



**ACT WorkKeys®: Awarding College Credit through the
ACT® National Career Readiness Certificate**

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**ACT WorkKeys®:
Awarding College Credit through the ACT® National Career Readiness Certificate**

Executive Summary

The ACT National Career Readiness Certificate (NCRC) is awarded at four levels of achievement – Bronze, Silver, Gold, and Platinum – based on performance on three of ACT’s WorkKeys assessments: *Applied Mathematics*, *Reading for Information*, and *Locating Information*. In 2012, after reviewing NCRC materials, documentation, and test forms, ACE recommended that institutions award three undergraduate credits in critical thinking to students who earned a Gold or Platinum certificate.

Only 19 % of individuals who earn an NCRC credential qualify at the Gold level or higher. Individuals at the Gold level have demonstrated the foundational work readiness skills needed for 93% of the jobs recently profiled in ACT’s Job Pro database. For the purpose of awarding college credit, achievement of the Gold or Platinum NCRC represents a rigorous standard.

ACT WorkKeys incorporates a rigorous process of item development to ensure that all scored items are workplace relevant, fair, and align to well-defined specifications. ACT content staff collaborate with ACT psychometricians to ensure that all forms are built to exact content and statistical specifications. ACT carefully monitors the administration of all WorkKeys tests to ensure the standardization, integrity, security, and fairness of the testing process.

In awarding college credits to students who have achieved a Gold or Platinum NCRC, an institution would be rewarding students who demonstrate that they have developed the foundational skills needed for today’s economy. Further, the institutions would be facilitating students as they strive to achieve their academic degrees. With the recent attention focused on the problem of student loan debt and the low graduation rates of some institutions, colleges may want to seek innovative ways to assist highly qualified students to attain academic success. A recent Gallop/Lumina Foundation poll showed that 87% of students felt they should receive college credit for knowledge and skills mastered outside the classroom and 75% said they would be more likely to enroll in a higher education institution if they could be evaluated and receive college credit for what they know. This last point is particularly relevant for highly-qualified at-risk students. They are also the students who are most likely to drop out, fail to graduate, and experience problems with financial debt. For these reasons, at-risk students are the individuals who would stand to benefit the most from a skills-based educational system - a system that would allow them to earn credit by demonstrating their 21st century skills through the attainment of a high-level NCRC. An institute would benefit by adopting this type of skills-based approach by demonstrating that they are putting students first and considering alternative paths to achieving higher education success.

The question has been asked frequently how credits earned for critical thinking fit into an academic program of study. Despite this, since John Dewey (1910) and probably before, educators have been aware of and concerned about teaching students to think critically. To assist students in successfully preparing for the workplace and to provide alternative paths to educational success, ACT proposes that three credits awarded for a Gold or Patinum NCRC be granted in a manner that aligns with the institution’s mission, curricular offerings, and student learning goals.

Background

ACT began issuing the ACT National Career Readiness Certificate (NCRC) in 2006 as a unique portable¹, evidence-based credential certifying that an individual possesses the essential problem solving and critical thinking foundational skills needed for workplace success. More than 2.3 million certificates have been registered to date. The NCRC is awarded at four levels of achievement – Bronze, Silver, Gold, and Platinum – based on performance on three of ACT’s WorkKeys assessments: *Applied Mathematics*, *Reading for Information*, and *Locating Information*. Since the WorkKeys assessment program was launched in 1992, more than twenty million assessments have been administered.

The NCRC is available in all 50 states and serves as a bridge for emerging, transitional, and current workers seeking to enter or reenter the workplace, receive job-related training, or pursue advanced opportunities. It is a proven predictor of performance both in the workplace and in college- and industry-based training/educational programs (Borman, 1991, Mayo, 2012).

ACT proposed in 2012 that the American Council on Education (ACE) review and accredit the NCRC as a credential students could use to achieve college credit. ACT proposed to ACE that they recommend the awarding of college credit to students who have earned a high-level NCRC. Granting college credit to students who have achieved the NCRC would be consistent with a skills-based educational approach while facilitating the opportunity for them to earn their degree.

As a part of the accreditation process, an ACE review team traveled to ACT in the summer 2012 to evaluate the NCRC program and provide recommendations. Following the review process, ACE recommended that institutions may award three undergraduate credits, at the lower-divisional level, in critical thinking to students who earned a Gold or Platinum certificate.

The purpose of this paper is to provide information to postsecondary institutions regarding the NCRC and why students who have earned a high-level credential should be awarded college credit. To make this case, the paper presents supporting information related to National Career Readiness Certificate, WorkKeys test development and administration standards, and critical thinking and the awarding of college credit.

¹ A credential is considered portable when it is recognized and accepted as verifying the qualifications of individuals in other settings – most often geographic regions or employing companies.

ACT National Career Readiness Certificate

ACT recognized 20 years ago that in the fast-paced technologically driven global economy, employers were looking for individuals who have the necessary skills to perform the jobs of today and to adapt to the jobs of tomorrow. ACT established the WorkKeys system in response to a very real need for better information about employability skills and job readiness. To develop the system, ACT consulted with employers, educators, and labor organizations to define essential, functional workplace skills. ACT selected and defined the initial WorkKeys skills by collaborating with a panel of advisors made up of educators and business persons, reviewing the literature on employer-identified skill needs, and surveying employers and educators. Survey participants, charter members of the WorkKeys development effort, came primarily from seven states and a network of community colleges in California. These charter members and panelists assisted in the design and reviewed the initial plans and materials.

As a part of the WorkKeys system, ACT has profiled more than 19,500 individual jobs across the United States to determine the skills and skill levels needed. According to ACT research, three skills are highly relevant for success across most jobs: reading for information, applied mathematics, and locating information. These skills constitute the three assessments of the NCRC. Each assessment is described below.

Reading for Information measures the skills people use when they read and use written text in order to do a job. The written texts include memos, letters, directions, signs, notices, bulletins, policies, and regulations. The test questions are developed from materials that reflect actual reading demands of the workplace.

Applied Mathematics measures the skills people use when they apply mathematical reasoning and problem-solving techniques to work-related problems. The test questions require the test taker to set up and solve the types of problems and do the types of calculations that actually occur in the workplace.

Locating Information measures the locating, comparative, summarization, and analytic skills people use when they work with workplace graphics such as charts, graphs, tables, forms, flowcharts, diagrams, floor plans, maps, and instrument gauges.

(For a detailed description of the construct of each assessment, the skill levels associated with each assessment, and the level score distribution, please see the paper's Appendix.)

All three assessments contain items presented in multiple choice format. Most items have associated stimuli in the form of passages, graphs, charts, or tables. At higher levels, two or three items may be based on a common stimulus. All three assessments are criterion referenced based on defined skill levels. An examinee who takes the three NCRC assessments receives a score report for each assessment providing both a scaled score and a level score. The score report provides descriptions of the skills that the examinee has demonstrated. It also provides a list of skills that he or she needs to improve upon to raise the level score. For *Reading for Information* and *Applied Mathematics*, examinees achieve a level score of <3, 3, 4, 5, 6, or 7. For *Locating Information*, they achieve a level score of <3, 3, 4, 5, or 6. To achieve an NCRC, an

examinee must score a minimum of Level 3 on all three assessments. Table One provides the criteria for achieving each credential level and its relationship to job skill requirements.

Table 1: NCRC Skill Levels

Credential Level	Skill Level and Its Relationship to Jobs
Bronze Level	Signifies an individual has scored at least a Level 3 on each of the three assessments and has the necessary skills for 16% of the jobs in the WorkKeys Job Pro database.
Silver Level	Signifies an individual has scored at least a Level 4 on each of the three assessments and has the necessary skills for 67% of the jobs in the WorkKeys Job Pro database.
Gold Level	Signifies an individual has scored at least a Level 5 on each of the three assessments and has the necessary skills for 93% of the jobs in the WorkKeys Job Pro database.
Platinum Level	Signifies an individual has scored at least a Level 6 on each of the three assessments and has the necessary skills for 99% of the jobs in the WorkKeys Job Pro database.

Only 19% of individuals who earn an NCRC credential qualify at the Gold level or higher. Individuals at the Gold level have demonstrated the foundational work readiness skills needed for 93% of the jobs recently profiled in ACT’s Job Pro database. For the purpose of awarding college credit, achievement of the Gold or Platinum NCRC represents a rigorous standard.

WorkKeys Test Development and Administrative Standards

WorkKeys assessments are administered in both paper/pencil and computer based format at secure test locations across the United States. To meet the demands of examinees, educators, and businesses, ACT is engaged in a process of continuous item and form development.

Item Development

ACT incorporates a rigorous process of item development to ensure that all scored items are workplace relevant, fair to all examinees, and align to well-defined content and statistical specifications.

Item writers are recruited in a variety of ways and represent a diversity of occupations and employment settings. They receive training and coaching from ACT Content Specialists, and they write items to defined WorkKeys skill levels (e.g., a writer may develop an item to measure Reading for Information skills at Level 4). Along with the item, writers are required to submit workplace justifications. All items undergo ACT’s thorough editing process to ensure clarity. Following the editorial review, items are reviewed by external reviewers for content relevance and cultural and job fairness. Before an item becomes a scored item, it is embedded in a test form for pretesting. Following pretest review, if it meets the defined statistical criteria, it becomes eligible for use as a scored item.

Form Development

New test forms are developed continuously. The general exam cycle consists of numerous forms per year: paper/pencil and computer based forms. Additionally, special forms are developed for clients during the year.

New test forms are developed to be parallel and equivalent to all other forms. ACT's Measurement and Research Division (MRD) utilizes sophisticated statistical methods to ensure each new form is on the identical score scale as test's base form. All new forms are anchored to a previously administered form. A new form will contain seven to ten items from the anchor form. The remaining items are added from the pool of eligible items to conform to content and statistical requirements. A draft of the new form with item history and keys are reviewed and approved for content standards by WorkKeys test development and for statistical and psychometric standards by MRD. (All MRD psychometricians associated with WorkKeys have doctoral degrees, and several of them have published papers and presented at professional conferences.) Upon approval, MRD issues a memo describing the type of equating performed and item statistics used to evaluate the form.

With the approval of a new form, WorkKeys Content Specialists lead the process of form publication. When the form is published, it and its associated keys and score conversion files are reviewed and approved by test development and MRD.

Test Administration

All WorkKeys tests, regardless of where testing occurs, are administered under standardized procedures. WorkKeys has well developed supervisor manuals for paper/pencil and computer based delivery. The Supervisor's Manual specifically describes the requirements for selecting staff to assist with coordinating and administering the WorkKeys assessments. The manual defines various testing roles. Requirements for each role are specified. Individuals responsible for overall supervision and coordination must complete and sign a statement of agreement. Conditions that disqualify an individual from performing a role are described, and there are penalties for violating any policy.

The Supervisor's Manual also describes several measures that are taken to ensure the security of the exams during administration. These measures include a general policy describing confidentiality: who may observe testing, conditions of fair testing, investigation procedures, and re-testing policy. It defines specific requirements regarding facilities including the physical requirements and the equipment that must be present.

Supervisors are instructed on measures to safeguard testing materials including limiting access, instructions for checking in materials, storing materials, and how to report suspected breaches. Supervisors must complete irregularity reports for any variation from the standard administration.

Finally, all examinees are required to read and sign (for paper/pencil administration) or electronically agree (for computer based administration) to the Terms and Conditions of testing.

Test Form Analysis

ACT's MRD conducts the analysis and evaluation of items and forms following an administration. MRD utilizes classical and Item Response Theory to evaluate test forms and individual items. Item data is stored in ACT's secure Item Bank and is reviewed by Content Specialists.

Critical Thinking and the Awarding of College Credit

The ACE accreditation study recommended the awarding of three college credits in the area of critical thinking, at the lower divisional level, for the achievement of a Gold or Platinum credential. Because the combined NCRC assessments overlap several academic disciplines, they determined that the combined assessments, at the higher levels, were best aligned to critical thinking.

The skill definitions for levels 5, 6, and 7 (see Appendix for skill definitions) align well with academic conceptualizations of critical thinking. As defined by the National Council for Excellence in Critical Thinking (1987), critical thinking skills includes the ability to

- analyze information,
- identify underlying assumptions,
- identify alternative courses of action,
- identify associated risks,
- make responsible decisions,
- draw accurate inferences,
- identify key ideas,
- solve complex problems
- evaluate evidence (Scriven & Paul, 1987, Paul & Elder, 2008, Paul, 1993).

At higher levels, NCRC skill levels require examinees to demonstrate the ability to infer word meaning from context, apply instructions to new situations, identify implied details, identify key ideas, identify trends, solve complex problems, sort through distracting information, and make decisions based on detailed information. All of these abilities are contained within the definition of critical thinking skills.

Carnevale and Smith (2013) summarized the skills that people need and employers want in the 21st century knowledge-based economy. These skills included basic skills (reading, writing, and mathematics), foundational skills (knowing how to learn), communications skills (listening and oral communication), adaptability (problem solving and creative thinking), and group effectiveness (interpersonal skills, negotiation skills, and teamwork). They maintained that to survive in the 21st century, workers need robust skills including "reading processes that allow them to locate information and use higher-level thinking strategies to solve problems" (Carnevale & Smith, 2013, p. 4). The WorkKeys skill definitions at the higher levels parallel the 21st century skills identified by Carnevale and Smith.

In the New Options –New Mexico (NONM) project, Innovate+Educate studied the employment opportunities for at-risk youth (ages 16 to 24) in the state of New Mexico. The project focused on the question of employer hiring practices. They asked if employers changed their hiring practices to focus on a skills-based approach would it assist or hinder at-risk youth (Mayo, 2012). Mayo believed that traditional methods of hiring, using diploma-based practices, reduced employment opportunities for at-risk students. She maintained that many non-cognitive factors resulted in at-risk students not being able to finish school and earn a diploma or degree. The non-cognitive factors that interfered with at-risk youths’ school success included the ability to afford school, to navigate arcane college admissions and financial support systems, the requirement to work full-time to support one’s family, and the responsibility to care for younger brothers and sisters.

NONM provided at-risk youth in high-poverty high schools the opportunity to take the three NCRC assessments and earn the credential. The students participating in the study were at high risk of dropping out of high school, and few of the students were expected to attend post-secondary schools. With over 500 students taking the WorkKeys assessments, the test score findings are reported in Table Two.

Table 2: Results of NONM WorkKeys Testing of At-Risk Youth

Certificate	Percent Achieving	NONM Description
No Certificate	38%	Unable to perform an entry level job.
Bronze	28%	Qualified for entry level job. New Mexico high school graduates typically test at this level.
Silver	30%	Qualified for blue or pink collar job. New Mexico college graduates typically test at this level.
Gold	4%	Well qualified for white collar job. Admission to competitive U.S. colleges occurs at this level.
Platinum	0%	Less than 1% nationwide achieves platinum. Rare combination of cognitive skill.

Although 38% of at-risk youth lacked the skills necessary for entry level positions, 62% of the students demonstrated that they were qualified for entry level positions or higher. From the study, Mayo (2012) concluded that a skills-based hiring approach would greatly increase the likelihood of employment opportunities for many at-risk youth. Although the majority of these 62% had experienced difficulties in school and their life chances appeared limited, they had developed the skills necessary for job success. NONM followed up on the testing by placing these students into jobs or job training programs. Employers generally found that the students performed well, and that they were very pleased with their new employees (Mayo, 2012).

This same skills-based hiring approach can be applied in higher education by awarding college credit to students who demonstrate that they possess 21st century knowledge based skills. In awarding college credits to students who have achieved a Gold or Platinum NCRC, an institution would be rewarding students

who demonstrate that they have developed the skills needed for today's economy. Further, the institutions would be facilitating students as they strive to achieve their academic degrees. With the recent attention focused on the problem of student loan debt and the low graduation rates of some institutions, colleges need to be seeking innovative ways to assist highly qualified students to attain academic success.

Recent surveys conducted by Gallup (2013) indicate that most Americans (87%) think that higher education institutions should award credit for knowledge and skills acquired outside the classroom. The same survey also found that most people indicate they would be more likely to enroll in higher education programs if such credit was awarded (75%) and that the credits should be given based on mastery of content versus seat time in a classroom (70%). These findings are particularly relevant for highly-qualified at-risk students. As Mayo (2012) explained, at-risk students are the individuals who would benefit most from skills-based hiring practices. They are also the students who are most likely to drop out, fail to graduate, and experience problems with financial debt. For these reasons, at-risk students are the individuals who would stand to benefit the most from a skills-based educational system - a system that would allow them to earn credit by demonstrating their 21st century skills through the attainment of a high-level NCRC.

From an institution's perspective, awarding college credit for the attainment of the Gold or Platinum NCRC would signify to students that the school is putting students first and considering alternative paths to achieving higher education success. Such a decision would be important for students who for financial or personal reasons, need to proceed as rapidly as possible toward their degree. For some students, it might encourage them to enter a more challenging field of study. It also could build bridges for transitioning workers seeking to upgrade their skills to become more marketable. For at-risk students who earned the Gold certificate (for example, the 4% of at-risk students who earned the Gold credential in the NONM study), providing credit might enable them to see that college is a viable option and that they could succeed in college studies.

Ultimately, there is a need for postsecondary institutions to produce graduates who possess the workplace skills that employers want, the evidence for which could be measured by the NCRC. The problem solving and critical thinking foundational skills measured by the NCRC have been shown by ACT Research to be required for the majority of jobs profiled in ACT's job profile database and in all of the U.S. Department of Labor Industry Competency Models. Of concern is recent evidence of a skills gap for these foundational work readiness skills for individuals who complete four or more years of postsecondary education for jobs that require a similar level of educational attainment (ACT, 2013).

The question has been asked frequently how credits earned for critical thinking fit into an academic program of study. As of today, the number of courses offered nationwide in critical thinking is small. Very few higher education institutions offer such a course. Despite this, since John Dewey (1910) and probably before, educators have been aware of and concerned about teaching students to think critically. A higher education course where the professor does not teach his or her students to think critically in the context of the subject matter would be a misnomer. Students develop and learn critical thinking skills through various experiences and course offerings. Each institute and each program of study is unique in its requirements and offerings. At the same time, every program wants its graduates to be able to think critically within the discipline.

As such, each institution should be granted sufficient leeway to determine how to best to implement and measure the teaching of critical thinking both within and across their curricular offerings. Institutions should be able to determine how the critical thinking credit would be awarded to a student who achieves a high-level NCRC credential. Toward the aforementioned goals of both preparing students to be successful in the workplace and providing alternative paths to education success, ACT proposes that the three credits awarded for a Gold or Platinum NCRC be granted in a manner that aligns with an institution's mission, curricular offerings, and student learning goals.

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**ACT WorkKeys:
Awarding College Credit through the National Career Readiness Certificate**

Appendix

Section 1: *Reading for Information* Content

Section 2: *Applied Mathematics* Content

Section 3: *Locating Information* Content

Section 1:
Reading for Information Test Content

Designed to measure the reading skills required for entering and succeeding in a wide range of jobs, *Reading for Information* is based on the premise that workers who possess foundational skills in reading can more readily learn job-specific skills through experience or additional training.

Reading for Information is a multiple-choice test designed to measure skills in reading work-related documents. The documents – which include memos, letters, directions, signs, notices, bulletins, policies, and regulations – are based on material that reflects the actual reading demands of the workplace. All of the reading selections and items formulated for inclusion in the *Reading for Information* assessment are based on a construct defined by three aspects: the categories of choosing main ideas or details, understanding word meanings, applying instructions, applying information, and applying reasoning. The Document Types used as reading selections are categorized as Instructions, Information, Policies, Contracts, and other Legal Documents. And, like all WorkKeys foundational skill assessments, *Reading for Information* incorporates an aspect of increasing complexity with respect to the tasks and skills assessed.

ACT translated this theoretical construct of *Reading for Information* into a working set of test specifications, which is used to guide the construction of standardized test forms. Guided by these specifications, ACT selects items for the test that present reading problems in the context of a job in which the problems are defined in terms of specific reading skills and document types, both of which increase in complexity by skill level. In addition, ACT used its Work-of-Work Career Clusters to ensure that the test items present reading problems in a variety of workplace situations.

Experts in reading education and workplace productivity agree that proficiency in reading is essential to successful participation in today's knowledge-based economy. The National Council of Teachers of English and the International Reading Association note in their current *Standards for the English Language Arts* that:

Literacy expectations are likely to accelerate in the coming decades. To participate fully in society and the workplace in 2020, citizens will need powerful literacy abilities that until now have been achieved by only a small percentage of the population. At the same time, individuals will need to develop technological competencies undreamed of as recently as ten years ago. One unexpected outcome of the recent explosion in electronic media has been a remarkable increase in the use of written language, suggesting that predictions about the decline of conventional literacy have been misplaced and premature (<http://www.ncte.org/about/over/standards>).

Understanding the requirements of the workplace, ACT designed *Reading for Information* to assess a wide range of skills related to reading and understanding workplace information, instructions, procedures, and policies. The action-oriented texts found in many workplaces differ from the explanatory and narrative texts on which most academic reading programs are based. In addition, unlike academic texts, which are usually organized to ease understanding, workplace communication is necessarily well written or easy to read. The reading selections in *Reading for Information* are based on actual workplace materials representing a variety of occupations and workplace situations. These selections and their associated test items are designed to the *Reading for Information* construct.

The *Reading for Information* construct is defined by three aspects: Reading Skills, Document Types, and Levels of Complexity. These aspects can be mutually exclusive or they can interact. Workplace Reading Skills vary in their Level of Complexity. Moreover, the Reading Skills applied depend on the Document Types employees are asked to read. These three aspects of the *Reading for Information* construct are enumerated below.

Levels of Complexity:

- Level 3
- Level 4
- Level 5
- Level 6
- Level 7

Reading Skills

- Choosing main ideas or details
- Understanding word meanings
- Applying instructions
- Applying information
- Applying reasoning

Document Types

- Instructions
- Information
- Policies
- Contracts
- Legal Documents

Skill Definitions for *Reading for Information*

Level	Skills
3	Identify main ideas and clearly stated details. Choose the correct meaning of a word that is clearly defined in the reading. Choose the correct meaning of common, every day, and workplace words. Choose when to perform each step in a short series of steps. Apply instructions to a situation that is the same as the one in the reading materials.
4	Identify important details that may not be clearly stated. Use the reading material to figure out the meaning of words that are not defined. Apply instructions with several steps to a situation that is the same as the situation in reading materials. Choose what to do when changing conditions call for a different action (follow directions that include “if-then” statements).
5	Figure out the correct meaning of a word based on how the word is used. Identify the correct meaning of an acronym that is defined in the document. Identify the paraphrased definition of a technical term or jargon that is defined in the document. Apply technical terms and jargon and relate them to stated situations. Apply straightforward instructions to a new situation that is similar to the one described in the material. Apply complex instructions that include conditionals to situations described in the materials.
6	Identify implied details. Use technical terms and jargon in new situations. Figure out the less common meaning of a word based on context. Apply complicated instructions to new situations. Figure out the principles behind policies, rules, and procedures. Apply general principles from the materials to similar and new situations. Explain the rationale behind a procedure, policy, or communication.
7	Figure out the definitions of difficult, uncommon words based on how they are used. Figure out the meaning of jargon or technical terms based on how they are used. Figure out the general principles behind the policies and apply them to situations that are quite different from any described in the materials.

Reading for Information
Score Distribution

Score Level	Percent of Examinees
<3	3%
Level 3	21%
Level 4	36%
Level 5	30%
Level 6	4%
Level 7	3%

*Percentages are derived from the scores of 698,253 examinees assessed in the United States from September 2011 through August 2012.

Section 2: *Applied Mathematics* Test Construct

Applied Mathematics is a multiple-choice test designed to measure the extent to which individuals can use the mathematics skills needed in workplaces, where the ability to think problems through in context and find and evaluation solutions is important. The assessment measures skills that individuals use when they apply mathematics reasoning and problem-solving to work-related problems.

Applied Mathematics is based on a construct defined involving the aspects of function, application, and the complexity of problems. The quantitative functions include performing basic operations; understanding and working with fractions, ratios, and proportions; using formulas to find solutions; converting measures or metrics from one form to another; solving assorted word problems; and estimating values and rounding in order to review problems and calculations to find errors. Applications refer to quantitative tasks typically encountered on the job, such as working with monetary units and solving problems of quantity, time, measurement, proportions and percentages, averages, and sequencing.

As they are presented to assess increasing levels of skill, *Applied Mathematics* problems also increase in complexity with respect to situations, concepts, and calculations. Problems include more information, and more steps are required to find solutions. The most complex problems present complicated situations in which arriving at the correct answer may require several steps. Typically, this means combining two or more applications, which increases complexity. For the most complex problems, it is necessary to think critically, make inferences, derive some information from what is given, and determine which information is not useful or relevant. The three aspects of the *Applied Mathematics* construct are designed to vary in complexity, with functions performed relative to work-related applications found in a variety of jobs.

ACT translated this construct into a working set of test specifications, which is used to guide the construction of standardized test forms. The test specifications determine for each level of items how and in what forms numbers are used, the tasks test takers need to perform, and the kinds of mathematical solutions required. These facets define the domain of mathematics skills covered in *Applied Mathematics*. In addition, ACT uses its World-of-Work Career Clusters to ensure that the test items present mathematical problems in a variety of workplace situations.

ACT designed the *Applied Mathematics* assessment to measure the extent to which test takers can use the mathematics skills needed in work situations, where the ability to think problems through in context and find and evaluate solutions is important. The assessment measures skills that individuals use when they apply mathematical reasoning and problem-solving techniques to work-related problems. Test takers set up and solve the types of problems and do the types of calculations that actually occur in workplaces. Although test takers may use calculators and a formula sheet as aids, they must use mathematics skills to solve job-related problems and to evaluate the accuracy of their solutions.

Situational and Problem Solving Complexity:

- Level 3
- Level 4
- Level 5
- Level 6
- Level 7

Functions:

- Perform basic operations
- Work with geometric shapes
- Use formulas
- Convert measures
- Estimate values
- Analyze problems and calculations

Applications:

- Quantity
- Money
- Time
- Measurement
- Proportions
- Percents
- Averages
- Sequencing

Skill Definitions for Applied Mathematics

Level	Skills
3	<p>Solve problems that require a single type of mathematics operation (addition, subtraction, multiplication, and division) using whole numbers.</p> <p>Add or subtract negative numbers.</p> <p>Change numbers from one form to another using whole numbers, fractions, decimals, or percentages.</p> <p>Convert simple money and time units (e.g., hours to minutes).</p>
4	<p>Solve problems that require one or two operations.</p> <p>Multiply negative numbers.</p> <p>Calculate averages, simple ratios, simple proportions, or rates using whole numbers and decimals.</p> <p>Add commonly known fractions, decimals, or percentages (e.g., $\frac{1}{2}$, .75, 25%).</p> <p>Add three fractions that share a common denominator.</p> <p>Multiply a mixed number by a whole number or decimal.</p> <p>Put the information in the right order before performing calculations.</p>
5	<p>Decide what information, calculations, or unit conversions to use to solve the problem.</p> <p>Look up a formula and perform single-step conversions within or between systems of measurement.</p> <p>Calculate using mixed units (e.g., 3.5 hours and 4 hours and 30 minutes).</p> <p>Divide negative numbers.</p> <p>Find the best deal using one- and two-step calculations and then comparing results.</p> <p>Calculate perimeters and areas of basic shapes (rectangles and circles).</p> <p>Calculate percentage discounts or markups.</p>
6	<p>Use fractions, negative numbers, ratios, percentages, or mixed numbers.</p> <p>Rearrange a formula before solving a problem.</p> <p>Use two formulas to change from one unit to another within the same system of measurement.</p> <p>Find mistakes in items that belong at Levels 3, 4, and 5.</p> <p>Find the best deal and use the result for another calculation.</p> <p>Find areas of basic shapes when it may be necessary to rearrange the formula, convert units of measurement in the calculations, or use the result in further calculations.</p> <p>Find the volume of rectangular solids.</p> <p>Calculate multiple rates.</p>
7	<p>Solve problems that include nonlinear functions and/or that involve more than one unknown.</p> <p>Find mistakes in Level 6 items.</p> <p>Convert between systems of measurement that involve fractions, mixed numbers, decimals, and/or percentages.</p> <p>Calculate multiple areas and volumes of spheres, cylinders, or cones.</p> <p>Set up and manipulate complex ratios or proportions.</p> <p>Find the best deal when there are several choices.</p> <p>Apply basic statistical concepts.</p>

Applied Mathematics
Level Score Distribuiton

Score Level	Percent of Examinees
<3	6%
Level 3	15%
Level 4	20%
Level 5	30%
Level 6	21%
Level 7	8%

*Percentages are derived from the scores of 704,063 examinees assessed in the United States from September 2011 through August 2012.

Section 3: *Locating Information* Test Content

Locating Information is designed to assess document literacy. The National Center for Educational Statistics defines document literacy as “the knowledge and skills needed to locate and use information contained in documents such as job applications, payroll forms, transportation schedules, maps, tables, and graphs (NCSALL Occasional Paper, 2011). Both educators and employers have noted the increasingly sophisticated kinds of document literacy, or locating information skills required in today’s global economy. However, traditional academic instruction in locating information may not provide workers with the skills they most need in the context of the workplace. Widespread concerns that American workers do not have the foundational skills in location information needed for success on the job led ACT to develop the WorkKeys *Locating Information* assessment. Designed to measure the locating information skills required for entering and succeeding in a wide range of jobs, *Locating Information* is based on the premise that workers who possess these foundational skills can more readily learn job-specific skills through experience or additional training.

Locating Information is a multiple-choice test designed to measure skills in using work-related graphics. These graphics are based on materials that reflect the actual locating information demands in the workplace. All of the graphics and item formulated for inclusion in the *Locating Information* assessment are based on a construct defined by three aspects: locating skills, types of graphics, and level of complexity. Locating skills include five categories, or strands:

- Finding one, two, or several pieces of information in one or more graphics;
- Summarizing and/or comparing information in one or more graphics;
- Drawing conclusions from the information presented;
- Applying information from the graphic(s) to specific situations;
- Making decisions and/or predictions based on the information presented.

They types of graphics used as stimuli include tables, data graphs, forms, charts, diagrams, maps, and gauges. And, like all WorkKeys foundational skill assessments, *Locating Information* incorporates as aspect of increasing complexity with respect to the graphics and the skills assessed. WorkKeys skill levels in *Locating Information* range from 3 to 6.

ACT translated the theoretical construct of *Locating Information* into a working set of test specifications, which is used to guide the construction of standardized test forms. Guided by these specifications, ACT selects items for the test that present locating information problems in the context of a job, where the problems are defined in terms of specific locating skills and types of graphics, both of which increase in complexity by skill level. In addition, ACT uses its World-of-Work Career Clusters to ensure that the test items present locating information problems in a variety of workplace situations.

The *Locating Information* construct is defined by three aspects: locating skills, types of graphics, and levels of complexity. These aspects can be mutually exclusive or they can interact. Workplace locating skills vary in their level of complexity. Moreover, the locating skills applied are dependent on the graphic types employees are asked to read. These three aspects of the *Locating Information* construct are enumerated below.

Levels of Complexity:

- Level 3
- Level 4
- Level 5
- Level 6

Locating Skills

- Find decisions in graphics
- Summarize information in graphics
- Draw conclusions from information
- Apply information to situation
- Make decision based on the information

Types of Graphs

- Table
- Graph
- Form
- Chart
- Diagram
- Map/layout/floor plan

Skill Definitions for *Locating Information*

Level	Skills
3	Find one or two pieces of information in a graphic. Fill in one or two pieces of information that are missing from a graphic.
4	Find several pieces of information in graphics. Notice how graphics are related to each other. Sum up information shown in straightforward graphics. Identify trends shown in straightforward graphics. Compare information and trends shown in straightforward graphics.
5	Sort through distracting information. Sum up information shown in detailed graphics. Identify trends shown in detailed graphics. Compare information and trends shown in detailed graphics.
6	Analyze data in one complicated graphic or several related graphics. Apply the information to specific situations. Use the information to make decisions. Use the information to draw conclusions.

Locating Information
Level Score Distribution

Score Level	Percent of Examinees
<3	6%
Level 3	15%
Level 4	59%
Level 5	20%
Level 6	1%

*Percentages are derived from the scores of 557,556 examinees assessed in the United States from September 2011 through August 2012.