2017 VERSION 1

TECHNICAL BULLETIN

PreACT®

PreACT®

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Preface

The *PreACT Technical Bulletin* contains technical information about the PreACT assessment. The principal purpose of the manual is to document technical characteristics of the PreACT assessment in light of its intended purposes. The *PreACT Technical Bulletin* documents the collection of validity evidence that supports appropriate interpretations of test scores and describes various content and psychometric aspects of the PreACT. Multiple test design and development processes are articulated documenting how ACT attends to building 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 psychometric analyses based on data from a pilot study of PreACT administered in the spring of 2016. These analyses support the validity argument for PreACT and lay the groundwork for future research and analyses using operational data when available.

ACT endorses and is committed to industry standards and criteria. 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 bulletin, or on a related topic, to contact ACT.

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CHAPTER 1

General Description of PreACT

1.1 Overview and Purpose of PreACT

The PreACT is designed to predict student performance on the full ACT test for English, mathematics, reading and science, and is administered to students in 9th through 12th grades, but highly recommended for 10th grade students.

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

PreACT is designed to provide students with an indication of their educational progress in the context of preparing for the ACT and their post-high school educational and career options they are considering. The results from PreACT can be used to help students make adjustments in their course work to help ensure that they are prepared for the ACT, and also what they want to do after high school. High schools use the data in academic advising and counseling.

PreACT includes four multiple-choice tests—English, mathematics, reading, and science. PreACT also collects information about student interests, needs, plans, and selected background characteristics that can be useful in guidance and planning activities.

ACT provides customers with administration materials including interpretive score report guides. The Student Score Report, which each PreACT examinee receives, contains sections about the student's scores, plans, career interests, and skills. Along with the report, PreACT provides a booklet called *Using Your PreACT Results*. Students can use this information to ensure their remaining

high school courses are the best ones possible to prepare them for college and to help them consider options for life after high school. This booklet along with the PreACT student report can be used to help students get a better sense of where they are, where they might want to go, and how to get there.

PreACT functions as a stand-alone assessment and as a precursor to the full ACT test. When used together, these assessments give educators at the secondary-school levels a powerful, interrelated sequence of instruments to measure student development from grades 10 through 12.

The PreACT and ACT programs are reported on common scales extending from 1 to 36; the maximum score on each PreACT subject test is 35, and the maximum ACT score is 36. The PreACT assessment results inform students, parents, teachers, and counselors about individual student strengths and weaknesses while there is still time to address them in preparation for the full ACT.

The assessments also provide standards-based interpretations through ACT's College Readiness Standards—statements that describe students' performance regarding the knowledge and skills they have acquired. Because the College Readiness 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 College Readiness Standards, secondary educators can determine the skills students have and those they are ready to learn next. The Standards clarify college expectations in terms that high school teachers understand. The Standards also offer teachers guidance for improving instruction to help correct student deficiencies in specific areas. PreACT and ACT results can be used to identify students who are on track to being ready for college. ACT's College Readiness Benchmark Scores—for English, mathematics, reading, and science—were developed to help identify examinees that would likely be ready for doing college-level work in these courses or course areas. Chapter 3 gives details about the College Readiness Standards and Benchmarks.

PreACT and ACT results give schools a way to get students engaged in planning their futures. Table 1.1 summarizes the assessment's components.

Table 1.1. Components of ACT's College and Career Readiness Assessments

Component	Grade 10	Grades 11/12
Career and education planning	PreACT: Interest Inventory Course Taking Needs Assessment	ACT: Interest Inventory Course Taking and Grades Student Profile
Objective assessments	PreACT: English Mathematics Reading Science	ACT: English Mathematics Reading Science Writing (optional)
Instructional support	College Readiness Standards	College Readiness Standards
Evaluation	Summary Reports Predicted ACT Score	Summary Reports

1.2 Purposes, Claims, Interpretations, and Uses of PreACT

The PreACT is designed to provide an accurate picture of student readiness as students prepare to take the ACT test. In each subject, the PreACT provides a PreACT score and a predicted ACT score range.

Students' achievement is expected to grow between 10th and 11th grades. Therefore, students who score below the ACT College Readiness Benchmarks on PreACT in 10th grade may still be on target to meet the Benchmarks in 11th grade. One way the PreACT can be used to evaluate student readiness is through the PreACT College Readiness Indicators. These indicators categorize the student into one of three readiness levels. These levels are On Target, On the Cusp, and In Need of Intervention. For details on how the benchmarks and indicators are derived, see Chapter 3 of this bulletin.

In creating the PreACT, a theory of action (TOA) was employed that integrates content validity (academic research, curriculum information, standards) with predictive validity (empirical data), thus following similar methodologies 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 are the intended benefits that may result from using the assessment? What are the intended interpretations or claims based on the assessment? What are measurable outcomes from using the assessment?

The answers to these questions emerge as a result of rigorous research and data collection that inform and allow for the identification of high-value skill

targets in each subject area, providing focal points for the development of tasks and test forms. The process set forth by the TOA further gives rise to hypothesized mechanisms or processes for bringing about the intended goals of the assessment results. 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.

Intended Purpose. The PreACT tests are shorter tests than the ACT. They are designed to predict student performance on the full ACT test for reading, English, science, and mathematics (excludes writing), and composite and STEM score when administered to students in grade 10. The tests may also be used by students, parents, and schools to determine areas of improvement for the purpose of preparing for the ACT test.

Intended Users. Primary users include students in grade 10 who plan to take the ACT in grades 11 or 12. Additional users include parents interested in their child's performance, as well as educators and school administrators interested in helping students to identify areas of improvement for preparing to take the ACT test.

Intended Uses. The primary use for PreACT is to simulate the ACT testing experience and empower students, parents, and educators with valuable insights even sooner than the ACT. Specifically, it provides PreACT scores and STEM and text complexity indicators for high school students who are planning to take the ACT test. Additional uses include prediction of a student meeting the ACT College Readiness Benchmarks when they take the PreACT, improvement ideas for preparing to take the ACT test, and being part of a more holistic assessment of student's knowledge and skills when paired with the interest inventory and other noncognitive information collected during the testing process.

Intended Benefits. The intended consequences of using PreACT include:

- Gaining exposure to the types of content featured on the ACT test
- Gaining exposure to the testing experience of taking the ACT test
- Predicting how a student is likely to perform on the ACT test
- Obtaining a profile of relative strengths and weaknesses in the subject areas assessed by the ACT test
- Using PreACT scores to better prepare for the ACT test specifically and for college and careers more generally
- Providing parents, educators, and administrators insights about their students' knowledge and skills
- Providing a more holistic view of a student in combination with the interest inventory and other noncognitive information

Interpretations and Claims. The principal claims and interpretations of PreACT include the following:

1. PreACT predicts performance on the full ACT in English, reading, mathematics, and science, as well as composite score
2. PreACT measures student readiness on an empirically derived college readiness trajectory. (Note that students taking the PreACT battery will receive ACT Readiness Benchmarks that are linked to the ACT.)

The secondary claims, interpretations, and uses of PreACT include the following:

1. PreACT provides instructionally actionable information to students, parents, and educators. Data from the PreACT assessment can be used to identify areas of student strength and weakness in content areas at a variety of levels (student, classroom, school). These data can inform instruction and facilitate the identification of interventions.
2. The PreACT includes the ACT Interest Inventory with documented evidence of validity for career planning purposes, which points students toward a range of good-fit options to consider. In the process of exploration, students can focus on educational and occupational options that are relevant to future satisfaction and success.

ACT Interest Inventory results, when used in conjunction with PreACT test scores, provide a more holistic picture of the student's educational development and career-relevant motivations.

The ACT Career Map provides a visual overview of the entire work world and provides students with the opportunity to understand their measured interests in that world. Rather than dry lists of occupational titles, the map provides students with a visual bridge for seeing the connections between work and the everyday activities they like to do.

Intended Outcomes

There are several intended outcomes for the PreACT, including:

- Connect to test preparation opportunities based on students' profile of relative strengths and weaknesses
- Help students to meet college and career readiness benchmarks
- Increased educational and occupational preparation as a result of meeting college and career readiness benchmarks
- Expanded educational and occupational opportunities as a result of increased preparation
- A more holistic understanding of students' knowledge and skills and connections to guidance and development opportunities (in combination with the interest inventory and other noncognitive information collected during the testing process)

1.3 PreACT Evidence and Validity

Artifacts of the assessment architecture emerge from the research and data collection process to ensure that items and test forms are eliciting the intended evidence to support the claims made by the assessment. For example, content and item specifications, test blueprints, and benchmarks influence the technical quality and output of test items and forms. These artifacts are informed by several factors, including:

- Subject-Matter Experts (SME)
- Academic research on skill targets, sequencing of skills, and grade placement
- Data and evidence of student understanding collected from the assessments
- The ACT National Curriculum Survey©
- Survey of standards frameworks—including, but not limited to ACT's College and Career Readiness Standards (CCRS), the Next Generation Science Standards (NGSS) and other college and career readiness standards.

These factors influence and inform each level of the assessment architecture.

The first step in building this architecture is to synthesize research on high-value skill targets—the skill targets that can be shown to offer the most useful evidence for college and career readiness. This evidence is achieved by organizing units of knowledge and skills into levels. The skill units have dozens of smaller components, so they need to be organized into rough levels of difficulty. Once these levels are established, they are connected to form larger skill progressions. This process provides a broader picture of the understanding that emerges from the research and helps to determine what to test for students who are preparing for the ACT test.

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

Test forms are then administered and student performance data are collected. By linking these data to the ACT college readiness benchmarks and, to a lesser extent, the WorkKeys performance levels, the research team established the predictive scores generated by the PreACT. A back mapping process is employed to statistically link the performance scale of the lower grades (PreACT test takers) to the upper grades (ACT test takers). This process supports longitudinal predictions for performance on the ACT and therefore postsecondary and workforce success.

In reviewing what students can do above and below these benchmarks, knowledge and skills statements are authored. These statements are informed by item level data, the CCRS, and SME review. They serve as an interpretive guide to student performance along the score levels. Claims about the assessment are directly related to these descriptions. For example, a student that has scored "Ready" in mathematics can reference descriptions across the content sampled by the PreACT to understand their performance, and also the knowledge and skills required to reach the next performance level.

The following diagram helps to illustrate how validity is composed of multiple sources of research, empirical data, and other forms of evidence. Content validity is shown coming from the research base. Predictive validity information flows in primarily from the ACT and, to a lesser extent, WorkKeys exams. Both channels of information feed into the knowledge and skills needed to perform well on the PreACT, thus supporting an iterative model of refinement that serves the common goal of informing whether a student is "on track" for college and career readiness.

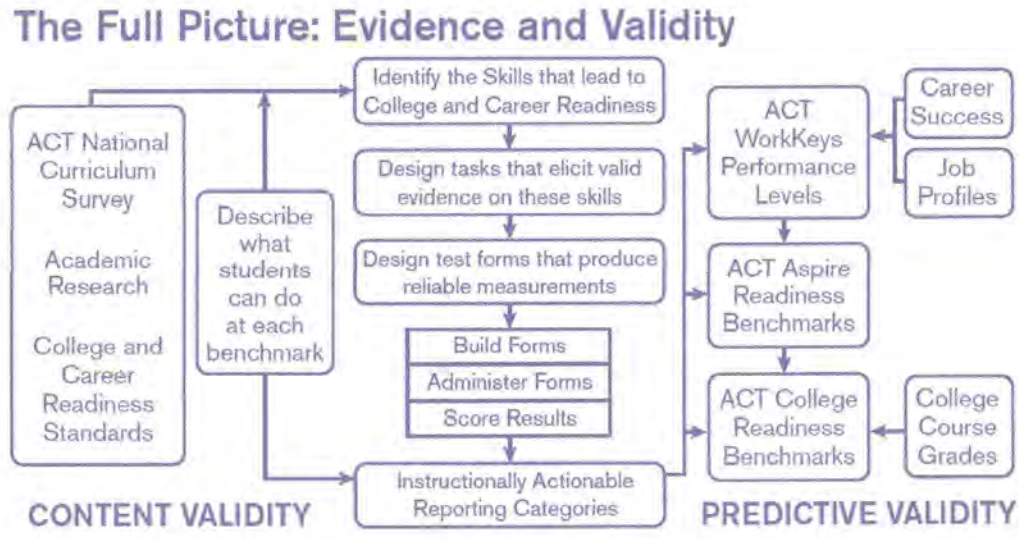

Figure 1.1. The full picture: evidence and validity.

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, Association for Measurement and Evaluation in Counseling and Development, American Educational Research Association, American

Psychological Association, American Speech-Language-Hearing Association, and National Council on Measurement in Education to advance, in the public interest, the quality of testing practices.

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

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

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

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

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

1.5 Philosophical Basis for ACT's Tests

The PreACT multiple-choice tests of educational development share a common philosophical basis with the ACT tests. These two testing programs measure student development in the same curriculum areas of English, mathematics, reading, and science. In simplest terms, the principal difference between the two testing programs are that they focus on knowledge and skills typically attained at different times in students' secondary school experience. The ACT, for 11th and 12th graders, focuses on knowledge and skills attained as the cumulative effect of the school experience. PreACT, intended for all 10th graders, focuses on knowledge and skills typically attained early in students' secondary school experience (by Grade 10). That is, the tests emphasize what students have learned in the long term and also give the examinees the chance to use knowledge and skills they currently are learning.

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

The ACT tests are designed to measure how prepared students are to achieve the general academic goals of college. The principal philosophical basis for the ACT is that college preparedness is best assessed by measuring, as directly as possible, the academic skills that students will need to perform college-level work. Complexity is certainly a characteristic of such skills. Thus, the ACT tests are designed to determine how skillful students are in solving problems, grasping implied meanings, drawing inferences, evaluating ideas, and making judgments. Also, the ACT tests are 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 tests 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.

The ACT and PreACT are measures of general student achievement with respect to college and career readiness. By contrast, measures of examinee knowledge of specific course content (as opposed to curriculum areas) often do not provide a common baseline for comparisons of students, because courses vary so much across schools, and even within schools. Also, course-specific tests may not measure students' skills in problem solving and the integration of knowledge from a variety of courses.

ACT's achievement tests can also be contrasted with tests of academic aptitude. The stimuli and test questions for aptitude tests are often purposefully chosen to be dissimilar to instructional materials, and each test within a battery of aptitude tests is usually designed to be homogeneous in psychological structure. Consequently, aptitude tests are often not designed to reflect the complexity of course work or the interactions among the skills measured.

Also, because ACT's tests measure skills that are taught in school, the best preparation for ACT's tests should be rigorous course work. Students are sent a clear message that high test scores are not simply a matter of innate ability—they reflect a level of achievement that has been earned as a result of hard work and dedication in school.

Finally, the ACT and PreACT tests are intended to reflect educational goals that are widely accepted and judged by educators to be important for success in college and work. As such, the content of the tests is designed with educational considerations, rather than statistical and empirical techniques, given paramount importance. For example, content representativeness of the tests is more important than choosing the most highly discriminating items.

1.6 Administering the PreACT Program

The PreACT product is available for administration September through May each year. Consult the *PreACT Implementation Plan* for further instructions about scheduling your testing and ordering materials.

Participation Procedures

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

Special Testing for Students with Accommodations

Special provisions are available for administering PreACT to students who have diagnosed learning or physical disabilities that require extended time or special materials. Special testing materials available include large type and Braille test books for visually impaired students, audio recordings of test books on DVD, and reader's scripts for oral presentation of the test items. Special format materials can be ordered through the online ordering system. Schools are encouraged to administer special tests on the same day as the timed testing session.

Administration Schedule

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

PreACT Support Materials

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

- The *PreACT Implementation Plan* includes links to online materials that provide information about the PreACT product and help schools begin planning their administration.
- The *PreACT Administration Manual* is designed to be used by PreACT test coordinators and testing staff. The manual provides detailed instructions for planning and administering the non-test sections and subject tests.
- The test materials package includes the test books, answer documents, and instruction booklets students will use to test. The administration manuals and other materials needed by test coordinators to administer PreACT are also included. Customers should order one test material package for each student testing, including students who are testing with accommodations materials. The number of administration manuals and answer document return envelopes included in each shipment is determined by the number of students testing. ACT sends a small overage of materials with each order.
- Student and school reports are typically shipped from ACT one to two weeks from the day ACT receives a school's completed answer folders.
- Each student who participates in PreACT will receive *Using Your PreACT Results*, which includes sections on interpreting the Student Report, planning for high school and beyond, career possibilities, and building academic skills.

CHAPTER 2

PreACT Test Development

2.1 Description of the PreACT Tests

The experience of taking the PreACT tests, combined with the selection of rigorous high school courses, will help students perform their best when they take the ACT. For those students who will go from high school to a vocational school or directly into a career, PreACT provides information that will be useful in the selection of courses to be taken in their junior and senior years in preparation for their career of choice.

PreACT and the ACT have a common purpose—to support students at key decision points in their academic preparation and planning. The programs encourage students to plan and act for their goals and dreams—thus increasing their chances of succeeding in life. PreACT and the ACT also provide information helpful to educators guiding students through these important educational and career decisions.

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

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

- a career interest inventory
- biographical data

- a student needs assessment
- and high school course information

Despite having different upper score ranges, PreACT, with a range of 1–35, and the ACT, with a range of 1–36, are on approximately the same score scale. This allows comparison of a student's scores on the two assessment programs. A score increase from PreACT to the ACT can be interpreted as academic development within the limitations of measurement error.

PreACT contains four subject tests—English, math, reading, and science. These tests are designed to measure students' curriculum-related knowledge and the complex cognitive skills important for future education and careers. PreACT results provide students with information that can help them begin making plans for beyond high school.

The fundamental idea underlying the development and use of these tests is that the best way to determine how well prepared students are for further education and for work is to measure as directly as possible the knowledge and skills needed in those settings.

ACT periodically conducts the ACT National Curriculum Survey® to ensure the continued appropriateness of the content on PreACT and the ACT tests. The most recent findings were summarized in ACT National Curriculum Survey 2016. The survey is the only one of its kind in the United States. The ACT (and the PreACT) test specifications are driven by this data. Its results have a direct and significant impact on the development of the tests in PreACT and the ACT. This publication is available in PDF at http://www.act.org/content/dam/act/unsecured/documents/NCS_Report_Web.pdf

2.2 The English Test

The PreACT English test measures a student's understanding of the conventions of standard written English (punctuation, usage, and sentence structure), production of writing (topic development, organization, unity, and cohesion), and knowledge of language (word choice, style, and tone). The test consists of three essays, or passages, each accompanied by a sequence of multiple-choice test questions. Different passage types are employed to provide a variety of rhetorical situations. Spelling, vocabulary, and rote recall of grammar rules are not tested.

Some items refer to underlined portions of the passage and offer several alternatives to the underlined portion. The student must decide which choice is most appropriate in the context of the passage. Some items ask about an

underlined portion, a section of the passage, or the passage as a whole. The student must decide which choice best answers the question posed. Many items offer "NO CHANGE" to the passage as one of the choices.

Four scores are reported for the PreACT English test: a total test score based on all 45 items and three reporting category scores based on specific knowledge and skills. The reporting categories are Conventions of Standard English, Production of Writing, and Knowledge of Language.

The three reporting categories cover six elements of effective writing: punctuation; usage; sentence structure and formation; topic development; organization, unity, and cohesion; and knowledge of language. These six elements are described briefly below. Note: The approximate percentage of the English test devoted to each reporting category is given in Table 2.1.

Conventions of Standard English

Punctuation: Recognize common problems with Standard English punctuation and make revisions to improve the writing.

Usage: Recognize common problems with Standard English usage in a text and make revisions to improve the writing.

Sentence Structure and Formation: Apply understanding of sentence structure and formation in a text and make revisions to improve the writing.

Production of Writing

Topic Development: Demonstrate an understanding of and control over the rhetorical aspects of texts. Identify the purposes of parts of texts, determine whether a text or part of a text has met its intended goal, and evaluate the relevance of material in terms of a text's focus.

Organization, Unity, and Cohesion: Use various strategies to ensure that a text is logically organized, flows smoothly, and has an effective introduction and conclusion.

Knowledge of Language

Demonstrate effective language use through ensuring precision and concision in word choice and maintaining consistency in style and tone.

2.3 The Mathematics Test

The PreACT mathematics test is designed to assess the mathematical skills students have typically acquired in high school math courses. The material covered on the test emphasizes the major content areas that are prerequisites to successful performance in entry-level courses in college mathematics. The test requires use of quantitative reasoning skills to solve practical problems in

mathematics. While students must demonstrate some computational skills and recall of basic formulas, extensive computation and recall of complex formulas will not be required.

Nine scores are reported for the PreACT mathematics test: a total test score based on all 36 questions and eight reporting category scores. The eight reporting categories addressed in the mathematics test are Preparing for Higher Math, which includes separate scores for Number & Quantity, Algebra, Functions, Geometry, and Statistics & Probability; Integrating Essential Skills; and Modeling. A description of each reporting category is shown below.

The overall score on the mathematics test is also used, with the science score, to determine the STEM score

The approximate percentage of the mathematics test devoted to each reporting category is given in Table 2.2.

Preparing for Higher Math

This category captures the more recent mathematics that students are learning, starting when students begin using algebra as a general way of expressing and solving equations. This category is divided into the following five subcategories.

- **Number & Quantity:** Demonstrate knowledge of real and complex number systems. Understand and reason with numerical quantities in many forms, including integer and rational exponents and vectors and matrices.
- **Algebra:** Solve, graph, and model multiple types of expressions. Employ many different kinds of equations, including linear, polynomial, radical, and exponential relationships. Find solutions to systems of equations, even when represented by simple matrices, and apply knowledge to applications.
- **Functions:** Use knowledge of function definition, notation, representation, and application. Manipulate and translate functions, as well as find and apply important features of graphs. Function types include linear, radical, piecewise, polynomial, and logarithmic.
- **Geometry:** Define and apply knowledge of shapes and solids, such as congruence and similarity relationships or surface area and volume measurements. Understand composition of objects and solve for missing values in triangles, circles, and other figures, including using trigonometric ratios and equations of conic sections.
- **Statistics & Probability:** Describe center and spread of distributions and apply and analyze data.

Integrating Essential Skills

This category addresses concepts typically learned before 8th grade, such as rates and percentages; proportional relationships; area, surface area, and volume; average and median; and expressing numbers in different ways.

Students will solve problems of increasing complexity, combine skills in longer chains of steps, and apply skills in more varied contexts.

Modeling

This category represents all items that involve producing, interpreting, understanding, evaluating, and improving models. This category is an overall measure of how well students use modeling skills across mathematical topics. Not all test items are in this category, but those that are in this category are also counted in other appropriate reporting categories detailed above.

Students are permitted but not required to use calculators when taking this test. All of the items can be solved without a calculator. Students who use a calculator should use one with which they are most familiar. Please refer to the ACT Calculator Policy found at www.act.org for specific limitations on student calculator use.

2.4 The Reading Test

The PreACT reading test measures the student's reading comprehension. The test questions ask students to derive meaning from three reading passages by (1) referring to what is explicitly stated and reasoning to determine implicit meanings. Specifically, questions ask students to use referring and reasoning skills 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; and analyze the author's or narrator's voice and method. The test includes a mix of literary narrative and informational passages that are representative of the levels and kinds of texts commonly encountered in 11th–12th grade and first-year college curricula. Each passage is preceded by a heading that identifies what type of passage it is (e.g., "Literary Narrative"), names the author, and may include a brief note that helps in understanding the passage. Each section contains a set of multiple-choice test items. These items do not test the rote recall of facts for outside the passage, isolated vocabulary terms, or rules of formal logic.

Four scores are reported for the PreACT reading test: a total test score based on all 25 questions and three reporting category scores based on specific knowledge and skills. The reporting categories are Key Ideas and Details, Craft and Structure, and Integration of Knowledge and Ideas. The approximate percentage of the reading test devoted to each reporting category is given in Table 2.3.

Key Ideas and Details

Read texts closely to determine central ideas and themes. Summarize information and ideas accurately. Read closely to understand relationships and draw logical inferences and conclusions including understanding sequential, comparative, and cause-effect relationships.

Craft and Structure

Determine word and phrase meanings, analyze an author's word choice rhetorically, analyze text structure, understand authorial purpose and perspective, and analyze characters' points of view. Interpret authorial decisions rhetorically and differentiate between various perspectives and sources of information.

Integration of Knowledge and Ideas

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

2.5 The Science Test

The PreACT science test measures scientific reasoning skills acquired in general introductory courses in the natural sciences. The test presents five sets of scientific information, each followed by a number of multiple-choice test items. The scientific information is conveyed in one of three different formats: data representation (graphs, tables, and other schematic forms), research summaries (descriptions and results of several related experiments), or conflicting viewpoints (expressions of several related hypotheses or views that are inconsistent with one another). The items require students to recognize and understand the basic features of, and concepts related to, the provided information; to examine critically the relationships between the information provided and the conclusions drawn or hypotheses developed; and to generalize from given information to gain new information, draw conclusions, or make predictions.

The PreACT science test is based on the type of content typically covered in early high school science courses. Materials are drawn from biology, chemistry, the Earth/space sciences, and physics. Advanced knowledge in these subjects is not required, but background knowledge that is typically covered in early high school general science courses is needed to answer some of the items. The test emphasizes scientific reasoning skills over recall of scientific content, skill in mathematics, or skill in reading. Students are not permitted to use calculators on the PreACT science test.

Four scores are reported for the ACT science test: a total test score based on all 30 questions and three reporting category scores based on scientific knowledge, skills, and practices.

The three reporting categories addressed in the science test are Interpretation of Data; Scientific Investigation; and Evaluation of Models, Inferences & Experimental Results. The approximate percentage of the test devoted to each

reporting category is given in Table 2.4. The overall score on the science test is also used, with the math score, to determine the STEM score.

Interpretation of Data

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

Scientific Investigation

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

Evaluation of Models, Inferences, and Experimental Results

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

Table 2.1. Specification by Number of Items and Reporting Category for English

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

Table 2.2. Specification by Number of Items and Reporting Category for Mathematics

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

Table 2.3. Specification by Number of Items and Reporting Category for Reading

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

Table 2.4. Specification by Number of Items and Reporting Category for Science

	Number of Items	Percentage of Test
Reporting Categories		
Interpretation of Data	11–13	37–43%
Scientific Investigation	9–11	30–37%
Evaluation of Models, Inferences & Experimental Results	7–9	23–30%
Total Number of Items	30	100%

2.6 Test Development Procedures

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

Reviewing Test Specifications

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

Content Specifications. Content specifications for the PreACT tests were developed through the curricular analysis discussed previously. While care is taken to ensure that the basic structure of the PreACT 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 specification category are reviewed regularly. Subject-matter experts review the new forms of the test in order to verify their content accuracy and the match of the content of the tests to the content specifications. At this time, the characteristics of the items that fulfill the content specifications are also reviewed. While the general content of the test remains constant, the particular kinds of items in a specification category may change slightly.

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

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

Selection of Item Writers

Each year, ACT contracts with item writers to construct items. The item writers are content specialists in the disciplines measured by the tests. Most are actively engaged in teaching at various levels, from high school to university, and at a variety of institutions, from small private schools to large public institutions. ACT makes every attempt to include item writers who represent the diversity of the population of the United States with respect to ethnic background, gender, and geographic location.

Before being asked to write items for the tests, potential item writers are required to submit a sample set of materials for review. Each item writer receives an item writer's guide that is specific to the content area. The guides include examples of items and provide item writers with the test specifications and ACT's requirements for content and style. Included are specifications for fair portrayal of all groups of individuals, avoidance of subject matter that may be unfamiliar to members of certain groups within society, and nonsexist use of language.

Each sample set submitted by a potential item writer is evaluated by ACT Test Development staff. A decision concerning whether to contract with the item writer is made on the basis of that evaluation.

Review of Items

After a unit is accepted, it is edited to meet ACT's specifications for content accuracy, word count, item classification, item format, and language. During the editing process, all test materials are reviewed for fair portrayal and balanced representation of groups within society and for nonsexist use of language. The unit is reviewed several times by ACT staff to ensure that it meets all of ACT's standards.

Copies of each unit are then submitted to content and fairness experts for external reviews prior to the pretest administration of these units. The content reviewers are high school teachers, curriculum specialists, and college and university faculty members. The content experts review the unit for content accuracy, educational importance, and grade-level appropriateness. The fairness reviewers are experts in diverse educational areas who represent both genders and a variety of racial and ethnic backgrounds. These reviewers help ensure fairness to all examinees.

Any comments on the units by the content consultants are discussed in a panel meeting with all the content consultants and ACT staff, and appropriate changes are made to the unit(s). All fairness consultants' comments are reviewed and discussed, and appropriate changes are made to the unit(s).

Item Tryouts

The items that are judged to be acceptable in the review process are assembled into tryout units for pretesting on samples from the national examinee population. These samples are carefully selected to be representative of the total examinee population. Each sample is administered a tryout unit from one of the four academic areas covered by the tests. The time limits for the tryout units permit the majority of students to respond to all items.

Item Analysis of Tryout Units

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

Proportions of students in each of the groups correctly answering each tryout item are tabulated, as well as the proportion in each group selecting each of the incorrect options. Biserial and point-biserial correlation coefficients between each item score (correct/incorrect) and the total score on the corresponding test of the regular (national) test form are also computed.

Item analyses serve to identify statistically effective test items. Items that are either too difficult or too easy, and items that fail to discriminate between students of high and low educational achievement as measured by their corresponding ACT test scores, are eliminated or revised for future item tryouts. The biserial and pointbiserial correlation coefficients, as well as the differences

between proportions of students answering the item correctly in each of the three groups, are used as indices of the discriminating power of the tryout items.

Each item is reviewed following the item analysis. ACT staff members scrutinize items flagged for statistical reasons to identify possible problems. Some items are revised and placed in new tryout units following further review. The review process also provides feedback that helps decrease the incidence of poor quality items in the future.

Assembly of New Forms

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

For each test in a battery form, items are selected to match the content distribution for the test shown in Tables 2.1 through 2.4. The content distributions are similar in proportion to the distributions of content on the ACT. Items are also selected to comply with statistical specifications as discussed in an earlier section. Operational data for PreACT is not available at this time. Summary of psychometric results from a spring 2016 pilot administration is given in Chapter 4 of this bulletin.

Item Construction

Each item writer under contract is given an assignment to produce a small number of multiple-choice items. The small size of the assignment ensures production of a diversity of material and maintenance of 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 test specialists, who assist them in producing items of high quality that meet the test specifications.

The item writers must create items that are educationally important and psychometrically sound. A large number of items must be constructed because, even with good writers, many items fail to meet ACT's standards.

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

Content and Fairness Review of Test Items

The preliminary versions of the test items are subjected to several reviews to ensure that the items are accurate and that the overall test forms are fair and conform to good test construction practice. The first review is performed by ACT

staff. Items are checked for content accuracy and conformity to ACT style. The items are also reviewed to ensure that they are free of clues that could allow test-wise students to answer the item correctly even though they lack knowledge in the subject area or the required skills.

The preliminary versions of the test items are also submitted to content and fairness experts for external review prior to the operational administration of the test forms. The content consultants are high school teachers, curriculum specialists, and college and university faculty members. The content consultants review the items for content accuracy, educational importance, and grade-level appropriateness. The fairness consultants are diversity experts in education who represent both genders and a variety of racial and ethnic backgrounds. The fairness consultants review the items to help ensure fairness to all examinees.

After the external content and fairness reviews, ACT summarizes the results from the reviews. Comments from the consultants are then reviewed by ACT staff members, and any necessary changes are made to the test items. Whenever significant changes are made, the revised components are again reviewed by the appropriate consultants and by ACT staff. If no further corrections are needed, the test forms are assembled and prepared for printing.

2.7 PreACT Scoring Procedures

For each of the four PreACT tests, the number of questions answered correctly is counted to obtain a raw score, which is then converted to a scale score.

The score scale is discussed further in Chapter 4 of this bulletin.

The composite score is the average of the four scale scores, and the STEM score is the average of the mathematics and science scale scores. The composite and STEM scores are both rounded to the nearest whole number (0.5 rounds up) and have a minimum score of 1 and a maximum of 35.

CHAPTER 3

ACT's College and Career Readiness Standards and College Readiness Benchmarks

PreACT test scores can be directly compared to the ACT 1 to 36 score scales. In addition, PreACT predicts how grade 10 students will do when taking the ACT 12 to 18 months later. The connection to the ACT allows an evaluation of college readiness for students with scores on the PreACT. This chapter describes how college readiness is evaluated through the ACT and also describes how the PreACT College Readiness Indicators predict whether students are on target for college readiness as measured by the ACT.

The knowledge and skills a student currently has (and areas for improvement) can be identified by examining the student's PreACT or ACT test scores with respect to ACT's empirically derived College and Career Readiness Standards. The performance levels on ACT's tests necessary for students to be ready to succeed in college-level work are defined by ACT's College Readiness Benchmarks. These two empirically derived tools support interpretations of college readiness and identification of key knowledge and skill areas needed to increase the likelihood of college success.

3.1 ACT College and Career Readiness Standards

The ACT College and Career Readiness Standards are statements that describe what students who score in various score ranges on the ACT tests are *likely* to know and to be able to do. ACT began work on developing the standards in

1997 and continues to refine the standards as new data becomes available. The standards are based on empirical data, that include normative data, college admissions criteria, and information obtained through ACT's Course Placement Service. Content area test specialists wrote the College Readiness Standards based on their analysis of the skills and knowledge students need in order 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 of the subject tests is given in *The ACT Technical Manual* (ACT, 2014).

3.2 ACT College Readiness Benchmarks

The ACT College Readiness Benchmarks are scores on the ACT subject-area tests that represent the level of achievement required for students 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. These college courses include English Composition I, College Algebra, introductory social science courses, and Biology. For STEM, the college courses include Calculus and a first year science course taken by students majoring in a STEM-related field, including Chemistry, Biology, Physics, or Engineering. The current ACT College Readiness Benchmarks are given in Table 3.1.

Table 3.1. ACT College Readiness Benchmarks

College Course	ACT Subject-Area Test	The ACT® Benchmark
English Composition I	English	18
College Algebra	Math	22
Social Sciences	Reading	22
Biology	Science	23
Calculus/Science/Engineering	STEM	26

The ACT College Readiness Benchmarks are empirically derived 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 grade and test score data from a large number of first-year students and across a wide range of postsecondary institutions. These data provide an overall measure of what it takes to be successful in selected first-year college courses.

The original ACT College Readiness Benchmarks established readiness indicators for common first-year college courses based on ACT scores. Benchmarks were developed for four courses: English Composition, using the ACT English score; College Algebra, using the ACT math score; Social Science courses, using the ACT reading score; and Biology, using the ACT science score (Allen & Sconing, 2005).

The Benchmarks are subject to change over time. Some of the possible reasons for updating the Benchmarks include change in college grading standards, aggregate change in college student performance, and change in the level of alignment of secondary and postsecondary course content. The ACT College Readiness Benchmarks were updated in 2013 with more recent data from 214 institutions and over 230,000 students (Allen, 2013).

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

A description of the development of the ACT College Readiness Benchmarks is given in the *ACT Technical Manual* (ACT, 2014) and ACT research reports (Allen & Sconing, 2005; Allen, 2013; Mattern, Radunzel, & Westrick, 2015).

3.3 PreACT College Readiness Indicators

Because students' achievement is expected to grow between 10th and 11th grade, students who score below the ACT College Readiness Benchmarks on PreACT in grade 10 may still be on target to meet the benchmarks in grade 11. One way the PreACT can be used to evaluate student readiness is through the PreACT College Readiness Indicators. Comparing the student's PreACT scale score to the ranges in Table 3.2 categorizes the student into one of three readiness levels. These levels are defined as:

1. On Target—students in this range have a 50% or higher chance of meeting the ACT College Readiness Benchmark in grade 11.
2. On the Cusp—these students have less than a 50% chance, but greater than approximately 25% chance, of meeting the ACT College Readiness Benchmark in grade 11.
3. In Need of Intervention—these students have less than a 25% chance of meeting the ACT College Readiness Benchmark in grade 11.

Table 3.2. Scale Score Ranges for PreACT College Readiness Indicators

PreACT Test	ACT Benchmark	In Need Range	On Cusp Range	On Target Range
English	18	1–11	12–14	15–35
Math	22	1–16	17–18	19–35
Reading	22	1–16	17–19	20–35
Science	23	1–17	18–20	21–35
STEM	26	1–21	22–23	24–35

When using the PreACT Readiness Indicators or the predicted ACT score ranges provided on the PreACT student score report, it is important to remember that these are statistical predictions based on typical student growth from grades 10 to 11. The predictions do not necessarily apply to students taking the PreACT or the ACT in other grades. Also, improved study habits or taking more challenging courses may allow students to improve upon the predicted ACT scores. Additionally, prediction accuracy may be compromised for students who do not make a serious effort when taking the test. PreACT scores and readiness indicators should be viewed cautiously if there is reason to believe the student performed substantially below their achievement level on the PreACT.

CHAPTER 4

Technical Characteristics of the PreACT Tests

This chapter discusses the technical characteristics—the score scale, equating, and reliability—of the PreACT tests. Limited data from operational testing are available at the time of this writing (fall of 2016), so this chapter will focus on the development of the PreACT scales and timing conditions as determined through a special study collected in the spring of 2016. Future versions of this manual will include psychometric analyses based on operational test data.

4.1 PreACT Score Scales

Scale scores are reported for the PreACT English, mathematics, 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 mathematics and science scale scores. The range of all PreACT scale scores is 1 to 35.

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

measurement is expected to be larger on the PreACT. Reliability and standard error of measurement estimates for the PreACT based on the pilot study are given later in this chapter.

The PreACT scales have a maximum of 35. The rationale for setting the maximum scale score on the PreACT tests to be 35, rather than 36 as it is for the ACT tests, stems from the fact that PreACT is intended to be a shorter and less difficult version of the ACT. Thus, it is easier to obtain a perfect score (all correct) on the PreACT than it is on the ACT. Consequently, it was decided to cap PreACT scores to a lower value. Due to the difference in maximum scale scores between the PreACT and the ACT, mean scores for the two tests likely will be different for a group of high scoring students.

4.2 Spring 2016 Pilot Study

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

Study Conditions and Samples

High schools from across the country were invited to participate in the study, testing either 10th graders, 11th graders, or both. Over 140 schools from 25 states agreed to participate. Students were administered one of four test forms: A1, B1, A2, or B2. Forms A1 and A2 had identical test content but were administered under different timing conditions. Likewise, forms B1 and B2 had identical content but different time limits. Timing conditions for the forms can be found in Table 4.1. Forms A1 and B1, which had different test questions, were spiraled together and administered to randomly equivalent groups. Due to practical considerations related to administering tests with different time limits within schools, Forms A2 and B2 were administered separately, with all students in each school being administered one of these forms. An attempt was made during school selection to balance the samples for students taking the different forms in terms of prior school performance on the ACT, but the balancing was impacted by school attrition from the study. Therefore, only the performance of students in the A1 and B1 conditions can be directly compared, as the other conditions likely had student samples with differing characteristics. Distributional data based on gender, ethnicity, and region of country are given in Tables 4.2, 4.3, and 4.4, respectively.

Table 4.1. Time Limit Conditions by Form and Subject in Pilot Study (in Minutes)

	A1/B1	A2	B2
English	30	25	35
Mathematics	40	45	35
Reading	25	30	30
Science	30	25	35

Table 4.2. Pilot Data Distribution by Gender, Grade, and Form

	Form							
Gender	A1 Grade 10	A1 Grade 11	B1 Grade 10	B1 Grade 11	A2 Grade 10	A2 Grade 11	B2 Grade 10	B2 Grade 11
Female	1152	235	1156	257	1180	503	1089	507
Male	984	166	926	166	1086	461	938	450

Table 4.3. Pilot Data Distribution by Ethnicity, Grade, and Form

	Form							
Race/Ethnicity	A1 Grade 10	A1 Grade 11	B1 Grade 10	B1 Grade 11	A2 Grade 10	A2 Grade 11	B2 Grade 10	B2 Grade 11
Black/African American	240	33	241	32	334	118	143	63
American Indian/ Alaskan Native	7	3	10	2	11	12	8	4
White	1109	171	1062	203	773	409	811	240
Hispanic/Latino	463	150	461	149	870	284	892	579
Asian	67	14	63	10	133	35	33	9
Native Hawaiian/ Other Pacific Islander	3	1	6	1	3	4	2	5
Two or more races	113	22	96	18	76	42	64	33
Prefer not to respond	55	12	50	11	51	31	64	33

Table 4.4. Pilot Data Distribution by Region of Country

Region	Number of Students	Number of Schools
East	3862	38
Midwest	919	23
Southwest	4951	30
West	1707	23

Examining Pre-Equating

One of the goals of the pilot study was to examine evidence that parameters from the ACT pool would be appropriate for 10th graders taking PreACT. Several analyses were conducted to examine support for using pre-equating including using the randomly equivalent groups' data from the pilot study.

Forms A1 and B1 were spiraled within classrooms and thus the samples taking these forms can be considered randomly equivalent. Two sets of analyses were conducted to evaluate pre-equating on PreACT using item parameter estimates from the ACT pool. The first analysis was an equipercentile equating between Form A1 and B1 using only the 10th graders. For this equating, the scale score conversion for Form A1 was considered the base. The results showed that for English, mathematics, and science, the equipercentile and pre-equated conversions generally differ by no more than one score point. However, for reading the differences are generally two to three score points in the middle of the scale. These results support using pre-equating for the English, mathematics, and science forms used in the study, but also suggest that further investigation is done to understand the pre/post results for reading.

A similar type of comparison was made using IRT scaling with groups A1 and B1. Calibrated parameters for pilot study 10th graders were scaled to the ACT item pool parameters with the Stocking-Lord procedure. Because A1 and B1 are randomly equivalent groups, the Form A1 scaling conversion should theoretically hold for scaling Form B1 to the ACT scale. Using the A1 conversion, Form B1 item parameter estimates for 10th graders were scaled to the ACT pool scale and Test Characteristic Curves (TCC) were compared to those derived from a direct scaling of B1 to the ACT scale. That is to say, the scaling based on randomly equivalent groups was compared to the direct scaling of B1 to the ACT scale. The TCCs for the two scalings are given in the Figures 4.1 to 4.4 below. The two methods of scaling were comparable for English, mathematics, and science, but differed for reading.

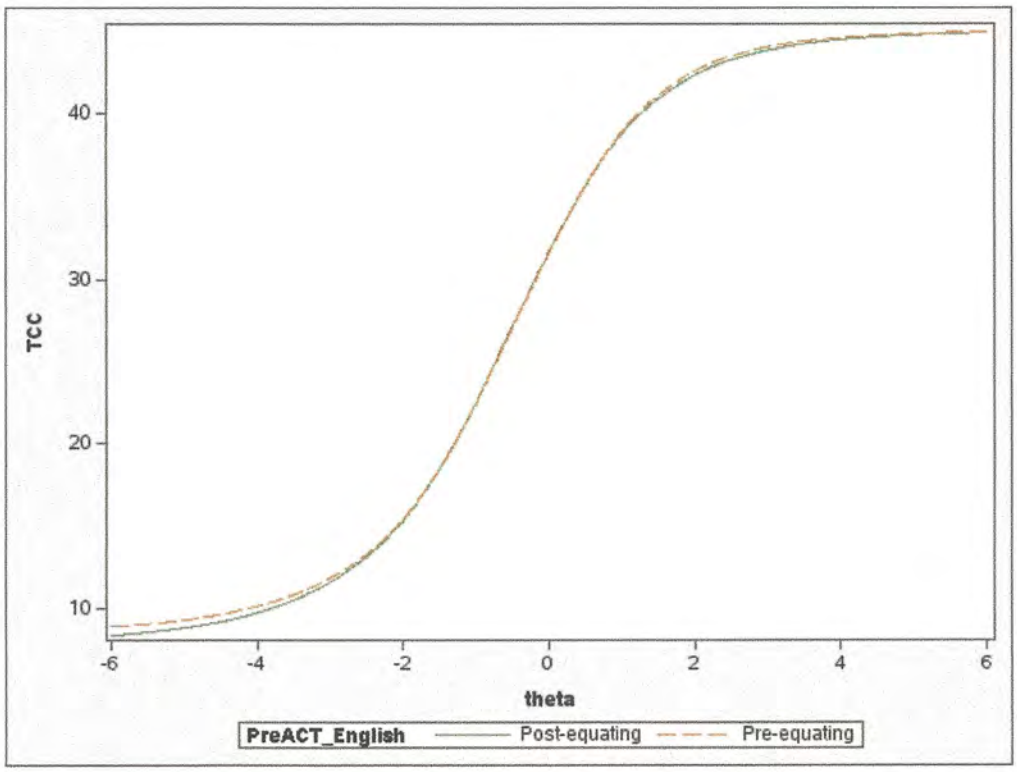

Figure 4.1. English TCCs Comparing Pre- and Post-Equating

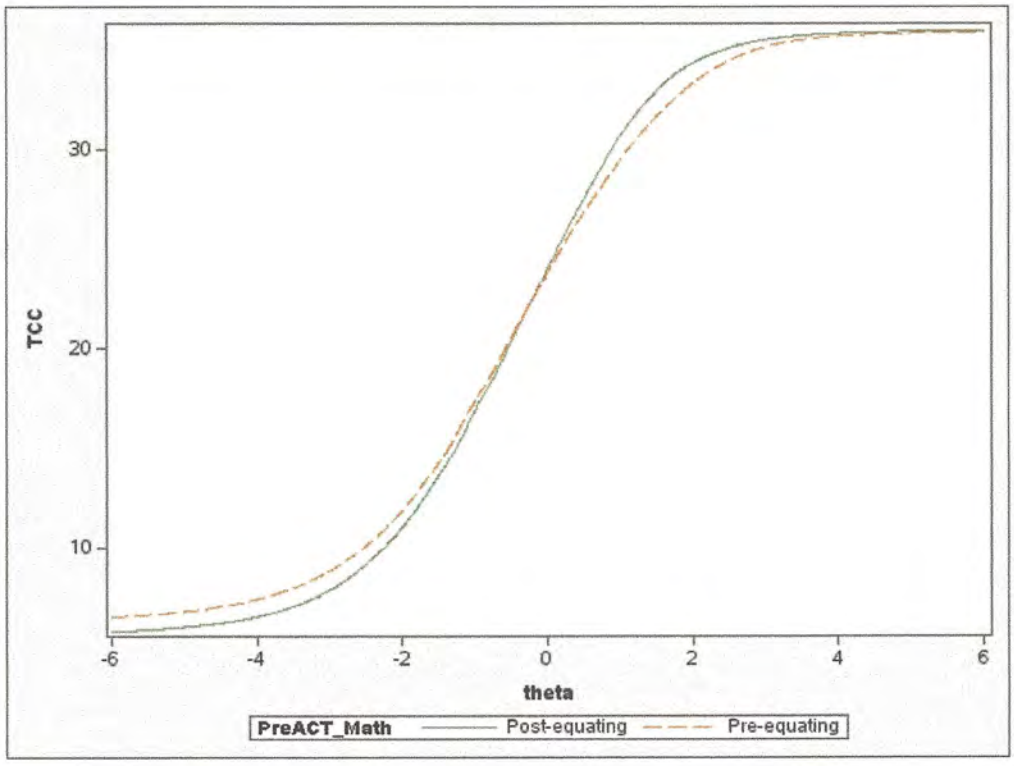

Figure 4.2. Mathematics TCCs Comparing Pre- and Post-Equating

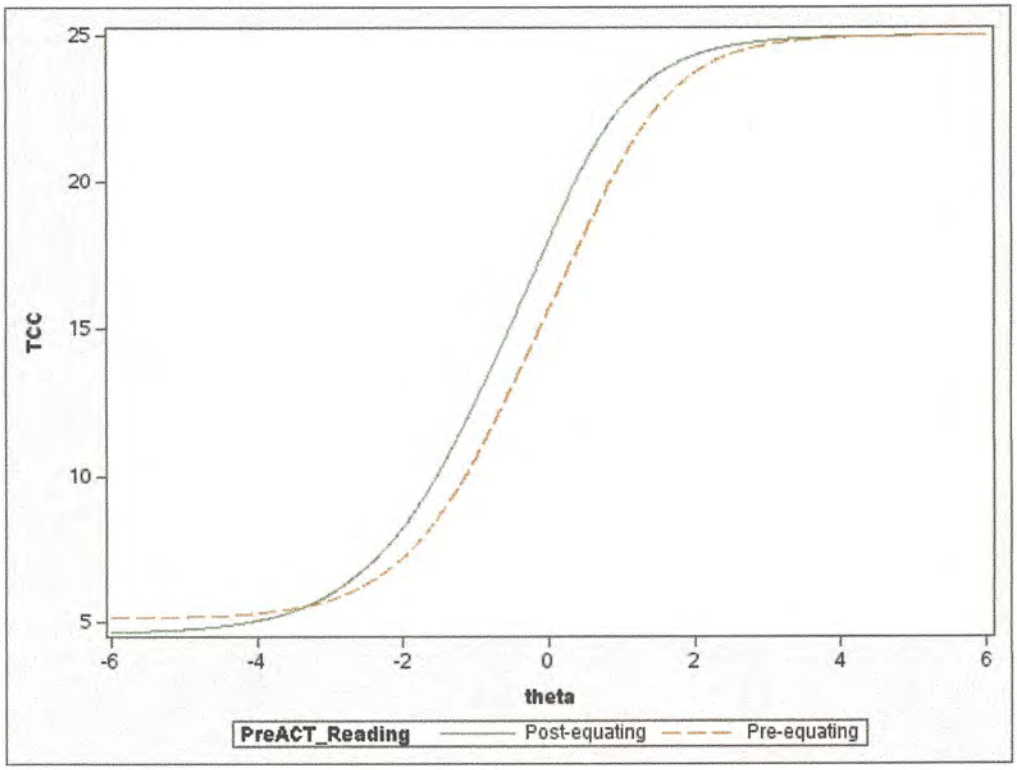

Figure 4.3. Reading TCCs Comparing Pre- and Post-Equating

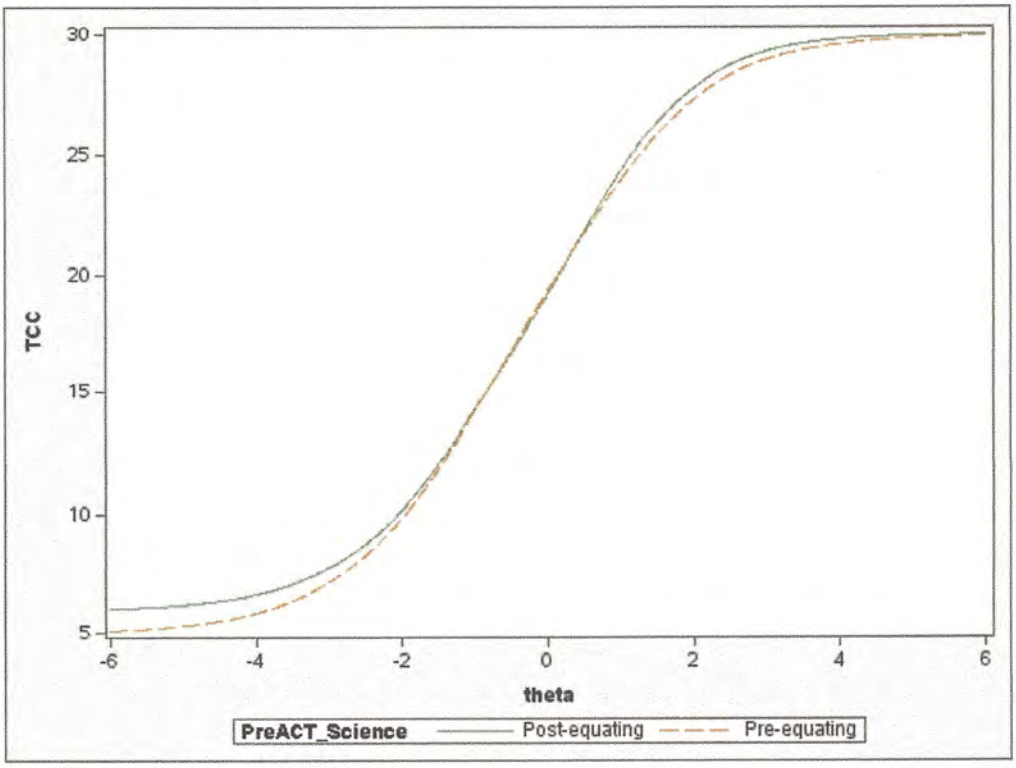

Figure 4.4. Science TCCs Comparing Pre- and Post-Equating

Using both classical and IRT equating methods, support for pre-equating was found for English, mathematics, and science, but reading showed important differences between pre- and post-equating. For the initial operational form given in the fall of 2016, these results are not problematic, as this form will set the scales for each of the subject tests. However, the analyses for reading indicate that for future forms of PreACT analyses of operational data and possibly on special study data should be conducted to provide firmer evidence for the validity of using pre-equating for the PreACT reading test.

Setting PreACT Timing Conditions

In the pilot study, each subject test was administered under two or three different timing conditions, as given in Table 4.1. The timing conditions for A1/B1 were set by giving approximately the same time per item as is given on the ACT. The other timing conditions for each test were set by adding or subtracting five minutes from this base time. Prior to the study, the expectation was that the groups with more time would score higher. However, because the A2 and B2 groups were not necessarily equivalent to each other or to the A1/B1 group, the sample characteristics of the groups taking each form was a confounding factor.

Figures 4.5 and 4.6 present the average form p-values for grades 10 and 11, respectively. Means for A1 and A2 can be compared and means for B1 and B2 can be compared. Some conditions showed the expected pattern where the group with more time scored higher, but in general the results were mixed and indicate that group differences were heavily influenced by sample differences. Also, based on pilot data, average item difficulty (*p*-value) for grade 10 PreACT is less than .50 for all subjects except English, regardless of form or timing. However, these results may have been impacted by low student motivation.

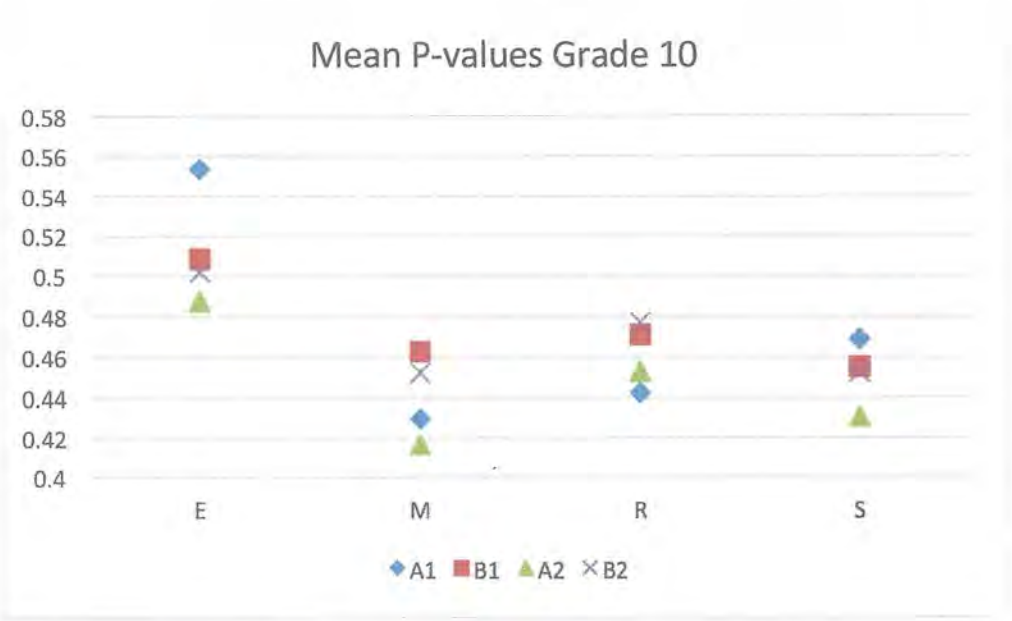

Figure 4.5. Mean *p*-values for Grade 10

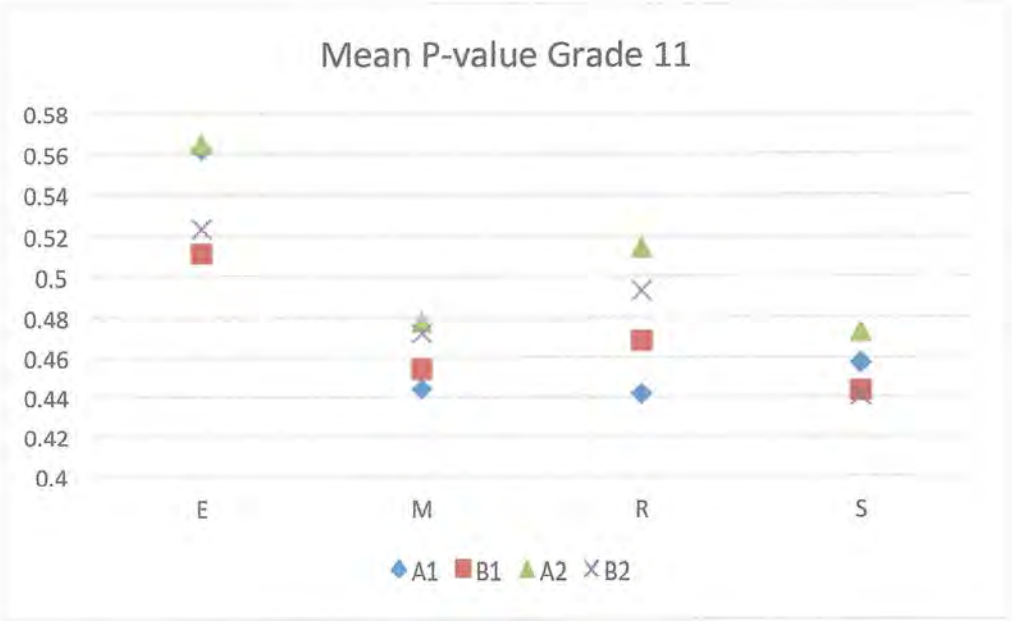

Figure 4.6. Mean *p*-values for Grade 11

A number of other analyses were conducted on the data with respect to examining timing, including comparing omit rates of items at the end of the test and conducting a randomly equivalent groups equating (as described previously) between forms A1 and B1 so that results from all conditions could be compared on a common scale. These results are not presented here for the sake of brevity, but like the mean p-value results reported previously, all analyses conducted on the pilot data indicated that groups taking form A2 and B2 were not comparable

to each other or to randomly equivalent groups taking A1 or B1. Due to sample differences, the data did not lend itself to making clear cut conclusions regarding timing. In order to attempt to mitigate sample differences between the groups, a matched sample technique was conducted to form a sample of students who participated in the pilot and who had taken the ACT within two months prior to the pilot.

Although the matched sample results that follow provide some evidence for the relative proficiency levels of the groups, it is important to keep in mind limitations of the matched sample data. First, the sample sizes by form and grade, given in Table 4.5, are fairly small, especially the grade 10 samples. Additionally, the matched sample may not be representative of the PreACT population, as it only includes students that had already taken the ACT. Given the non-representativeness and the low sample sizes, the results should be interpreted cautiously.

One way the matched sample data were used to inform timing results was to compare ACT and PreACT scale scores. Because students may have been less motivated in the PreACT pilot, it would not be surprising if PreACT mean scores were lower for some conditions. But some interpretations might be drawn if the relative differences of the two tests varied across timing condition, or if the PreACT scores were actually higher than ACT scores. The latter finding could plausibly occur if the PreACT condition had relatively more time per item than the ACT.

Tables 4.5 to 4.8 compare PreACT and ACT mean scale scores across forms and grades and examines the statistical significance of the PreACT and ACT score differences through *t*-tests. For English, the condition with the shortest time limit (A2) had higher ACT scores and showed a significant difference for 11th graders, but no significant score differences for 10th graders. However, the 10th grade sample was small. The medium timing conditions (A1, B1) showed significant score differences favoring the ACT for both 10th grade samples and one 11th grade sample. The longest timing condition (B2) did not show significant differences for either grade. Results for mathematics were similar, showing statistical significance favoring ACT scores for some but not all groups in the shorter timing conditions (B2 shortest; A1/B1 medium), but no significant differences for the longest timing condition (A2). Reading showed statistical significance only for the A1 condition for both grades, but not for condition B1, which had the same timing. The longer timing conditions (A2, B2) showed no significant differences for reading. Science showed statistical significance for all conditions in grade 11, but only one condition (A1) in grade 10.

Table 4.5. English Matched Sample Descriptive Statistics and Paired *t*-test Results for Scale Scores

Grade	Form	N	Test	Mean	Standard Deviation	Mean Difference	df	*t*	*p*
10	A1	138	ACT	24.04	5.67	.74	137	2.00	0.0473*
			PreACT	23.30	6.00				
	B1	142	ACT	23.78	5.72	.74	141	2.40	0.0176*
			PreACT	23.04	5.94				
	A2	29	ACT	21.14	5.19	.62	28	1.01	0.3197
			PreACT	20.52	5.71				
	B2	50	ACT	22.48	5.38	0	49	0.00	1
			PreACT	22.48	5.48				
11	A1	113	ACT	20.79	6.46	.55	112	1.34	0.1822
			PreACT	20.24	7.23				
	B1	119	ACT	21.54	6.73	.91	118	2.55	0.012*
			PreACT	20.63	6.55				
	A2	278	ACT	22.00	6.33	1.54	277	7.71	<0.0001*
			PreACT	20.46	6.45				
	B2	231	ACT	18.71	5.32	.24	230	0.89	0.375
			PreACT	18.47	5.85				

*p < .05

Table 4.6. Mathematics Matched Sample Descriptive Statistics and Paired *t*-test Results for Scale Scores

Grade	Form	N	Test	Mean	Standard Deviation	Mean Difference	df	*t*	*p*
10	A1	138	ACT	22.03	4.13	.54	137	2.09	0.0085*
			PreACT	21.49	4.67				
	B1	142	ACT	21.89	4.20	-.10	141	-0.40	0.6886
			PreACT	21.99	5.04				
	A2	29	ACT	23.07	4.99	-.31	28	-0.72	0.4765
			PreACT	23.38	4.79				
	B2	50	ACT	21.82	4.38	-.42	49	-1.17	0.2465
			PreACT	22.24	4.55				
11	A1	113	ACT	20.59	5.01	.71	112	2.68	0.0085*
			PreACT	19.88	5.09				
	B1	119	ACT	20.65	4.63	.89	118	3.66	0.0004*
			PreACT	19.76	4.58				
	A2	278	ACT	22.24	5.27	.12	277	0.70	0.4842
			PreACT	22.12	5.88				
	B2	231	ACT	19.36	4.11	.49	230	2.42	0.0163*
			PreACT	18.87	3.91				

*p < .05

Table 4.7. Reading Matched Sample Descriptive Statistics and Paired *t*-test Results for Scale Scores

Grade	Form	N	Test	Mean	Standard Deviation	Mean Difference	df	*t*	*p*
10	A1	138	ACT	23.04	5.22	2.21	137	5.86	<0.0001*
			PreACT	20.83	5.42				
	B1	142	ACT	22.94	5.15	-.09	141	-0.20	0.8423
			PreACT	23.03	5.96				
	A2	29	ACT	23.10	6.30	.48	28	0.61	0.5478
			PreACT	22.62	6.56				
	B2	50	ACT	22.98	4.56	-.86	49	-1.53	0.1329
			PreACT	23.84	5.39				
11	A1	113	ACT	21.83	6.11	2.57	112	6.36	<0.0001*
			PreACT	19.26	6.31				
	B1	119	ACT	22.03	5.84	.54	118	1.24	0.2161
			PreACT	21.49	5.85				
	A2	278	ACT	22.22	6.05	.50	277	1.84	0.0662
			PreACT	21.72	6.38				
	B2	231	ACT	19.43	5.16	-.55	230	-1.70	0.0905
			PreACT	19.98	5.68				

*p < .05

Table 4.8. Science Matched Sample Descriptive Statistics and Paired *t*-test Results for Scale Scores

Grade	Form	N	Test	Mean	Standard Deviation	Mean Difference	df	*t*	*p*
10	A1	138	ACT	22.62	3.65	1.61	137	4.32	<0.0001*
			PreACT	21.01	4.65				
	B1	142	ACT	22.45	4.08	.40	141	1.26	0.2091
			PreACT	22.05	4.86				
	A2	29	ACT	22.21	4.51	.11	28	0.19	0.8501
			PreACT	22.10	4.39				
	B2	50	ACT	22.12	3.79	-1.30	49	-2.70	0.0094*
			PreACT	23.42	4.82				
11	A1	113	ACT	20.86	4.87	1.79	112	4.26	<0.0001*
			PreACT	19.07	5.50				
	B1	119	ACT	21.55	4.53	1.47	118	4.25	<0.0001*
			PreACT	20.08	5.12				
	A2	278	ACT	22.20	4.95	1.87	277	8.78	<0.0001*
			PreACT	20.33	5.26				
	B2	231	ACT	19.71	4.05	1.29	230	4.42	<0.0001*
			PreACT	18.42	4.97				

*p < .05

Omit rates across items for the matched sample were also compared. However, these results did not give a clear indication of the preferred timing condition and so are excluded here for brevity. In some cases like mathematics form B2, the timing condition with the least amount of time did have noticeable higher omit rates. However, there were cases, like B2 for 10th graders in English and science, where the condition with the most allotted time had the most omits. Due to the small samples sizes involved, it was judged better not to over interpret the omit results.

The results from a number of analyses, such as p-values, mean scale scores, item omit rates, comparisons of PreACT and ACT score on the matched sample, and matched sample omit rates were taken into consideration in making decisions on timing. Many of these analyses are discussed above. However, the different analyses did not strongly indicate which of the timing conditions would be most appropriate for the PreACT, either based on comparisons to ACT scores or on omit rate. There were specific cases though, as for form A1 in reading for the matched sample results or form B2 for mathematics in the omit results, where evidence suggested that the lowest timing condition should be avoided. There were less obvious differences between the middle or greatest time allotment conditions. Because the middle timing conditions were thought prior to the study to line up best with time allotments on the ACT relative to the number of items on the PreACT, and because the results did not show consistent evidence to the contrary it was decided that the middle timing condition be used operationally for each subject. For reading, which only had a low and a high timing condition, the higher value was used. The final timing for each subject is given in Table 4.9. These timing conditions will be revisited as data from operational administrations become available.

Table 4.9. Operational Time Limits (in Minutes)

	Time Limit
English	30
Mathematics	40
Reading	30
Science	30
Total	130

Score Distributions for Pilot Study

Score distributional data were generated in each subject for grade 10 students who took the form and timing condition that matched the operational timing condition given Table 4.9. These score distributional data are given in Table 4.10. It should be noted that the distributions are likely to differ from operational data due to differences in potential student motivation, population characteristics, and the time of year the test was given. At the time of this writing, student performance data is not available from operational administrations of the PreACT.

Table 4.10. English Scale Score Distributions for Grade 10

Scale Score	English Cumulative Percent	Math Cumulative Percent	Reading Cumulative Percent	Science Cumulative Percent
1	0.00	0.05	0.17	0.18
2	0.00	0.05	0.17	0.18
3	0.09	0.05	0.91	0.18
4	0.09	0.05	0.91	0.28
5	1.06	0.05	0.91	0.28
6	3.55	0.23	2.52	0.74
7	7.18	0.23	2.52	0.74
8	12.48	0.23	5.05	1.47
9	15.38	0.37	5.05	2.90
10	21.36	0.37	9.83	2.90
11	28.18	1.06	14.70	10.04
12	32.32	2.21	22.44	22.88
13	35.68	5.06	29.49	28.50
14	42.40	18.00	36.84	34.16
15	49.13	36.19	44.06	41.02
16	52.90	51.52	55.81	45.90
17	60.22	63.81	62.51	57.00
18	63.67	71.36	67.59	61.19
19	66.76	74.95	71.25	69.11
20	73.48	77.85	75.21	73.25
21	78.82	80.85	78.95	80.99
22	81.58	86.10	82.43	85.08
23	87.34	88.63	86.34	88.44
24	89.50	90.38	86.34	91.02
25	91.30	93.78	89.82	93.28
26	92.86	95.49	92.30	95.63
27	95.07	96.64	92.30	95.63
28	96.87	97.74	94.61	96.96
29	96.87	97.74	94.61	96.96
30	98.25	98.76	96.61	98.48
31	98.25	98.76	96.61	98.48
32	99.03	99.17	98.22	98.48
33	99.03	99.17	98.22	99.40
34	99.77	99.59	99.39	99.40
35	100	100	100	100

4.3 Predicting ACT Score Ranges

PreACT score reports include a PreACT scale score that indicates current student achievement on the ACT scale. The score reports also give predicted ACT scale score ranges that are intended to give grade 10 students an idea of how well they are expected to do on the ACT after a year's time. Because PreACT is a new product, data for students taking PreACT in grade 10 and the ACT in grade 11 were not available at the time of this writing. Therefore, analyses were conducted by examining ACT data from national samples of students who took the ACT in both grade 10 and grade 11. Because the PreACT is on the ACT scale, it is appropriate to estimate growth from grade 10 to grade 11 in this way. However, because the PreACT is a shorter test and consequently less reliable than the ACT, it is expected that predicted score ranges based on grade 10 ACT to grade 11 ACT would be narrower than using PreACT scores for the prediction. Once longitudinal data are available for the same students taking both the PreACT and ACT, the predicted score ranges will be updated.

Three years of ACT student data were examined. Student records were matched for students taking the ACT in grade 10 and then within 12 to 18 months taking the ACT in grade 11. For students with multiple testing occasions within a grade, the most recent administration was taken.

Score distributions for grade 11 were obtained conditioned on grade 10 scores. Following some of the procedures that have been used for one-year ACT Aspire to ACT predictions, the values closest to the 25th and 75th percentiles of the conditional grade 11 distributions were obtained and used as the end points of the score ranges. The resulting score ranges represent approximately 50% of the examinees for a given grade 10 score, although the actual percentage could be higher or lower due to the discreet score scale. Values in the lower end of the score scale were adjusted to account for the sparseness of the data in that region. Additional hand adjustments were made so that at a maximum PreACT score, the prediction range for the ACT included 36. Finally, hand adjustments were made so that an increase in PreACT score did not give a lower predicted ACT score range.

4.4 Reliability and Measurement Precision

Coefficient alpha reliability from the pilot study are given in Table 4.11 for the different forms and timing conditions studied. As data become available, reliability of operational administrations will be reported.

Table 4.11. Raw Score Coefficient Alpha Reliability

Grade	Form	Reliability			
		English	Mathematics	Reading	Science
10	A1	.902	.876	.827	.852
	B1	.898	.882	.852	.852
	A2	.897	.871	.851	.819
	B2	.879	.860	.837	.848
11	A1	.918	.884	.832	.870
	B1	.904	.878	.844	.835
	A2	.907	.898	.866	.856
	B2	.870	.845	.824	.819

4.5 PreACT Score Ranges

Measurement precision on the PreACT student score reports is represented by +/-1 CSEM (Conditional Standard Error of Measurement) from the student's score. CSEM values were computed by form. Because the values across forms were very similar, however, for simplicity it was decided to base the scale score CSEM values on the main form to be administered in the fall of 2016. For future forms the scale score CSEM values will be monitored and will be updated if significant deviations are found. These CSEM values for all PreACT scale scores can be found in Table 4.12.

Table 4.12. PreACT CSEM Values

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

4.6 Validity Evidence

Due to the lack of operational data, limited validity evidence is currently available for PreACT. When data are available, ACT will provide additional validity evidence, such as correlations between ACT and PreACT scores.

Some validity evidence can be gleaned from the pilot study. Students in the pilot study were examined for matching ACT score records. Across all conditions and forms, a total of 1100 students in the pilot study were found to have ACT scores. Based on these matching data, the correlations between PreACT pilot and ACT scale scores are shown in Table 4.13, with disattenuated correlations shown in parentheses. The observed correlations between corresponding subject tests are in the range of .66 to .82 and disattenuated correlations are in the range of .80 to .93. Because of potentially lower motivation effects and other population differences, it is expected that correlations between ACT scale scores and PreACT operational scale scores will be larger than those given in the table.

Table 4.13. Correlations, Observed and (Disattenuated), Between PreACT Pilot and ACT Scores

		PreACT					
		English	**Mathematics**	**Reading**	**Science**	**Composite**	**STEM**
ACT	**English**	0.81 (.90)	0.66	0.67	0.61	0.80	0.69
	Mathematics	0.63	0.82 (.93)	0.57	0.65	0.76	0.80
	Reading	0.69	0.58	0.68 (.80)	0.60	0.74	0.64
	Science	0.64	0.68	0.58	0.66 (.80)	0.73	0.73
	Composite	0.79	0.76	0.70	0.70	0.84 (.93)	0.79
	STEM	0.68	0.80	0.61	0.70	0.79	0.81 (.95)

4.7 PreACT Norms

Norms are not currently available for the PreACT, as limited operational data exist. As data become available, ACT will create norm tables for the PreACT.

CHAPTER 5

The ACT Interest Inventory

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

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

Science & Technology (*Investigative*): Investigating and attempting to understand phenomena in the natural sciences through reading, research, and discussion.

Arts (*Artistic*): Expressing oneself through activities such as painting, designing, singing, dancing, and writing; artistic appreciation of such activities (e.g., listening to music).

Social Service (*Social*): Helping, enlightening, or serving others through activities such as teaching, counseling, and working in service-oriented organizations.

Administration & Sales (*Enterprising*): Persuading, influencing, directing, or motivating others through activities such as sales, supervision, and aspects of business management.

Business Operations (*Conventional*): Developing and/or maintaining accurate and orderly files, records, etc.; designing and/or following systematic procedures for performing business activities.

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

5.1 Score Interpretation and Reporting

The ACT Career Map. The Career Map (Figure 5.1) is an empirically based tool for occupational exploration and interest inventory score interpretation. The map visually displays the similarities and differences between occupations by showing the locations of 26 career areas (groups of similar occupations) with respect to four compass points. The compass points are based on two orthogonal work-task dimensions shown to underlie the six Holland types and the work activities of all occupations across the work world (ACT, 2009): working with data/ideas and people/things.

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

Development of the current edition of the Career Map involved the use of three large databases providing three diverse perspectives for classifying occupations to career areas and determining career area locations on the map: (a) general nature of work (expert ratings); (b) detailed nature of work (job analysis data); and (c) interests of workers (mean interest scores). Data/ideas and people/things scores based on each data source were obtained for hundreds of O*NET occupations. For the data/ideas scores, correlations for the three sets of database pairs ranged from .75 to .78. For the people/things scores, the correlations ranged from .74 to .81. These correlations, which are unusually high

for scores based on diverse data sources, provide good support for the work task dimensions underlying the Career Map. As expected, the data/ideas and people/things scores were essentially independent. Additional details are found in Prediger & Swaney (2004).

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

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

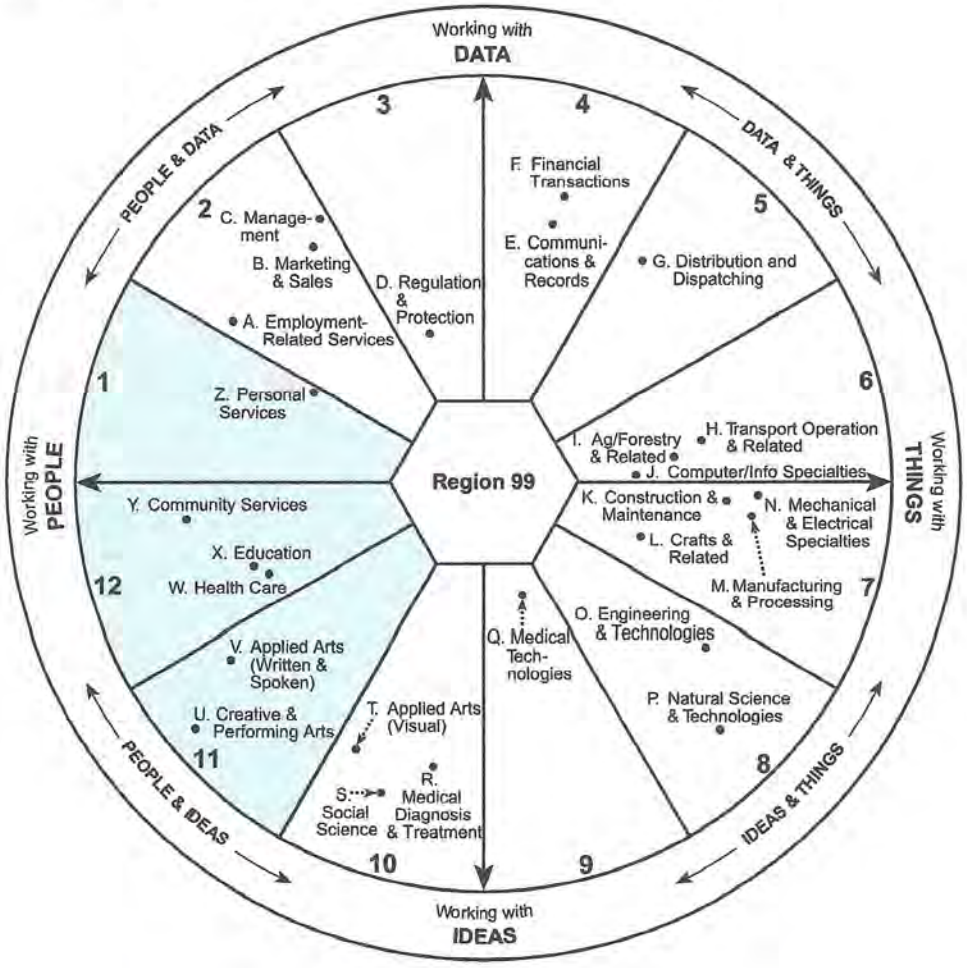

Figure 5.1. The ACT Career Map and Example Results (three shaded map regions)

5.2 Development and Norms

Development. Item selection for the current edition of the ACT Interest Inventory involved evaluating tryout items with respect to four item content criteria and five rigorous item performance criteria. Performance and content criteria were prioritized to permit the ranking of items based on quality of functioning. Based on data from 9000 students in grades 8, 10, and 12, the best 72 items (12 per scale) were selected. Item/scale functioning was subsequently evaluated on 60,000 students in grades 8, 10, and 12. A complete discussion of these procedures is found in ACT (2009).

Norms. Development of the norming sample was based on interest inventory responses from students who participated in ACT PLAN, a comprehensive national assessment program designed to help guide 10th graders in education and career planning. The target population for the Interest Inventory in PreACT consisted of students enrolled in grade 10 in the United States. Although the ACT PLAN program tested a sizable percentage of U.S. high school students, some sample bias was inevitable. To improve the national representativeness of the sample, individual records were weighted to more closely match the characteristics of the target population with respect to gender, ethnicity, school enrollment, school affiliation (public/private), and region of the country. The sample consisted of 407,325 students from 4,030 schools. Additional information on the weighting, precision, and representativeness of this grade 10 norming sample is available in ACT (2009).

5.3 Psychometric Support

The ACT Interest Inventory Technical Manual (ACT, 2009) describes the rationale, development, norms, reliability, and validity of the instrument. ACT invites readers to examine the full scope of information available on the ACT Interest Inventory in that manual. The following is a small portion of the available technical information.

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

Validity. Construct validity refers to the extent to which assessment scores measure what they are purported to measure, and is evaluated in light of the purpose of the assessment. ACT Interest Inventory results are primarily used

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

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

ACT Interest Inventory item responses were obtained for a random sample of 10,992 high school seniors who registered for the ACT, completed all 72 items, and reported that they were "very sure" of their future occupational choice. Students were assigned to one of six career groups on the basis of occupational choice. The unweighted average hit rate across the six scales was 42%. (By chance alone the hit rate is one out of six, or 17%). This approach to assessing ACT Interest Inventory validity has been used in many earlier studies, involving over 68,000 people and 23 sets of criterion groups. Across these studies, unweighted average hit rates have ranged from 31% to 55% (median of 42%). These hit rates meet or exceed the hit rates reported for comparable inventories, supporting the use of the ACT Interest Inventory in career exploration and counseling.

Another type of validity pertains to the structural relationships among the scales. Holland's (1997) career theory uses a hexagon to visually represent the relationships between the six career types. Thus, if ACT Interest Inventory scales are measuring their intended constructs, we should expect to see a pattern of scale relationships that, when displayed visually, reveal an approximately hexagonal shape. As noted earlier, research suggests that the data/ideas and people/things work task dimensions underlie Holland's (1997) hexagon. The coordinates of the six points on a hexagon were used in a principal components analysis to target the expected correlations between the scales and these two dimensions. Correlations (loadings) between ACT Interest Inventory scales and the work task dimensions, as determined by the targeted principal components analysis, were obtained for large national samples of

8th, 10th, and 12th grade students. Factor loadings were plotted for males and females in all three grades. The obtained structures were in accord with theory: plots were approximately hexagonal for all grades and quite similar across gender. The observed relationships support the structural validity of the scales and the generalizability of the work task dimensions. A complete discussion of analyses and results is found in ACT (2009).

CHAPTER 6

Reporting and Data Services

This chapter describes the reporting and data services of the PreACT. Additional information on reporting and data services may be found in the *PreACT Interpretative Guide for Student and Aggregate Reports* available in PDF at http://www.act.org/content/dam/act/unsecured/documents/InterpretiveGuide-PreACT.pdf.

6.1 Student Report

Two PreACT Student Reports are provided to the school. One is intended for the student, the other can be retained for school use.

The Student Report includes the following information:

a. Test Scores for the four academic tests (English, mathematics, reading, and science), the Composite score, and the STEM score. The Composite score is the arithmetic average of the four academic test scores; the STEM score is the average of the mathematics and science scores only.
b. Predicted ACT Composite Score Range, which is the range within which the student's ACT Composite score would be expected to fall when he or she takes the ACT in the next year. Also included are the predicted ACT score ranges for the four academic tests and the predicted STEM score range. The predicted score ranges were derived using procedures described in Chapter 4.
c. Detailed PreACT Results, which is performance on the reporting categories of the four academic tests as well as a proficiency indicator for Understanding Complex Texts.
d. Your High School Course Plan Compared to Core. Students' self-reported plans for high school course work in a set of core courses are compared to

the course of study in English, mathematics, social studies, and science recommended by ACT as the minimum necessary for students to be prepared for entry-level college courses.

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

f. Your Interest-Career Fit, which displays the level of agreement between the student's interests and the career area (a group of similar occupations) they selected. For example, high fit means that the student's measured interests are in agreement with the kinds of occupations they prefer.

g. Item Response Analysis, which shows how a student answered each question and the correct response. Also included are Ideas for Progress, which are based on each academic test's scale score.

6.2 Student Score Label

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

6.3 Student List Report

Each participating school receives an alphabetical list of students who took part in PreACT with a summary of each student's academic tests, career and educational plans, estimated ACT score ranges, and Special Status and Accommodation codes.

On the list report, students from the same grade level (as reported on their answer folders) are grouped together. For example, all 9th grade students are listed alphabetically, then all 10th grade students, etc. Students who did not indicate a grade are listed separately.

6.4 Educator Reports

ACT will provide to schools and districts an Educator Report, which aggregates and summarizes PreACT results, for the grade with the highest number of students (above or below 25) and any additional grade with 25 or more students.

The PreACT Educator Report consists of a series of tables to address the following issues:

- What is the frequency of the PreACT scores of our students?
- Do our students' PreACT scores differ by gender and/or ethnic group?

- Do our students' PreACT scores differ by the courses they have taken or are currently taking?
- How do our students' PreACT Composite scores and coursework plans relate to their educational plans?
- How do our students' PreACT Composite scores and coursework plans relate to their expressed needs for help?
- How do our students PreACT Composite scores, coursework plans, and educational plans relate to their career interests?
- How did our students' respond to the local items (if applicable)?

The District Educator Report consists of the same series of tables found in the Educator Report. These reports summarize selected PreACT information about a district's tested population.

6.5 Early Intervention Rosters

Early Intervention Rosters include lists of students who quality under four possible categories. For the first three categories, students are listed alphabetically by name with their PreACT scores, coursework plans, and educational plans. Under the fourth category, students are listed alphabetically by name with their PreACT scores and selected area(s) for which they indicated needing help. The four categories are:

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

6.6 Item-Response Summary Reports

The Item-Response Summary Report provides tables for each academic test, describing item by item the performance of examinees. Item response results are categorized by test (e.g., math) and by reporting category (e.g., Preparing for Higher math).

6.7 Data Service

The Data Service provides a school's and district's PreACT student records on CD. These records can be integrated into a school's database.

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