READY FOR WHAT?

DEVELOPMENT OF A HIERARCHICAL FRAMEWORK

LINKING COLLEGE READINESS AND CAREER READINESS

MARY LEFEBVRE & KRISTA MATTERN
ACT, Inc.

ABSTRACT

The phrase “college and career readiness” is often used casually, as if readiness for college and readiness for a career are one and the same and that a research foundation exists to fully support such a claim. In reality, research evaluating two important questions is acutely needed: 1) whether an individual requires the same *knowledge, skills, abilities, and other characteristics (KSAOs)* to be ready for college and ready for career, and 2) whether the same *level* of KSAOs is needed for each.

In this report, evidence collected across various ACT education and workforce research studies as well as other data sources are used to empirically address these questions. We argue that, to properly operationalize “college readiness” and “career readiness” in a given case, one must take into account the *level of generality* that is required for the case. Further, we propose a hierarchical framework of college readiness and career readiness, which conceptualizes each type of readiness at varying tiers of generality, from a very general conception (i.e., a single standard of readiness for all students and all careers) to very specific use cases (readiness to succeed at a specific college or in a specific job). The overarching framework of readiness proposed in the report enables education and workforce stakeholders to better understand the differences and similarities between college readiness and career readiness and the different use cases of readiness diagnosis to not only help individuals achieve success but also to inform educational and workforce policy.

TABLE OF CONTENTS

ACKNOWLEDGMENTS

The authors thank Wayne Camara, Justine Radunzel, Gregory Kienzl, and Dan Vitale for their comments and suggestions on earlier drafts of this report.

CHAPTER 1.
Introduction of the Issue

The use of the term "career readiness" is prolific across the education and workforce development literature. It is a phrase commonly used in the professional literature (see Association for Career and Technical Education, 2010; Darling-Hammond, Wilhoit, & Pittenger, 2014; Meeder & Suddreth, 2012), as well as throughout education- and workforce-related federal legislation (i.e., Carl D. Perkins Career and Technical Education Improvement Act, 2006; Every Student Succeeds Act, 2015; Workforce Innovation and Opportunity Act, 2014).

This intense use of the phrase leads one to ask several questions: Why should we care about career readiness? Is career readiness different than college readiness? Does career readiness only apply as a goal for students in the secondary education system or is it something that one continually strives toward? The first question can be better answered with an understanding of the United States labor market and the various challenges that training providers, educators, and policymakers face with respect to training and education in preparing individuals for the world of work. The second question will be addressed later in this report with a proposed framework of readiness developed to enable education and workforce stakeholders to better understand the various definitions of readiness depending on how that metric is being used and the problem that it is trying to help solve.

POLITICAL LANDSCAPE OF READINESS

In the U.S., the bulk of career education and training provided to youth and adults is funded through the U.S. Departments of Education and Labor. The current federal legislation that funds secondary and postsecondary career and technical education (CTE) for all U.S. states and territories and is administered by the U.S. Department of Education (USED), namely the Carl D. Perkins Career and Technical Education Improvement Act (2006), requires that each K-12 or postsecondary school receiving funds provide courses within defined career pathways. The recently passed federal secondary education legislation, the Every Student Succeeds Act (ESSA), is another major funding stream for youth career education and training. The legislation includes a mandate that each U.S. state must track student progress against three required indicators[1] and at least one optional indicator of school quality or student success, the latter of which can include career readiness metrics (ESSA, 2015). At the state level, there are currently 34 states that publicly report and/or include some type of career-focused indicator in their secondary education accountability systems (Achieve & Advance CTE, 2016).

The Workforce Innovation and Opportunity Act (WIOA) provides career readiness funding through the U.S. Department of Labor (USDOL) for assisting vulnerable workers such as low-income adults and youths with limited skills and work experience. The act directs funds to offer support to targeted youth in the attainment of a high school diploma or its recognized equivalent, entry into postsecondary education, and individualized delivery of 14 types of career readiness opportunities (WIOA, 2014). Provisions in WIOA promote the use of sectoral and career pathway approaches and have been funded by USDOL in the past via Workforce Innovation in Regional Economic Development (WIRED), Trade Adjustment Assistance Community College Career Training (TAACCCT), and Workforce Innovation grants (Holzer, 2015).

The overarching goal of each of these laws is to provide funding for training and education to ensure that individuals of all ages are prepared to successfully transition into the workplace. Determining the effectiveness of the U.S. career preparation system—namely, deciding whether individuals have been adequately prepared for the workplace—is complex at best. For the adult career training programs, performance is determined via fairly straightforward criteria: individual employment and wages after program completion (USDOL, 2014). For secondary and postsecondary career preparation programs, criteria used to determine success may include: 1) performance on assessments aligned to "college and career readiness standards" (e.g., PARCC and Smarter Balanced); 2) performance on assessments measuring readiness for success in postsecondary education (e.g., ACT and SAT); or 3) dual enrollment rates in combination with CTE course participation (Achieve & Advance CTE, 2016).

This emphasis on postsecondary education as the pathway for career success is supported by projections regarding the education requirements of future U.S. jobs. In particular, nearly two-thirds (63%) of jobs will require some postsecondary training by 2018 (Carnevale, Smith, & Strohl, 2010). Postsecondary enrollment data for the U.S. show 17.0 million students enrolled in undergraduate programs and about 2.9 million enrolled in post baccalaureate programs. Within the total undergraduate enrollment, 6.5 million students attended 2-year institutions and 10.5 million attended 4-year institutions in fall 2015 (USED, 2017). Increases in the non-traditional college student population have been rising at a faster pace than enrollment of recent high school graduates. In 2015, there were about 11.8 million college students under age 25 and 8.1 million students age 25 years old and over, with the numbers of both younger and older students increasing between 2000 and 2015 (from 8.9 million to 11.8 million and 6.3 million to 8.1 million, respectively) (USED, 2017).

If postsecondary *enrollment* is to be considered a prerequisite of career readiness, the U.S. is doing fairly well. But what about the *completion* rates for those entering postsecondary education? Analysis of national educational attainment data from 2010 by Holzer, Linn, and Monthey (2013) shows that nearly two-thirds of adults aged 25–29 had not earned a postsecondary degree of any kind. And while 60% of students at four-year institutions and 55% of students at two-year colleges completed college (including certificates at two-year colleges) within 150% of normal time, completion rates at four-year universities were lower among minorities, males, and individuals from low-income families (Holzer et al., 2013). If a large percentage of students is failing to complete a postsecondary degree or certificate, does that mean a large percentage of students lacks career readiness? To begin to address this question, we focus our attention on the labor market returns for individuals with varying levels of educational attainment.

IMPACT OF READINESS ON OUTCOMES

The relationship between level of education and individual earnings has been typically assumed to be that more is better. To investigate this assumption, Acemoglu and Autor (2012) calculated the return to wages for U.S. workers over time by education level and found that the increase in wage premiums for college graduates is mainly due to decreases in wages for the non–college-going population of workers. This decline in wages for non–college-going individuals was also supported by more recent work by Autor (2014), who analyzed earnings for all working-age adults from 1979 to 2012. The earnings gap between U.S. workers with only a high school diploma and those with a bachelor's degree was $17,411 in 1979 (measured in constant 2012 dollars) and rose to $34,969 in 2012 (Autor, 2014).[2]

The aforementioned research examined the relationship between educational level and wages. Other research has explored whether a similar relationship exists between skills and wages. Results from an international study on wage returns by cognitive skill levels can speak to this issue (Hanushek, Schwerdt, Wiederhold, & Woessmann, 2015). Using data from the Programme for the International Assessment of Adult Competencies (PIAAC), which was administered to large representative samples of adults in 22 countries between 2011 and 2013, the researchers found that the average wage increase corresponding to one "unit" or standard deviation increase in cognitive skills was 18%. Moreover, the U.S. stood out as having the highest measured return to skill with a 28% per unit wage increase per unit increase in cognitive ability (Autor, 2014; Hanushek et al., 2015). The results suggest that higher skills are related to higher earnings.

Wages provide an indirect metric of skills and the value of education, but many other factors, including overall labor market supply and demand, may determine wage returns. Cappelli (2015) posits that the nature of the labor market is such that skill supply and demand are not in perfect balance and that, when employers set job requirements and wages and then look for candidates, only the most highly qualified candidates are selected, not those who are minimally qualified.[3] Vaisey (2006) compared educational qualifications to the education requirements of jobs using O*NET[4] to define job requirements. He found that, on average, workers in the U.S. were overqualified for their jobs and that the total number of workers overqualified in the U.S. has increased between 1972 and 2002. Evidence of skills mismatch that impacts labor market returns to education (due to both over- and under-qualification) in the U.S. has also been found by other researchers both nationally and internationally (Acemoglu & Autor, 2011; Slonimczyk, 2008).

Currently, the U.S. education system largely defines career readiness through postsecondary educational attainment, a goal which is supported by traditional analysis of labor market returns by education level. However, far too many individuals are simply not completing postsecondary education. Individuals often choose a career path that does not require a postsecondary degree, or may purposely avoid careers requiring postsecondary education because of the costs. Adults who have already entered the workforce may not be able to enroll in postsecondary education programs for financial reasons or due to competing time commitments (e.g., family, work).

In this paper, we argue that career readiness should focus on the acquisition of knowledge, skills, abilities, and other characteristics (KSAOs) needed to be successful once in the workforce rather than using indirect measures such as the level of higher education attained. A more nuanced understanding of career readiness and how an education and training system can more effectively measure success at each step within an individual's career path over a lifetime is needed. An education and training system that uses a more holistic framework could foster a more holistic implementation of best practices, which could be applied to both college programs and career preparation programs. Toward that end, clarifying current readiness terminology is a key step in the development of a comprehensive framework of readiness.

EXISTING FRAMEWORKS OF READINESS

In education policy, career readiness is a term commonly used to discuss CTE options and/or in comparison with college readiness. Barnes and Slate (2013) reviewed the college and career readiness literature and concluded that the emphasis is clearly on college readiness at the exclusion of other non-education options. The authors further contend that college readiness is not a dichotomous variable but rather a continuum—individuals may be college ready for one level of postsecondary education but not for other levels—and that high school curricula and programs should be developed to ensure that all students graduate ready for post–high school endeavors, including those who plan to earn an occupational certificate, an associate's degree, or a 4-year degree.

The emphasis of "college" within "college and career readiness" has also been noted by others. In a report for the PARCC Governing Board, Camara and Quenemoen (2012) noted the convenience in stating that competencies and performance levels for college and career training programs are identical but found that there is not sufficient evidence to make such claims or assumptions. In particular, assessments designed to measure college readiness make claims to measure and/or report measures of both college and career readiness. Specifically, assessments developed under the Partnership for Assessment of Readiness for College and Careers (PARCC) and Smarter Balanced Assessment Consortium (SBAC) initiatives and the SAT make such claims with no evidence (Camara, 2012). Both PARCC and SBAC state that their respective assessments measure the academic knowledge, skills, and practices necessary to enter directly into and succeed in credit-bearing courses in content areas within programs leading to a credential or degree from a two- or four-year university, but neither consortium provides any evidence for how their assessments are aligned with career education and training programs or workplace outcomes (PARCC, 2015; SBAC, 2013). Similarly, the College Board's SAT assessment, while claiming to measure college and career readiness, only provides empirical evidence for predicting postsecondary performance (Camara, 2012).

Others such as Conley (2011) have recommended that states validate the connection between assessments of college and career readiness and the actual knowledge and skills required in college courses and career preparation programs, and that such assessments be aligned to the broader conception of career readiness, which he defined as knowledge and skills students need to pursue a pathway in a career.

ACT'S PERSPECTIVE ON READINESS

ACT's perspective on "career readiness" has evolved over the years. In 2006, ACT released *Ready for College and Ready for Work: Same or Different?*, a comparison of student performance on two ACT assessments, WorkKeys and the ACT test (ACT, 2006). The study found that the levels of readiness in reading and mathematics needed to succeed in college-level courses without remediation were comparable to the level of skills needed to be prepared to work in jobs based on job analysis data. Within that context, high school students were found to need comparable levels of reading and mathematics, regardless of their post–high school plans. Since that report, ACT has released several others that, in recognition of the variability of prerequisite KSAOs across both careers and programs of study, attempt to create readiness benchmarks by occupation, industry, career path, and plan of study; ACT has also developed frameworks of readiness for individuals over a lifetime (ACT, 2011; ACT, 2015; Camara et al., 2015; LeFebvre, 2015; Mattern et al., 2014; Mattern, Radunzel, & Westrick, 2015).

Previously proposed frameworks for "career readiness" were largely built on employer surveys designed to ascertain which knowledge, skills, and abilities employers are demanding in the labor market (Cappelli, 2015). While simply listing all possible competencies may be valuable as a comprehensive academic exercise, students and educators alike need a more practical framework, developed in a way that can be scaled and implemented at a programmatic level. This paper represents a first step at achieving that goal.

CHAPTER 2.

A Hierarchical Education and Workplace Readiness Framework

The framework of readiness presented here attempts to tease out the similarities and distinctions between "career readiness" and "college readiness" as well as the complexities that arise when considering more finely grained levels of readiness. This point is particularly important because different uses of readiness require different levels of generality. For example, how one conceptualizes readiness from a policy or accountability perspective should look very different from a conception of readiness used in career counseling, and both of those cases should differ from cases in which readiness is used to make decisions regarding postsecondary admissions, course placement, and employee selection.

We therefore propose a readiness framework that is flexible to address different uses, each of which is supported by empirical evidence collected across various ACT education and workforce research studies (e.g., empirically derived benchmarks, subject matter expert [SME] standard setting, job analysis ratings, and criterion data) and supplemented with O*NET data. This framework enables education and workforce stakeholders to better understand the differences and similarities between college readiness and career readiness and the different use cases of readiness diagnosis to not only help individuals achieve success but also inform national educational and workforce policy.

ACT has published several studies that have attempted to create a framework for defining and aligning different types of readiness. In *Unpacking College and Career Readiness*, ACT identified three types—work readiness, job readiness, and career readiness—defining the latter as the skills and proficiency levels needed for specific career clusters (ACT, 2015). Expanding on that report and the contributions of other career readiness frameworks, we propose the following **Hierarchical Education and Workplace Readiness Framework** (hereinafter referred as the "Framework") to support various readiness diagnosis use cases (see Figure 1).

The Framework encompasses the different types and levels of readiness needed for success in both college and career. The definitions and, more importantly, the measures of readiness are contextualized for the specific setting, whether college or the workplace. Research shows that contextualized measures are more predictive of a wide range of outcomes than are more general measures (Shaffer & Postlethwaite, 2012). The tiers of readiness in the Framework transition from general to specific (top to bottom) to support different uses by policymakers, educators, and individuals. More general concepts of readiness are useful from a state and national policy perspective, while more specific concepts of readiness are important for educators and individuals developing a plan of study or for entry into an occupation or degree-granting program.

Figure 1. The ACT Hierarchical Education and Workplace Readiness Framework

LEVEL OF GENERALITY

GENERAL

COLLEGE READINESS

- Description: KSAOs and level of KSAOs needed to succeed in the typical courses students take in the first year at a typical college or university
- Use cases: Setting national, state, and local educational policies; accountability purposes
- Examples: ACT College Readiness Benchmarks

CAREER READINESS

- Description: KSAOs and level of KSAOs needed to succeed in a typical job at a typical organization
- Use cases: Setting national, state, and local educational and workforce training policies; accountability purposes
- Examples: ACT WorkKeys National Career Readiness Certificate levels

COLLEGE MAJOR PATHWAY READINESS

- Description: KSAOs and level of KSAOs needed to succeed in typical courses students take in target majors linked to a career pathway
- Use cases: Career counseling and exploration
- Examples: ACT STEM Benchmark

CAREER PATHWAY READINESS

- Description: KSAOs and level of KSAOs needed to succeed in a typical job within a career pathway
- Use cases: Career counseling and exploration
- Examples: ACT WorkKeys Career Readiness Benchmarks for STEM Careers

SPECIFIC

INSTITUTION READINESS

- Description: KSAOs and level of KSAOs needed to succeed in a specific major and/or course at a specific college or university
- Use cases: College admissions, placement, and major selection
- Examples: Local validity studies; locally set admission and placement cut scores

WORK READINESS

- Description: KSAOs and level of KSAOs needed to succeed in a specific job at a specific organization
- Use cases: Employee selection and promotion
- Examples: Local validity studies; hiring criteria

EDUCATION-TO-WORK CONTINUUM

DESCRIPTION USE CASES EXAMPLES

The Framework is set up to illustrate that the KSAOs and levels of KSAOs that one needs may differ as a user moves from general to specific uses. The Framework stipulates a *single* standard of readiness at the most general tier ("college readiness" and "career readiness") whereas the other tier of readiness will have *multiple* standards (i.e., individual benchmarks or cut scores) to represent the various career pathways, colleges, and organizations. For example, the KSAOs and levels of KSAOs for college readiness as a general construct may be different than those necessary for college major pathway readiness in a STEM career pathway. Research on the ACT College Readiness Benchmarks and the ACT STEM Benchmark highlight this point succinctly (we will return to this topic later). Moreover, the KSAOs and level of KSAOs for college major pathway readiness in the STEM career pathway will almost certainly differ from those necessary for college major pathway readiness in a Business Management and Administration career pathway.

What readers may still be wondering is whether the KSAOs and levels of KSAOs needed to be considered ready are comparable on both the education and workforce sides of the Framework. That is, at similar levels of specificity, does research suggest that what students need to know and be able to do to be successful in college is the same as what is required for success in the workplace? In the following sections, we consider this question at each tier of the Framework.

We can easily answer this question at the most general level of the Framework because ACT has conducted extensive research to investigate the KSAOs that are important for readiness across the education and workplace domains. A holistic approach to readiness throughout the education-to-work continuum was presented in *Beyond Academics: A Holistic Framework for Enhancing Education and Workplace Success* (Camara et al., 2015). This report proposed a research-based framework of broad construct domains that are important for both education and workplace success (Figure 2).

Figure 2. Holistic Model of Education and Workplace Success

A full literature review on the multidimensional nature of education and workplace success, included in Mattern et al. (2014), served as the theoretical basis for the holistic framework (Camara et al., 2015) and also provides the foundation of the Framework in the present report. The holistic framework makes a compelling case that identical KSAOs (i.e., core academic skills, cross-cutting capabilities, behavioral skills, and education and career navigation skills) are needed for success in both school and the workplace. Given that the same KSAOs generalize across both domains, we can examine whether the same *level* of KSAOs is needed for each. We begin by addressing this question at the most general tier of the framework: Does college readiness equal career readiness? For simplicity's sake, we will focus the conversation on the core academic skills and cross-cutting capabilities measured by the ACT and ACT WorkKeys, respectively.[5]

READINESS FOR COLLEGE AND READINESS FOR A CAREER

At the top of our Framework, we have specified the most general and broadly applicable readiness use cases: college readiness and career readiness (see Figure 3). College readiness is defined as the "KSAOs and level of KSAOs needed to succeed in the typical courses students take in the first year at a typical college and university." Examples would include ACT (and SAT) college readiness benchmarks, which are increasingly used in setting national, state, and local educational policies and for accountability purposes. This definition explicitly focuses on the *typical* level of KSAOs needed for college readiness at a *typical* institution since the goal is to have a single metric by which to measure progress, such as progress over time and across state lines. Having multiple definitions of readiness for different entities (e.g., states, career pathways) would prohibit such comparisons and diminish the utility of such metrics. Similarly, career readiness is defined as the "KSAOs and level of KSAOs needed to succeed in a typical job at a typical organization." Examples include the ACT National Career Readiness Certificate (NCRC) and WorkKeys levels. Similar to college readiness benchmarks, career readiness benchmarks are useful for setting national, state, and local educational and workforce training policies and for accountability purposes. Again, the focus is on the typical level of KSAOs needed to succeed in the workforce across organizations and job families.

Figure 3. General Conceptualizations of College Readiness and Career Readiness

COLLEGE READINESS

DEFINITION: *KSAOs and level of KSAOs needed to succeed in typical courses students take in the first year at a typical college or university*

USE CASES: *Setting national, state, and local educational policies; accountability purposes*

EXAMPLES: *ACT College Readiness Benchmarks*

CAREER READINESS

DEFINITION: *KSAOs and level of KSAOs needed to succeed in a typical job at a typical organization*

USE CASES: *Setting national, state, and local educational and workforce training policies; accountability purposes*

EXAMPLES: *ACT WorkKeys National Career Readiness Certificate levels*

College Readiness. How does ACT currently define college readiness in terms of KSA levels? The ACT College Readiness Benchmarks are scores on the ACT subject-area tests that represent the level of achievement required for students to succeed[6] in corresponding credit-bearing first-year college courses (Allen, 2013). These college courses include English composition, college algebra, introductory social science courses, and biology. Table 1 summarizes the current ACT College Readiness Benchmarks. For example, students are considered college ready in mathematics if they earn a score of 22 or higher on the ACT Mathematics test. As shown in Table 1, 41% of ACT-tested 2017 high school graduates met the ACT Benchmark for mathematics (ACT, 2017); 27% met all four ACT benchmarks.

Table 1. ACT College Readiness Benchmarks[7]

COLLEGE COURSE	ACT SUBJECT TEST	ACT BENCHMARK	PERCENT OF 2017 ACT-TESTED HIGH SCHOOL GRADUATES MEETING ACT BENCHMARK
ENGLISH COMPOSITION	ENGLISH	18	61%
COLLEGE ALGEBRA	MATHEMATICS	22	41%
SOCIAL SCIENCES	READING	22	47%
BIOLOGY	SCIENCE	23	37%

Career Readiness. How does ACT currently define career readiness in terms of KSA levels? Minimum scores on each of three ACT WorkKeys cognitive assessments—Reading for Information, Locating Information, and Applied Mathematics[8]—form the basis for the ACT WorkKeys NCRC: platinum, gold, silver, or bronze. As indicated in Table 2, NCRC platinum level is achieved by earning a minimum score of 6 on each of the assessments; minimum scores for gold, silver, and bronze are 5, 4, and 3 on each assessment, respectively.

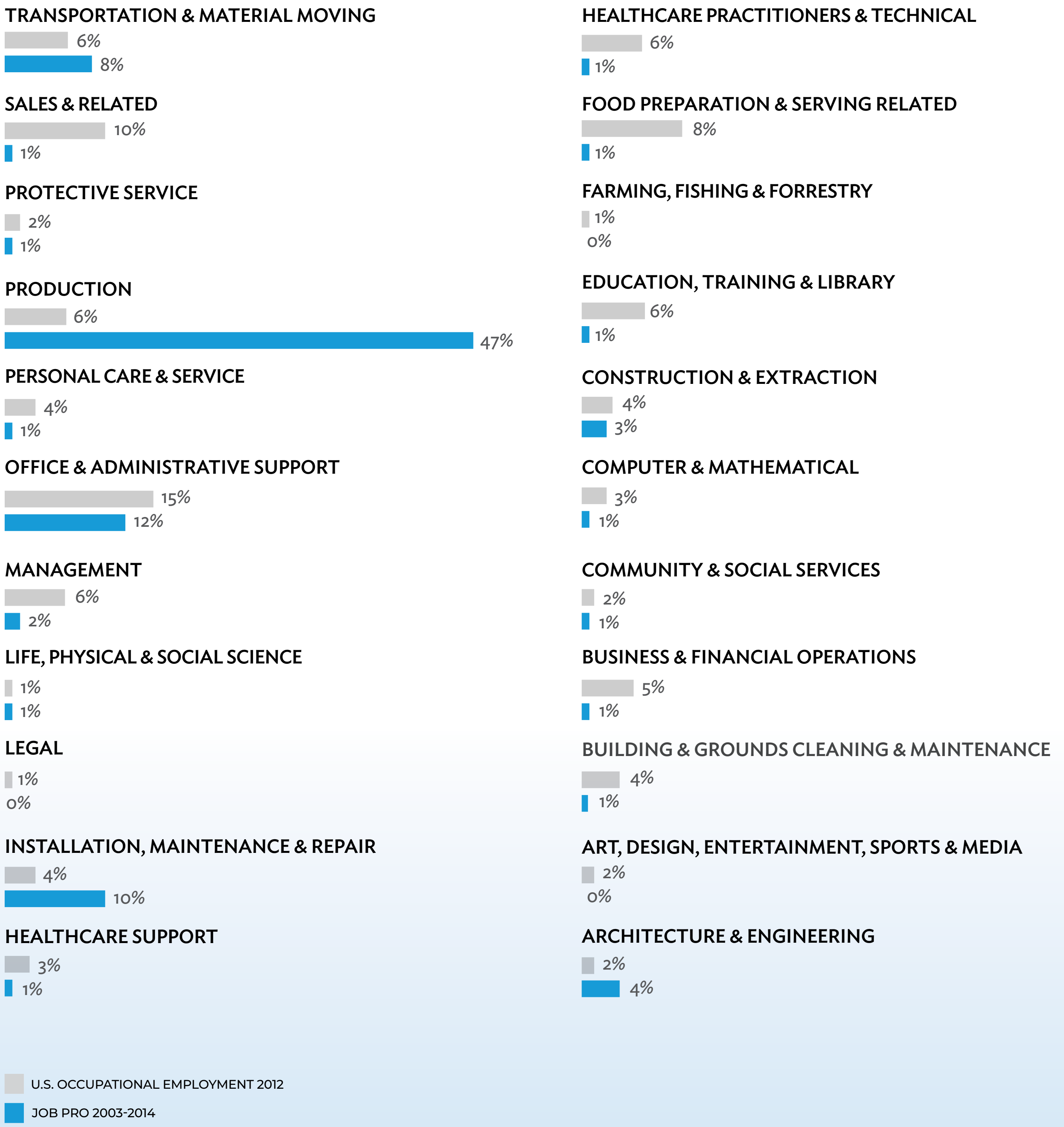
Table 2. ACT Career Readiness Levels[9]

CERTIFICATE LEVEL	MINIMUM LEVEL SCORE ON EACH OF THE THREE ACT WORKKEYS ASSESSMENTS	PERCENTAGE OF JOBS IN THE ACT JOB-PRO DATABASE FOR WHICH AN EXAMINEE IS QUALIFIED BASED ON NCRC LEVEL*
Platinum	6	99%
Gold	5	93%
Silver	4	67%
Bronze	3	16%

*The ACT JobPro database includes 20,000 job profiles that identify the ACT WorkKeys skill levels required for specific jobs and groups of jobs.

ACT WorkKeys assessments are designed to assess generalizable skills associated with many jobs. As such, the content-related validity evidence for ACT WorkKeys assessments is established through ACT job profiling, which involves job profilers working with subject matter experts (SMEs) across numerous jobs to link ACT WorkKeys skills and skill levels to specific tasks and job behaviors for a particular job. Each profile represents a content validation study at the organizational level. The ACT JobPro database is a job skills database comprised of 20,000 ACT job profiles conducted by ACT-authorized job profilers. JobPro represents a wide cross-section of jobs, including 53% (584) of all O*NET codes (1,091). The database provides foundational skills data for 193 (50%) of the 387 Bright Outlook Occupations as defined by O*NET using U.S. Bureau of Labor Statistics Occupational Projections data for 2012–2022. JobPro data are representative of occupations across major occupational families and levels of education and training required for entry. Figure 4 provides the distribution of a cohort of job profiles by major occupational family. When aggregated by occupation, the aggregate job profile data represent 86% of the total occupational employment in the U.S. (LeFebvre, 2016).

Figure 4. Distribution of Job Profiles and U.S. Employment by Occupational Family



The NCRC levels may obfuscate meaningful differences in the levels of KSAs (Reading for Information, Locating Information, and Applied Mathematics) needed across jobs by employing a conjunctive model to determine one's NCRC level. That is, a platinum-level NCRC requires a level of 6 on all three assessments; however, many jobs may require a higher skill level in one content area but not the others (LeFebvre, 2015). Additionally, the three assessments are not scaled to the same level of difficulty. Among individuals who took all three assessments, 27% to 28% earned a 6 or higher on Reading for Information and Applied Mathematics whereas only 1% earned a 6 on Locating Information. Given these disparate distributions, less than 1% of WorkKeys examinees qualifies for a platinum NCRC.

With that in mind, we examined the percentage of jobs in the ACT JobPro database for which an examinee is qualified based on WorkKeys level score (see Table 3). The results indicate that achieving a level score of 5 or higher on each of the three WorkKeys assessments is associated with being qualified for almost all ACT-profiled jobs. In the Appendix, a table of performance level descriptors for WorkKeys Applied Mathematics is provided as an example of the skill progression by level.

Table 3. Percentage of Jobs in the ACT JobPro Database for which an Examinee is Qualified Based on WorkKeys Level Score

LEVEL SCORE	APPLIED MATHEMATICS	READING FOR INFORMATION	LOCATING INFORMATION
7	**100%**	**100%**	**N/A**
6	**100%**	**99%**	**100%**
5	**98%**	**98%**	**100%**
4	**86%**	**78%**	**87%**
3	**48%**	**26%**	**19%**

Are College Readiness and Career Readiness the Same? If we conclude that individuals need a score of 5 or higher on WorkKeys assessments to be considered career ready, how does that compare to the ACT College Readiness Benchmarks? We examined this question using a sample of more than 350,000 individuals who took both the ACT and ACT WorkKeys. Specifically, the relationship between performance on the two readiness measures was examined by content area to determine how cut scores on one measure related to cut scores on the other. The sample was created by identifying students from the 2015 ACT-tested graduating class who also took the ACT WorkKeys assessments. Students took the ACT between September of 2012 through June of 2015 and ACT WorkKeys between July of 2010[10] and June of 2015. The average duration between the two test administrations was less than 1 month (Mean = 0.08 months) with the middle 50 percentile taking the two assessments within 2 months of each other (Min = −31.18, 5^{th} % = −10.59; 25^{th} % = −1.57; Median = 0.23; 75^{th} % = 2.23; 95^{th} % = 9.48; Max = 55.54). Table 4 provides descriptive information on how this sample compares to both the national population of ACT-tested students and WorkKeys-tested individuals.

Table 4. Demographic Characteristics of Study Sample Compared to WorkKeys- and ACT-Tested Populations

Characteristics	WorkKeys Population	ACT-WorkKeys Sample	ACT Population
Sample Size	**1,016,089**	**363,621**	**1,924,436**
Gender			
Female	**49.3%**	**50.5%**	**52.7%**
Male	**50.7%**	**48.7%**	**46.6%**
Missing	**0.0%**	**0.7%**	**0.8%**
Race/Ethnicity			
African American	**17.0%**	**16.0%**	**13.1%**
Asian & Pacific Islander	**2.6%**	**3.0%**	**4.9%**
Hispanic	**10.4%**	**11.6%**	**15.6%**
Other	**5.2%**	**4.7%**	**4.7%**
Prefer Not to Respond	**3.6%**	**7.7%**	**6.7%**
White	**61.3%**	**57.0%**	**55.0%**
Region			
East	**0.3%**	**0.0%**	**8.4%**
Midwest	**69.8%**	**69.7%**	**32.0%**
South	**28.6%**	**28.9%**	**41.6%**
West	**1.3%**	**1.4%**	**18.0%**
NCRC Level			
0-Non Qualifier	**10.9%**	**9.4%**	**n/a**
1-Bronze	**21.3%**	**20.3%**	**n/a**
2-Silver	**46.9%**	**47.4%**	**n/a**
3-Gold	**20.2%**	**22.3%**	**n/a**
4-Platinum	**0.7%**	**0.6%**	**n/a**
ACT Composite	n/a	19.9 (5.3)	21.0 (5.5)

Notes. The ACT-tested population was defined as the 2015 ACT-tested graduating class. Because WorkKeys data are not aggregated and reported as graduating classes, we selected WorkKeys examinees who took the WorkKeys assessments during the same time frame as students who took the ACT in the matched ACT–WorkKeys sample (September 2012 through June 2015) to create the WorkKeys population. For the ACT–WorkKeys matched sample, 8.8% of students did not take all three WorkKeys assessments. Thus, the NCRC level percentages are based on the 331,545 who had all three scores.

As shown in Table 4, the study sample was fairly comparable to both the WorkKeys- and ACT-tested populations; however, there were some notable differences. For example, the racial/ethnic composition was slightly different across the three groups, with African American students representing a larger share of WorkKeys-tested individuals and Hispanic and Asian students representing a larger share of ACT-tested individuals. More pronounced regional differences were observed. The majority of WorkKeys-tested individuals were from the Midwest (69.8%), more than double the percentage for ACT-tested students (32.0%). Finally, students in the matched ACT–WorkKeys sample who took all three WorkKeys assessments had slightly higher NCRC levels compared to the WorkKeys population; however, the average ACT Composite score was slightly lower for the ACT–WorkKeys sample than for the ACT-tested population (19.9 vs. 21.0).

Correlations between ACT tests and WorkKeys assessments were moderately high (r = .79 for ACT Mathematics with WorkKeys Applied Mathematics; r = .66 for both ACT Reading with WorkKeys Reading for Information and ACT Science with WorkKeys Locating Information). Although correlations between two measures that are below .86 are generally considered insufficient to justify a score concordance (Dorans, 2004), the two tests were adequate to use in a prediction to determine, for illustrative purposes in this paper, the WorkKeys score associated with a 50% probability of meeting the ACT Benchmark in the same content area. Our intent is not to suggest that the ACT can substitute for WorkKeys or vice versa, but rather to provide a means to address questions about the comparability of benchmarks and performance criteria between college readiness and career readiness.

For readiness in mathematics, we determined via logistic regression that a WorkKeys Applied Mathematics cut score of 82 is associated with a 50% probability of earning a 22 or higher on the ACT Mathematics test (i.e., with meeting or exceeding the ACT College Readiness Benchmark for mathematics). This score is also the minimum score scale associated with a WorkKeys Applied Mathematics level score of 6 (corresponding scale scores are 82 through 86). In our sample, 33.6% met the ACT Benchmark for mathematics and 30.3% achieved a WorkKeys Applied Mathematics score of 6 or 7. In terms of classification accuracy between the two assessments, 84.2% of students were classified consistently (60.1% failed to meet the benchmark on either assessment and 24.1% met the benchmark on both assessments). Of the 15.8% who were not classified consistently, 9.6% met the ACT Benchmark for mathematics but did not achieve a WorkKeys Applied Mathematics score of 6 or 7, and 6.2% achieved a WorkKeys Applied Mathematics score of 6 or 7 but did not meet the ACT Benchmark for mathematics.

A comparison of the mathematics readiness levels for ACT (22) versus WorkKeys (Level 5) suggests that a slightly lower level of mathematics knowledge is needed for career readiness than for college readiness, in that, on average, students would need to earn a Level 6 or higher on WorkKeys to have a reasonable chance of earning a 22 or higher on the ACT. However, the data show a somewhat closer correspondence: 29% of students with a WorkKeys level score of 5 in Applied Mathematics met the ACT Benchmark for mathematics. It should also be noted that the methodologies used to set cut scores for the ACT and WorkKeys are quite different. For the ACT, empirically derived benchmarks were developed to identify the skill level needed to have a reasonable chance of success in first-year college courses in the corresponding content area (for ACT Mathematics, course grades in College Algebra were examined). For WorkKeys, results from job analysis/profiling were used, which relies on

SMEs' judgments to determine the level of skills needed for a particular job. **Therefore, it is not surprising that the two methods would not perfectly align.**

It should be noted that we have used data from ACT and WorkKeys for illustrative purposes, not with the intent of mandating the use of specific assessments or the adoption of specific cut scores to determine college readiness or career readiness. The important point is that there is utility in specifying very generally what readiness means, but it should align with the intended purpose or use. For individuals who need more personalized information related to career counseling and exploration, or for entities that need to develop aligned curriculum and educational training programs to best serve those individuals, more finely grained information is needed. This leads us to the next tier of the Framework.

READINESS FOR A COLLEGE MAJOR AND READINESS FOR A CAREER PATHWAY

For College Major Pathway Readiness and Career Pathway Readiness, readiness information is provided at a finer degree of specificity in that the KSAOs and the level of KSAOs may be slightly different for *each* major and career pathway (Figure 5). This is in contrast to the first tier of the Framework, in which there is just one set of benchmarks for college readiness and one for career readiness. For the workplace, career pathway readiness is defined as the KSAOs and level of KSAOs needed to succeed in a typical job within a career pathway (Figure 5). The skills and levels of proficiency needed within a career pathway can also vary by level of educational attainment needed.

Figure 5. College Major and Career Pathway Readiness

COLLEGE MAJOR PATHWAY READINESS

DEFINITION: *KSAOs and level of KSAOs needed to succeed in typical courses students take in target majors linked to a career pathway*

USE CASES: *Career counseling and exploration*

EXAMPLE: *ACT STEM Benchmark*

CAREER PATHWAY READINESS

DEFINITION: *KSAOs and level of KSAOs needed to succeed in a typical job within a career pathway*

USE CASES: *Career counseling and exploration*

EXAMPLES: *ACT WorkKeys Career Readiness Benchmarks for STEM Careers*

A career pathway is a coordinated and non-duplicative sequence of secondary and postsecondary education courses (which may include work-based learning experiences) and associated credits that culminates in technical skill proficiency and an industry-recognized credential, certificate, or degree, and includes challenging academic and CTE content. Career pathways may include the opportunity for secondary students to participate in dual credit or concurrent enrollment programs or other ways to acquire postsecondary credits (Perkins Act, 2006).

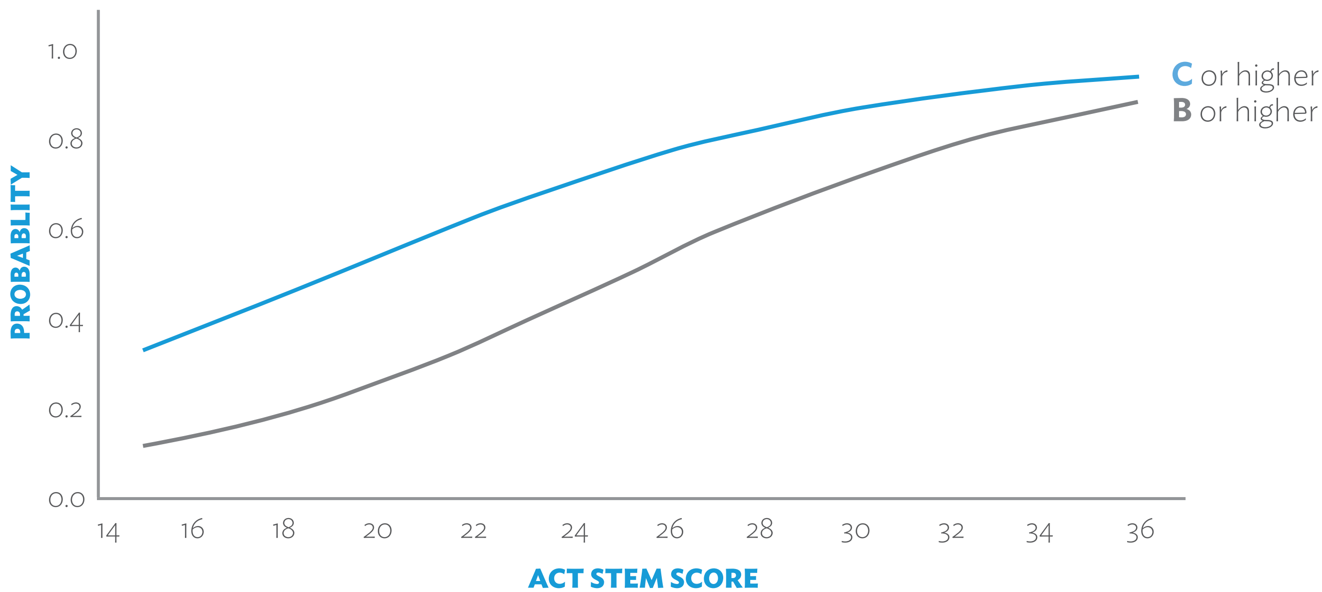
Career clusters are groupings of occupations that are used by education/training providers to develop coursework, programs of study, and career navigation tools for students in both secondary and postsecondary education settings (Advance CTE, 2017). The clustering of industry or occupation data is a common strategy used by these providers, as well as by economic and workforce developers, to analyze and describe a national or regional economy in terms of employment and skills (Porter, 1990).

Career clusters are also used by workforce developers to understand the knowledge and skills possessed by a national or local workforce and to bridge the gap between workforce and economic development when constructing a regional economic development strategy. Hamilton (2012) conducted an extensive evaluation of career pathway and career cluster programs in the workforce and education sectors in the U.S. and provided a good overview of the use of clusters in regional economic development strategies. In his review, Hamilton emphasized the importance of balancing the skill needs of specific employers versus broadly integrating the foundational skills for individuals that are needed across occupations and industries.

Data on skills and skill levels needed for individual jobs can be aggregated by occupational title or even more broadly by career cluster. Aggregated skill benchmarks for success in a specific career cluster can be used to provide a more complete picture of the factors important for individuals to be prepared for success in the workforce and throughout their career (LeFebvre, 2015). Career pathway benchmarks for both the college and career tracks have been developed in previous studies.

College Major Pathway Readiness. We have defined college major pathway readiness as the KSAOs and level of KSAOs needed to succeed in typical courses students take in target majors linked to a career pathway. Research conducted at ACT examining the preparation levels needed to be successful in STEM majors highlights one example of college major pathway readiness that is useful for students exploring and/or considering a career in STEM (Mattern et al., 2015; Radunzel et al., 2015). Mattern et al. (2015) found that STEM majors tend to take more rigorous mathematics and science courses in the first year of college. For example, whereas the average first-year student tends to take college algebra and biology, first-year STEM majors tend to take calculus and multiple science courses including biology, chemistry, and physics. Due to variations in course-taking patterns and the level of preparation needed for those courses, Radunzel et al. (2015) derived an empirically based STEM readiness benchmark by estimating the ACT STEM score (average of the ACT Mathematics and Science test scores) associated with a 50% probability of earning a grade of a B or higher in STEM courses. The results indicated that a STEM score of 26 was needed to have a reasonable chance of success in first-year STEM-related courses as compared to the ACT College Readiness Benchmarks in mathematics and science of 22 and 23, respectively (see Figure 6). The researchers then validated the STEM benchmark on long-term indicators of college success and found that STEM majors who met the ACT STEM Benchmark were more likely to earn a cumulative grade point average (GPA) of 3.0 or higher, persist in a STEM major, and earn a STEM-related bachelor's degree than those who did not meet the ACT STEM Benchmark.

Figure 6. Probability of Success in First-Year STEM-Related Courses by ACT STEM Score at a Typical Four-Year Institution



Career Pathway Readiness. For the workforce, previous research using job analysis data has defined readiness benchmarks by career cluster in the U.S. for selected cognitive skills (LeFebvre, 2015). In the study, career clusters were developed using a combination of clusters from both O*NET and the National Career Clusters Framework and then grouped into low, middle, and high education groupings.[11] Skill benchmarks were created for each career cluster by establishing the level at the 85th percentile for each education grouping. The purpose of the benchmarks was to provide individuals with skill benchmarks for different career paths that require varying levels of education and training. Similar methodologies have been used to create aggregate skill benchmarks by industry cluster with breakouts by level of education required for different job groups (ACT, 2011).

In LeFebvre (2015), benchmarks were determined for twelve career clusters (e.g., Agriculture, Finance, Manufacturing) and highlight how the required skill levels vary across these different career areas. The WorkKeys Career Readiness Benchmarks for the STEM Career Cluster are an example of a definition of career pathway readiness for STEM careers that is useful for individuals considering a STEM career (see Figure 7). The results showed that the job requirements of STEM careers required individuals to achieve a level score of 5 on WorkKeys Applied Mathematics for jobs typically requiring an associate's degree or a postsecondary non-degree award and a level score of 6 for jobs requiring a bachelor's degree or higher.

Figure 7. WorkKeys STEM Career Readiness Benchmarks

EDUCATION GROUP	APPLIED MATHEMATICS (Range: 3-7)	READING FOR INFORMATION (Range: 3-7)	LOCATING INFORMATION (Range: 3-6)
SKILL LEVEL REQUIRED FOR 85% OF OCCUPATIONS			
LOW-EDUCATION OCCUPATIONS	N/A	N/A	N/A
MIDDLE-EDUCATION OCCUPATIONS	5	5	5
HIGH-EDUCATION OCCUPATIONS	6	5	5

Source: ACT Job Profiles, Janurary 2004-December 2013
Note. N/A = Insufficient number of job profiles or occupations within an education grouping in order to calculate a benchmark.

Are College Major Pathway Readiness and Career Pathway Readiness the Same? Similar to the analyses conducted to determine if college readiness requires a similar level of proficiency as career readiness, we identified the WorkKeys Applied Mathematics score that was associated with a 50% chance of achieving the ACT STEM Benchmark of 26 as an illustration of the alignment between feedback provided by this benchmark and the benchmarks for the STEM Career Cluster. The results indicated that an 86 on WorkKeys Applied Mathematics (the maximum score associated with a Level 6) is associated with a 50% probability of meeting the ACT STEM Benchmark, suggesting that a similar level of mathematics preparation is needed to succeed in a STEM major as is needed to succeed in a STEM career that requires a bachelor's degree or higher. Note that we focused on high-education occupations because the STEM benchmark is based on students attending four-year institutions and because many STEM careers require at least a bachelor's degree.

It is important to point out that, even though the values for the two benchmark scores differ (22 versus 26), the identical level of mathematics preparation on WorkKeys (level 6) is needed to meet the ACT Benchmark for mathematics as is needed to meet the ACT STEM Benchmark. However, the ACT WorkKeys scale score results tell a different story, highlighting the higher preparation needed for STEM readiness. Specifically, the overall mathematics readiness analyses estimated a WorkKeys scale score of 82, which is the minimum scale score associated with level 6, while the STEM analyses indicated a WorkKeys scale score of 86, the maximum scale score associated with level 6. As summarized in Table 5, a comparison of the percentage of students meeting the ACT College Readiness Benchmark for mathematics and the ACT STEM Benchmark by WorkKeys Applied Mathematics level scores underscores these preparation differences. Specifically, 71% of students with a WorkKeys Applied Mathematics level score of 6 met the ACT Benchmark for mathematics whereas only 32% met the ACT STEM Benchmark.

Table 5. ACT Mathematics and STEM Readiness Rates by WorkKeys Applied Mathematics Level Score

WorkKeys Applied Mathematics Level Score	ACT Mathematics Readiness	ACT STEM Readiness
less than 3	1%	0%
3	1%	0%
4	5%	1%
5	29%	5%
6	71%	32%
7	96%	77%

Given the limited variability in the level of mathematics preparation needed for STEM careers (Applied Mathematics Level Score of 6) as compared to all careers (Applied Mathematics Level Score of 5) based on the JobPro data coupled with the fact that ACT data suggest very different levels of mathematics preparation needed for college in general as compared to STEM majors, additional data sources were investigated. Specifically, we examined the importance and level of mathematics knowledge needed for occupations overall and for those in the STEM Career Cluster, based on data from O*NET (Peterson, Mumford, Borman, Jeanneret, & Fleishman, 1999). Across 966 different occupations, the importance and level of mathematics knowledge were 51.9 and 48.9 (on a 100-point scale), respectively. For occupations only in the STEM Career Cluster, the corresponding values were 73.8 and 72.7, underscoring the need for higher levels of mathematics preparation for success in college and on the job for those pursuing STEM careers.

Again, we want to emphasize that we are not advocating for the use of particular assessments or certain cut scores to determine readiness; rather, we are interested in showing that definitions of college readiness and career readiness do not have to be at odds with one another. By taking into consideration how individuals will use this information and thus the appropriate level of analysis, we hope that individuals can make use of this information as they progress from education into satisfying and well-suited careers.

READINESS FOR A SPECIFIC INSTITUTION AND READINESS FOR A SPECIFIC JOB

At the base of the Framework, Institution Readiness and Work Readiness are defined with an even finer degree of specificity (Figure 8). Specifically, we have defined Institution Readiness as the KSAOs and level of KSAOs needed to succeed in a specific major and/or a specific course at a specific college or university. Examples include institution-specific admission and placement cut scores that can be used for admission decisions into a university or a particular college/field of study, or placement into particular first-year postsecondary courses. On the workplace side, Work Readiness is defined as the KSAOs and level of KSAOs needed to succeed in a specific job at a specific organization. Examples include local validity studies that help determine hiring criteria that can be used for employee selection and promotion.

Figure 8. Institution and Work Readiness

INSTITUTION READINESS

DEFINITION: *KSAOs and level of KSAOs needed to succeed in a specific major and/or course at a specific college or university*

USE CASES: *College admissions, placement, and major selection*

EXAMPLES: *Local validity studies; locally-set admission and placement cut scores*

WORK READINESS

DEFINITION: *KSAOs and level of KSAOs needed to succeed in a specific job at a specific organization*

USE CASES: *Employee selection and promotion*

EXAMPLES: *Local validity studies; hiring criteria*

Institution Readiness. With regard to developing degree program benchmarks for specific colleges and universities, the ACT Course Placement Service provides guidance to individual institutions to set cut scores for specific courses with the goal of matching students with appropriate coursework to help increase retention. To set the cut score, a postsecondary institution provides information on student grades from different courses and an overall GPA. An analysis of the relationship between end-of-term course grades and selected placement variables (predictors) is then conducted by ACT on behalf of the institution. For each course analysis, the ACT Course Placement Service provides several key statistics that allow an institution to determine the impact of setting potential placement cut scores higher or lower. Institutions offering the same courses and/or programs of study may set different cut scores depending on the rigor of their curriculum offerings and grading practices. Placement cut scores and admission criteria provide a signal to potential applicants regarding the degree to which they are academically prepared to succeed at a specific institution. Such information can help inform students about which colleges, and more specifically which majors at a particular college, may be a good academic fit. Students may choose to use this information to help reduce their set of potential colleges to a manageable set of colleges to which to apply.

Work Readiness. Success on the job, or job performance, is the focus of much of the literature in Industrial/Organizational (I/O) Psychology. A full treatment of the literature on determinants of job performance was provided in Mattern et al. (2014). Regarding the use of cognitive assessments for training and employment selection, Ones et al. (2012) conducted a meta-analysis of the I/O literature on general cognitive ability and specific aspects of cognitive ability as predictors of training success and performance and found that validity of cognitive ability is generalizable across situations. General cognitive ability (GCA), or the developed ability to learn, is highly predictive of job performance (Schmidt, 2002). Analysis of the determinants of job performance shows that the major effect of GCA is on the acquisition of job knowledge. People higher in GCA acquire more job knowledge and acquire it faster. GCA has a direct effect on job performance independent of job knowledge (Hunter & Schmidt, 1996; Schmidt & Hunter, 1992). GCA has been found to consistently predict several outcomes including: school performance and achievement in secondary and postsecondary education, education level attained, adult occupational level, adult income level, poverty (negative relation), accident rates on the job (negative relation), and disciplinary problems in secondary school (negative relation) (Schmidt, 2002).

ACT has published several studies that presented empirically defined benchmarks for work readiness (ACT, 2013a; ACT, 2013b). In ACT (2013a), job analysis data from ACT JobPro were used to determine skill readiness levels for jobs in the workplace. The work readiness benchmarks are defined as the descriptions of the knowledge and combination of skills that individuals need to be minimally qualified for a target occupation, as determined by the level of skills profiled via job analysis for a national representative sample of jobs in a given occupation. Job analysis is a process that identifies the knowledge, skills, and behaviors directly related to performance on the job. Work readiness benchmarks are considered to be a target skill level (i.e., median) that an individual should aim for in order to be considered work ready in that occupation.

The work readiness benchmarks at the occupational level were defined using the median skill level for job profiles within the same O*NET occupational code. The report presented work readiness benchmarks data for three WorkKeys cognitive assessments: Reading for Information, Applied Mathematics, and Locating Information. Occupational profiles in the ACT JobPro database were used to determine work readiness benchmarks for three selected groups of targeted occupations: those projected to be in demand, growing, and high paying. The benchmarks allow both current and prospective employees to align their skills with employer skill requirements and help to ensure that individuals develop the foundational and job-specific skills necessary to be successful throughout a lifetime (ACT, 2013a). A main takeaway from the report is that different occupations require different levels of KSAOs (see Table 6 below for an example). Note that even more finely grained benchmarks or cut scores can be developed beyond those shown, by estimating target skill levels for specific organizations (e.g., skill levels needed to be an accountant at Organization X versus the average skill level for accountants generally).

Table 6. A Comparison of Work Readiness Benchmarks for Accountant versus Welders

Skill Required	Accountants (O*NET Code 13-2011.01) Median Skill Level	Welders, Cutters, and Welder Fitters (O*NET Code 51-4121.06) Median Skill Level
Applied Mathematics	5	3
Reading for Information	5	3
Locating Information	5	4
Applied Technology	N/A	3
Writing	3	3
Teamwork	3	3
Observation	4	4
Business Writing	4	N/A

Education and workforce stakeholders can use work readiness benchmarks by aligning career curricula to the benchmarks via curriculum profiling to ensure that individuals have the levels of skills needed for a reasonable chance of success in completing occupational training programs and, ultimately, gaining a job. In addition, the benchmarks can be used in program evaluation of education and training interventions that improve individual training and employment outcomes.

WHAT ABOUT THE "O" IN KSAOS?

The multidimensional nature of educational and workplace readiness and success, which includes traits beyond knowledge, skills, and abilities, has been well documented (Mattern et al., 2014). Other constructs such as behavioral skills, career navigation skills, and other cross-cutting capabilities are also needed for individual progression in each tier of the Framework across college and career domains. For example, Campbell (1990) proposed an eight-factor model of job performance in which, along with core task proficiency, demonstrating effort and maintaining personal discipline are important components of performance in virtually every job. Similarly, numerous meta-analyses have documented the importance of personality on education and work outcomes. The results show that among the five major personality traits, conscientiousness tends to be most strongly related to education and work outcomes (Barrick & Mount, 2012; Poropat, 2009); however, the importance of personality traits or behavioral skills varies across programs of study and career pathways. Additionally, vocational interests have been linked to educational and career outcomes (Rounds & Su, 2014). In particular, when interests are aligned with program of study or career pathway, individuals are more likely to achieve success. For example, students who declare a major that is well aligned with their interests are more likely to stay in the major and earn a degree in the major (Allen & Robbins, 2010).

Research on these other factors has repeatedly demonstrated that they can compensate for weaknesses in knowledge and skills (ACT, 2017). That is, a student who fails to meet the ACT STEM Benchmark yet is extremely hard working may be more likely to succeed in college in an engineering major than a student who meets the ACT STEM Benchmark but is not motivated to work hard in class. For this reason, focusing solely on academic preparation may result in the misclassification of an individual's readiness or likelihood of future success. Unfortunately, we lack data to compare whether the same levels of these "Other" characteristics are needed for education and the workforce, nor to determine the degree to which they compensate for deficiencies in other areas in either setting; nevertheless, the research clearly indicates that they are important both in school and on the job. Therefore, we advocate using information about these other domains to get a more accurate picture of an individual's readiness and potential for future success, especially for very specific use cases such as determining which colleges, majors, or jobs an individual should explore further.

CHAPTER 3.
Use of the Hierarchical Readiness Framework and Associated Benchmarks

The tiers of the Framework go from general to specific to allow for differentiation of purpose or uses by policymakers, educators, and individuals. General concepts of readiness are useful from a state and national policy perspective, while more specific concepts of readiness are important for educators and individuals developing a plan of study or for entry into an occupation or a degree-granting program. At the highest tier of the Framework, College Readiness and Career Readiness, benchmarks can be used to set goals for national, state, and regional education and workforce planning efforts. For those purposes, aggregate measures of a population's readiness are needed in order to effectively plan and respond to gaps in attainment of KSAOs needed for entry into college or career training programs after high school graduation. Such aggregate benchmarks could be used in accountability metrics for college and career readiness or in workforce development skill gap alignment.

At the next tier of the Framework, College Major Pathway Readiness and Career Pathway Readiness, benchmarks can be used to guide individuals who are exploring different college majors or job training programs linked to different career pathways. Individuals can work with high school or career counselors to set goals for KSAO development in alignment with the individual's college major or career pathway interests. Major or career pathway benchmarks can also be used in program development to help education and training providers better align programs with student learning objectives and ensure alignment with the KSAOs demanded by local industry.

Of utmost importance is the most detailed tier of the framework, Institution Readiness and Work Readiness, whose benchmarks can be used by institutions to develop entry or exit criteria for specific college majors or by employers for selection into a specific job, respectively. Individuals can use these benchmarks to set goals for skill development for entry into a desired postsecondary degree program or to apply for a job opening for a specific employer. Ultimately, any benchmark of readiness at this tier of the Framework that is used for high-stakes decisions (i.e., for entry or selection criteria) needs to be determined via a local benchmark or validation study.[12]

CHAPTER 4.
Policy Implications & Discussion

This report analyzed and compared examinee scores from two separate assessments, the ACT and ACT WorkKeys, to theoretically compare the level of KSAOs for college readiness and career readiness benchmarks at the highest tier of the Framework and to highlight the specific example of STEM at the middle tier. However, the authors emphasize that caution should be used in interpreting the results from any crosswalk across different assessments. Such crosswalks should not be used to rationalize substituting one assessment for the other, as different assessments are designed to measure different constructs. A useful analogy can be made in terms of hat size and shoe size. While both sizes may be statistically "related," it would not be advisable for an individual to put their shoes on their head nor wear hats on their feet. The goal of comparing different measures of college and career readiness in this report was to lay to rest any assumptions of disparate levels of rigor in college and career readiness benchmarks. While one may not be substituted for the other for reasons of differences in constructs and contexts, measures of an individual's readiness for their next step beyond high school completion are equal with respect to value and importance.

This report seeks to provide education and workforce policymakers with a clear framework for quantitatively defining individuals as being "ready" for college or career at different degrees of specificity. The ACT Hierarchical Education and Workplace Readiness Framework builds on the prior work of Conley (2012) in the development of a more nuanced understanding of college and career readiness and is in alignment with frameworks of career readiness proposed by both the Association for Career and Technical Education (ACTE, 2010) and the U.S. Chamber of Commerce Foundation Center for Education and Workforce (U.S. Chamber of Commerce, 2016). Both of these frameworks include a combined set of skills and activities that ensure proficient academic knowledge, workplace contextualized skills, and cross-cutting competencies important for navigating college and workplace contexts. However, the authors of this report are cognizant of the fact that empirically defined frameworks developed to inform education and workforce policy are often not implemented for reasons other than validity or applicability. Funding, state and location implementation, program quality, and equity of opportunity are all serious barriers to effective career education and training.[13]

At the same time, fewer employers are investing in training their current workforces or new hires and are relying more on higher education (including community colleges) for workforce training. In his review of different approaches to providing workforce services and job training through higher education, Holzer (2015) notes that models of collaboration between higher education and industry (employers or their associations) called "sectoral" training and "career pathway" programs have a point of weakness: that many of the low-income student and adult workers who would benefit from these approaches are lacking the basic academic and applied skills needed to succeed in a training program. Holzer posits that high-quality CTE programs in secondary school do not have to be mutually exclusive with college-preparatory work and that CTE offers contextualized and applied learning that can complement more traditional classroom teaching (Holzer, 2015; Holzer et al., 2013).

Currently, there are large gaps in the readiness foci of U.S. secondary education programs, and even larger gaps in student mastery of such curricula. Bromberg and Theokas (2016) analyzed transcript data from the High School Longitudinal Study, a dataset that followed a national representative group of U.S. ninth graders from 2009 to 2013 through the fall after their expected graduation to investigate their experiences and preparation in high school. In the study, high school students were grouped into four categories based on curriculum completed: college prep, career prep, college and career prep, and no cohesive curriculum[14] (Bromberg & Theokas, 2016). The study found that only 8% of 2013 U.S. high school graduates completed a full college and career prep program; 31% completed a college prep program, 13% career prep, and 47% had no cohesive curriculum. More disturbing was the gap found between student program completion and mastery of that program (where mastery was defined as earning a minimum of a 2.5 GPA or higher in courses in a track as well as completion of the curriculum). One in seven graduates, or 14%, completed a cohesive curriculum but did not demonstrate mastery of that curriculum, while more than half of U.S. high school graduates (61%) had either not taken or not mastered a college or career readiness curriculum (Bromberg & Theokas, 2016).

For existing career readiness programs, another challenge is the "tracking" of students into a program. Academic and CTE leaders at the state and local levels have challenged the silos between their disciplines and now work to ensure that new standards engage all students in both academic and CTE courses (CCSSO, 2014; Meeder & Suddreth, 2012). In an analysis of leading career preparation practices and policies at the state level, the Council of Chief State School Officers' (CCSSO) Career Readiness Task Force emphasized the need for establishing rigorous standards for all students, and that career pathways must offer both a college-ready academic core emphasizing real-world applications and a technical core that meets industry expectations (CCSSO, 2014). However, in their review of best practices involving the integration of CTE and academic standards, Meeder and Suddreth (2012) found that efforts to formally integrate mathematics and literacy strategies in CTE courses are sporadic and that, even in places where integration of academic content into CTE courses is systematic, integration of real-world CTE content in core academic courses is almost nonexistent. In fact, the researchers found no consistent policy on directing academic teachers to integrate real-world relevance into their teaching.

Perhaps the most challenging issue that policymakers face when trying to address readiness is the issue of equity of opportunity. While domestic and international research support the assumption that higher educational attainment and cognitive skill levels are related to increased lifetime earnings, does everyone, regardless of socioeconomic status, have an equal chance of increasing their education and skills? Research that plotted the relationship between cross-sectional inequality and earnings mobility among 13 Organisation for Economic Co-operation and Development (OECD) countries shows that the U.S. has both the lowest mobility and the highest inequality among all wealthy democratic countries (Corak, 2013). In fact, the analysis showed that countries with the highest returns to education generally had low earnings mobility, which is troubling since two of the strongest predictors of educational attainment are parental education level and parental earnings (Autor, 2014; Corak, 2013).

Breaking the pattern of income inequality in the U.S. is intricately tied to providing individuals of all ages with the knowledge and skills needed to successfully navigate career and education transitions throughout their lifetimes. While the barriers of implementation, quality, and equity are daunting, they are challenges that are worth facing head on. In a small way, the clarity provided in our Framework addresses each aforementioned challenge by redefining our understanding of an individual's journey to success as consisting of multiple pathways, not just one.

REFERENCES

Acemoglu, D. & Autor, D. (2011). Skills, tasks and technologies: Implications for employment and earnings. In O. Ashenfelter & D. Card, (Eds.), *Handbook of labor economics*, (Vol. 4), (pp.1043-1171). Amsterdam: Elsevier-North Holland.

Acemoglu, D. & Autor, D. (2012). What does human capital do? A review of Goldin and Katz's *The race between education and technology*. NBER Working Paper No. 17820, February 2012.

Achieve, Advance CTE (2016). *How states are making career readiness count: A 2016 update*. Retrieved from https://careertech.org/resource/making-career-readiness-count.

ACT. (2006). *Ready for college and ready for work: Same or different?* Iowa City, IA: ACT.

ACT. (2011). *A better measure of skills gaps*. Iowa City, IA: ACT.

ACT. (2013a). *Condition of work readiness in the U.S. 2013*. Iowa City, IA: ACT.

ACT. (2013b). *Work readiness standards and benchmarks: The key to differentiating America's workforce and regaining global competitiveness*. Iowa City, IA: ACT.

ACT. (2015). *Unpacking "career readiness."* Iowa City, IA: ACT.

ACT. (2017). *The condition of college and career readiness 2017*. Iowa City, IA: ACT.

Advance CTE. (2017). National Career Clusters Framework. Retrieved from https://careertech.org/careerclusters.

Allen, J. (2013). *Updating the ACT college readiness benchmarks*. Iowa City, IA: ACT.

Allen, J., & Robbins, S. (2010). Effects of interest–major congruence, motivation, and academic performance on timely degree attainment. *Journal of Counseling Psychology, 57*(1), 23-35.

Association for Career and Technical Education. (2010). *What is career ready?* Alexandria, VA: Association for Career and Technical Education.

Autor, D. (2014). Skills, education, and the rise of earnings inequality among the "other 99 percent". *Science, 344*, 843-851.

Barnes, W. B., & Slate, J. R. (2013). College-readiness is not one-size-fits-all. *Current Issues in Education*, 16(1), 1-11.

Barrick, M. R., & Mount, M. K. (2012). Nature and use of personality in selection. In N. Schmitt (Ed.), *The Oxford handbook of personnel assessment and selection* (pp. 225-251). New York, NY: Oxford University Press.

Bransford, J.D., Brown, A.L., & Cocking, R.R. (2004). *How people learn: brain, mind, experience, and school.* Expanded edition. Retrieved from http://www.nap.edu/openbook/php?isbn=0309070368.

Bromberg, M. & Theokas, C. (2016). Meandering toward graduation: Transcript outcomes of high school graduates. Washington, DC: The Education Trust.

Camara, W., O'Connor, R., Mattern, K., & Hanson, M.A. (2015). *Beyond academics: A holistic framework for enhancing education and workplace success*. ACT Research Report Series 2015-4. Iowa City, IA: ACT.

Camara, W., & Quenemoen, R. (2012). *Defining and measuring college and career readiness and informing the development of performance level descriptors (PLDs)*. Retrieved on January, 24, 2013.

Campbell, J. P. (1990). Modeling the performance prediction problem in industrial and organizational psychology. In M. D. Dunette & L. M. Hough (Eds.), *Handbook of industrial and organizational psychology* (2nd ed., Vol. 1, pp. 687-732). Palo Alto, CA: Consulting Psychologists Press.

Campbell, J. P., McCloy, R. A., Oppler, S. H., & Sager, C. E. (1993). A theory of performance. In E. Schmitt, and W.C. Borman, & Associates (Eds.), *Personnel Selection in Organizations* (pp. 35-70). San Francisco, CA: Josey-Bass.

Cappelli, P. (2015). *Will college pay off?* New York, NY: PublicAffairs.

Carl D. Perkins Career and Technical Education Improvement Act (2006). 20 U.S.C. 2301 et seq.

Carnevale, A.P., Smith, N., & Strohl, J. (2010). *Help wanted: Projections of jobs and education requirements through 2018*. Washington, DC: Georgetown University Center on Education and the Workforce.

Camara, W. (2012, April). *Defining and measuring college and career readiness: Developing performance level descriptors and defining criteria*. Presented at the National Council on Measurement in Education Annual Meeting, Vancouver, BC. Retrieved from: https://research.collegeboard.org/sites/default/files/publications/2012/7/presentation-2012-3-developing-performance-level-descriptors-criteria.pdf.

Conley, D. T. (2011). *Designing common assessments to be measures of college and career readiness: Challenges and opportunities*. Arabella Advisors and the Bill & Melinda Gates Foundation, 1-16.

Conley, D. T. (2012). *A complete definition of college and career readiness*. Educational Policy Improvement Center (NJ1).

Corak, M. (2013). Income inequality, equality of opportunity, and intergenerational mobility. *The Journal of Economic Perspectives*, 27(3), 79-102.

Council of Chief State School Officers. (2014). *Opportunities and options: making career preparation work for students*. Retrieved from http://ccsso.org/Documents/2014/CCSSOTaskForceCareerReadiness120114.pdf.

Darling-Hammond, L., Wilhoit, G., & Pittenger, L. (2014). Accountability for college and career readiness: Developing a new paradigm. *Education Policy Analysis Archives, 22*(86), 1-38.

Dorans, N.J. (2004). Equating, concordance, and expectation. *Applied Psychological Measurement, 28*(4), 227-246.

Every Student Succeeds Act (2015). S. 1177; Pub.L. 114-95.

Hamilton, V. (2012). *Career pathway and cluster skill development: Promising models from the United States*. OECD Local Economic and Employment Development (LEED) Working Papers, 2012/14, OECD Publishing.

Hanushek, E. A., Schwerdt, G., Wiederhold, S., & Woessmann, L. (2015). Returns to skills around the world: Evidence from PIAAC. *European Economic Review, 73*, 103-130.

Holzer, H. (2015). *Higher education and workforce policy: Creating more skilled workers (and jobs for them to fill)*. Washington, DC: Brookings Institution.

Holzer, H. J., Linn, D., & Monthey, W. (2013). The promise of high-quality career and technical education: Improving outcomes for students, firms, and the economy. New York, NY: College Board.

Hunter, J.E., & Schmidt, F.L. (1996). Intelligence and job performance. Economic and social implications. *Psychology, Public Policy, and Law, 2*, 447-472.

LeFebvre, M. (2016). *A summary of ACT WorkKeys validation research*. ACT Research Report Series 2016-4. Iowa City, IA: ACT.

LeFebvre, M. (2015). *Career readiness in the U.S. 2015*. Iowa City, IA: ACT.

Mattern, K., Burrus, J., Camara, W., O'Connor, R., Hanson, M.A., Gambrell, J., Casillas, A., & Bobek, B. (2014). *Broadening the definition of college and career readiness: A holistic approach*. ACT Research Report Series 2014-5. Iowa City, IA: ACT.

Mattern, K., Radunzel, J., & Westrick, P. (2015). *Development of STEM readiness benchmarks to assist educational and career decision making*. ACT Research Report 2015-3. Iowa City, IA: ACT.

Meeder, H., & Suddreth, T. (2012). *Common core state standards & career and technical education: Bridging the divide between college and career readiness*. Achieve, Inc.

Ones, D. S., Dilchert, S., & Viswesvaran, C. (2012). 10 cognitive abilities. *The Oxford Handbook of Personnel Assessment and Selection*, 179.

Partnership for Assessment of Readiness for College and Careers (PARCC). (2015). PARCC college- and career-ready determination policy in English language arts/literacy and mathematics & policy-level performance level descriptors. Retrieved from: http://parcc-assessment.org/content/uploads/2017/11/PARCCCCRDPolicyandPLDsFINAL.pdf.

Peterson, N. G., Mumford, M. D., Borman, W. C., Jeanneret, P. R., & Fleishman, E. A. (Eds.). (1999). *An occupational information system for the 21st century: The development of O*NET*. Washington, DC: American Psychological Association.

Poropat, A. E. (2009). A meta-analysis of the five-factor model of personality and academic performance. *Psychological bulletin, 135*(2), 322.

Porter, M.E. (1990). *The competitive advantage of nations*. New York, NY: The Free Press.

Radunzel, J., Mattern, K., Crouse, J., & Westrick, P. (2015). *Development of STEM benchmark based on the ACT STEM score*. ACT Technical Brief. Iowa City, IA: ACT.

Rounds, J., & Su, R. (2014). The nature and power of interests. *Current Directions in Psychological Science*, 23(2), 98-103.

Schmidt, F. L. (2002). The role of general cognitive ability and job performance: Why there cannot be a debate. *Human Performance, 15*(1-2), 187-210.

Schmidt, F.L., & Hunter, J.E. (1992). Causal modeling of processes determining job performance. *Current Directions in Psychological Science, 1*, 89-92.

Schmitt, N. (2014). Personality and cognitive ability as predictors of effective performance at work. *Annual Review of Organizational Psychology and Organizational Behavior, 1*(1), 45-65.

Shaffer, J.A. & Postlethwaite, B.E. (2012). A matter of context: A meta-analytic investigation of the relative validity of contextualized and noncontextualized personality measures. *Personnel Psychology, 65*, 445-494.

Slonimczyk, F. (2008). *Earnings inequality and skills mismatch in the U.S.: 1973-2002*. Doctoral dissertation, University of Massachusetts, Amherst, MA.

Smarter Balanced Assessment Consortium (SBAC). (2013). College content readiness policy. Retrieved from: https://www.smarterbalanced.org/wp-content/uploads/2015/07/College-Content-Readiness-Policy.pdf.

U.S. Chamber of Commerce Foundation Center for Education and Workforce (2016). *Career readiness: A business-led approach for supporting K-12 schools*. Washington, DC: U.S. Chamber of Commerce.

U.S. Department of Education, National Center for Education Statistics. (2017). Integrated Postsecondary Education Data System (IPEDS), spring 2001 through 2016, fall enrollment component. Retrieved from http://nces.ed.gov/programs/coe/indicator_cug.asp.

U.S. Department of Labor. (2014). Training and employment notice 05-14. Retrieved from https://wdr.doleta.gov/directives/attach/TEN/TEN_5-14.pdf.

Vaisey, S. (2006). Education and its discontents: Overqualification in America, 1972–2002. *Social Forces, 85*(2), 835-864.

Westrick, P. (2016). *Profiles of persisting fourth-year STEM majors* (ACT Research Report No. 2016-5). Iowa City, IA: ACT, Inc.

Workforce Innovation and Opportunity Act (2014). H.R. 803; Pub.L. 113-128.

ENDNOTES

1. For high schools, these indicators include: 1) proficiency rates in mathematics and reading/English language arts, 2) graduation rates, and 3) English-language proficiency rates among English language learners.

2. Earnings were calculated for median college-educated and median high school-educated U.S. males working full time in year round jobs. Median earnings were converted to constant 2012 dollars (to account for inflation) using the CPI-U_RS price series.

3. Cappelli refers to this as "bumping." For example, when employers hire college graduates for jobs that do not require a college degree, they thereby force individuals with just a high school degree to find jobs that require less than a high school degree. There is some support for this concept of "bumping" in the U.S. labor market.

4. O*NET, sponsored by the U.S. Department of Labor, Employment & Training Administration and developed by the National Center for O*NET Development, is a source of occupational information containing standardized occupational data for roughly 1,000 occupations in the U.S.

5. The ACT is a curriculum-based educational achievement test designed to measure skills acquired in high school that are important for postsecondary success and may be used in the Hierarchical Education and Workplace Readiness Framework as a measure of core academic skills. ACT WorkKeys cognitive assessments are criterion-referenced tests that measure the workplace skills critical to job success as well as the reasoning, critical thinking, and problem-solving techniques to solve work-related problems. Within the Framework, WorkKeys assessments can serve as measures of cross-cutting capabilities in work contexts in that they measure an individual's ability to apply concepts and knowledge previously learned to a new and unfamiliar context in a situation where information does not easily move from the abstract to the concrete—the notion of knowledge "transfer" (Bransford, Brown, & Cocking, 2014).

6. "Success" here is defined as about a 50% chance of obtaining a B or higher, or about a 75% chance of obtaining a C or higher, in the courses.

7. ACT English, Math, Reading, and Science tests are scored on a scale of 1 through 36.

8. After the research summarized in this report was conducted, the three WorkKeys assessments that comprise the NCRC were redesigned. Most notably, Locating Information was renamed Graphical Literacy to more accurately reflect the content specifications of the new assessment. Specifically, graphical literacy measures an individuals' ability to derive and evaluate information from graphical and visual resources. Reading for Information and Applied Mathematics were updated and their names were changed to Workplace Documents and Applied Math, respectively.

9. Level scores for Reading for Information and Applied Mathematics range from 3 through 7, while Locating Information level scores range from 3 through 6.

10. Only 0.52% of students took ACT WorkKeys prior to September of 2012.

11. Occupational education groupings were based on the U.S. Bureau of Labor Statistics' Most Significant Source of Education/Training. Low-education occupations were those that required no formal training beyond a high school diploma, middle-education occupations were those that required formal training after high school up through an associate's degree, and high-education occupations were those that required a Bachelor's degree or higher.

12. When ACT WorkKeys tests, or any assessment for that matter, are used for pre-employment screening or other high-stakes employment decisions, employers should demonstrate that the knowledge and skills in the pre-employment measure is linked to work behaviors and job tasks either through (1) job profiling or (2) research that links the test to job performance.

13. Unfortunately, the U.S. federal government is currently investing less in workforce programs (including training), spending $5 billion a year through WIOA compared to the $40 billion in current dollars spent through the Comprehensive Employment and Training Act (CETA) of 1980 (Holzer, 2015).

14. College prep consists of four credits in English, three credits in mathematics including Algebra II, three credits in social studies including U.S. history or world history, three credits in science including biology and either chemistry or physics, and two credits in the same foreign language. Career prep consists of three or more credits in a broad career field such as health science or business. College and career prep consists of both college- and career-ready course taking sequences. "No cohesive curriculum" refers to a lack of both the college-ready and the career-ready sequence of credits.

APPENDIX

Performance Level Descriptors for WorkKeys Applied Mathematics

Level	Skills
3	» Solve problems that require a single type of mathematical operation. They add or subtract either positive or negative numbers (such as 10 or -2). They multiply or divide using only positive numbers (such as 10). » Change numbers from one form to another. For this they use whole numbers (such as 10), fractions (such as ½), decimals (such as 0.75), or percentages (such as 12%). For example, they can convert ⅘ to 80%. » Convert simple money and time units (for example, hours to minutes and vice versa). » For example, at this level employees can add the prices of several products to reach a total, and they can make the correct change for a customer.
4	» Solve problems that require one or two operations. They may add, subtract, or multiply using several positive or negative numbers (such as 10, -2), and they may divide positive numbers (such as 10). » Figure out averages (such as $\frac{(10+11+12)}{3}$), simple ratios (such as ¾), simple proportions (such as 10⁄100 cases), or rates (such as 10 mph). For this they use whole numbers and decimals. » Add commonly known fractions, decimals, or percentages (such as ½, .75, or 25%). » Add three fractions that share a common denominator (such as ⅛ + ⅜ + ⅞). » Multiply a mixed number (such as 12 ⅛) by a whole number or decimal. » Put the information in the right order before they perform calculations. » For example, at this level, employees can figure out sales tax or a sales commission on a previously calculated total, and they can find out rates of use or business flow.
5	» Decide what information, calculations, or unit conversions to use to find the answer to a problem. » Look up a formula and change from one unit to another in a single step within a system of measurement (for example, converting from ounces to pounds). » Look up a formula and change from one unit to another in a single step between systems of measurement (for example, converting from centimeters to inches). » Calculate using mixed units, such as adding 3.50 hours and 4 hours 30 minutes. » Divide negative numbers (such as -10). » Identify the best deal by doing one- and two-step calculations and then comparing the results to determine the solution that meets the stated conditions. » Calculate perimeters and areas of basic shapes like rectangles and circles. » Calculate percent discounts or markups.

6	» Use fractions with unlike denominators, reverse percentages, or multiply two mixed numbers. » Rearrange a formula before solving a problem (for example, $8X = 20 \Rightarrow X = \frac{20}{8}$). » Look up and use two formulas to change from one unit to another unit within the same system of measurement (for example, 1 cup = 8 fluid ounces; 1 quart = 4 cups). » Look up and use two formulas to change from one unit in a system of measurement to a unit in another system of measurement (for example, 1 mile = 1.61 kilometers; 1 liter = 0.264 gallons). » Find mistakes in problems that belong at Levels 3, 4, and 5. » Find the best deal and use the result for another calculation. » Find the area of basic shapes (rectangles and circles) when it may be necessary to rearrange the formula, convert units of measurement in the calculations, or use the result in further calculations. » Find the volume of rectangular solids. » Calculate multiple rates (such as by comparing production rates or pricing plans).
7	» Solve problems that include nonlinear functions (such as rate of change) and/or that involve more than one unknown. » Find mistakes in Level 6 problems. » Convert between systems of measurement that involve fractions, mixed numbers, decimals, or percentages. » Calculate multiple areas. » Calculate volumes of spheres, cylinders, or cones. » Set up and manipulate complex ratios or proportions. » Determine the better economic value of several alternatives by using graphics or by finding a percentage difference or a unit cost. » Apply basic statistical concepts such as measures of central tendency (e.g., mode, median, and weighted mean).

www.act.org

ACT®
REPORT