7.11. PreACT Scores Associated with Approximately a 50% Chance of Success on AP Exams

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

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

*Cut scores are not reported for AP Calculus BC. As recommended by College Board as part of AP Potential, students who meet the AP Calculus AB cut scores and perform well in courses leading up to Calculus may consider taking AP Calculus BC.

**Cut scores are not reported for AP Physics 2. As recommended by College Board as part of AP Potential, students who meet the AP Physics 1 cut scores and perform well in prerequisite courses for AP Physics 2 may consider taking AP Physics 2.

7.5 Evidence Related to Consequences of Testing

Consequences of testing include (a) interpretations and uses of test scores intended by the test developer, (b) claims made about the test that are not directly based on test score, and (c) unintended consequences (AERA et al., 2014). ACT continually seeks evidence of both positive and negative consequences. In this section, we discuss intended consequences of PreACT Secure testing and discuss research that examined the effects of PreACT adoption on college readiness outcomes.

7.5.1 Intended Consequences of PreACT Secure Testing

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

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

7.5.2 Effects of PreACT Adoption on College Readiness Outcomes

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

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

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

As the PreACT Secure assessment program matures, additional research will be needed to examine the consequences of testing.

Chapter 8
Growth Interpretations

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

- Measuring growth from the PreACT Secure test to the ACT® test when the PreACT Secure test is administered in Grade 10 and the ACT test is administered in Grade 11.
- Measuring growth from the PreACT 8/9® test to the PreACT Secure test when PreACT 8/9 is administered in Grade 8 or 9 and the PreACT Secure test is administered in Grade 10.

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

8.1 Gain Scores

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

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

8.1.1 Gain Score Statistics

For all subject areas, positive mean gain scores are anticipated because students are expected to increase their knowledge and skills in the tested areas with more schooling. In this section, we examine gain score summary statistics. Table 8.1 uses PreACT 8/9 and PreACT data collected through winter 2023 and ACT test scores obtained through spring 2022 to provide summary statistics for eight groups of students. The groups are defined by which assessments they took, the grade levels and seasons during which they tested, and the time elapsed between the tests.

We classified student records as having been disrupted by the onset of the pandemic if the first test occurred before April 1, 2020, and the second test occurred after June 1, 2020. (Across the United States, most in-person schooling was suspended during this period.) For each group listed in Table 8.1, we provide the number of students and the mean Composite score gains by pandemic disruption status. For Groups 1 and 2, there were very few cases where growth was disrupted by the pandemic. For Groups 11 and 12, nearly all cases were disrupted by the pandemic. For all other groups, we find that mean Composite score gains were lower for students whose gains were disrupted by the onset of the pandemic.

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

The gain score statistics presented in this chapter are based on data from PreACT assessments. While we expect similar results from PreACT Secure assessments, additional research is needed to examine the extent to which gain scores are different when based on PreACT Secure instead of PreACT.

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

Group	Number of students		Mean composite gain		
	Not disrupted	Disrupted	Not disrupted	Disrupted	Difference
1. PreACT 8/9 to PreACT 8/9, fall Grade 8 to fall Grade 9, 10–14 month span	6,352	94	0.93	—	—
2. PreACT 8/9 to PreACT 8/9, spring Grade 8 to spring Grade 9, 10–14 month span	4,052	365	0.91	—	—
3. PreACT 8/9 to PreACT, fall Grade 9 to fall Grade 10, 10–14 month span	30,823	3,710	0.51	0.00	−0.51
4. PreACT 8/9 to PreACT, spring Grade 9 to spring Grade 10, 10–14 month span	18,455	1,095	0.31	0.02	−0.29
5. PreACT to PreACT, fall Grade 9 to fall Grade 10, 10–14 month span	44,965	5,598	1.50	1.28	−0.22
6. PreACT to PreACT, spring Grade 9 to spring Grade 10, 10–14 month span	47,987	1,890	1.55	1.11	−0.44
7. PreACT to ACT, spring Grade 10 to spring Grade 11, 10–14 month span	344,156	16,683	1.11	0.62	−0.50
8. PreACT to ACT, fall Grade 10 to spring Grade 11, 15–19 month span	577,301	200,760	1.55	0.67	−0.87
9. PreACT to ACT, spring Grade 9 to spring Grade 11, 22–26 month span	24,936	28,135	2.75	1.75	−1.00
10. PreACT to ACT, fall Grade 9 to spring Grade 11, 27–31 month span	22,680	38,415	3.86	2.78	−1.08
11. PreACT 8/9 to ACT, spring Grade 9 to spring Grade 11, 22–26 month span	22	4,992	—	0.97	—
12. PreACT 8/9 to ACT, fall Grade 9 to spring Grade 11, 27–31 month span	0	22,933	—	1.15	—

The summary statistics presented in Table 8.2 include the mean Test 1 (PreACT 8/9 or PreACT) and Test 2 (PreACT 8/9, PreACT, or ACT) scores, correlations of Test 1 scores and Test 2 scores, the mean gain score, and the standard deviation of the gain score. The mean gain per month is also presented to allow comparisons of growth rates across the different groups. The samples include students who tested with PreACT 8/9 or PreACT through winter 2023 and ACT test scores obtained through spring 2022, excluding cases where growth was disrupted by the onset of the pandemic.

Table 8.2. Gain Score Summary Statistics

Group	Subject	Mean scores		*r*	Mean gain	SD gain	Mean gain per month
		Test 1	Test 2				
1. PreACT 8/9 to PreACT 8/9, fall Grade 8 to fall Grade 9, 10–14 months apart	Composite	15.80	16.73	0.87	0.93	2.14	0.08
	English	14.02	14.71	0.75	0.69	3.74	0.06
	Math	16.00	16.65	0.74	0.65	2.52	0.05
	Reading	16.97	18.22	0.71	1.25	4.57	0.10
	Science	15.67	16.84	0.70	1.16	3.33	0.10
2. PreACT 8/9 to PreACT 8/9, spring Grade 8 to spring Grade 9, 10–14 months apart	Composite	17.95	18.86	0.88	0.91	2.18	0.08
	English	16.61	17.75	0.77	1.14	3.76	0.10
	Math	17.65	18.36	0.76	0.72	2.81	0.06
	Reading	19.76	20.29	0.71	0.53	4.49	0.04
	Science	17.26	18.54	0.74	1.29	3.26	0.11
3. PreACT 8/9 to PreACT, fall Grade 9 to fall Grade 10, 10–14 months apart	Composite	17.63	18.14	0.88	0.51	2.25	0.04
	English	15.84	16.46	0.78	0.62	3.59	0.05
	Math	17.80	17.80	0.79	0.00	2.67	0.00
	Reading	19.09	19.93	0.73	0.83	4.73	0.07
	Science	17.26	17.86	0.72	0.61	3.58	0.05
4. PreACT 8/9 to PreACT, spring Grade 9 to spring Grade 10, 10–14 months apart	Composite	19.26	19.58	0.88	0.32	2.46	0.03
	English	17.56	17.93	0.80	0.37	3.85	0.03
	Math	19.11	19.08	0.80	−0.03	2.93	0.00
	Reading	21.31	21.58	0.72	0.27	4.93	0.02
	Science	18.54	19.25	0.72	0.71	3.79	0.06
5. PreACT to PreACT, fall Grade 9 to fall Grade 10, 10–14 months apart	Composite	17.18	18.68	0.89	1.50	2.32	0.13
	English	15.36	17.28	0.81	1.92	3.68	0.16
	Math	17.10	18.38	0.81	1.28	2.61	0.11
	Reading	18.49	20.23	0.76	1.74	4.61	0.15
	Science	17.25	18.32	0.71	1.07	3.76	0.09
6. PreACT to PreACT, spring Grade 9 to spring Grade 10, 10–14 months apart	Composite	18.16	19.72	0.89	1.56	2.35	0.13
	English	16.58	18.45	0.81	1.87	3.71	0.16
	Math	17.90	19.40	0.83	1.51	2.78	0.13
	Reading	19.46	21.33	0.76	1.87	4.64	0.16
	Science	18.20	19.19	0.72	0.99	3.83	0.08
7. PreACT to ACT, spring Grade 10 to spring Grade 11, 10–14 months apart	Composite	19.13	20.27	0.91	1.14	2.35	0.10
	English	17.30	19.61	0.84	2.31	3.74	0.19
	Math	18.75	19.81	0.86	1.06	2.74	0.09
	Reading	20.67	20.80	0.79	0.13	4.33	0.01
	Science	19.30	20.36	0.76	1.06	3.79	0.09
8. PreACT to ACT, fall Grade 10 to spring Grade 11, 15–19 months apart	Composite	18.14	19.69	0.90	1.55	2.46	0.09
	English	16.14	18.68	0.83	2.54	3.78	0.15
	Math	18.18	19.55	0.84	1.37	2.86	0.08
	Reading	19.50	20.20	0.77	0.70	4.46	0.04
	Science	18.25	19.83	0.74	1.58	3.90	0.10
9. PreACT to ACT, spring Grade 9 to spring Grade 11, 22–26 months apart	Composite	18.33	21.16	0.88	2.82	2.70	0.12
	English	17.03	20.85	0.82	3.83	3.95	0.16
	Math	18.14	20.55	0.81	2.42	3.10	0.10
	Reading	19.19	21.66	0.74	2.47	4.61	0.10
	Science	18.50	21.06	0.71	2.56	3.99	0.11
10. PreACT to ACT, fall Grade 9 to spring Grade 11, 27–31 months apart	Composite	18.13	21.99	0.87	3.86	2.94	0.13
	English	16.58	21.70	0.80	5.12	4.27	0.18
	Math	18.04	21.49	0.80	3.45	3.50	0.12
	Reading	19.05	22.47	0.75	3.43	4.69	0.12
	Science	18.35	21.78	0.72	3.43	4.10	0.12

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

The PreACT to ACT gain score results from Table 8.2 can be summarized as follows:

- Gain scores tend to be highest in English relative to the other subject areas.
- Average gain scores increase with more time between the PreACT and ACT tests.
- The average gains per month are similar across the four PreACT-to-ACT groups, except for reading. Average monthly gains range from 0.09 to 0.13 for the Composite, 0.15 to 0.19 for English, 0.08 to 0.12 for math, 0.01 to 0.12 for reading, and 0.09 to 0.12 for science.
- The mean gain in Composite score ranges from 1.14 (for spring Grade 10 to spring Grade 11) to 3.86 (for fall Grade 9 to spring Grade 11).
- Correlations between PreACT and ACT test scores are highest for the Composite, followed by English and math. Correlations are lowest for reading and science, which is expected because the reading and science tests are shorter (and have lower reliability) than the English and math tests.
- The standard deviations of gain scores suggest that there is considerable variability in gain scores. Some of this variability is due to the measurement error inherent in PreACT and ACT test scores.

The results from Table 8.2 also show that average gains from PreACT 8/9 to PreACT (Groups 3 and 4) are smaller than the average gains from PreACT to PreACT (Groups 5 and 6). More research is needed to understand why the average gains are lower when PreACT 8/9 is used as the first test.

Average PreACT-to-PreACT gain scores (Groups 5 and 6) can also be compared to the average PreACT-to-ACT gain scores for students who tested approximately one year apart (Group 7). For reading, the mean PreACT-to-PreACT gain scores (1.74 and 1.87) are notably higher than the mean PreACT-to-ACT gain score (0.13). Conversely, the mean PreACT-to-PreACT gain scores for English (1.92 and 1.87) are lower than the mean PreACT-to-ACT gain score for English (2.31).

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

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

Student group		*N*	Test section/ score				
			English	Math	Reading	Science	Composite
All students		537,162	2.52	1.34	0.73	1.60	1.55
Gender	Female	269,563	2.53	1.29	0.68	1.52	1.51
	Male	251,142	2.53	1.42	0.83	1.69	1.62
Race/ethnicity	Black	85,449	1.99	0.69	0.43	1.23	1.08
	Asian	17,718	4.00	2.19	1.34	2.29	2.45
	Hispanic	73,762	2.33	1.11	0.58	1.38	1.35
	Native American	7,950	1.97	0.71	0.60	1.21	1.12
	Native Hawaiian/OPI	1,058	2.47	1.20	0.51	1.74	1.50
	Two or more races	33,080	2.38	1.26	0.70	1.52	1.47
	White	312,032	2.65	1.56	0.82	1.73	1.69
English learner		26,846	2.30	0.90	0.56	1.25	1.25
Special education		10,343	1.91	0.34	0.56	1.08	0.97
Free/reduced-price lunch eligible		7,322	1.99	0.64	0.57	1.06	1.05

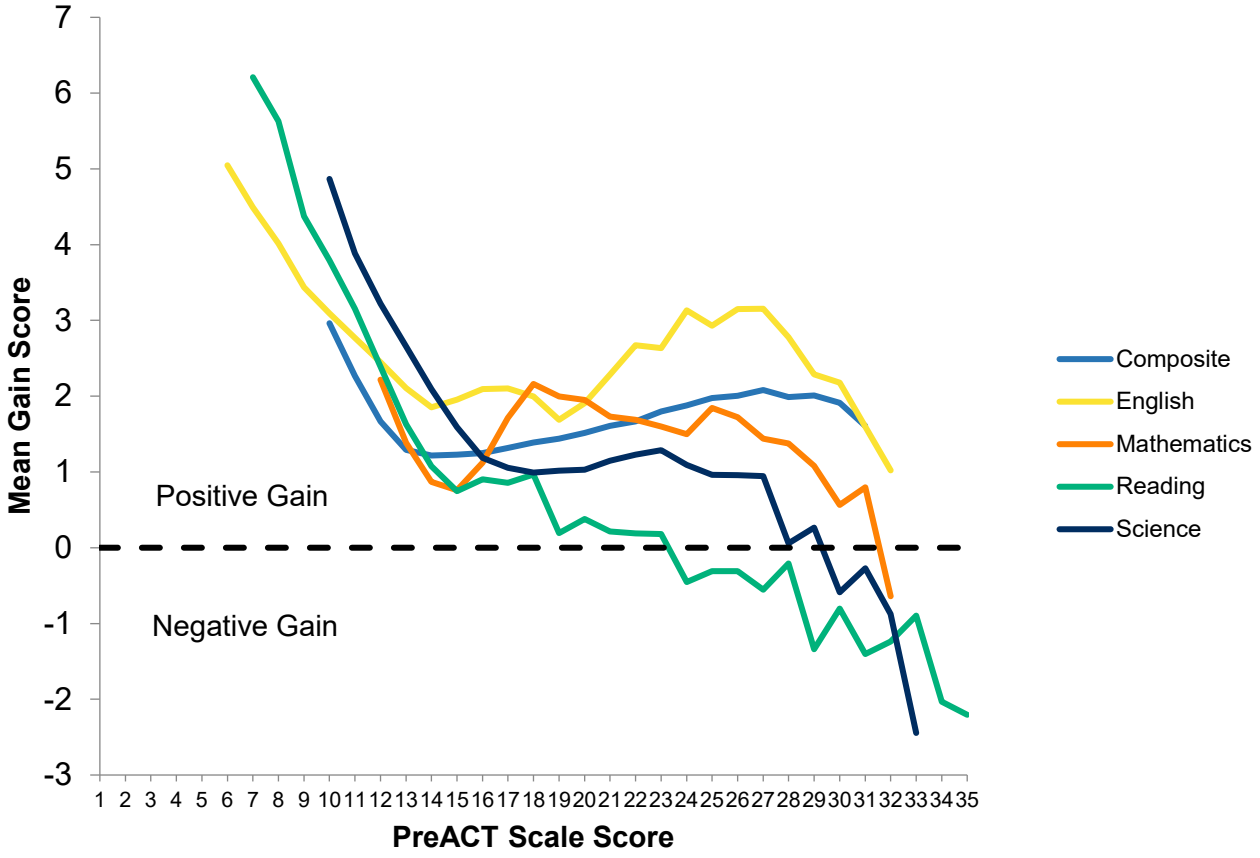
Note. OPI = Other Pacific Islander

The results from Table 8.3 can be summarized as follows:

- Mean gain scores are very similar for male and female students.
- Mean composite gain scores are highest for students who are Asian, followed by those who are White, Native Hawaiian/Other Pacific Islander, two or more races, Hispanic/ Latino, American Indian/Alaska Native, and Black/African American.
- Students who are in special education or who are eligible for free or reduced-price lunch tend to have below-average gain scores.

PreACT-to-ACT gain scores tend to be high for students with very low PreACT scores and low for students with very high PreACT scores (Figure 8.1). For example, students with a PreACT Composite score of 10 had a mean gain of 3.0, while students with a PreACT Composite score of 31 had a mean gain of 1.6. This phenomenon is known as *regression to the mean* and is related to the gain score measurement error issue described earlier. In the middle of the PreACT test score distributions, the average gain scores are more consistent. When determining how much gain should be expected from the PreACT test to the ACT test, one should consider the mean gain, conditional on the PreACT score.

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



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

8.2 Student Growth Percentiles

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

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

The SGPs presented in this chapter are based on data from PreACT assessments. While we expect similar results from PreACT Secure assessments, additional research is needed to examine the extent to which SGPs are different when based on PreACT Secure instead of PreACT.

8.2.1 ACT Growth Modeling Resources

SGP tables are available on the ACT growth modeling resources website (*https://www.act.org/content/act/en/research/services-and-resources/act-growth-modeling-resources.html*). Currently, the SGP tables cover the following assessment scenarios involving the PreACT test:

- ACT Aspire Grade 9 to PreACT Grade 10 (10–14 months' growth period)
- PreACT fall Grade 10 to ACT spring Grade 11 (15–19 months' growth period)
- PreACT spring Grade 10 to ACT spring Grade 11 (10–14 months' growth period)

For the 2019 version of the SGP tables, the samples used to estimate the PreACT-to-ACT SGPs were chosen to be similar to the population of ACT-tested high school graduates of 2018. For each growth period and for each test section, a stratified random sample of up to 25,000 students with scores from both grades was selected. Students who had taken the PreACT and ACT tests through spring 2019 were included. The sampling procedure ensures that each sample is similar to a common population (the 2018 ACT-tested graduating class) on race/ethnicity, school affiliation (public or nonpublic), and school percent eligible for free or reduced-price lunch. This also ensures that the samples are consistent across growth periods.

For students tested in the fall of Grade 10 and spring of Grade 11, Table 8.4 presents SGP estimates for combinations of PreACT and ACT Composite scores. For example, the SGP for a student who earned a PreACT Composite score of 20 and an ACT Composite score of 23 is 79. Yellow highlighting indicates score combinations with SGP values of at least 25 but no greater than 75. These are cases where growth can be considered average. Score combinations to the left of the yellow highlighting indicate below-average growth (SGP < 25), and score combinations to the right indicate above-average growth (SGP > 75). Table 8.4 includes only scores of 10 and higher; the growth modeling resources provide SGPs for all subjects and all score combinations.

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

PreACT Composite score	ACT Composite score																										
	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
10	2	10	30*	60*	76	86	92	96	97	98	99	99	99	99	99	99	99	99	99	99	99	99	99	99	99	99	100
11	2	9	24	44*	67*	80	89	94	97	98	98	99	99	99	99	99	99	99	99	99	99	99	99	99	99	99	100
12	1	4	14	32*	53*	73*	85	92	95	97	98	99	99	99	99	99	99	99	99	99	99	99	99	99	99	99	100
13	1	2	8	20	39*	60*	77	88	93	96	98	98	99	99	99	99	99	99	99	99	99	99	99	99	99	99	100
14	1	1	3	14	31*	48*	67*	80	87	93	96	98	98	98	99	99	99	99	99	99	99	99	99	99	99	99	100
15	1	1	1	5	15	29*	45*	62*	76	86	92	95	97	98	98	99	99	99	99	99	99	99	99	99	99	99	100
16	1	1	1	1	6	14	27*	42*	57*	73*	84	91	95	97	98	98	99	99	99	99	99	99	99	99	99	99	100
17	1	1	1	1	2	5	11	21	37*	57*	72*	83	90	94	97	98	98	99	99	99	99	99	99	99	99	99	100
18	1	1	1	1	1	2	3	10	18	37*	55*	69*	80	89	93	96	97	98	98	99	99	99	99	99	99	99	100
19	1	1	1	1	1	1	2	4	10	20	35*	52*	68*	81	89	94	96	98	98	98	99	99	99	99	99	99	100
20	1	1	1	1	1	1	1	1	5	11	22	36*	50*	66*	79	87	93	96	97	98	99	99	99	99	99	99	100
21	1	1	1	1	1	1	1	1	1	4	11	21	33*	49*	63*	76	86	92	95	97	98	99	99	99	99	99	100
22	1	1	1	1	1	1	1	1	1	1	4	10	20	33*	48*	64*	76	85	91	95	97	98	99	99	99	99	100
23	1	1	1	1	1	1	1	1	1	1	1	4	9	18	33*	46*	62*	76	86	90	94	97	98	99	99	99	100
24	1	1	1	1	1	1	1	1	1	1	1	1	3	8	17	31*	45*	61*	76	83	89	95	97	98	99	99	100
25	1	1	1	1	1	1	1	1	1	1	1	1	1	2	7	16	31*	42*	56*	70*	80	89	96	97	99	99	100
26	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	7	15	27*	38*	54*	68*	83	92	96	98	99	100
27	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	3	7	12	25*	37*	53*	71*	85	93	96	98	100
28	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	3	8	14	27*	40*	58*	73*	87	94	98	100
29	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	4	9	16	30*	43*	60*	77	89	97	100
30	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	4	9	18	33*	47*	64*	81	93	100
31	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	4	10	20	33*	48*	68*	88	100
32	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	4	10	20	33*	58*	82	100
33	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	4	10	20	39*	70*	100
34	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	4	11	24	69*	100
35	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	3	16	52*	100

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

8.2.2 Aggregating SGPs

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

Table 8.5 shows mean SGPs by subject area and student group for students who took the PreACT in the fall of Grade 10 and the ACT in the spring of Grade 11 (Group 8). The overall mean SGP values ranged from 45.0 in English to 47.7 for math. Because an SGP of 50 represents typical growth, we might have expected the overall means to be closer to 50. The SGPs used for this analysis were established in 2019, using ACT tests taken through 2019. The Group 6 sample included ACT tests taken through spring 2022. Because the mean SGP values are all below 50, we can conclude that typical growth for the Group 8 sample was lower than that of the reference group.

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

Student group		N	Test section/ score				
			English	Math	Reading	Science	Composite
All students		571,301	45.2	47.9	44.3	47.3	45.3
Gender	Female	286,840	45.9	47.4	44.9	47.1	44.9
	Male	266,598	44.8	48.6	43.9	47.8	46.0
Race/ethnicity	Black	87,713	38.3	43.0	37.0	39.3	40.3
	Asian	18,525	56.7	56.6	52.3	57.0	54.9
	Hispanic	77,169	42.3	46.8	40.8	43.3	43.7
	Native American	8,731	39.9	43.2	39.8	41.0	41.3
	Native Hawaiian/OPI	1,118	43.3	46.6	41.2	46.2	45.2
	Two or more races	35,707	44.9	47.4	44.3	46.7	44.9
	White	335,933	47.2	49.1	46.6	50.1	46.5
English learner		30,481	42.3	44.9	39.3	41.6	42.5
Special education		10,905	34.6	38.5	35.4	36.0	37.5
Free/reduced-price lunch eligible		8,200	39.6	42.4	38.7	39.3	40.2

Note. OPI = Other Pacific Islander

From Table 8.5, we see that mean SGP varies by student subgroup. Male students have slightly higher growth in math and science, whereas female students have slightly higher growth in English and reading. SGP differences are more pronounced across racial/ethnic groups, with students who are Asian showing the highest growth (Composite mean SGP = 54.9) and students who are Black/African American showing the lowest growth (Composite mean SGP = 40.3). Students in the other groups (English learner, special education, and free/reduced-price lunch eligible) have lower growth than the total group in all subject areas. The lowest mean SGP value was observed for students in special education in English (mean SGP = 34.6).

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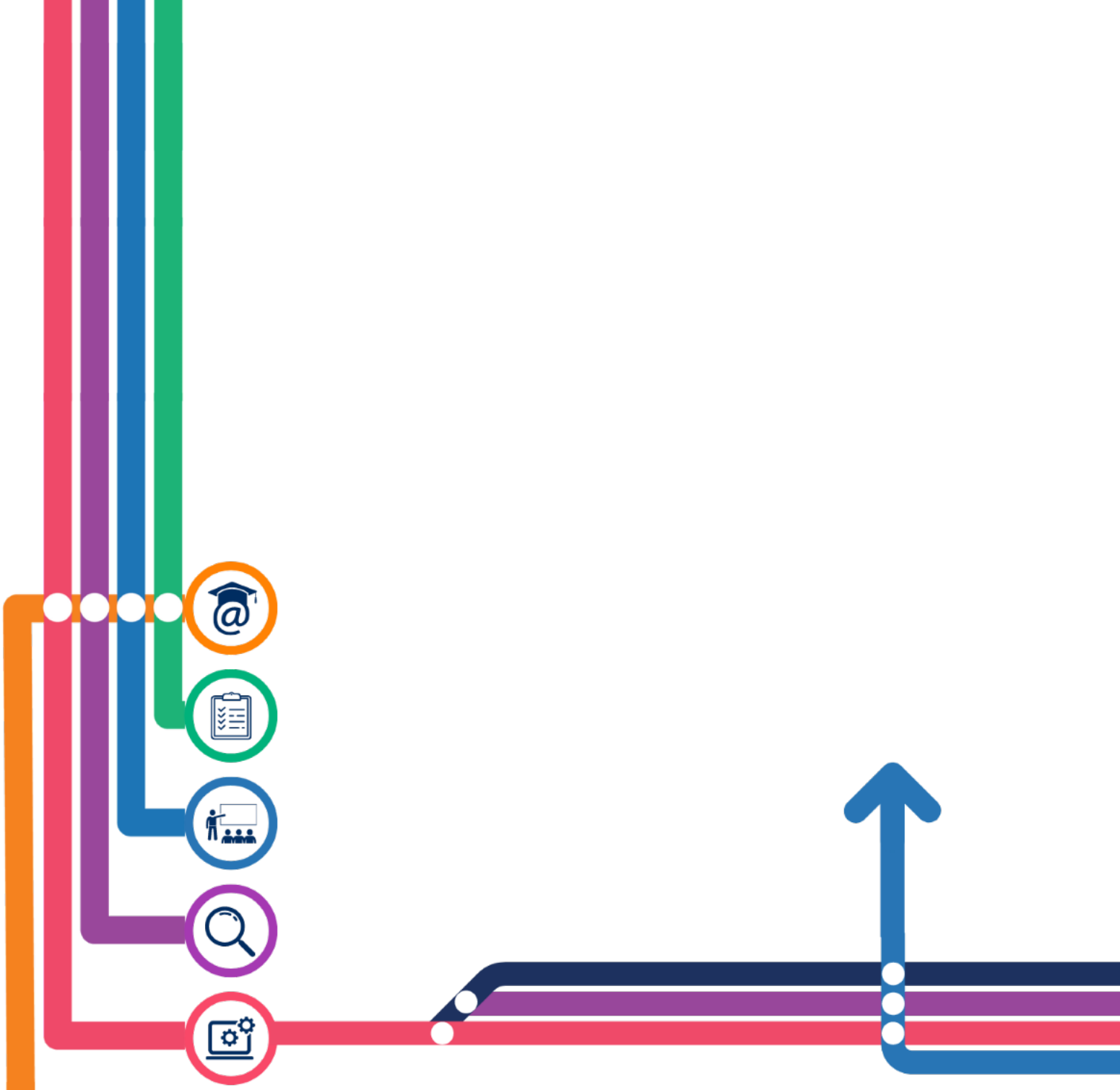

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