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# Beyond Academics: A Holistic Framework for Enhancing Education and Workplace Success



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## Executive Summary

In 1997, ACT released its College Readiness Standards (ACT, 2004; 2007) which identified the skills required for success in entry level postsecondary courses and described skills associated with specific score ranges across its assessments (EXPLORE, PLAN, and the ACT® test). Shortly after this, ACT published cut scores, or benchmarks, which identified the minimum scores required for college readiness in grades 8–12. These efforts gained national recognition with policy makers, educational organizations, and education reformers who had long argued that low standards and minimum competency testing disguised the large inequities which existed across schools and states and led to complacency among parents and students who assumed a high school diploma and proficiency on graduation tests were indicators of readiness to proceed to the next level—credit bearing college courses, rigorous postsecondary career training, or entry into the workforce. By the turn of the century it was evident that receipt of a diploma and passing a graduation test did not ensure preparation for these postsecondary experiences. In fact, research and policy reports showed just the opposite: students with such credentials were largely in need of remediation in college and were not prepared for postsecondary training or job entry.

On January 8, 2002, President George W. Bush signed the No Child Left Behind Act of 2001 (NCLB; 2002) into law, which mandated standards and statewide testing in reading and math for grades 3–8 and in high school, with provisions in place to measure and report on school, district, and state performance over time. More recently, the Common Core State Standards effort was undertaken with strong incentives from the federal government to both adopt higher standards and build assessments based on the college and career readiness work ACT had already made foundational. In fact, the evidentiary basis from ACT-conducted curriculum surveys of high school and college faculty and statistical studies examining the relationship between performance (e.g., scores on ACT tests) and outcomes in college courses provided a substantial foundation for the development of the Common Core State Standards. The development of the Standards also included many additional studies that relied on the judgments or observations of educators, but statistical evidence from ACT was unique in providing an empirical link between mastery (or absence) of specific skills and academic performance in entry-level college courses across two- and four-year colleges.

ACT's suite of curriculum-based achievement tests measured four academic domains (English language arts, reading, mathematics, and science) and subsequent research on standards, benchmarks and assessments both at ACT and nationally focused exclusively on these academic domains for a number of reasons. First, public school students were mandated to take assessments in reading, math, and science so there were convenient measures available. Second, NCLB and other accountability efforts focused nearly exclusively on student performance in these academic domains. Finally, as assessments were increasingly used to measure teacher accountability, it became much more difficult to incorporate other skills or competencies related to college and career success because teachers and schools could not be held directly responsible for such skills.

In the past decade, performance on reading, math, and to a lesser extent science assessments have come to define college and career readiness in the K–12 sector because of their convenience and the focus of accountability efforts. This has occurred while higher education and the workforce have focused increasingly on other competencies and skills that appear to be equally important for success in college and careers. ACT has long been a leading source of research on some of

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these additional dimensions that are essential for college and career success, such as interests (Discover® and the ACT), behaviors (ACT Engage®, ACT WorkKeys® Personal Skills Assessments), and generalized cognitive skills (ACT WorkKeys®), as well as a source of information on how core academic skill requirements (such as math and reading) can be assessed across different contexts such as work, career training, liberal arts, or the sciences.

Colleges have long recognized the importance of multiple domains. Admissions officers look to high school grades as indicators of persistence and achievement; student statements and letters of recommendation as indicators of character, behavior, and adaptability; the rigor of courses completed in high school as evidence of effort, motivation, and challenge; and activities and extracurricular involvement as indicators of leadership, teamwork, and collaboration. Research summarized in this report and an earlier report (Mattern et al., 2014) calls attention to the research basis for examining multiple domains and the importance of nonacademic domains for predicting outcomes such as retention, persistence, and engagement in college as well as graduation from college. These reports also summarize similar findings for employment, where employers use a wide range of practices to make inferences about individuals' likely adaptation, persistence, and contribution to the job, organization, and society. Most know of academically talented students who did not persist in college and highly skilled workers who failed in their jobs. Unfortunately, the early research focus on academic skills as measured by assessments coupled with the focus on school and teacher accountability have led to a common assumption that college and career readiness are defined by one's math and reading skills. It is a mistake to focus only on what is commonly measured when research findings clearly show success in postsecondary environments is related to multiple domains and that the specific behaviors, academic skills, interests, and cognitive skills needed may actually differ somewhat across settings, whether we focus on college majors or occupations.

Building on research conducted at ACT over the last fifty years, this report describes the development of a holistic framework that can provide a more complete description of education and work readiness. The framework is organized into four broad domains: core academic skills, cross-cutting capabilities, behavioral skills, and education and career navigation skills. To take full advantage of emerging knowledge in this area, development of this framework is based on a comprehensive review of relevant theory, education and work standards, empirical research, input from experts in the field, and a variety of other sources for each of the four broad domains.

- **Core academic skills** include the domain-specific knowledge and skills necessary to perform essential tasks in the core academic content areas of English language arts, mathematics, and science.
- **Cross-cutting capabilities** include the general knowledge and skills necessary to perform essential tasks across academic content areas. This includes technology and information literacy, collaborative problem solving, thinking and metacognition, and studying and learning.
- **Behavioral skills** include interpersonal, self-regulatory, and task-related behaviors important for adaptation to and successful performance in education and workplace settings.
- **Education and career navigation skills** include the personal characteristics, processes, and knowledge that influence individuals as they navigate their educational and career paths (e.g., make informed, personally relevant decisions; develop actionable, achievable plans).

The report also begins to build an integrated view of education and work readiness, acknowledging that constructs across the four broad domains are not independent, that their combined effects

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provide a more holistic understanding, and that different constructs are often more or less important for different outcomes associated with education and work success. To illustrate the multidimensional nature of readiness for education and workplace success, examples are provided that focus on two key transitions: the transition from high school to college and the transition from college to work. For each of these two transitions, we present a holistic model of success, specifying factors from each of the broad domains that are important for success. Similar models can and should be developed for different outcomes, since the same constructs are not equally important across all outcomes.

We hope the reader will take away a few central findings and ideas from this report and other research conducted by ACT on college and career readiness. Preparation for college, careers or life requires skills and competencies from multiple domains. Academic skills, whether focused solely on math and reading, or more broadly to include science, are clearly essential to most definitions of postsecondary success, but alone they are not sufficient to ensure success. The specific skills needed in a domain like math may differ somewhat across majors or occupations, and our assessments and benchmarks need to be sensitive to these complexities even when one size fits all is more convenient for accountability. We invite the reader to examine the complexities associated with behavioral skills, how their manifestations change with growth and development over time, and how important behavioral skills are for success in any environment or context. Finally, we hope the reader recognizes the role that cross-cutting cognitive skills play in learning, self-direction, and a positive predisposition to lifelong learning, as well as how important education and career navigation skills are to progressing along the continuum from school to college to career. It is our belief that a holistic examination of college and career readiness such as this can improve outcomes that lead to education and workplace success.





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# ACT Holistic Framework of Education and Work Readiness

KRISTA D. MATTERN AND MARY ANN HANSON

A limitation of current definitions of college and career readiness is that they tend to focus exclusively on academic preparation and, in particular, to focus narrowly on the level of knowledge and skills students need in mathematics and English. Such a focus may be driven in part by an emphasis on educator accountability rather than a student-driven model that emphasizes the broader set of skills and competencies associated with success (Conley, 2013).<sup>1</sup>

An earlier report presented a mounting body of evidence showing success in school and work is multidimensional (Mattern et al., 2014). In the workplace, it has long been recognized that performance on the job requires more than just completing tasks in a timely manner with sufficient quality. For instance, Campbell's (1990) eight-factor model of job performance is widely accepted. Based on a factor analysis of the various behaviors related to overall job performance, Campbell subdivided job performance into the following dimensions: task-specific behaviors, nontask-specific behaviors, oral communication, effort, personal discipline, teamwork, supervision or leadership, and managerial skills. Constructs such as organizational citizenship behaviors and counterproductive work behaviors have been proposed as additional dimensions of job performance, reinforcing the notion that task-specific behavior is an insufficient representation of the broader construct of job performance (Borman & Motowidlo, 1993).

Academic performance can be similarly conceptualized as multidimensional because it too encompasses a wide range of behaviors important for overall success (Camara, 2005; Conley, 2011; Oswald, Schmitt, Kim, Ramsay, & Gillespie, 2004; Shultz & Zedeck, 2011). For example, Oswald et al. (2004) proposed a twelve-factor model of academic performance that included both a traditional academic component (knowledge, learning, mastery of general principles) and nontraditional components such as continuous learning, multicultural tolerance, leadership, and career orientation. Given that all these various dimensions are important components of success, it follows that readiness and preparation should be similarly focused on a broad and diverse set of personal characteristics.

Previous research has demonstrated that although cognitive indicators of readiness tend to be most strongly related to traditional indicators of work success, noncognitive predictors such as behaviors, career interests, and self-related beliefs are also reliable predictors of performance in the workplace (Barrick & Mount, 1991; Judge & Bono, 2001; Nye, Su, Rounds, & Drasgow, 2012; Schmidt & Hunter, 1998). In a similar vein, empirical findings in the educational setting have shown that while cognitive skills tend to be the best predictors of academic performance, noncognitive skills can also reliably predict academic performance (Poropat, 2009; Richardson, Abraham, & Bond, 2012).

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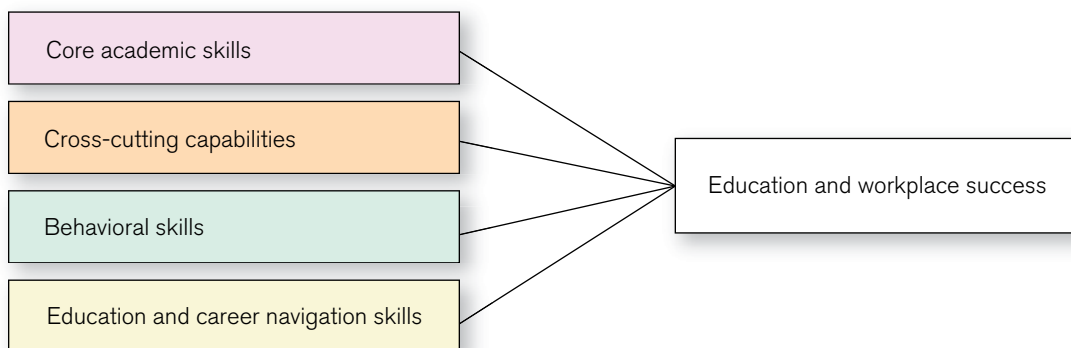
<sup>1</sup> No Child Left Behind (NCLB), for example, requires assessments in reading and mathematics, neglecting other cognitive skills and behaviors that have been shown to predict success in educational and work settings.

When performance and other work-related outcomes are defined more broadly, noncognitive skills take on added value. For example, on the job several noncognitive skills are related to important aspects of performance, such as helping coworkers and being cooperative (Berry, Ones, & Sackett, 2007; Borman, Penner, Allen, & Motowidlo, 2001). Research has also shown that noncognitive skills predict other important outcomes, such as job satisfaction and the intention to quit (Kristof-Brown, Zimmerman, & Johnson, 2005; Zimmerman, 2008). In educational settings, both cognitive and noncognitive skills predict college retention (Radunzel & Noble, 2012; Robbins et al., 2004).

Research conducted at ACT has explored ways to better understand and predict education and work success. The ACT approach to assessment has been student centered and has included multiple broad domains: core academic measures (e.g., science, English language arts, mathematics), behavioral measures (e.g., motivation, engagement, self-regulation), and career and education navigation measures (vocational interests, work-related values). Mattern et al. (2014) describe the multidimensional nature of college and career success and introduce the ACT holistic framework, which moves beyond just academic measures of college and career readiness to a research-based continuum that includes the important noncognitive components. Equally important is the developmental progression associated with each of the broad domains from middle school—and even grade school—forward to the workplace.

To provide a more holistic and integrated picture of education and work readiness from kindergarten to career, ACT has created a framework of readiness that includes knowledge and skills organized into four broad domains (see Figure 1):

- **Core academic skills** in mathematics, science, and English language arts (ELA) based on an expanded, more granular definition of the skills and mapped to learning progressions from kindergarten through career (K–Career)
- **Cross-cutting capabilities**, such as critical thinking, collaborative problem solving, and information and technology skills
- **Behavioral skills** related to success in education and the workforce, such as dependability, working effectively with others, adapting, and managing stress
- **Education and career navigation skills** related to education and career paths, including self-knowledge of abilities, values, likes, and dislikes; knowledge about majors and occupations; and a variety of skills related to education and career exploration, planning, and decision making



**Figure 1.** Holistic Model of Education and Workplace Success

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It should be noted that other multidimensional models of success in education and the workplace have been proposed (e.g., Camara, 2005; Campbell, 1990; Conley, 2011; Oswald, Schmitt, Kim, Ramsay, & Gillespie, 2004; Shultz & Zedeck, 2011). Across these various models, we find significant overlap in terms of what predictors have been identified as important for education and workplace success. For example, Conley's model of college and career readiness can be broken down into four areas: key cognitive strategies, key content knowledge, key learning skills and techniques, and key transition knowledge and skills. Indeed, his model includes many of the same constructs proposed in the current framework. The model proposed here builds on all of the previous research and extends it in important ways. For one, previous research on college and career readiness has focused on the high school to college transition; however, a primary goal of the current effort is to articulate what students need to know and be able to do at numerous points along the K–Career continuum. In a similar vein, most research on college and career readiness focuses exclusively on the educational setting and educational outcomes; however, the current effort is also focused on understanding important predictors of workplace success, allowing one to meaningfully evaluate whether the same knowledge and skills—moreover, the same level of knowledge and skills—are needed to achieve education and workplace success. Finally, the current framework also drills down to more specific levels of knowledge and skills to clearly define what students need to know and be able to do.

In this report, we first build on the research conducted at ACT over the last fifty years to provide the context for a holistic model of education and work readiness that includes each of the four broad domains. We then describe the holistic model of readiness, highlighting the importance of each broad domain at key developmental transitions in education and work, the relevant constructs included, and the research support for how these constructs apply to specific outcomes. The discussion also includes a comparison of how the constructs for academic and workplace success are similar across ages and settings (e.g., school vs. work) yet may be expressed differently at different ages or in different settings, highlighting theoretical and empirical support for the constructs included in the broad domain. The report concludes with a discussion of an integrated view of education and work readiness, acknowledging that constructs from the four broad domains are not independent, that together they provide a more holistic view, and that different constructs are relatively more or less relevant for different aspects of success over time. To illustrate the multidimensional nature of readiness for education and work success, the examples focus on two key transitions: the transition from high school to college and the transition from college to work. For these two transitions, we present a holistic model of success that specifies factors in each of the domains that are important for success. The example models highlight the fact the relevancy of various constructs in our framework in terms of predicting success depends on the outcome being examined, as well as the transition. For example, some constructs are more relevant for performance in college as compared to persistence in college. Likewise, different constructs are more relevant for performance in college as compared to performance on the job.

## **The ACT Assessments across Broad Domains**

As mentioned in the preceding section, based on our own experience and the research literature, we have organized this framework into four broad domains. First, the ACT® test focuses on achievement in broad cognitive domains—tests grounded in the ACT National Curriculum Survey®. These academic domains also require students to demonstrate complex reasoning in the core academic content of English language arts, science, and mathematics. Second, broad cross-cutting cognitive

competencies that are not specific to any one academic domain (e.g., mathematics), such as critical thinking, problem solving, and metacognition, have been shown to be related to college and career success (Conley, 2011). This sort of cross-cutting capability is now more directly addressed by a fourth broad domain, which can be viewed as not only contributing to students' core academic achievement, but also positioning them for success across a variety of activities and settings. Third, behaviors and psychosocial factors clearly play an important role in education and work success, and ACT has increasingly approached readiness in terms of behaviors that are related to effort, interpersonal engagement, and appropriate conduct (Robbins et al., 2004). Fourth, students need help navigating the complex decisions involved in achieving education and work success, and ACT has addressed this need in a variety of ways, including work that combines academic assessment scores with an assessment of interests to help guide education and career decisions (e.g., ACT, 2014b).

An underlying assumption of the ACT portfolio of tools and solutions is that education and work readiness represents a continuum across one's life span rather than an isolated point in time (e.g., high school graduation). Acknowledging the importance of the K–Career continuum, ACT assessments cover the longitudinal nature of the continuum as well as the multidimensional nature of education and work readiness and success. It is important to emphasize that skill acquisition, learning, and personal growth and development does not end at the culmination of high school or college. This is especially true in light of the fact that the majority of individuals will hold numerous jobs over their lifetimes. Based on information collected from 1978 to 2010, the mean number of jobs held by individuals from age 18 to 47 was 11.3 (Bureau of Labor Statistics, 2012b). Over a quarter of respondents indicated that they had held 15 or more jobs. Clearly, the need to assess and enhance readiness for what comes next continues throughout one's career. Many of the constructs highlighted in the navigation domain (e.g., networking, job searching, lifelong learning) facilitate transitions as people explore, apply for jobs, and move into new positions and roles throughout their lives.

### **Core Academic Skills**

Among its solutions, ACT is best known for the ACT test, a curriculum-based educational achievement test comprising four academic subject tests (English, mathematics, reading, and science). The ACT is primarily completed by high school juniors and seniors. In 2014, 57% of all high school graduates in the US and virtually 100% of students in 12 states completed the ACT. To provide feedback on students' readiness for college, empirically derived benchmarks have been developed to identify the level of knowledge and skills students need in each of the four academic areas to have a high likelihood of earning a B or higher in typical first-year college courses (ACT, 2004; Allen & Sconing, 2005; Allen, 2013). Table 1 displays the subject-specific benchmarks, which were derived by estimating the ACT subject test score associated with a 50% probability of earning a B or higher in the typical credit-bearing first-year course completed by students in the relevant subject matter. These benchmarks are based on a sample of 214 institutions and more than 230,000 students from across the United States (Allen, 2013).

With the goal of providing diagnostic feedback to students at earlier grades, ACT developed ACT Plan® for tenth-grade students and ACT Explore® for eighth- and ninth-grade students. Both of these exams cover the same content domains as the ACT. The ACT College Readiness Benchmarks have been mapped back to performance on these assessments, providing students with earlier feedback concerning whether they are on track for college readiness (ACT, 2006).

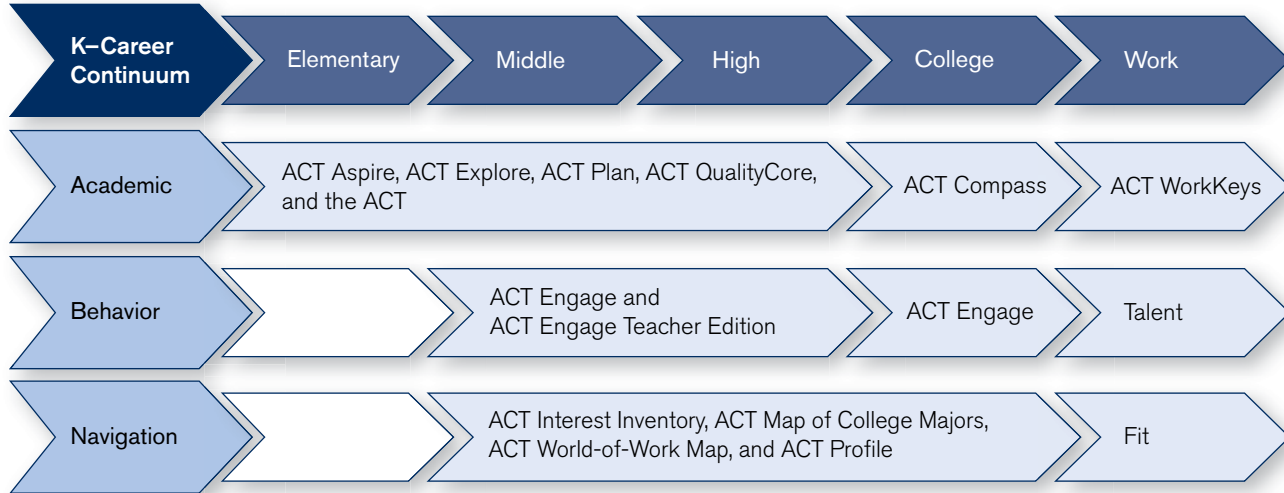
**Table 1. ACT College Readiness Benchmarks**

| College course      | Subject-area test | ACT Explore Benchmark (Grade 8) | ACT Explore Benchmark (Grade 9) | ACT Plan Benchmark | ACT Benchmark |
|---------------------|-------------------|---------------------------------|---------------------------------|--------------------|---------------|
| English Composition | English           | 13                              | 14                              | 15                 | 18            |
| College Algebra     | Mathematics       | 17                              | 18                              | 19                 | 22            |
| Social Sciences     | Reading           | 16                              | 17                              | 18                 | 22            |
| Biology             | Science           | 18                              | 19                              | 20                 | 23            |

Research indicates that feedback provided in eighth grade may still be too late to allow students who are not on track for college readiness to get on track by the end of high school (ACT, 2008; Dougherty, 2014). Only a very small percentage of students who are off track in eighth grade will graduate from high school ready for college. ACT Aspire®, a longitudinal assessment system launched in 2014 and designed to measure and track students' academic progress and to provide diagnostic information such as on/off-track indicators, addresses this issue. It assesses students' mastery of mathematics, ELA,<sup>2</sup> and science in grades 3 through 10, allowing for even earlier monitoring of students' academic strengths and weaknesses.

ACT has also developed a suite of cognitive assessments that extend into the workplace. Informed by the findings of the US Department of Labor Secretary's Commission on Achieving Necessary Skills (SCANS) report (1991), the ACT WorkKeys® assessments were developed to assess the following skills: locating information, reading for information, applied mathematics, workplace observation, teamwork, applied technology, writing, listening, and business writing. ACT also offers the ACT National Career Readiness Certificate™ (ACT NCRC®), a portable credential that demonstrates achievement and employability skills based on performance on three ACT WorkKeys assessments: Applied Mathematics, Locating Information, and Reading for Information. The focus of ACT WorkKeys is to measure real-world skills that employers believe are critical to job success. For example, the ACT WorkKeys Applied Mathematics test measures the skills people use when they apply mathematical reasoning, critical thinking, and problem-solving techniques to work-related problems. The test questions require examinees to set up and solve the types of problems and make the types of calculations they actually would perform in the workplace. The ACT WorkKeys Reading for Information test measures the skills people use when they read and use written texts to do a job. The written texts include memos, letters, directions, signs, notices, bulletins, policies, and regulations. Figure 2 shows some ACT assessments and resources that support education and work readiness across the K–Career continuum.

<sup>2</sup> ACT Aspire includes five separate assessments in grades 3–10 (mathematics, science, reading, English, and writing) and replaces ACT Explore and ACT Plan.



**Figure 2.** ACT Education and Workplace Readiness Solutions across the K–Career Continuum

### Cross-Cutting Capabilities

Research and the results from workforce surveys highlight the importance and demand for a broader range of cognitive skills that students and adults need to develop to be more adequately prepared for education and workplace success (Casner-Lotto & Barrington, 2006). Cross-cutting capabilities includes skills like the ability to think critically, work with others to solve problems, use effective study strategies, and use technology to research, transform, and share information. Many of ACT’s core academic assessments already described (e.g., ACT WorkKeys) capture some of the higher-order skills included in this broad domain (e.g., critical thinking); however, given the importance of these constructs, isolating these skills as a unique domain apart from core academic skills can ensure that they get the attention they deserve.

### Behavioral Skills

To assess behavioral skills important for success in school, ACT developed ACT Engage® (originally named the Student Readiness Inventory), a measure of a student’s level of motivation, social engagement, and self-regulation. Research has shown that these behaviors predict academic achievement above and beyond academic measures such as high school grade point average (HSGPA) and test scores (e.g., Robbins et al., 2004). Three versions of this behavioral assessment were developed to be appropriate for specific educational levels: middle school, high school, and college. All three allow for the identification of at-risk students who may benefit from interventions to help them along their education journeys.

In a similar vein, ACT developed the ACT WorkKeys Talent assessment to measure behaviors and attitudes related to important workplace outcomes. The 165-item assessment consists of twelve scales: carefulness, cooperation, creativity, discipline, goodwill, influence, optimism, order, savvy, sociability, stability, and striving. Respondents are asked to rate how well statements such as “I am punctual” and “I like to take the initiative” describe them, using a six-point scale ranging from “strongly disagree” to “strongly agree.” Research on the validity of the ACT WorkKeys Talent assessment showed that several of the scales were related to overall job performance, in particular

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carefulness, cooperation, discipline, and savvy (ACT, 2009). Additionally, when more specific dimensions of job performance were examined—such as organizational citizenship behavior, counterproductive work behavior, and safety—ACT WorkKeys Talent scales showed additional value as predictors of workplace success.

### **Education and Career Navigation Skills**

The ACT assessment portfolio also includes measures of education and career navigation skills needed for success in education and work. The first edition of the ACT Interest Inventory (ACT, 2009) was developed in the early 1970s to supplement the feedback ACT provides to students about their academic strengths and weaknesses. Results from the ACT Interest Inventory are designed to help individuals more effectively navigate the career-exploration and decision-making process by providing them with information about occupations and college majors that align with their personal characteristics. The ACT Interest Inventory is designed to address developmentally relevant needs as individuals progress in their education careers. In earlier grades, the information gleaned from the inventory provides an opportunity for students to explore and learn about different careers, whereas by the end of high school, the information can help students home in on a specific career path and—if they hope to enroll in a postsecondary institution—to select a major. In addition, examining student's achievement, expressed interest and measured interest has allowed ACT to develop multidimensional models of readiness for particular career pathways (e.g., STEM—science, technology, engineering, and mathematics) that take into account multiple factors (Radunzel, Mattern, & Westrick, in press). The ACT Interest Inventory continues to provide value into adulthood as individuals change careers and take on new roles.

Also part of the ACT portfolio for many years, Discover<sup>®</sup>,<sup>3</sup> a computerized career guidance program (Taber & Luzzo, 1999), provided students with the opportunity to learn about their career interests, abilities, and work values and to explore occupations, majors, and schools, allowing self-discovery that included exploration, via a Career Map, of how their personal characteristics relate to careers. Research on the effectiveness of Discover found that its use was associated with increases in career decidedness, career decision-making self-efficacy, and perceived control over the career decision-making process among college students (Eveland, Coyne, & Blakney, 1998; Maples & Luzzo, 2005).

Currently, a new online college- and career-planning platform, ACT Profile, is under development. The beta version of ACT Profile provides high school students with personalized data and valuable information related to education and career options. ACT Profile includes measures of interests, values, and self-rated abilities, which provides individuals with an opportunity for self-discovery and for identifying personally relevant options. Based on an individual's responses, occupations that fit the individual's interests, values, and abilities are presented visually on the Career Map. A similar tool, the Majors Map, focuses on education planning to help students identify and explore college majors that fit their interests. Individuals can also use the extensive information in ACT Profile to find more information about particular majors and occupations, such as training requirements, salary outlook, and related fields.

As a measure of navigation skills that can assist human resources and workforce development practices, ACT offers the ACT WorkKeys Fit assessment, which measures the degree to which an individual's interests and values fit with particular occupations. This 100-item tool assesses six

<sup>3</sup> ACT Discover was retired in 2012.

broad categories of work-related interests (i.e., realistic, artistic, investigative, social, enterprising, and conventional) and a range of work-related values (e.g., autonomy, physical activity, influencing others, and precision). Information about both interests and values is combined into a single Fit Index. Research examining the validity of the Fit Index for predicting important workplace outcomes has found that it is positively related to job satisfaction and commitment (ACT, 2007; Swaney, Allen, Casillas, Hanson, & Robbins, 2012).

## Looking toward the Future: The Expanded ACT Framework for Readiness

Today, most policymakers and accountability systems focus solely on academic measures when discussing college and career readiness. Despite this focus, the current review shows that ACT has long supported a variety of assessments to address the multidimensional nature of college and career readiness. Each assessment was developed to be appropriate at a specific developmental stage for students and adults as they prepare for high school, postsecondary, and career opportunities and success. The assessments, some of which we have briefly described, cross all four broad domains associated with college and career readiness. However, these assessments were developed without the benefit of a unified and comprehensive model of education and work success. Research has demonstrated that different constructs are relevant for different outcomes, with some predictors demonstrating stronger predictive validity for specific criteria (e.g., first-year grades, retention to sophomore year, engagement at a college, time to graduation [Camara, 2005]). The purpose of this report is to discuss and describe how a broad range of factors contribute to navigating the various transitions along the K-Career continuum and to provide early indications of a broader definition of college and career readiness.

An assessment system should be guided by a research-based model in that it requires a systematic understanding and specification of how constructs across different broad domains are related and to what extent they determine or predict success related to the various outcomes of interest that all fall under the common reference of education and work success. One specific objective of this report is to articulate both an overall model of education and work readiness and more detailed models articulating constructs from each broad domain salient for predicting success for specific outcomes. Research clearly shows that many cognitive constructs predict outcomes such as academic grades and persistence (retention, time to graduation) in academic environments (Bowen & Bok, 1998; Sackett, Borneman, & Connelly, 2008), but it also shows that additional constructs contribute uniquely in predicting success across different outcomes. Many students who drop out of college do so not because of a lack of academic preparedness but rather due to a range of other factors, such as choosing a major that is a poor fit, having poor study/time-management skills, lacking clear academic goals, or having low academic self-efficacy (e.g., Allen & Robbins, 2010; Credé & Kuncel, 2008; Nye et al., 2012; Robbins et al., 2004). If we continue to ignore these additional characteristics in models of readiness, we will fail to identify many at-risk students who thus may not receive the interventions or support they need to get on track for success.

This report represents another step in an ongoing effort to build an expanded framework of readiness and success: what people need to know and be able to do in order to achieve education and work success. ACT began work in this area many years ago. The ACT College Readiness Benchmarks were developed to articulate the level of core academic skills a student needs to have a high probability of success in specific first-year college courses. The ACT College Readiness



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Benchmarks and the corresponding ACT College and Career Readiness Standards have been back-mapped to ACT Plan, ACT Explore, and ACT Aspire, allowing for the articulation of what students need to know and be able to do academically at several key transitions along the K–Career continuum. Such information can be used to assess whether a student is on track for college and career readiness. There has been substantial progress since ACT originally developed the ACT College Readiness Benchmarks and the ACT College and Career Readiness Standards (ACT, 2004; 2007). Our understanding and measurement of readiness for education and work success has advanced, and it is now clear that a more holistic approach holds a great deal of promise. To support this holistic approach, ACT is building a comprehensive framework with the goal of articulating what people need to know and be able to do in each of the four broad domains at each of the key transitions across the K–Career continuum.

To take full advantage of the emerging knowledge in this area, development of this framework is based on a comprehensive review of relevant theory, education and work standards, empirical research, input from experts in the field, and a variety of other sources for each of four broad domains.<sup>4</sup> The framework spans the K–Career continuum, since the precursors of success emerge very early in life and development continues well beyond the confines of traditional secondary and postsecondary education. To describe what people need to know and be able to do across this continuum, both the education and work readiness framework and the associated model of success are defined in terms of critical transitions. These transitions differ slightly across the four broad domains, but some major transitions are relevant to all four. For example, to make a successful transition from elementary school to middle school, students need a variety of knowledge and skills from all four broad domains (see Figure 1).

For each of these transitions, the framework describes what individuals need to know and be able to do to be successful. A hierarchical taxonomy within each broad domain organizes the more specific dimensions and the knowledge and skills and provides a common language for describing the precursors of success. The focus is ultimately on knowledge, behaviors, and skills because these are amenable to change. Thus, the taxonomy is well positioned to inform education and other interventions aimed at helping people achieve education and workplace success. Because the taxonomy is holistic and comprehensive, it can be used to identify new ways to assess and improve education and workplace readiness. The taxonomy is intended to provide a road map for students, teachers, and other stakeholders. It also begins to highlight how skills build over time and the similarities and differences in the skills required across the life span. For example, we know that much of the knowledge and many of the skills in the achievement domain are part of learning progressions that develop over time. Students must have a fundamental understanding of addition and subtraction before learning higher-order mathematical concepts like algebra. Likewise, one must possess a good deal of prerequisite mathematical knowledge to be in a position to learn calculus. Similar developmental considerations are important for the other broad domains as well. For example, in the navigation domain, students need to have a good understanding of what they know, what they are able to do, and what they like and value before they are in a position to make an informed decision about selecting a major or occupation that would be a good fit. The framework clearly emphasizes the developmental nature of these broad domains, where some constructs are likely to be more or less important at different transitions and are manifested differently over time.

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<sup>4</sup> See appendix for more detailed information about the methodology used for each broad domain.

## Core Academic Skills

RYAN O'CONNOR, JAMES GAMBRELL, AND ROBERT PULVERMACHER

The purpose of the core academic skills part of the holistic framework is to identify, describe, and organize the cognitive knowledge and skills in key foundational areas. No Child Left Behind (2002) and the Common Core State Standards (CCSS; 2010) have focused exclusively on core academic indicators, specifically in mathematics and English language arts (ELA). While readiness in mathematics and ELA are critical prerequisites for success in education and workplace settings, this is a narrow view of college and career success that is primarily designed to serve accountability needs rather than student needs (Mattern et al., 2014). A holistic model of education and work success should not be restricted to just core academic subjects in K–12 education. The goal of the achievement framework is to identify the cognitive learning outcomes required for success in the twenty-first century and provide a detailed articulation of their development from kindergarten through career.

### Core Academic Skills Framework

The development of core academic skills is the traditional focus of primary, secondary, and postsecondary general education curricula and coursework (Nelson Laird, Shoup, Kuh, & Schwarz, 2008). These courses are limited to a small number of academic disciplines that provide a necessary foundation for future learning. Specifically, students need some level of proficiency in reading, writing, and mathematics in earlier stages of learning to be prepared for more advanced learning in subsequent grades or for specialization in postsecondary education and employment (Allen & Sconing, 2005; Handel, 2010).

ACT has long employed an expanded model of college and career readiness that incorporates scientific skills and knowledge in addition to ELA and mathematics. This focus on scientific reasoning and practices is significant because these evidence-based reasoning skills are central to many fields of study and have wide applicability on the job (Jonassen & Kim, 2010; Windschitl, Thompson, & Braaten, 2008). In addition, ACT assessments have long included science as a separate academic domain because the skills and interest in science are not totally subsumed by mathematics or ELA. With the increased demand for STEM skills, direct measures of science are critically important to prepare students, and use of math or ELA as proxies introduces construct irrelevance and does not provide a substantive validity argument to support inferences about science skills and readiness. The core academic skills framework (presented in Table 2) expands on the current ACT College and Career Readiness Standards (ACT CCRS) by adding STEM and cross-cutting concepts to the current science framework.

The achievement framework also expands on the current ACT CCRS in ELA by adding speaking and listening skills to the English language arts domain (see Table 2). In the United States, oral communication has not traditionally received as much attention in the curriculum as written communication skills, yet it is universally acknowledged as critical for success in both academic and organizational settings (Carnevale, 1990; CCSS, 2010; Darling & Dannels, 2003; Maes, Weldy, & Icenogle, 1997). The practical challenges involved in standardized assessment of speaking and listening may be partially responsible for this narrow accountability focus. The framework emphasizes the important role of language in communication by including a fourth strand that

focuses on the linguistic resources necessary for learning and communicating in a range of school and work contexts. This strand extends the focus on standard English in current ACT assessments to cover knowledge about how language functions to support a broad range of communication activities, such as interacting with classmates and coworkers, expressing opinions, and engaging in dialogue and argumentation. Other leading literacy scholars and frameworks have proposed similar integrated approaches (Derewianka, 2012).

Proficiency in each of these core academic skills greatly facilitates later efforts to develop specialized expertise from major courses and job training experiences (Carter, 2002; Kraiger, Ford, & Salas, 1993).

**Table 2. Core Academic Skills Framework**

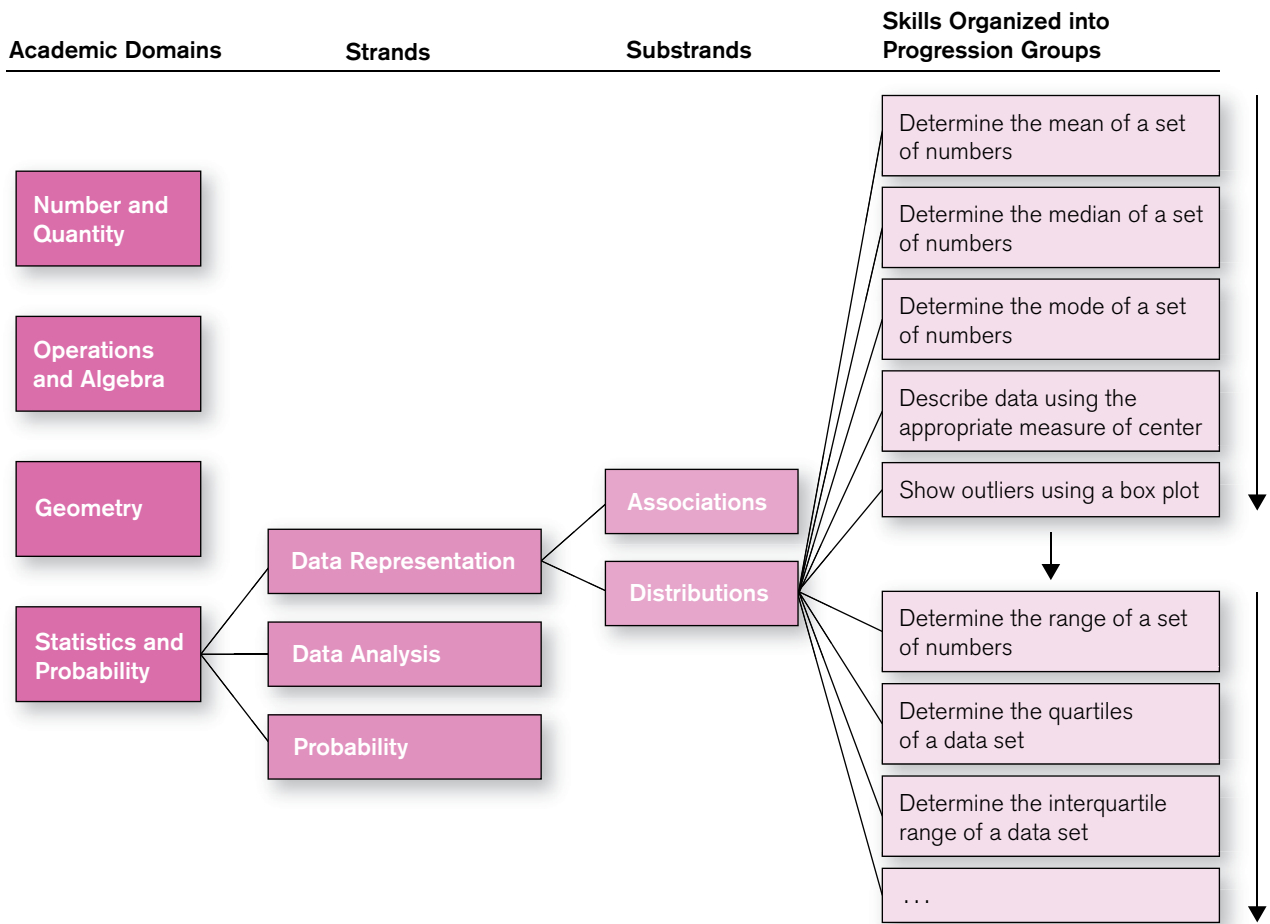
| Subject               | Domain                                  | Domain definition  |
|-----------------------|---|--|
| English language arts | Reading                                 | The process of understanding and interpreting written text. Guided by specific purposes, readers use knowledge, skills, and strategies to make meaning with and reason logically about a range of texts.   |
|                       | Writing                                 | The production and use of written language to accomplish a range of purposes, including communication, expression, persuasion, learning, and research. Writers use knowledge, skills, and strategies to plan, draft, and revise a range of texts.                                  |
|                       | Speaking and Listening                  | Producing and comprehending spoken messages. Individuals draw on speaking and listening knowledge, skills, and dispositions to produce meaning in a range of communication contexts.   |
|                       | Language for Learning and Communication | Knowledge of standard English at the word, sentence, and text levels; special focus on using oral, written, and visual texts in a range of school and workplace settings for collaborating, presenting ideas and opinions, and engaging in dialogue and argumentation.             |
| Mathematics           | Number and Quantity                     | Understanding relationships among number representations, including whole numbers, fractions, decimals, integers, rational and irrational numbers, complex numbers, and quantities represented in vectors and matrices. Applications include creating equivalent forms of numbers. |
|                       | Operations and Algebra                  | Understanding and applying processes to simplify, solve, and perform operations with numbers and variables. Focal areas include solving equations, applying proportional reasoning, and understanding functions.   |
|                       | Functions                               | Understanding functions and relations between variables or numbers. These include finding and interpreting domain and range, transformations, maxima and minima, roots and factors, and end behavior.  |
|                       | Geometry                                | The understanding of and relationships among two- and three-dimensional shapes. Topics include measurement, properties, figure composition, classification, and applying postulates and theorems within and between shapes.  |
|                       | Statistics and Probability              | Understanding and applying processes to calculate and interpret chance, distributions, descriptive statistics, and inferential statistics. Topics include probability, central measures of tendency, confidence intervals, and expected values.                                    |

**Table 2 (continued)**

| Subject | Domain                  | Domain definition  |
|---------|-------------------------|--|
| Science | Physical Science        | Concepts and applications in chemistry and physics. These include modeling based on systems, particle, atomic, and energy considerations. Considerations of the interactions of objects and energy from the atomic scale up to and including the cosmic scale. |
|         | Earth and Space Science | Concepts and applications in the earth sciences, astronomy, and cosmology. These include models that predict past, present, and future events on Earth and in space using causal relationships and the interactions of matter, energy, and forces.             |
|         | Life Science            | Concepts and applications in biology and ecology. These include models that explain and predict structure and function on the molecular, cellular, organism, population, and ecosystem scales.   |
|         | Science Practices       | The practices scientists use to understand and explain the world. Practices focus on the design and use of experiments to collect interpretable data that can serve as evidence for both scientific argumentation and modeling.                                |
|         | Cross-Cutting Concepts  | Concepts common across all domains of science. These concepts link the separate fields of science and promote transfer of knowledge. Together with the practices, they serve as a unifying framework for understanding the world in a scientific way.          |

### Organization of the Framework

The core academic skills framework outlined in Table 2 is hierarchical; at the highest level, it includes the three academic subjects (ELA, mathematics, and science), each of which is organized into a set of academic domains specific to each subject. Most of these domains are so large they might be the focus of an entire course or sequence of courses. Each of these academic domains is then broken down into large strands and more focused substrands. To provide an example, Figure 3 illustrates this hierarchical breakdown for mathematics. Importantly, the terminology of strands and substrands is meant to emphasize the connected, progressive nature of their content. Substrand topics in particular were chosen to highlight distinct progressions of understanding identified in the literature and by expert panels. Each substrand focuses on a sequence of skills, but these skills are supplemented by a comprehensive list of related knowledge, misconceptions, common errors, and strategies in order to provide a richer picture of student learning. The learning information in each substrand is organized into fine-grained progressions that can be aggregated upward to form coherent learning sequences at any desired level of specificity.



**Figure 3.** Illustration of the Core Academic Skills Framework for Mathematics Organized from Math Domains to Specific Skills and Progressions

## English Language Arts

The current ACT CCRS for English offer one approach to capturing the complex reading, writing, and reasoning skills required for success in college and careers. The rapid shift toward what is called a “global knowledge economy” has increased the demand for students to have a strong, adaptable, and integrated set of literacy skills. Both the value and the definition of literacy have changed under these pressures. Educators have tried to keep pace through numerous high-level research initiatives and reforms over the past two decades (Bills, 2004; Pellegrino & Hilton, 2012). This report draws on this body of research and practice to develop an ELA framework that builds on the traditional strengths of the English framework while accommodating and encompassing an expanded set of literacy skills.

To attain the literacy skills vital for success in school and at work, students must learn to engage with complex print and digital texts written for a variety of purposes, think critically about what they read and hear, articulate their thoughts in a range of spoken and written genres, and communicate collaboratively with others. Equally important is the ability to integrate these skills in complex tasks, like research projects and presentations, and to transfer this learning to new situations and problems (ACT, 2012).

Evidence shows that facility with the English language positively predicts important outcomes at the high-school-to-college transition (N. E. Jackson, 2005; Reder, 2000). Efforts to improve foundational literacy in the US have produced favorable results with students in the primary grades, but adolescents and students at the secondary level continue to demonstrate lower literacy skills than their counterparts in other leading nations (Carnegie Council on Advancing Adolescent Literacy, 2010). To meet the requirements of a postsecondary curriculum, students need to be able to comprehend and evaluate complex texts, synthesize information, and clearly communicate their ideas in writing (ACT, 2012). Today, colleges and universities invest considerable resources in remedial or developmental reading and writing programs for underprepared first-year students (NCES, 2001; Parsad, Lewis, & Greene, 2003). Such remedial or developmental courses do not award college credits, and research shows that up to 50% of students will not complete such courses and thus are unlikely to obtain a college degree (T. Bailey, Jeong, & Cho, 2010). Approximately two-thirds of US high school students struggle with literacy proficiency (NCES, 2011), and educators at multiple levels are concerned that high school students do not have adequate ELA skills upon graduation (Prior, 2012). One consequence of inadequate literacy proficiency is that students are less prepared to handle the complex reading tasks required in college, leading to diminished overall performance (Schoenbach, Greenleaf, & Murphy, 2012).

Inadequate literacy proficiency continues to plague individuals as they transition into the workforce, and communication skills are widely regarded as a primary concern as new graduates enter organizations (Conrad & Newberry, 2011; Kassim & Ali, 2010). Research indicates that speaking, listening, reading, and writing skills are useful, if not necessary, for career success (College Board, 2004; Cooper, 1997; Roebuck, 2000) and influence important outcomes such as manager ratings (Maes et al., 1997; Mueller & Lee, 2002), sales (Ramsey & Sohi, 1997), salary (Finn & Gerber, 1998), success in management positions (Maes et al., 1997), and ability to socialize into an organization (Miller, 1996; Morrison, 1993). A lack of communication skills is a primary deterrent to individuals' ability to stay employed and succeed in their careers (Corrado & Jäger, 2014). Furthermore, private organizations spend \$3.1 billion each year to improve the writing skills of entry-level workers (College Board, 2004).

ACT has considered both academic and workplace literacy demands in the design of the ELA framework presented here; as such, the framework takes a purpose-driven approach to proficiencies in the different ELA domains. Because development is integrated across the more specific academic domains and strands of ELA, the framework is organized to show connections to the greatest extent possible. The traditional academic skill domains of Reading and Writing are complemented by a Speaking and Listening strand, which includes oral-language skills vital to communicating one-on-one and in groups. Additionally, the Language for Learning and Communication strand offers a more integrated focus on literacy development. The Language strand emphasizes knowledge about the role language plays in a wide range of communication contexts, both in the classroom and the workplace. Literacy and applied linguistics researchers refer to these features, shared by many academic genres, as "the language of school" and "academic language." Research suggests that student proficiency with academic language has a significant impact on many learning outcomes (A. L. Bailey, 2007; Schleppegrell, 2004; Snow & Uccelli, 2009). Language for Learning and Communication does not simply focus on knowledge about linguistic features of *written* texts, but also includes knowledge about structural and stylistic differences between spoken and written genres, both of which are crucial for education and work success.

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Another important consideration in the ELA framework design was the changing nature of the texts students encounter as they progress through school and into the world of work. ACT has been a leading voice in the conversation around “text complexity.” Texts do not simply become increasingly difficult as students move upward (ACT, 2006); their difficulty stems from different linguistic and semantic structures related to the purposes they serve. Students must read texts that are longer and that have more sophisticated vocabulary, sentence, and text organization and higher conceptual density—the kinds of texts students must understand, assimilate, and produce in challenging majors and careers (C. D. Lee & Spratley, 2010; Moje & Speyer, 2008).

For this reason, both the Reading and Writing strands emphasize higher-order skills for analyzing and evaluating text content and structure, as well as rhetorical knowledge about how different features produce effects on the audience. Because progress with text complexity requires flexibility and breadth, the framework also draws on current research about strategies and dispositions in literacy activities. ACT is already applying this forward-thinking approach to texts in our current assessments through a mixed-methods approach for evaluating reading passage complexity and a new student Progress with Text Complexity indicator. The ELA framework builds on these innovations.

## Mathematics

The ACT mathematics framework proposes a more interconnected and progression-based approach to ensure that the concepts and skills against which students are assessed are those necessary for education and work success. The framework can be likened to a stack of blocks that depend on each other for support. Topics that provide little support for the whole were removed to allow greater focus on those that remain. Resources used in making these decisions include ACT National Curriculum Survey data, analysis of college course syllabi, empirical research, theoretical and empirical learning progressions, major initiatives such as the Common Core State Standards, the National Council of Teachers of Mathematics (NCTM) Standards, and mathematics frameworks from various states and countries.

Despite our natural ability to relate to numbers, many students experience challenges when it comes to mathematical computation as they progress through formal schooling. While there are countless reasons for mathematical challenges—including developmental and learning disabilities—for many learners, the struggle results from a lack of fluency with foundational mathematical concepts. On a 2007 National Assessment of Educational Progress (NAEP) assessment, no more than 60% of eighth-grade students could identify fractions listed in ascending order—traditionally an elementary school skill (NCES, 2013). The lack of foundational mathematical concepts becomes a barrier to success in future mathematics courses. ACT has focused on these foundational mathematical concepts to provide students with a stronger foundation for success in future mathematics study.

Weakness in mathematics is not just an issue in middle school. Just 43% of ACT-tested 2014 graduates met the ACT College Readiness Benchmark in mathematics, and only 37% met the benchmark in science (ACT, 2014a). Even among graduates interested STEM, benchmark attainment was only slightly higher: 50% in mathematics and 43% in science (ACT, 2014b). Moreover, research suggests that higher levels of mathematics and science knowledge are needed to be ready for a STEM major as compared to the ACT College Readiness Benchmarks, given that the typical first mathematics course is Calculus, and not College Algebra (Mattern, Radunzel, & Westrick, 2015). Based on the typical mathematics and science courses of STEM majors, STEM benchmarks on the

ACT mathematics and science tests were estimated to be 27 and 25, respectively. Based on the ACT-tested 2014 graduates, only 16% met the STEM benchmark in mathematics and 23% met the STEM benchmark in science. Those who go on to higher education still have difficulty: about 22% of students who entered college in 2000 needed remedial courses in mathematics, the highest remediation rate of all subjects (Parsad et al., 2003). A need for greater focus on foundational skills is echoed in the concerns college faculty voiced on the 2012 ACT National Curriculum Survey (2013a). Over 90% of faculty surveyed agreed that basic Algebra I skills, such as finding the slope of a line and solving linear equations, were important prerequisites for college coursework, but less than 60% felt that more advanced skills, such as quadratic inequalities or exponential functions, were even moderately important.

Existing bottlenecks in the K–12 mathematics curriculum are caused by course prerequisites designed to ensure students have acquired the mathematical concepts required for success. For many years, algebra has been a gatekeeper to higher mathematics learning, preventing students who are not successful with algebraic concepts from studying mathematics that may or may not rely on those concepts. Most college tracks require a firm understanding of algebra and prealgebra mathematics (Gamoran & Hannigan, 2000). This means students must first clear the hurdle of algebra before they can choose the direction they would like to go, yet a large majority of 17-year-old students struggle to solve multistep algebra problems (Snyder, Dillow, & Hoffman, 2009). In terms of mathematics-intensive college coursework, the most common directions lead to courses in statistics, calculus, accounting, and physics (NCES, 2013). Each of these directions places heavy demands on core arithmetic and algebraic fluency.

To succeed in majors and careers that are even moderately demanding mathematically, students must have a level of fluency that allows them to spare attention and working memory to adapt to unfamiliar situations. In addition, a firm conceptual understanding is critical to leveraging tools and technology to solve real-world problems. Something as seemingly straightforward as unit conversions can quickly cause confusion in real-world situations, leaving students unsure which calculations to perform in what order. Frequently, this confusion is caused by an inability to apply past learning to new and unfamiliar contexts where information may not smoothly associate from the abstract to the concrete—essentially a problem of “transfer” (see Bransford, Brown, & Cocking, 2004). This last issue touches on the need to complement core academic mathematics skills with more applied skills such as the Common Core Mathematics Practices and our own cross-cutting capabilities. The ACT mathematics framework, therefore, is designed purposefully to move beyond a cursory exposure to advanced mathematics topics to ensure that students acquire the ability to combine foundational mathematics skills with technology and problem-solving skills.

## Science

The existing ACT CCRS articulate the knowledge and skills required to perform core scientific processes, such as designing experiments, interpreting data, and evaluating models. These processes are common to any education in science no matter which particular sequence of courses a student may have taken. Building on this core, the expanded framework also highlights the importance of scientific knowledge and cross-cutting concepts (See Table 2; National Research Council, 2012). A foundational understanding of science requires an appreciation of how scientific knowledge and processes interrelate and is crucial to making informed decisions about socioscientific issues using evidence-based reasoning (Metz, 2008). Owing to the importance of



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scientific education, many states continue to test science as part of the NCLB accountability system in elementary, middle, and high school, generally reporting scores for physical science, life science, earth/space science, and science practices/process skills.

This expanded framework is also designed to focus on the development of a set of science knowledge and skills that will be essential if the United States hopes to maintain an adequate supply of STEM graduates to retain its competitive advantage in the global economy (Atkinson, Hugo, Lundgren, Shapiro, & Thomas, 2007). In 2011, approximately 12.4% of the American population was employed in purely STEM fields, while another 11.3% was employed in STEM-related fields (US Census Bureau, 2013; see Table 10). The rate of students entering STEM fields in America trails that of several key national competitors (National Science Board, 2010). Even with recent findings indicating up to 40% of students expressing interest in majoring in STEM prior to entering college (ACT, 2014b), the percentage of students who actually declare a STEM major upon enrollment is substantially lower (Chen, 2013; Chen & Ho, 2012; Chen & Weko, 2009). For example, in the 2003–2004 academic year, only 28% of undergraduates declared a STEM major in the first year, with just over 2% entering into mathematics or physical science fields (Chen, 2013).

The United States also trails other developed nations in the percent of students graduating with degrees in STEM majors. By spring 2009, 48% of students who originally declared STEM majors had left STEM fields, either leaving college entirely or declaring a non-STEM major (Chen, 2013). Only 37% of first-year STEM majors earned a degree or certificate within six years. In addition, only a little over half (56%) of STEM graduates obtain employment in their field of study after graduation (Carnevale, Smith, & Melton, 2011).

The problem may be systemic. Research shows that many science majors have unrealistic expectations concerning how they will perform in science courses, contributing to their overly optimistic view of earning a science degree (Stinebrickner & Stinebrickner, 2014). Put simply, many students who aspire to enter a STEM field are not academically prepared to do so when they enter college. For example, of students who declared an interest in a STEM major, only 41% had at least a 50% probability of earning a grade of a B or higher in college biology (Noeth, Cruce, & Harmston, 2003). More recently, ACT has examined the typical first mathematics and science courses taken by STEM majors and examined the level of knowledge and skills needed for a student to have a reasonable chance of earning a B or higher in those courses (Mattern, Radunzel, & Westrick, 2015). As compared to the ACT College Readiness Benchmarks in mathematics and science of 22 and 23, respectively, STEM readiness benchmarks of 27 in mathematics and 25 in science were empirically derived based on the relationship between ACT scores and course grades in typical STEM first-year courses (i.e., calculus, biology, chemistry, physics, and engineering). Clearly, to be prepared to succeed in STEM majors, students need a higher level of academic preparation than that of the typical student entering college.

For those who do earn entry into a STEM field, there are a number of advantages in comparison to other occupations. Specialized knowledge of scientific content is highly correlated with salary (Altonji, 1995; Finnie & Frenette, 2003; Rumberger & Thomas, 1993). In particular, engineers reported the highest average salary of all job categories available with only a bachelor's degree in 2014 (NACE, 2014). Graduates with health science degrees reported the highest average salary increase of any discipline in 2014 (NACE, 2014). In addition, science skills such as determining cause and effect, extrapolating trends, and testing predictions are all relevant to many workplace applications (O\*NET, 2014; Watts, 2014).

The expanded approach to science readiness enumerated here builds on the ACT College and Career Readiness Standards by highlighting additional knowledge and skills that are foundational in science. This should provide students with the foundation necessary to pursue careers in STEM fields while also enabling them to effectively transfer scientific knowledge and skills to a broad range of non-STEM careers.

## Summary

In summary, the core academic skills framework:

- Identifies and organizes key cognitive knowledge and skills in the academic domains that are most necessary for preparation for more advanced learning
- Focuses on bottleneck skills that are known barriers to college and career success
- Provides a detailed articulation of knowledge and skill development from kindergarten through career
- Emphasizes the connected, progressive nature of learning
- Provides rich context by integrating research on misconceptions and strategies
- Expands the current ACT College and Career Readiness Standards by putting more emphasis on STEM and oral communication
- Continues to constitute the core of our holistic model of education and workplace success
- Together with the cross-cutting capabilities framework, identifies the cognitive learning outcomes necessary for success in the 21st century

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## Cross-Cutting Capabilities

RYAN O'CONNOR, JAMES GAMBRELL, AND ROBERT PULVERMACHER

The nature of work is changing. Jobs that require routine, rule-based action free of complex problem solving, critical thinking, or collaboration are rapidly being replaced by technology (Manyika et al., 2011). In 1970, more than half of US jobs were in blue-collar or clerical work. By 2004, that number had dropped to less than 40% (Levy & Murnane, 2004). The proportion of these jobs in the US economy has decreased further over the past decade, and the jobs that do exist have low or even negative wage growth. In 1979, the average 30-year-old with a bachelor's degree earned just 17% more than a 30-year-old with a high school diploma. By 2004, this gap had increased to 50% (Levy & Murnane, 2004), and today it is well over 80% (Carnevale, Strohl, & Melton, 2014). The median earnings of working men aged 30 to 45 without a high school diploma fell 20% from 1990 to 2013 when adjusted for inflation, and the corresponding earnings of working women fell 12%. Individuals without degrees are also now less likely to work in operations and labor jobs that have average annual salaries of \$25,500 and more likely to work in food, cleaning, and groundskeeping jobs that have average annual salaries of \$20,400 (Kearney, Hershbein, & Jacome, 2015). Conversely, jobs that involve complex thinking and the ability to communicate such thinking in a variety of formats have seen substantial growth in openings as well as wages (Autor, Levy, & Murnane, 2003). As our reliance on technology increases and jobs become more specialized, the gap between jobs that require both routine and high-level cognitive skills and those that are only routine will continue to grow (David, Katz, & Kearney, 2006).

Because these skills are integral to entry and success in desirable jobs, they should and must be developed during the course of a student's academic career. Consider how a problem in mathematics might be solved in an organizational setting as opposed to a typical academic setting. In the classroom setting, the student solves for  $x$  given a series of statements about how  $x$  relates to  $y$ . In a workplace setting, an employee must find ways of cutting costs for a regular series of shipments. In the academic setting, students can often get through a course or pass a test simply by matching known procedures to easily recognizable questions because the setting provides a high degree of scaffolding and prompting. Textbooks and test questions pose problems in highly standardized formats. Unsurprisingly, research shows that students often fail to transfer what they have learned in an academic setting to practical or workplace settings (Pellegrino & Hilton, 2013).

In the workplace setting, by contrast, the employee may be given little guidance as to how to proceed. Rather than being presented as a mathematics problem, the demand to cut costs is presented simply as a task that must be accomplished. The employee must decide to research potential methods, develop a spreadsheet, evaluate solutions to find the best one, and then communicate his or her findings and justify his or her methods in a manner that is understandable to a variety of audiences. This is not a particularly unusual or advanced application, yet it is very different from what we demand of students on current assessments. Academic skills such as locating and reading sources, performing mathematical calculations, and writing explanations are heavily involved in the process, but accomplishing the task requires combining them with many different behavioral, social, technology, and problem-solving skills.

As discussed in the previous section, core academic skills are a central component of education and work readiness and have often been the exclusive focus of large-scale assessment and educational accountability. However, as just illustrated, core academic skills are necessary but insufficient (Pellegrino & Hilton, 2012). Data from workforce surveys document the demand and need for a broader range of cognitive skills to adequately prepare students and adults for high-demand jobs. For example, a survey of 431 US employers reported that teamwork and critical thinking were rated “very important” more often than were traditional academic areas such as writing, mathematics, and science (Casner-Lotto & Barrington, 2006). Teamwork, critical thinking, and skills related to information and technology enhance the ability to transfer and apply knowledge in a variety of settings. We refer to these skills as cross-cutting capabilities (CCCs) because they enhance learning and application in most, if not all, disciplines and careers.

The ACT CCC framework described below addresses this gap with the inclusion of skills like the ability to think critically, work with others to solve problems, use effective study strategies, and use technology to research, transform, and share information. These capabilities are important for success but are rarely given the attention they deserve, particularly when it comes to assessment and grading. The problem occurs at least in part because they are not associated with a specific academic subject and often suffer from a lack of clear articulation. Educators and employers have increasingly cited the importance of such CCCs, and there have been attempts to incorporate some CCCs within core academic content standards. However, there is little evidence that most teachers foster such skills well or that all students are at the same developmental level on such skills when they are prescribed at specific grade levels, as they are in the Common Core State Standards. More often, these skills are implicitly assumed to be incorporated into formal education but are rarely the explicit focus of assessment.

Given this lack of attention, it is perhaps unsurprising that CCCs are consistently identified as an area of weakness for current graduates. For example, 52% of executives identified their employees' inadequate problem-solving skills as a serious skills deficiency, whereas only 30% cited inadequate mathematics skills (Deloitte & The Manufacturing Institute, 2011). In another survey, an overwhelming majority of employers indicated that colleges should place more emphasis on written and oral communication (89%), critical thinking (81%), complex problem solving (75%), and teamwork (71%; Hart Research Associates, 2010). Even among college instructors, critical thinking and problem-solving skills were rated as extremely important (ACT, 2013a). Within academic domains, professors indicated knowledge and skills in their academic area were most important for success in their course (e.g., mathematics professors rated mathematics skills as most important for success in mathematics courses); however, when the survey responses were analyzed across academic domains (i.e., mathematics, science, reading, writing), critical thinking and problem-solving skills were rated as most important overall.

## **The Cross-Cutting Capabilities Framework**

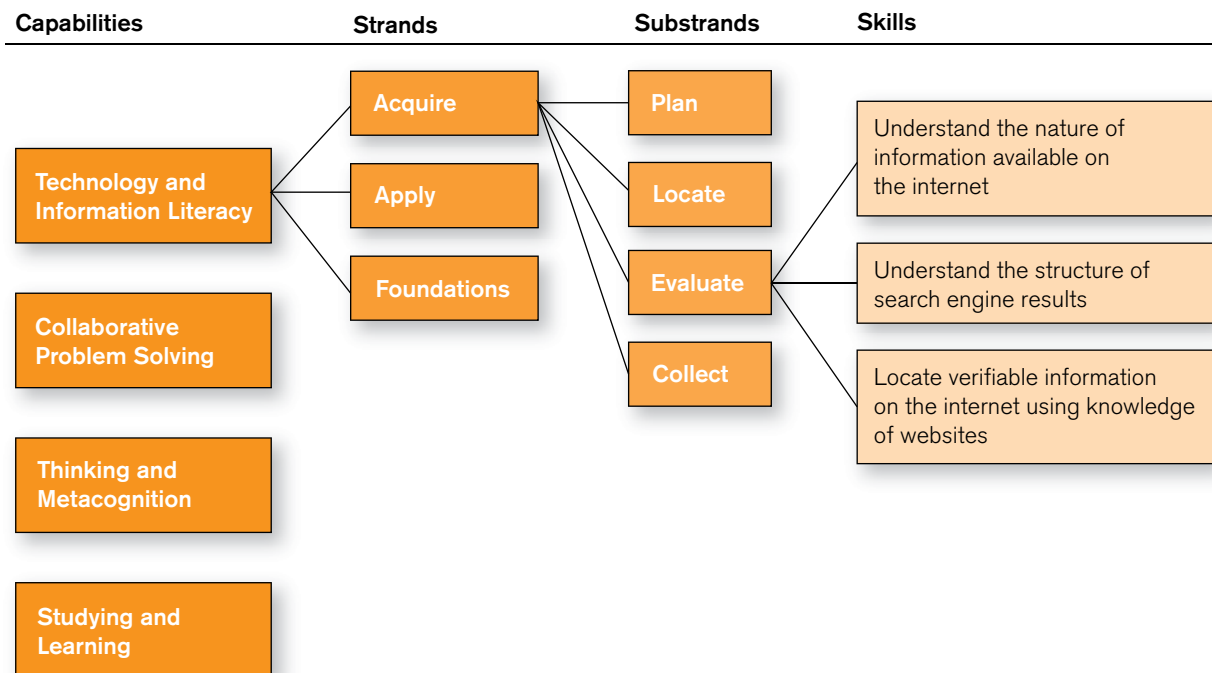
Our holistic framework identifies four broad cross-cutting capabilities: (1) technology and information literacy, (2) collaborative problem solving, (3) thinking and metacognition, (4) studying and learning (see Table 3 for descriptions). Each of these four capabilities constitutes a relatively broad collection of skills and some (e.g. collaborative problem solving) have aspects that blend together and integrate skills from the core academic and the behavioral sections of the framework.

**Table 3. Cross-Cutting Capabilities Framework**

| Cross-cutting capability            | Definition   |
|-------------------------------------|--|
| Technology and information literacy | Using technology to acquire, evaluate, transform, and share information                    |
| Collaborative problem solving       | Contributing to group problem-solving processes  |
| Thinking and metacognition          | Mastering modes of thinking that apply to broad classes of problems                        |
| Studying and learning               | Using learning strategies to enhance comprehension, integration, and retention of learning |

Mirroring core academic skills, the cross-cutting capabilities framework breaks each broad capability down into more specific strands and skills (See Figure 4). For example, as illustrated in the figure, Technology and Information Literacy is broken down into three strands: (1) the ability to research and acquire information using technology, (2) the ability to apply and create artifacts using technology, and (3) foundational knowledge and skills related to specific hardware and software technologies. Each strand is composed of substrands related to a particular process or technology, such as evaluating information. Proficiency in each substrand is then defined in terms of detailed tasks and attendant knowledge.

In the following sections we present research evidence and rationale behind our decision to focus on these four broad capabilities. Each capability corresponds to a skill domain that is valuable across a wide range of academic subjects and careers. Details on the selection process and our criteria for inclusion in the framework are provided in the appendix.



**Figure 4. Illustration of the Cross-Cutting Capabilities Framework Organized from Broad Capabilities to Specific Skills**

## Technology and Information Literacy

The Technology and Information Literacy capability focuses on the ability to research, collect, manage, transform, and exchange information using technologies such as web browsers, email, word processing, and spreadsheet software. The ability to understand and use technology to acquire and apply information is vital to success in modern academic and organizational environments (ACT, 2014b; Association of College and Research Libraries, 2000; Autor et al., 2003; Partnership for 21st Century Skills, 2012). It is not surprising that technology and information literacy (TIL) has been a growing concern over the past decade, with many countries identifying these skills as necessary for future occupations (Bakia, Murphy, Anderson, & Trinidad, 2011; US Department of Education, 2010). Nationally representative data on TIL is sorely lacking, but the 2013 Organization for Economic Cooperation and Development (OECD) Survey of Adult Skills did collect representative data on US problem-solving skills in technology-rich environments. Fewer than half of US 16–24 year olds scored above a basic proficiency level, indicating a strong need for attention in this area (OECD, 2013).

Use of technology to communicate is central to daily tasks in a majority of occupations (Autor et al., 2003; Conrad & Newberry, 2011). As technology becomes more integrated into organizations, collaboration and group problem-solving processes are becoming increasingly virtual (O\*NET, 2014; Scardamalia, Bransford, Kozma, & Quellmalz, 2012). Technology is an important mediator in many studies of team performance because the majority of team communication is usually conducted via email, chat, or remote meeting software (Lira, Ripoll, Peiro, & Zornoza, 2013). Already, levels of daily technology use at work are strongly correlated with membership in higher-level technical, managerial, and executive positions. This implies that a lack of fluency with these technologies can create numerous barriers to participation and, ultimately, advancement.

Instruction in and use of technology has been associated with increases in academic achievement. For example, a four-week program of instruction in TIL skills followed by one year of experience with a personal computer led to substantial test-score increases in reading, writing, and mathematics for at-risk middle and high school students (Amiri, 2009). Frequent use of classroom technology is also generally associated with higher grades in college courses (Huffman & Huffman, 2012). In addition, Fitzgerald (2004) found that college faculty had high expectations for first-year students' information literacy skills. Access to technology is strongly associated with household income and educational attainment (Pew, 2008). This highlights both the importance of technology in the workplace and the risk of a “digital divide” between those who have access to technology and those who do not (Law, 2006; Raizen, 1997). For some students, school is the only place where they can access technology; accordingly, education has an important role to play in ensuring that all students have access to and familiarity with technology.

## Collaborative Problem Solving

Collaborative problem-solving skills enable individuals to effectively communicate and contribute to problem-solving processes when serving as members of a group or team. Collaborative skills are critical for team and team-member success (Chung, de Vries, Cheak, Stevens, & Bewley, 2002; Hesse, Care, Buder, Sassenberg, & Griffin, 2015; H. F. O'Neil, Chuang, & Chung, 2003). At an individual level, superior collaborative skills improve cognitive learning outcomes (Pace, 1990; Simons & Peterson, 2000), in part because a variety of metacognitive skills, such as comprehension monitoring and evaluation of information, are promoted through collaboration (Chung et al., 2002; Johnson, Johnson, & Smith, 1998, 2007). At a group level, teams composed of individuals with

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well-developed collaborative skills report positive group outcomes, such as increased cohesion, improved communication, and superior conflict resolution (Beal, Cohen, Burke, & McLendon, 2003; Lott & Lott, 1961; Rosen & Tager, 2013). Research has demonstrated that good collaborative skills may be particularly beneficial for teams that are computer supported or technology mediated (Rosen & Tager, 2013; Vendlinks & Stevens, 2002). In addition, employer surveys have consistently revealed an ability to work within a team as one of the skills that is most valued and most lacking in new hires (Griffin, Care, & McGaw, 2012).

But what are these collaborative skills that foster benefits for the individual and the group? Our framework focuses on collaborative problem solving as a way to operationalize the broader construct of collaboration and group work in order to identify specific cognitive skills and strategies that can improve performance. For example, the ability to monitor group progress (or lack of progress) toward resolving a problem is vital to the success of the group (Dickinson & McIntyre, 1997; Marks, Mathieu, & Zaccaro, 2001). We view collaborative problem solving as a composite construct composed of skills from three areas: problem solving, communication, and behavior. Such a composite construct truly reflects the nature of group work, where one must not only possess the individual ability and drive to solve a challenging problem, but also be able and willing to productively leverage the knowledge and skills of other group members.

## Thinking and Metacognition

The thinking and metacognition capability includes five highly general skills that all involve the regulation of thinking. These skills are critical thinking, problem solving, decision making, computational thinking, and metacognition. The decision to focus on these five skills was driven by a confluence of factors. With the exception of computational thinking, each skill has an extensive and distinct empirical literature base and is a known predictor of success in various contexts. The closely interrelated cluster of critical thinking, problem solving, and decision making is strongly associated with job zone and salary in the O\*NET database, and these are among the most in-demand skills cited by employers (Levy & Murnane, 2004; O\*NET, 2014).

Instruction in general thinking skills, particularly metacognition and problem solving, has been associated with improvements in both academic and workplace performance. For example, a metaanalysis of thinking-skills interventions in the United Kingdom found an overall effect size of .62 on various curricular outcomes (Higgins, Hall, Baumfield, & Moseley, 2005). In addition, instruction in metacognition has been shown to have beneficial effects on grades in ELA (Haller, Child, & Walberg, 1988), mathematics (Mevarech, & Amrany, 2008; Oladunni, 1998), and science (Schweizer, Wüstenberg, & Greiff, 2013). Instruction in problem-solving techniques has been shown to increase creative productivity compared to controls (Wang & Horng, 2002), and Assessment Center measures of problem-solving ability have among the highest validities as predictors of job performance ( $r = .38$ ).

Computational thinking helps individuals reconceptualize problems in ways that allow their solutions to be efficiently computed by an information-processing system (Wing, 2006). This is a relatively new construct, but it is actually an extension of traditional problem-solving skills to put a greater focus on the design of algorithmic solution processes. The ever-rising prevalence of automation in the workplace means that computational thinking is likely to be a key determinant of career success in the twenty-first century (Malyn-Smith & Sheldon, 2014). Managers believe it will likely increase in importance over the next twenty years (Institute for the Future, 2011), and already over 70% of the specialized skills most frequently listed by individuals hired in 2014 were directly related to computational thinking (Murthy, 2014).

## Studying and Learning

The studying and learning capability involves the development of critical study strategies related to the comprehension, integration, and retention of information. These learning strategies and habits are fundamental to academic performance, and mastering them can have a large impact on learning outcomes (Gettinger & Seibert, 2002; Robbins et al., 2004). Poor study skills lead to academic adjustment problems in the transition from high school to college, including withdrawal from school (Abbott-Chapman, Hughes, & Wyld, 1992; Pantages & Creedon, 1978). In an attempt to address this, colleges and universities are devoting increased attention to the development of student study skills by added courses specifically aimed at “learning to learn.” From an instructional perspective, it is a safe assumption that students who understand how they learn new information will also have a more accurate understanding of what they have and have not mastered and thus will be in a better position to develop expertise in both academic and workplace settings.

Instruction in studying and learning strategies has been shown to have substantial effects ( $d = .26-.59$ ) on course grades (Hattie, Biggs, & Purdie, 1996; Liu et al., 2014), yet these strategies are rarely taught by typical instructors, who are focused on covering domain-specific curricular content (Kistner et al., 2010). Everson, Weinstein, and Laitusis (2000) found that subscales on the Learning and Study Strategies Inventory (LASSI) measuring active and metacognitive study strategies were significant predictors of both PSAT scores and high school GPA.

A meta-analysis of the predictive and incremental validity of measures of study skills found strong support for learning skills and college performance. In particular, the incremental validity of study skills constructs above and beyond test scores and HSGPA ranged from .04 to .12 in the prediction of first-year GPA (Credé & Kuncel, 2008). Given their findings, the authors deemed study skills the third pillar of academic success, after test scores and HSGPA. Skills that enhance learning are considered by managers to be important to success within organizations (Corporate Education Board, 2012; Crawford, 2011; Society for Human Resource Management, 2008). An ability to monitor one’s learning processes, combined with a willingness to improve them, is characteristic of productive employees (Parker & Collins, 2010). The ACT framework for studying and learning is designed to enhance the ability of learners at any stage to effectively comprehend, integrate, and retain information in a way that improves their learning and positions them for success.

## Summary

In summary, the cross-cutting capabilities framework:

- Focuses on skills that are consistently identified as critical by professors and employers
- Complements the core academic skills framework by highlighting skills that are not the focus of traditional academic instruction
- Expands ACT’s current standards by acknowledging the importance of technology, problem solving, and other applied skills
- Adds an integrative component to our holistic model of education and workplace success
- Together with the core academic skills framework, identifies the cognitive learning outcomes necessary for success in the 21st century



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## Behavioral Skills

ALEX CASILLAS, JASON WAY, AND JEREMY BURRUS<sup>5</sup>

Behaviors are valued across cultures and are often embedded in folktales and fables (e.g., “The Little Engine That Could,” “The Boy Who Cried Wolf,” “The Tortoise and the Hare”) as a way to illustrate that some behaviors lead to rewards while others lead to negative consequences. In fact, much of early childhood education focuses on shaping students’ behavior by modeling appropriate behavioral skills, such as waiting one’s turn, communicating one’s needs, sharing toys and school supplies, as opposed to the more traditional academic subjects emphasized in later grades. However, as students progress developmentally, conveying academic content (e.g., mathematics) is generally viewed as the primary responsibility of the educational system, and the role of teachers and schools in guiding behaviors is not as clear. Attendance, punctuality, conduct, effort, and responsibility are acknowledged as important factors in many grading systems (Camara, Kimmel, Scheuneman, & Sawtell, 2003), and negative behaviors often result in disciplinary actions that impact educational and learning outcomes. However, behavioral skills are not codified in a systematic fashion the way academic skills are. Despite the fact that most states have developed behavioral standards for students, these standards lack definitional clarity, are overly general, are not research based, and do not include a developmental progression mirroring the learning progressions or content standards of traditional subject areas like mathematics and English. Yet there is a preponderance of research that attests to the importance of behavior in predicting and explaining performance in education (e.g., McAbee, Oswald, & Connelly, in press; Poropat, 2009) and work settings (Barrick & Mount, 1991; Viswesvaran, Ones & Schmidt, 1996), as well as in serving as an important driver of elements of economic growth, such as employee wages (e.g., Heckman, Stixrud, & Urzua, 2006; Lleras, 2008).

In this section, we articulate the framework and taxonomy of behavioral skills that are included in the ACT holistic model of education and work readiness. We outline a general conceptual model of behavior, its foundations, and the research evidence that supports the constructs included across critical transition points along the K–Career continuum. We use “behavior” as an overarching term that includes psychosocial factors, socioemotional learning, character, personal and soft skills, and similar terms that tap the same content and are common in both the scientific literature and popular press (for an illustration of how these terms overlap conceptually, see Tooley & Bornfreund, 2014).

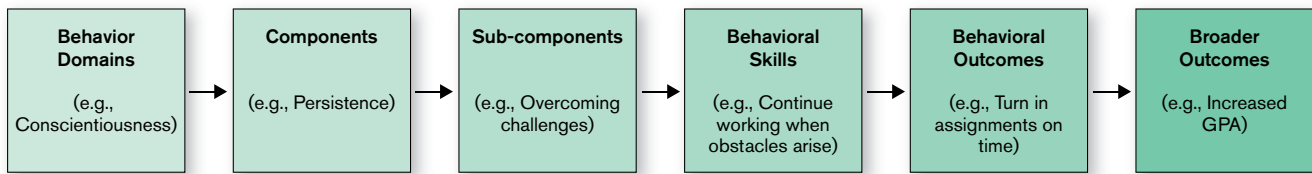
### General Conceptual Model

As a key component of the holistic approach ACT takes to education and work readiness, the behavior domain focuses on interpersonal, self-regulatory, and effortful behaviors related to successful performance in education and workplace settings. Our conceptualization of this broad domain leverages research from multiple areas of psychology, including educational, developmental, industrial/organizational, and personality, to define what individuals need to know and be able—and willing—to do from a behavioral perspective in order to be successful across a range of settings.<sup>6</sup>

The general conceptual model of behavior is presented in Figure 5. In this model, broad domains, which capture the consistency of behavior across time and situations, serve as the organizing

<sup>5</sup> Fred Oswald and Ryan Whorton reviewed earlier versions of this manuscript and provided helpful comments.

<sup>6</sup> In particular, we draw heavily on personality psychology, since this area has historically focused on the relatively stable patterns of *behavior* (as well as thoughts and feelings) particular to an individual that are consistent across time and across situations (Feist & Feist, 2009).



**Figure 5.** Conceptual Model for the ACT Behavioral Skills Framework

framework. However, these are not sufficiently specific to be useful in applied settings, such as describing what students and workers need to know and be able to do to be successful. Therefore, the behavior framework drills down to a more specific level of behavioral skills. This is the level at which behavior influences important and measurable outcomes, such as academic and job performance (Furr, 2009; J. J. Jackson et al., 2010). Theory and research show that behavior can be organized hierarchically; that is, behavior domains are composed of clusters of narrower characteristics or “components,”<sup>7</sup> which in turn are composed of even more specific “subcomponents” that include behavioral skill dimensions and, finally, of specific behaviors (e.g., Digman, 1990; Markon, Krueger, & Watson, 2005). Narrower characteristics are useful for increasing theoretical understanding of how personality and behavior relate to each other and to outcomes, as well as for improving prediction (e.g., Ashton et al., 1995; Hogan & Roberts, 1996).<sup>8</sup> The specific behavioral skill dimensions in the behavioral skills taxonomy can be used to more clearly define what people need to know and be able to do at different transition points, as well as to tailor training and interventions to address individuals’ developmental needs.

In addition to proposing a more specific (behavioral) level of description (and prediction), this model also makes a distinction between narrower behavioral outcomes (e.g., showing up to class consistently) and broader, generalized outcomes of success (e.g., improved grades). This distinction is important because specific behavioral outcomes are more proximal to the behavioral skill dimensions articulated in the framework and can increase our understanding of the types of behavioral changes that interventions are trying to impact (e.g., reduction in absenteeism) in order to produce improvements in broader outcomes of interest down the road (e.g., improved grades, improved graduation rates). Focusing on narrower observable behavioral skills can allow educators and employers to better concentrate their efforts and resources on helping individual students or employees develop the skills they need to improve and thrive.

## Models of Personality as Organizing Structures for Behavior

The Five Factor Model (aka The Big Five) has been the dominant model for studying personality and its behavioral correlates for approximately two decades. This model states that the whole of human personality is comprised of five major domains and all individuals exhibit different profiles based on their differing levels of each domain. Much of the work that led to the widespread acceptance of this

<sup>7</sup> These are typically referred to as “facets” in the research literature.

<sup>8</sup> Historically, psychologists who emphasized a strict behaviorist approach thought that personality was irrelevant (along with thoughts and feelings) in predicting behavior. However, in the last few decades, the research is clear that the magnitude of the associations between personality and various consequential outcomes is important. And, for some outcomes (e.g., persistence to degree attainment), the predictive power of personality is similar to the predictive power of cognitive skills and demographic factors (for a discussion of this issue, see Roberts et al., 2007).

model was conducted in the 1980s and 1990s (e.g., Peabody & Goldberg, 1989; Goldberg, 1990) and showed that statistical analyses of words used in English to describe individuals consistently resulted in the emergence of the same five personality factors across varieties of samples, including children, college students, military personnel, and working adults. The descriptive words found in each factor reflect the content of each broad personality domain, defined in Table 4 (see Barrick & Mount, 1991, or Costa & McCrae, 1992, for similar definitions).

**Table 4. Five-Factor Model Definitions**

| Domain                 | Definition  | Common components   |
|------------------------|---|---|
| Extraversion           | The extent to which an individual is interested in being around people and engaged in the environment, as opposed to preferring being by oneself and focusing on one's inner life | Sociability, dominance, ambition, positive emotionality       |
| Agreeableness          | The degree to which a person tends to be kind, considerate, and cooperative, and to focus on interpersonal relationships and social harmony                                       | Cooperation, trust, compassion, altruism                      |
| Conscientiousness      | The extent to which an individual is careful, disciplined, and achievement oriented   | Dependability, order, cautiousness, persistence               |
| Emotional Stability    | The tendency to respond to stress calmly and manage emotions effectively  | Lack of anxiety, personal insecurity, vulnerability to stress |
| Openness to Experience | Preferences for new experiences and complexity in an individual's mental and experiential life  | Creativity, curiosity, broad-mindedness                       |

The HEXACO model is an alternative six-factor model that attempts to address some of the perceived weaknesses of the Big Five model. The HEXACO model addresses concerns about the applicability of the Big Five across cultures, where the research shows that a sixth factor emerges (e.g., Ashton & Lee, 2007; Ashton et al., 2004). Moreover, it suggests that the traditional Big Five model can be subsumed within this alternative model with only minor adjustments to some of the factors.

The acronym HEXACO is derived from the six broad domains contained in the model: Honesty-Humility (H), Emotional Regulation (E), Extraversion (eX), Agreeableness (A), Conscientiousness (C), and Openness (O) (Ashton et al., 2004). The most important addition of this model is the Honesty-Humility domain, which captures individual differences in adherence to principles of honesty, fairness, and ethical behavior. Common components include sincerity, fairness, and modesty (Lee & Ashton, 2004). Honesty-Humility has shown value in predicting outcomes of interest in both education and work settings, including grade point average and counterproductive academic behavior (de Vries, de Vries, & Born, 2011), job performance (Johnson, Rowatt, & Petrini, 2011), and self-reported workplace integrity and delinquency (Lee, Ashton, & de Vries, 2005; Lee et al., 2009). In sum, based on its relevance across cultures and languages and the addition of the Honesty-Humility factor, the HEXACO model can be seen as a cutting-edge replacement for the Big Five as a highest-order organizing model for human personality.<sup>9</sup>

<sup>9</sup> Because of the obvious similarities between the HEXACO and Big Five models, the extensive research results showing the value of the Big Five also apply to the HEXACO.

**Table 5.** Example Behavioral Items Used to Measure the HEXACO Personality Domains

| HEXACO domain        | Behavioral item example                                |
|----------------------|--|
| Honesty-Humility     | I would never take things that aren't mine.            |
|                      | I don't pretend to be more than I am.                  |
|                      | I cheat to get ahead. <sup>a</sup>                     |
| Emotional Regulation | I don't worry about things that have already happened. |
|                      | I get stressed out easily.                             |
|                      | I remain calm under pressure.                          |
| Extraversion         | I talk to a lot of different people at parties.        |
|                      | I take charge.   |
|                      | I smile a lot.   |
| Agreeableness        | I am usually a patient person.                         |
|                      | I rarely complain.                                     |
|                      | I am nice to people I should be angry at.              |
| Conscientiousness    | I get started quickly on doing a job.                  |
|                      | I work hard.   |
|                      | I make plans and stick to them.                        |
| Openness             | I come up with something new.                          |
|                      | I see beauty in things that others might not notice.   |
|                      | I avoid philosophical discussions. <sup>a</sup>        |

*Note.* Items are from the International Personality Item Pool (Goldberg, 1999).

<sup>a</sup> Item is reversed such that it represents the low end of the domain.

To illustrate behavioral content typically included in HEXACO measures, item examples are featured in Table 5.

## The Value of Narrow Characteristics or Components

In addition to efforts to understand the structure of behavior and personality, some researchers have expressed concerns about the broad nature of the domains included in these models and have argued for a focus on narrower components (i.e., more specific aspects of behavior within each broad domain). Research suggests that component-level domains (e.g., planning) may result in better prediction of narrower, more specific outcomes (Ashton et al., 1995; Hogan & Roberts, 1996; Mount & Barrick, 1995; Ones & Viswesvaran, 1996; Schneider, Hough, & Dunnette, 1996). Conversely, this basic argument suggests that broad, global domains should better predict broad, global criteria than narrow, component-level characteristics (Cronbach, 1960). For example, Stewart (1999) showed that while global Conscientiousness was related to all stages of job performance, components such as Order were more strongly associated with early stages of job performance, whereas Achievement was associated with later maintenance stages of performance. Research shows

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that some components influence behavioral outcomes more strongly than global characteristics (e.g., Schouwenburg & Lay, 1995). For example, a number of studies have found that the Conscientiousness components Achievement Striving, Dependability, and Dutifulness have validity over and above a general measure of Conscientiousness in predicting academic performance outcomes (Chamorro-Premuzic & Furnham, 2003; De Fruyt & Mervielde, 1996; Gray & Watson, 2002; Lievens, Coetsier, De Fruyt, & De Maeseneer, 2002). Importantly, the value of components as predictors has been explicitly addressed in the HEXACO model, with each factor being further subdivided into components (Ashton & Lee, 2009; Ashton, Lee, & de Vries, 2014). Given the present state of the literature, it is clear that including component-level information in a hierarchical framework to organize and describe the behaviors important for predicting a range of education and work outcomes is an ideal starting point.

## **Developmental Antecedents of Behavior**

Research on behavior and personality structure in children has been far less extensive than that on adolescents and adults, but the work that exists suggests the Big Five and HEXACO models provide excellent coverage of behavior and personality in children as young as preschool age (e.g., Caspi & Shiner, 2006; Kohnstamm, Halverson, Mervielde, & Havill, 1998; Goldberg, 2001; Tackett et al., 2012). A brief summary of that evidence follows.

### **Honesty-Humility**

Research shows that the precursors to this domain, sometimes referred to as early conscience, begin to emerge as early as toddlerhood and become more stable markers of future adaptive behavior (e.g., following rules, telling the truth, taking responsibility for actions) by age five (Kochanska, Koenig, Barry, Kim, & Yoon, 2010).

### **Emotion Regulation**

Children vary in their experience of a variety of negative emotions (e.g., distress, anxiety, sadness); thus, the Emotionality domain is often referred to as Negative Emotionality in the child literature. Starting at preschool age and continuing into adolescence, these individual differences become more complex as children's cognitive capacities and awareness of themselves and their environment continue to develop (Shiner & DeYoung, 2013). Negative emotionality has been linked to children's capacity to deal effectively with negative emotions, adjust to stressful circumstances, and develop a sense of self-confidence and mastery over their environment (Caspi & Shiner, 2006; Durbin, Hayden, Klein, & Olino, 2007).

### **Extraversion**

From infancy, children also display individual differences in Extraversion, referred to as positive emotionality in the developmental literature (Gartstein & Rothbart, 2003). By preschool age, children display a variety of the behaviors that are markers of this domain, including socializing with peers, exhibiting positive emotions such as joy and enthusiasm, and expressing a willingness to engage their external environment (De Pauw, Mervielde, & Van Leeuwen, 2009).

### **Agreeableness**

Given the importance of maintaining positive relationships with others, the domain of Agreeableness, referred to as affiliativeness in the child literature, has received considerable attention. Some of the early behavioral markers of this domain include displays of irritability, physical aggression, and early manifestations of empathy (e.g., Knafo, Zahn-Waxler, Van Hulle, Robinson, & Rhee, 2008; Tremblay & Nagin, 2005). By preschool age, these markers also include relational aggression, prosocial behavior including cooperation and helpfulness, and more elaborate manifestations of empathy (Shiner & DeYoung, 2013).

### **Conscientiousness**

Children also vary in their display of this domain, referred to as effortful control (Shiner & DeYoung, 2013). By toddlerhood, children are able to sustain attention and persist in basic tasks. And by preschool age, children display a variety of behavioral skills that facilitate planning, inhibit impulses, and regulate attention (e.g., Rothbart, Chew, & Gartstein, 2001). These markers continue to diversify and deepen into improved impulse control, goal striving, orderliness, and dependability, particularly as children face increased demands from academic environments.

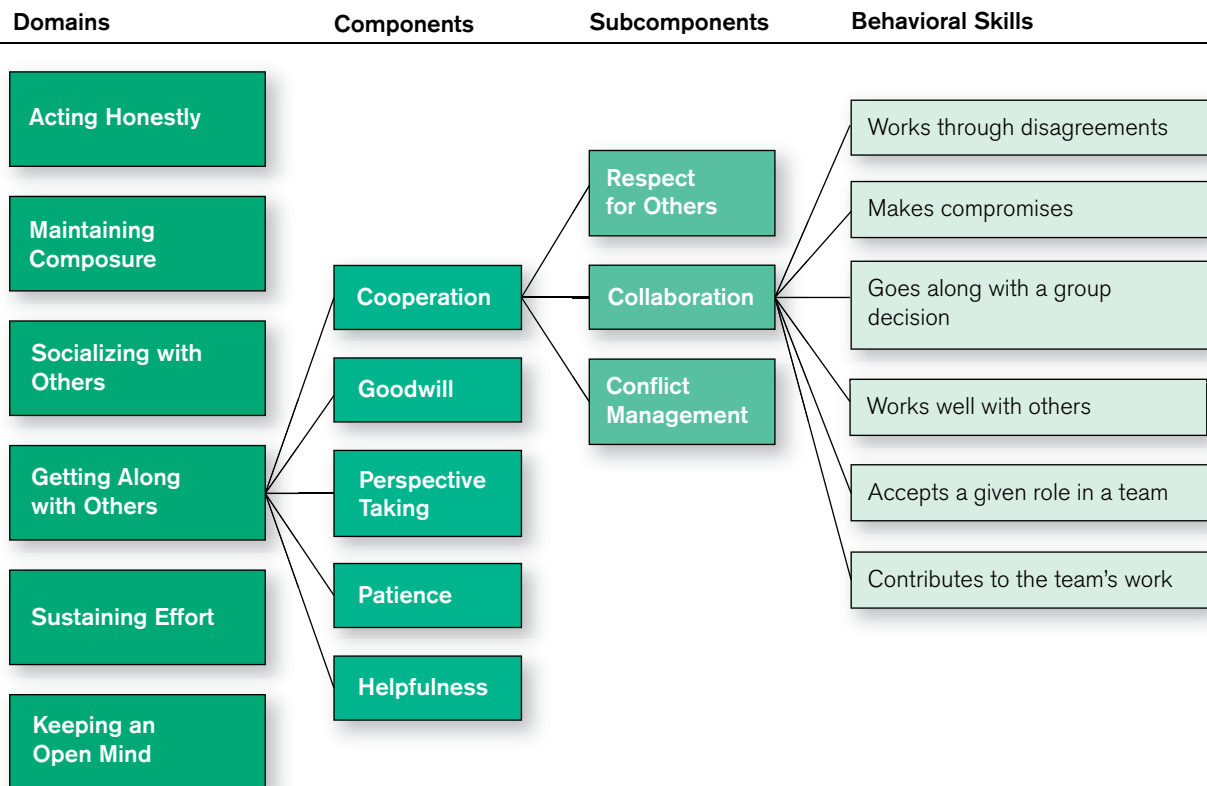
### **Openness to Experience**

This domain, referred to as orienting sensitivity in the child literature, is less understood in terms of its developmental antecedents. However, there is evidence suggesting that it can be measured in children as early as preschool age (DePauw et al., 2009), and that behavioral markers include expressing curiosity, exploring new situations, exhibiting sensitivity to internal and external stimuli, engaging in imaginative play, and adapting in the face of uncertainty (Caspi & Shiner, 2006; Evans & Rothbart, 2007).

## **A Framework of Behavior**

### **Organization of the Framework**

The ACT behavioral skills framework is hierarchical; at the highest level, it includes six broad domains of behavior and drills down into more detailed (and age-appropriate) components, subcomponents, and behavioral skill dimensions. In addition to components of behavior, the framework also includes additional levels of specificity that are developmentally appropriate and aligned to important school and work transitions. To our knowledge, this is the first time such a comprehensive *and* detailed model has been advanced (see Figure 6 for an illustration of the framework's hierarchical organization). The work was generally guided by the HEXACO taxonomy (Ashton et al., 2004), such that an attempt was made to group behavioral skill dimensions within the appropriate HEXACO domains.



**Figure 6.** Illustration of the ACT Behavioral Skills Framework Organized from Broad Domains to Specific Behavioral Skills

The behavioral skills framework's highest-order domains are consistent with HEXACO (see Table 6 for a full list of ACT behavioral domains and definitions, and their respective components and subcomponents). Altogether, the framework includes 23 components and 50 subcomponents, and—unlike other frameworks in the behavior and personality literature—it is not symmetrical. This reflects the extant research and expert opinion as to the relative importance and utility of certain domains for education and work outcomes. For example, the Sustaining Effort domain has the largest number of components and subcomponents and reflects the research evidence that Conscientiousness is the most consistently important behavioral predictor of education and work outcomes (e.g., Poropat, 2009; Sacket & Walmsley, 2014; Schmidt & Hunter, 1998). Figure 7 provides two examples of how the behavioral skills in this framework provide a richer description than the components and subcomponents that are included in many other taxonomies.

**Table 6.** Domains, Components, and Subcomponents of the ACT Behavioral Framework

| Domains   | Components   | Subcomponents                                   |
|---|--|---|
| <b>Acting Honestly</b><br>(Honesty-Humility)<br>Describes the extent to which a person values and adheres to ethical and moral standards of behavior, as well as personal level of humility | <b>Genuineness</b><br>Being sincere and truthful in interactions, appropriately giving others credit, and acknowledging his or her mistakes  | Truthfulness<br>Acceptance of Responsibility    |
|   | <b>Fairness<sup>a</sup></b><br>Acting in ways that are intended to be unbiased and fair to everyone  | Fairness  |
|   | <b>Modesty<sup>a</sup></b><br>Being humble about achievements, presenting a realistic view of himself or herself, and avoiding boasting or acting superior to others                       | Modesty   |
| <b>Keeping an Open Mind</b><br>(Openness to Experience)<br>Describes a person's level of open-mindedness and curiosity about a variety of ideas, beliefs, people, and experiences           | <b>Creativity</b><br>Generating original ideas, using existing ideas or things in new ways, and having an active imagination   | Originality<br>Active Imagination               |
|   | <b>Curiosity</b><br>Seeking out information to better understand a wide range of topic areas and/or obtaining a depth of understanding in one topic area that goes beyond what is required | Information Seeking<br>Depth of Knowledge       |
|   | <b>Flexibility</b><br>Adapting to new environments and making adjustments to accommodate changes   | Environmental Adaptability<br>Accommodation     |
|   | <b>Accepting Differences</b><br>Being open-minded and accepting of ideas, cultures, and ways of doing things that are different from his or her own  | Open-mindedness<br>Embracing Diversity          |
| <b>Maintaining Composure</b><br>(Emotionality)<br>Describes the extent to which a person is relatively calm, serene, and able to manage emotions effectively                                | <b>Stress Tolerance</b><br>The degree to which a person can control feelings of anxiety and other negative emotions in order to function effectively in a range of situations              | Worry Management<br>Negative Feeling Management |
|   | <b>Self-Confidence</b><br>A tendency to be self-assured and to make decisions without needing a lot of input from others   | Decisiveness<br>Independence                    |
| <b>Socializing with Others</b><br>(Extraversion)<br>Describes a person's preferred level of social interaction, behavior in interpersonal situations, and optimism                          | <b>Assertiveness</b><br>Influencing others and preferring to be in charge in social interactions and group activities  | Taking Charge<br>Influence                      |
|   | <b>Optimism</b><br>The degree to which a person expresses a positive mood and a positive outlook   | Cheerful Mood<br>Positive Outlook               |
|   | <b>Sociability</b><br>Seeking out and enjoying situations involving interpersonal interaction and building relationships with others   | Interacting with Others<br>Networking           |



**Table 6** (continued)

| Domains  | Components   | Subcomponents  |
|--|--|--|
| <p><b>Getting Along with Others</b><br/>(Agreeableness)<br/>Describes the extent to which a person interacts positively and cooperates with others, and is generally kind, friendly, and tactful</p> | <p><b>Cooperation</b><br/>Being respectful, polite, collaborative, and skilled at working through conflict with other people</p>   | <p>Respect for Others</p> <hr/> <p>Collaboration</p> <hr/> <p>Conflict Management</p>                      |
|  | <p><b>Perspective Taking</b><br/>Identifying, acknowledging, and understanding the emotions of others, showing concern for others, and considering the audience when providing information</p> | <p>Interpreting Emotional Reactions</p> <hr/> <p>Showing Concern</p> <hr/> <p>Considering the Audience</p> |
|  | <p><b>Goodwill</b><br/>Assuming others have good intentions, trusting others, being able to forgive and not holding grudges</p>  | <p>Forgiveness</p> <hr/> <p>Trust</p>  |
|  | <p><b>Helpfulness</b><br/>Helping others and being generous with his or her time and/or resources despite personal cost</p>  | <p>Assisting Others</p> <hr/> <p>Selflessness</p>  |
|  | <p><b>Patience</b><br/>Tolerating frustrations presented by others or by situations without expressing irritation or hostility</p>   | <p>Tolerating Frustrations with Others</p> <hr/> <p>Tolerating Situational Frustrations</p>                |
| <p><b>Sustaining Effort</b><br/>(Conscientiousness)<br/>Describes a person's level of diligence, effort, organization, self-control, and compliance.</p>   | <p><b>Dependability</b><br/>Reliably fulfilling responsibilities, meeting deadlines, and producing quality work</p>  | <p>Timeliness</p> <hr/> <p>Follow Through</p> <hr/> <p>Quality</p>   |
|  | <p><b>Order</b><br/>Planning and organizing tasks and materials, creating schedules, monitoring progress, and paying close attention to details</p>  | <p>Organization</p> <hr/> <p>Planning</p> <hr/> <p>Monitoring</p>  |
|  | <p><b>Persistence</b><br/>Working hard, making progress on relevant tasks, and maintaining focus despite setbacks or difficulties</p>  | <p>Overcoming Challenges</p> <hr/> <p>Maintaining Effort</p> <hr/> <p>Focusing</p>                         |
|  | <p><b>Rule Consciousness</b><br/>Following rules and procedures and complying with authority</p>   | <p>Compliance</p> <hr/> <p>Respect for Rules/Authority</p>   |
|  | <p><b>Goal Striving</b><br/>Setting challenging goals, doing tasks without being told, and working to improve or learn new skills</p>  | <p>Self-Improvement</p> <hr/> <p>Initiative</p> <hr/> <p>Goal Setting</p>                                  |
|  | <p><b>Self-Control</b><br/>Managing impulses and weighing the consequences of one's behavior before acting</p>   | <p>Restraint</p> <hr/> <p>Thinking Before Acting</p>   |

<sup>a</sup> Only one subcomponent exists for this component.

**Persistence** is part of the Sustaining Effort domain and includes behavioral skills associated with working hard, making progress on relevant tasks, and maintaining focus despite setbacks or difficulties. Persistence is further subdivided into three subcomponents describing narrower sets of behavior, each associated with more specific behavioral skill examples: (1) **Overcoming Challenges** (e.g., working through obstacles in order to complete tasks, responding to failure by trying harder), (2) **Maintaining Effort** (e.g., steadily making effort on tasks over time; putting forth effort on tasks even when he or she finds them boring, uninteresting, or unimportant), and (3) **Focusing** (e.g., focusing attention on current task despite distractions, spending a sufficient amount of time focusing all his or her attention on the task at hand without moving to a different task).

**Cooperation** is part of the Getting Along Well with Others domain and includes behavioral skills associated with being respectful, polite, and collaborative, and with working through conflict with other people. Cooperation is further subdivided into (1) **Respect for Others** (e.g., using polite and respectful language when speaking to others, not interrupting when others are speaking), (2) **Collaboration** (e.g., sharing ideas about potential ways to define tasks and/or solve problems, actively listening and asking questions when appropriate to better understand what others are saying), and (3) **Conflict Management** (e.g., identifying sources of conflict in the group, compromising with others in order to resolve conflict).

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**Figure 7.** Examples of Behavioral Skill Domains

## The Value of Behavioral Skills at Work and School

A large body of research has shown that the behavior domains and components included in this framework predict success in a variety of important education and work outcomes. In some instances, behavioral skills have been shown to predict outcomes as effectively as cognitive skills. In fact, cognitive skills are themselves influenced by behavioral skills (Almlund, Duckworth, Heckman, & Kautz, 2011; Heckman & Kautz, 2014). Research summarized in the following paragraphs establishes the importance of broad domains and more specific behaviors in predicting specific outcomes in three populations of interest: workers, postsecondary students, and K–12 students.

### Behavior Predicts Important Outcomes for Workers

Industrial/organizational psychology provides substantial evidence concerning the role of behavior for predicting important workplace outcomes. Specifically, this literature documents the utility of behaviors for predicting a broad range of job performance criteria, including task performance, engaging in appropriate and ethical work conduct, use of interpersonal skills (e.g., leadership, teamwork), and other important outcomes like work satisfaction and perceived work stress (e.g., Barrick & Mount, 1991; Barrick, Mount, & Judge, 2001; Judge, Higgins, Thoresen, & Barrick, 1999; Lindqvist & Vestman, 2011; Ones, Viswesvaran, & Schmidt, 1993; Roberts, Kuncel, Shiner, Caspi, & Goldberg, 2007; Salgado, 2003; Schmidt & Hunter, 1998; Van Iddekinge, Roth, Raymark, & Odle-Dusseau, 2012).

When it comes to an individual's level of task performance at work, research has shown that behavior predicts whether an individual completes tasks on time, the amount of work completed, and the quality and accuracy of that work (e.g., Anderson, Roush, & McClary, 1973; Thoresen, Bradley, Bliese, & Thoresen, 2004; Viswesvaran et al., 1996), as well as more personal outcomes that can affect

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performance, such as satisfaction, stress, and burnout (e.g., Bogg & Roberts, 2004; Judge, Heller, & Mount, 2002; Swider & Zimmerman, 2010). Further, behaviors have been associated with a range of activities that contribute to positive social and psychological aspects of an organization (aka contextual performance; Borman & Motowidlo, 1993) and generally involve more interpersonally relevant tasks, such as working in teams, providing courteous service, managing conflict, and displaying leadership (e.g., Hogan & Holland, 2003; Judge, Bono, Ilies, & Gerhardt, 2002; Morgeson, Reider, & Campion, 2005; Organ & Ryan, 1995; Sharma, Bottom, & Elfenbein, 2013). Similarly, these predictors have been associated with inappropriate interpersonal conduct (often referred as workplace incivility; Cortina, Magley, Williams, & Langout, 2001), including discrimination, bullying, sexual harassment, and other forms of aggression in the workplace (e.g., Bolton, Becker, & Barber, 2010; Roberts, Harms, Caspi, & Moffitt, 2007; Spector et al., 2006).

As already noted (and in Mattern et al., 2014), most of the workforce research is based on a predictive validity paradigm. However, some authors (e.g., Sackett & Walmsley, 2014) caution that (1) predictive validities may not reflect what employers actually value and (2) the research literature contains convenience samples of occupations, which may not fully represent the full range of occupations in the workplace. As such, Sackett and Walmsley determined which behavior domains are most valued by looking both at the types of interview questions job candidates are asked during structured interviews and at job analysis data collected by the Department of Labor's O\*NET. The results of these analyses were consistent with those of meta-analyses using predictive validities from the literature. That is, when behavior components were ranked in terms of importance for a wide variety of job families, components from all six domains in the ACT behavior framework were represented in the top three spots among all the job families (Sackett & Walmsley, 2014), with Conscientiousness being considered the most important. These results also are generally consistent with national surveys of employers, which have found that employers value behaviors in general and particularly value work ethic (a component of Conscientiousness; see Casner-Lotto & Barrington, 2006).

As can be seen, behavior predicts a broad range of important outcomes in the workplace. Research shows that behavior also predicts important outcomes in educational settings; however, educational research has traditionally focused on two broad educational outcomes—academic performance (e.g., GPA) and persistence (e.g., degree attainment)—rather than the broader range of outcomes found in workplace research (e.g., Lounsbury, Gibson, Sundstrom, Wilburn, & Loveland, 2004; Poropat, 2009; Robbins et al., 2004).

### **Behavior Predicts Important Outcomes for Postsecondary Students**

When it comes to an individual's level of academic performance in postsecondary settings (college and graduate-level programs), research has shown that behavior predicts academic grades above and beyond the effects of cognitive tests (ACT or SAT scores) and high school GPA (e.g., McAbee et al., in press; O'Connor & Paunonen, 2007; Poropat, 2009; Richardson et al., 2012; Trapmann, Hell, Weigand, & Schuler, 2007). Research also shows that these predictors are related to engagement in the academic and interpersonal environment of college, such as participating in class discussions, participating in extracurricular activities, and establishing relationships with peers (e.g., Asendorpf & Wilpers, 1998; McClenney, Marti, & Adkins, 2006), all of which educational theory and research support as being important contributors to higher quality academic experiences and improved performance in college (e.g., Astin, 1999; Conley, 2007; Kuh, Kinzie, Buckley, Bridges, & Hayek, 2006; Pascarella & Terenzini, 2005).

In addition, behavior predicts persistence in postsecondary settings, and these results hold up across a variety of time periods and different definitions of persistence. These outcomes range from those focused on a single semester, such as class attendance in specific courses and dropped courses (e.g., Conard, 2006; Credé, Roch, & Kieszezyuka, 2010; Willging & Johnson, 2009), to measures spanning multiple years, such as number of terms enrolled, credit hours completed, and time to degree attainment (e.g., McClenney et al., 2006; Robbins et al., 2004). Moreover, there is a growing literature that shows behavior (measured by checklists, experience sampling, or other ratings) predicts a range of other outcomes in postsecondary settings, including academic dishonesty, time management and procrastination, ability to cope with problems and stressors, satisfaction with the college environment, and health and well-being (Cochran, Wood, Sellers, Wilkerson, & Chamblin, 1998; Lounsbury, Saudargas, Gibson, & Leong, 2005; Marshall, Wortman, Vickers, Kusulus, & Hervig, 1994; Saenz & Barrera, 2007; Steel, 2007; Watson & Hubbard, 1996).

### **Behavior Predicts Important Outcomes for K–12 Students**

When it comes to an individual's academic performance in elementary and secondary school, research has shown that behavior provides incremental validity for predicting academic grades above and beyond more traditional predictors like achievement test scores, demographics, and school characteristics (e.g., Almlund et al., 2011; Casillas et al., 2012; Duckworth, Quinn, & Tsukayama, 2012; Gaertner & McClarty, 2014; Kaufman & Bradbury, 1992; Lounsbury, Sundstrom, Loveland, & Gibson, 2003; Oswald et al., 2004; Poropat, 2009; Willingham, Pollack, & Lewis, 2002; Zins, Bloodworth, Weissberg, & Walberg, 2004). Further, behavior tends to predict procrastination, prosocial interactions, aggression, and conduct problems, all of which, in turn, facilitate (or impede) academic performance (e.g., Ehrler, Evans, & McGhee, 1999; Jensen-Campbell, Gleason, Adams, & Malcolm, 2003; Loveland, Lounsbury, Welsh, & Buboltz, 2007; Malecki & Elliott, 2002; see Farrington et al., 2012 for a review). In addition, research shows that behavior predicts persistence in secondary school across short intervals, such as absences during a school year, as well as longer ones, such as on-time high school graduation (e.g., Balfanz, Herzog, & Mac Iver, 2007; Duckworth, Peterson, Matthews, & Kelly, 2007; Moore et al., in press; Rumberger & Lim, 2008; Vallerand, Fortier, & Guay, 1997; Zins et al., 2004).

### **Specific Domains of the ACT Behavioral Skills Framework Predict Success**

Behaviors predict a broad range of important outcomes across education and work settings (for reviews, see Mattern et al., 2014; McAbee et al., in press; Poropat, 2009; Viswesvaran, Ones, & Schmidt, 1996). In fact, research shows that the components in the ACT behavioral skills framework are more effective at predicting more specific outcomes than are broader measures of behavior. This section presents research evidence on the validity of some of these specific components (and their underlying behaviors) for specific outcomes at school and at work.

**Acting Honestly.** Although this domain is a relatively new addition to the literature, behaviors such as being honest, ethical, and fair have been of interest to educators and organizations for a long time, and research shows that components from this domain relate to measures of integrity in education and workplace settings (Lee, Ashton, & de Vries, 2005; Lee et al., 2009). In education settings, high scores on components containing behaviors such as acting sincerely, treating others fairly, and being modest are associated with higher GPAs and lower levels of counterproductive behavior in college students (de Vries, de Vries, & Born, 2011), as well as higher levels of other positive outcomes, such as continuous learning, ethics, and leadership (McAbee et al., in press). High scores on integrity tests, many of which tap Acting Honestly content, have also been found

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to predict better job performance even after taking into account employees' scores on cognitive ability tests (Schmidt & Hunter, 1998), a finding corroborated by more recent research examining behaviors related to being modest, fair, and sincere with others (Johnson, Rowatt, & Petrini, 2011; Judge, Rodell, Klinger, Simon, & Crawford, 2013). Such scores also turn out to predict lower levels of counterproductive work behavior (Ones, Viswesvaran, & Schmidt, 1993; Van Iddekinge et al., 2012), a finding replicated when looking at the component of Fairness that includes behaviors like avoiding cheating or taking advantage of others (O'Neill, Lewis, & Carswell, 2011).

**Getting Along with Others.** The components in this domain have to do with the manner in which a person interacts with others, such as being respectful and patient, showing concern when appropriate, and trusting and assisting others. In the K–12 area, these components predict fewer instances of rule breaking—especially those related to inappropriate interpersonal behaviors (Lounsbury, Steel, Loveland, & Gibson, 2004)—as well as better academic performance (Loveland, Lounsbury, Welsh, & Buboltz, 2007). Among college students, they predict higher performance (Okun & Finch, 1998) and are associated with higher levels of study and communication skills, social connections with others, and commitment to college (Peterson, Casillas, & Robbins, 2006). Finally, in the work domain, these components predict a wide range of outcomes, including higher performance (Mount, Barrick, & Stewart, 1998), more interpersonal helping behavior and lower counterproductive behavior (Gonzalez-Mule, Mount, & Oh, 2014), higher job satisfaction (Judge & Bono, 2001), and fewer intentions to quit (Zimmerman, 2008).

**Keeping an Open Mind.** Traditionally, this domain was not considered to be strongly relevant for performance-related outcomes, but this view is beginning to change. For example, components in this domain have recently been shown to predict achievement in elementary school (Poropat, 2009), college (Paunonen & Ashton, 2013), and medical school.<sup>10</sup> High levels of these components also predicted greater levels of continuous learning, appreciation for diversity and the arts, and interpersonal skills (McAbee et al., in press). In addition, intellectual curiosity was found to be a strong predictor of academic performance independent of intelligence (von Stumm, Hell, & Chamorro-Premuzic, 2011). In the work context, there has been increased emphasis on components in this domain, even calling out specific subtypes of work performance related to the behaviors underlying these components, such as adaptive performance (Pulakos et al., 2002) and change-related citizenship behaviors (Chiaburu, Oh, Berry, Li, & Gardner, 2011). A recent meta-analysis summarizing over 1,700 studies also found a fairly strong relationship between Keeping an Open Mind behaviors, such as being open to new ideas and curious about new topics, and job performance (Oh, Wang, & Mount, 2011). Finally, these components are unsurprisingly related to creativity and innovation in organizations (Hammond, Neff, Farr, & Schwall, 2011).

**Maintaining Composure.** Research on components in this domain has shown that being effective at tolerating stress, regulating emotion, and having confidence improves one's chances of success, both at school and at work. In academic contexts, components in this domain containing behaviors such as effectively managing stress and anxiety and making decisions without being overly reliant on others predict academic achievement and performance in K–12 students (Lounsbury, Gibson, Sundstrom, Wilburn, & Loveland, 2004; Poropat, 2009) and college students (Robbins, Lauer, Le, Davis, & Langley, 2004). These components also predict a wide range of work outcomes, including higher performance, more interpersonal helping behavior, lower counterproductive behavior, higher job satisfaction, and fewer intentions to quit (Gonzalez-Mule et al., 2014; Judge & Bono, 2001; Mount, Barrick, & Stewart, 1998; Zimmerman, 2008).

<sup>10</sup> Curiosity, in particular (Lievens, Ones, & Dilchert, 2009).

**Socializing with Others.** Research has found that this domain consistently predicts positive outcomes. In K–12 settings, components comprising this domain, including seeking out others' company and staying optimistic even when things go wrong, predict higher levels of academic performance and fewer instances of inappropriate interpersonal behavior such as yelling or pushing (Lounsbury et al., 2003). They have also been found to predict higher GPAs in college (Paunonen & Ashton, 2013). In particular, measures of Optimism predict better academic performance in K–12 students (Lounsbury et al., 2004; Poropat, 2009), as well as higher levels of performance and engagement in employees (Judge et al., 2013). In college settings, Optimism behaviors (e.g., being cheerful) have been shown to predict more continuous learning, adaptability and life skills, and perseverance (McAbee et al., in press). In workplace settings, components associated with the Socializing with Others domain predict higher job satisfaction (Judge & Bono, 2001), less emotional exhaustion (Alacron, Eschleman, & Bowling, 2009), and fewer intentions to quit (Zimmerman, 2008).

**Sustaining Effort.** In all the research on behavior, personality, and their correlates, aspects of this domain, including being motivated, organized, dependable, and self-controlled, have consistently been found to strongly relate to performance across all age groups. When examining effects in a number of individual studies on academic achievement, it was the only domain that consistently predicted achievement from elementary school all the way into college (Poropat, 2009). Further, this domain also turns out to be important for people moving into the workforce, as it has repeatedly been shown to be the strongest predictor of job performance after cognitive ability (e.g., Almlund et al., 2011; Schmidt & Hunter, 1998) and is consistently considered to be the most important behavior domain for work whether one is looking at predictors of performance, employer-desired attributes in employees, or skills required on the job (Sackett & Walmsley, 2014). In fact, the behaviors in this domain (such as exhibiting high effort and staying on task) predict a wide range of work outcomes, including higher performance and more voluntary “good citizen” behaviors (Judge et al., 2013), lower counterproductive behavior (Berry, Ones, & Sackett, 2007), higher job satisfaction (Judge & Bono, 2001), and fewer intentions to quit (Zimmerman, 2008). The Persistence component in particular, which includes overcoming challenges in the face of obstacles, maintaining effort, and focusing on tasks in the presence of distractions, predicts higher GPAs in college students (deVries et al., 2011) and in medical school students (Lievens, Ones, & Dilchert, 2009), as well as fewer counterproductive behaviors in college students (deVries et al., 2011). This component also predicts managerial performance, effort, and interpersonal effectiveness in work settings (Christiansen & Robie, 2011).

## Summary

In summary, the ACT framework and taxonomy of behavioral skills:

- Integrates research across multiple areas of psychology
- Includes general behavior domains as organizers and more specific behavioral skill dimensions as descriptors of behavior content useful for applied settings
- Applies to a broad range of ages, settings, and outcomes throughout the K–Career pipeline
- Is useful for articulating what individuals need to know and be able (and willing) to do to develop and thrive in education and workplace settings
- Contributes an important component to the ACT holistic model of education and work readiness

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## Education and Career Navigation

BECKY BOBEK AND RAN ZHAO<sup>11</sup>

The education and career navigation domain includes the personal characteristics, processes, and knowledge that influence individuals as they progress along their education and career paths (Patton & McMahon, 2006; Peterson, Sampson, & Reardon, 1991). Individuals gain adaptive advantages in the present and better education and career outcomes in the future when they have the inclination and know-how to make informed decisions, create achievable plans, and purposefully engage in motivated self-directed actions. Individuals who have an understanding of their own characteristics (interests, for example) and knowledge of the world of work and education, along with a variety of skills related to education and career exploration, decision making, and planning, are likely to have expanded opportunities (Zikic & Klehe, 2006), make decisions that better fit them (Hirschi, 2011; Tsabari, Tziner, & Meir, 2005), increase their motivation to learn and achieve (Bartley & Robitschek, 2000), and experience more positive outcomes in both school and work settings (Greenwood, 2008; Herman, 2010; Schiefele, Krapp, & Winteler, 1992).

Personal journeys through education and career pathways are often filled with challenges and obstacles, making progress difficult and compromise frequent. Students and workers, faced with a myriad of choices and courses of action, can struggle to set a course and navigate a path successfully. Some people end up in satisfying and successful careers on their own, others get assistance (e.g., from an educator or mentor), some may struggle and not make the most of their potential, and all too often many end up making choices that lead to unhappiness or failure. There are similar tasks most individuals complete to navigate education and career paths successfully, such as taking the right high school courses to prepare for college or work, selecting the postsecondary education setting that best meets their needs, exploring and choosing majors, deciding on and pursuing a specific occupation, and changing organizations and occupations during a work career. Many individuals make these choices without knowing the available options or how to make informed decisions and plans. Given the consequences of these decisions, it is critical for individuals to build the knowledge and skills that will help them navigate their education and career tasks effectively.

Many students and job seekers do not have the knowledge, skills, and preparation needed to set personally relevant, informed goals and formulate strategies to achieve them. According to the US Department of Education (2006), almost 90% of twelfth-grade students aspire to attend some form of college after high school, but only 67% of students will actually enroll in college the fall after graduating. This highlights a major discrepancy between what students aspire to and what they actually achieve. Of the 2013 ACT-tested graduating high school students who responded to whether they need help with education or occupation plans, 80% reported needing help (J. Radunzel, ACT personal communication, October 15, 2014). From 25-year-old young adults to graduating twelfth graders to eighth graders facing the transition to high school, individuals overwhelmingly express a desire and a need to have someone to talk to and a planning process they can participate in to help them navigate their education and career journey (Johnson, Rochkind, & Ott, 2011; Lapan, 2004).

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According to the American School Counselor Association (2013) and other leading national organizations (e.g., National Association for College Admission Counseling), there are serious and systemic barriers inhibiting individuals from getting the education and career guidance they need and want. For example, with a caseload of more than 400 students to every counselor in US public schools, there are few opportunities for one-on-one personalized career-guidance experiences. Counselors also have extremely limited time to focus on these navigation tasks because they are called upon to help students and their families deal with a wide range of pressing behavioral, mental health, and other life issues, not to mention nonguidance administrative tasks required to help overburdened public schools function (Lapan, 2013). The lack of opportunity to develop navigation-related knowledge and skills during students' K–12 schooling compromises their education (Whiston, 2002) and follows them into college and work, where they often lack direction or continue to experience stumbling blocks to navigating their pathways effectively.

## **Navigation Knowledge and Skills Important for Education and Workplace Success**

Education and career navigation is a complex process requiring different tasks across the K–Career continuum. The knowledge and skills needed to complete these tasks successfully are wide-ranging and may differ across a person's lifetime. Briefly, some of these involve individuals gaining insights into their own personal characteristics (e.g., interests, values, skills/abilities) and knowledge of the critical aspects of the transitions they are moving through and the options they are choosing among. Specific skills help individuals relate their own characteristics to important aspects of the environment and the decisions they face, while other skills are needed to successfully implement choices, evaluate progress, and adjust direction. In addition, there are signposts along this journey that help people know they are on a path that has the potential to lead to desired outcomes. Some of these signposts include being able to distinguish between what an individual likes and what he or she is good at, having thought about occupations one wants to pursue, and being confident in the ability to make a career decision that will be a good fit.

Research on education and career navigation provides some insights as to how different skills, personal characteristics, and other factors relate to a variety of education outcomes. Students who have interests in the academic subjects they are studying have higher grades and are more likely to persist in school (Allen & Robbins, 2008). High school students who seek out college information to learn about their education options are more likely to enroll in college (Plank & Jordan, 2001). College students who choose majors that are a good fit based on their interests have higher GPAs and are more likely to persist in college and complete their degrees in a timely manner (Tracey & Robbins, 2006). College students are also more likely to persist and obtain degrees when they are more certain about their educational goals (Allen & Robbins, 2008). College students are more satisfied with their college experience when they attend institutions that better fit them socially, academically, and physically (Bowman & Denson, 2014; Wintre et al., 2008).

Research also points to the importance of specific navigation-related factors for predicting work outcomes. In one study, unemployed individuals who participated in a focused career planning process that included exploratory job search strategies increased their quality of reemployment and job satisfaction compared to individuals who did not take this approach (Koen, Klehe, Van Vianen, Zikic, & Nauta, 2010). Individuals who have knowledge of and engage in effective job search behaviors obtain more job interviews and receive more job offers leading directly to employment



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(Werbel, 2000). Individuals who enter jobs that better fit them have both higher job performance and greater job satisfaction (Oh et al., 2014). Once in jobs, individuals' confidence about their ability to perform work tasks effectively has a positive influence on salary and tenure (Chang, Ferris, Johnson, Rosen, & Tan, 2012).

## **Importance of Navigating the Education and Career Journey**

As individuals progress through their education and career pathways, navigation plays a key role in facilitating their opportunities and successful transitions. Positive effects accumulate when attention to navigation knowledge and skills begins early, is intentional, and becomes a personally relevant commitment. For early elementary school students, exploration of nontraditional careers can decrease the possibility of foreclosing too soon on occupation options that have historically been sex-typed along traditional gender lines (Hartung, Porfeli, & Vondracek, 2005; Watson & McMahon, 2005). Navigation factors, such as exploration of potential careers, academic and career-related self-efficacy beliefs, and initial goal orientations, form early, become more tailored to individuals' personal characteristics, and are thought to play key gatekeeper roles at critical transitions and developmental milestones (Lent & Brown, 2013). For example, exploratory actions are a precondition to identifying one's career direction, and limited exploration can delay or impede making informed choices about high school, college, or work.

Research also suggests that making plans during the middle school years starts the process of developing realistic career plans later and encourages postsecondary planning (Noeth & Wimberley, 2002). High school students who have career goals are more likely to engage in meaningful planning related to those goals (Rogers, Creed, & Ian Glendon, 2008). Further, high school students who are intentional about planning for college (e.g., finding help with the college application or writing the college essay) are more likely to follow through with the application process required for college admission (Cabrera & La Nasa, 2001). Research by Saks and Ashforth (1999) also shows that planning related to preparatory job-search behaviors (e.g., finding job information, identifying job leads) among graduating college students is positively correlated with obtaining employment four months after graduation. The planning aspects of navigation help facilitate a successful transition whether it is getting into college or finding a job.

The emergence of a global economy, changing technology, and the need for more advanced skills require students to be better informed about their postsecondary education or training decisions (e.g., college majors). According to the Georgetown University Center on Education and the Workforce, nearly two-thirds (63%) of US jobs are projected (through 2018) to require postsecondary education (Carnevale, Smith, & Strohl, 2010). Further, postsecondary education is directly related to increased income. In 2012, median annual wages for individuals with a high school diploma were \$35,170, while individuals with an associate's degree earned \$57,590 annually, and these earnings increased with additional postsecondary education (Bureau of Labor Statistics, 2012a). Thus, individuals who make the decision to pursue education beyond high school increase their available occupational opportunities and their earning potential.

Informed decisions about college majors are also important. College students who change their majors multiple times spend more time in college earning their degrees (Filce, 2010). Each additional year required to complete a four-year degree may cost an average of \$46,000 when tuition and lost wages are considered (Lippman et al., 2008). College students who select majors that fit their

interests are less likely to change college majors (Allen & Robbins, 2008), which is also the case for students who are more decided about the direction of their career paths (Restubog, Florentino, & Garcia, 2010).

In summary, there is strong evidence supporting the importance of navigation knowledge and skills for helping individuals progress along their education and career pathways.

## Education and Career Navigation Framework

The education and career navigation framework is a comprehensive structure designed to facilitate identification and organization of the knowledge, skills, and other factors needed to help individuals make informed, personally relevant decisions and build actionable, achievable plans. The theoretical, empirical, and intervention literatures in this area provide a variety of perspectives on what contributes to effective navigation. Existing US and international navigation-related standards and assessments offer additional insights into what is important for education and career success. This framework integrates these different perspectives and sources of information into a holistic taxonomy that provides a guide for what individuals should know and be able to do to navigate their education and work paths effectively.

Together, the four dimensions at the highest level of the navigation taxonomy (see Table 7) capture the broad areas critical to effective navigation. Navigation can be thought of as a process that requires ongoing acquisition of knowledge about oneself and the environment (Self-Knowledge and Environmental Factors), informed personally relevant education and career decision making and planning (Integration), and the implementation and negotiation of actions (Managing Career and Education Actions) that facilitate progress throughout one's education and work life (Patton & McMahon, 2006; G. W. Peterson et al., 1991; Super, 1990; Savickas, 2002, 2005).

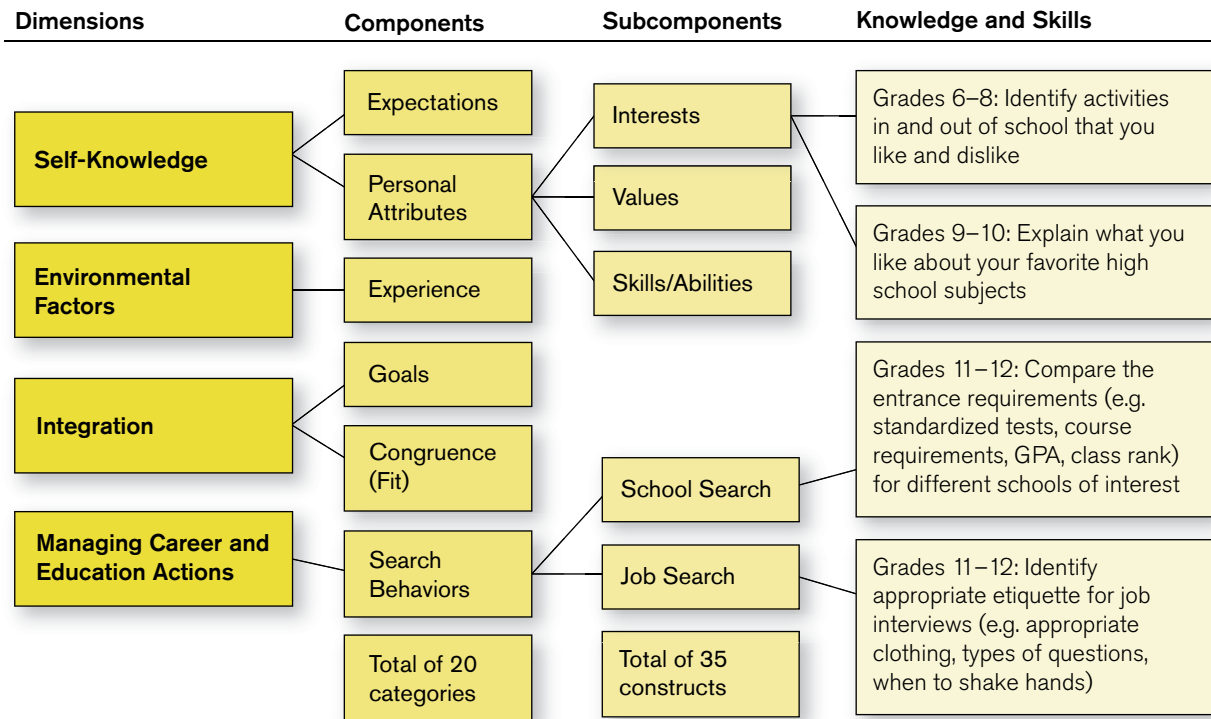
**Table 7. Education and Career Navigation and Definitions**

| Dimension                             | Definition   |
|---------------------------------------|--|
| Self-Knowledge                        | Perceptions of one's own abilities, interests, skills, values, attitudes, and beliefs that contribute to understanding the self  |
| Environmental Factors                 | Information, conditions, and experiences related to education and work that are acquired primarily from external sources and surroundings  |
| Integration                           | Ongoing process of combining self-knowledge and environmental factors to form personally relevant knowledge structures used to evaluate information and to plan courses of action pertaining to education and work |
| Managing Career and Education Actions | Ongoing process of implementing plans and enacting purposive behaviors that facilitate education and occupation progress   |

An effective navigation process requires individuals to become aware of the conditions and choices that confront them and that sensitize them to the need for relevant education- or career-related activities (Hirschi & Läge, 2007; Van Esbroeck, Tibos, & Zaman, 2005). It is also necessary for individuals to develop an accurate understanding of themselves (e.g., personal characteristics and beliefs) and the world of work or education (Germeijs & Verschueren, 2007; G. W. Peterson et al.,

1991). These are reflected in the Self-Knowledge and Environmental Factors dimensions. Both of these dimensions are essential for providing guidelines by which individuals evaluate whether choices are personally relevant and realistic (Herr, Cramer, & Niles, 2004). Next, individuals integrate information about themselves and the environment through exploring and building goals, which allows for making better-informed comparisons and personally relevant choices among education or work alternatives (Gati & Asher, 2001; Hirschi & Lage, 2007). While education and career decisions are a major part of the navigation process, this process would be incomplete if it stopped there. Effective navigation must also include translating choices into achievable plans and purposeful actions as well as developing strategies to implement one's choices—a process that further motivates action. The Managing Career and Education Actions dimension sets in motion efforts to implement one's plan and achieve personal goals. This dimension also focuses on the process of adaptation and maintenance after achieving an education or work goal such as attending a college of choice or obtaining a job (Hershenson, 2005).

Each of the four broad dimensions is made up of a set of hierarchically organized components, subcomponents, and finally, at the most specific level, navigation knowledge and skills. (Figure 8 illustrates the hierarchical organization of the navigation framework.) This structure allows for connecting broader concepts to the specific skills that facilitate effective education and career navigation and comparison across important transitions.



**Figure 8.** Illustration of ACT's Hierarchically Organized Education and Career Navigation Framework

The complete framework is made up of 20 components and 35 subcomponents. Table 8 organizes the components (subcomponents) and component definitions by the four broad dimensions.

**Table 8.** Components (Subcomponents) in the Education and Career Navigation Framework

| Dimension  | Component (Subcomponent)   | Definition   |
|--|--|--|
| <b>1. Self-Knowledge</b><br>(Perceptions of one's own abilities, interests, skills, values, attitudes, and beliefs that contribute to understanding the self)                  | <b>Awareness</b><br>(Self-Awareness, Education/Work Awareness, Gap Awareness)  | States of perceiving, feeling, or being conscious of oneself, education, work, and the gaps among them   |
|  | <b>Personal Attributes</b><br>(Interests, Values, Skills/Abilities, Personality)   | Relatively stable individual differences in characteristics that contribute to one's thoughts, decisions, and behaviors  |
|  | <b>Attitudes</b><br>(Attitudes toward Work, Attitudes toward Education, Attitudes toward Career/Education Development)                 | Stable evaluations of people, objects, events, activities, and ideas that are manifested as feelings, beliefs, or positions  |
|  | <b>Expectations</b>  | Anticipatory beliefs about the causes or consequences of education- or work-related decisions and actions (e.g., ability to positively influence one's own occupation choice, belief that going to college will result in more job options later)  |
|  | <b>Self-Efficacies</b>   | Confidence in one's ability to complete specific tasks related to identifying occupation and educational goals and accomplishing academic or career tasks successfully   |
| <b>2. Environmental Factors</b><br>(Information, conditions, and experiences related to education and work that are acquired primarily from external sources and surroundings) | <b>Education and Work Knowledge</b><br>(Work-Related Knowledge, Education-Related Knowledge, Fundamental Career Development Knowledge) | Specific information about the world of work and occupations, education, and training, and fundamental information applicable to developing and navigating one's education and work path   |
|  | <b>Supports</b>  | Environmental events or conditions that facilitate efforts to develop and navigate one's education or career (e.g., people who provide assistance based on their knowledge and skills, organizations providing assistance through programs and services, and people who provide reassurance and encouragement) |
|  | <b>Barriers</b>  | Environmental events or conditions (e.g., pressure from family, friends, expectations of peers, attitudinal, policy, financial, gender, cultural, physical, socioeconomic, access to resources, language) that impede progress toward one's education or career goals  |
|  | <b>Experience</b>  | Activities, paid or unpaid, in which the individual gains knowledge, skills, and attitudes that are relevant to education or work  |

**Table 8** (continued)

| Dimension  | Component<br>(Subcomponent)  | Definition  |
|--|--|---|
| <p><b>3. Integration</b><br/>(Ongoing process of combining self-knowledge and environmental factors to form personally relevant knowledge structures used to evaluate information and plan courses of action pertaining to education and work)</p> | <p><b>Identity Formation</b><br/>(Differentiation, Synthesis)</p>                    | <p>Process of recognizing individual and distinct characteristics that define oneself and using these characteristics in combination when evaluating education and career information and making education/career decisions</p>   |
|  | <p><b>Exploration</b></p>  | <p>Seeking and processing education and occupation information guided by knowledge of the self (e.g., identifying specific occupations that are of interest to you)</p>   |
|  | <p><b>Goals</b></p>  | <p>Ideal, provisional aspirations or realistic and specified future education or career activities an individual wants to pursue</p>  |
|  | <p><b>Career and Education Decision Making</b></p>                                   | <p>Process of making informed education- or occupation-related choices (using appropriate and effective decision-making strategies) under varied conditions (including difficulties related to indecision, a lack of certainty about one's choice, and decision-making anxiety)</p> |
|  | <p><b>Congruence (Fit)</b></p>   | <p>Degree to which an individuals' personal characteristics are similar to or compatible with the corresponding characteristics of the chosen environment (e.g., college major program of study, occupation, job, organization)</p>   |
| <p><b>4. Managing Career and Education Actions</b><br/>(Ongoing process of implementing plans and enacting purposive behaviors that facilitate education and occupation progress)</p>  | <p><b>Relational Behaviors</b><br/>(Socialization, Feedback Seeking, Networking)</p> | <p>Self-initiated behaviors in relation to others that facilitate understanding different aspects of the environment and further an individual's progress toward education or work goals</p>  |
|  | <p><b>Roles</b><br/>(Role Salience, Role Clarity, Role Balance)</p>                  | <p>Understanding and managing identified life roles</p>   |
|  | <p><b>Search Behaviors</b><br/>(Job Search, School Search)</p>                       | <p>Self-initiated behaviors that pertain to seeking admittance to a particular education institution or employment at a particular work organization</p>  |
|  | <p><b>Implementation</b></p>   | <p>Ongoing actions that take place to execute, monitor, and evaluate one's plan for achieving goals (e.g., collecting and analyzing information to track progress, comparing one's plan to what has been accomplished)</p>  |
|  | <p><b>Lifelong Learning</b></p>  | <p>Extent to which an individual engages in ongoing behaviors to develop competence by acquiring new skills and knowledge and mastering new situations</p>  |

## Education and Career Navigation: Framework Support

Leading career development theories lend support to the inclusion of the various components (subcomponents) in the navigation framework. Person–environment fit and correspondence theories (e.g., Dawis & Lofquist, 1984; Holland, 1959, 1997) postulate specific concepts that interact to influence career choice and satisfaction. For Holland, these include similarities and differences between personal attributes (personality and interests) and the attributes of vocational environments whereby the degree of match or congruence between these attributes influences important vocational outcomes, such as job choice, performance, satisfaction, and turnover. The Theory of Work Adjustment (Dawis, 2005) argues that job satisfaction and performance are inextricably linked to the relationships between personal characteristics (needs, values, and skills) and environmental characteristics (available rewards and needed skills and abilities).

From a different theoretical perspective, Super's (1990) life-stage career development theory focuses on the development and implementation of the self-concept through vocational tasks that involve the understanding of personal attributes during the exploration stage, making choices consistent with those attributes, being planful, and pursuing goals. For Super, implementing the self-concept is instrumental not only to identity development, but also to later satisfaction. Super (1990) also emphasizes contextual influences on this development, including the salience of life roles such as worker, student, parent, and so forth, and role conflicts in the life space and across the life span. The combination of roles a person assumes changes over time, which requires individuals to clarify and balance those roles based on which roles are more or less important at a given time.

Gottfredson's (1981) Theory of Circumscription and Compromise is a process model of career choice guided by important influences on the self-concept, such as occupational perceptions, sex-role norms and attitudes, social class and status, and the development of personal attributes, that intersect with the realities of the world of work to shape individuals' choice options. For Gottfredson, there is a dynamic interplay between the individual and the environment. Children are influenced more by external factors (e.g., social class) than internal factors (e.g., interests) as they eliminate occupation alternatives, while internal factors become more prominent in determining occupation fit for adolescents. This theory also addresses external realities and constraints (e.g., available jobs in a desired geographic area) by suggesting that individuals will accommodate what they wish to do given what is realistically achievable, and compromise on their occupational compatibility on one factor (e.g., interests) to maintain greater fit with another factor (e.g., values).

Social Cognitive Career Theory (Lent, 2013b) seeks to explain how vocational interests develop and how individuals make education and career choices through the interplay of self-efficacy beliefs, outcome expectations, and personal goals. The relationship between these constructs also works to influence performance and satisfaction, according to this theory. Regarding interests, individuals who engage in activities they believe they can accomplish (self-efficacy) and anticipate such participation will produce a valued outcome and are likely to prefer those activities. Interest in particular activities encourages personal goals or intentions to continue involvement in these activities, and choices are often linked to interests. However, when interests are constrained by environmental conditions, choices will be influenced by available options, resources, self-efficacy beliefs, and outcome expectations (Lent, 2013a).

The above theories emphasize constructs represented by the components and subcomponents included in the navigation framework. Additional information used to inform which components (subcomponents) to include in the navigation framework was drawn from national and international

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standards, guidelines, and competencies derived from numerous sources that provide navigation-related information (e.g., National Career Development Guidelines, 2004; Australian Blueprint for Career Development, 2010; International Association of Educational and Vocational Guidance, 2004; American School Counselor Association, 2012; McREL, 2014; European Qualifications Framework, 2005; Council for Accreditation of Counseling and Related Educational Programs, 2009; Stein, 2000; International Labour Office, 2002). A majority of these sources focus on a variety of common themes that pertain to the education and career navigation framework including, but not limited to, academic and technical skills/abilities, beliefs, knowledge of education and the workplace, skills to explore career options, making choices and plans, securing and maintaining work, and ongoing learning.

Important components (subcomponents) in the framework were also identified by examining navigation-related assessments that have been developed to test relevant theories and to facilitate and evaluate interventions.<sup>12</sup> A bridge between theory and practice, these assessments provide support for key components (subcomponents) that influence the real-world questions and circumstances confronting many individuals. These instruments frequently assess personal attributes (including interests, skills/abilities, and values), domain-specific self-efficacies related to making career decisions and searching for jobs, supports and barriers, career decision making, and different aspects of congruence (fit) such as person–organization fit and person–job fit. Multidimensional assessments capture role salience, attitudes, self-efficacy, action planning, exploration, career identity, and implementation, which are part of the navigation framework.

## Linking Education and Career Navigation Subcomponents to Outcomes

Subcomponents included in this framework demonstrate empirical relationships to important proximal and distal outcomes in education and work. To illustrate these relationships, sample subcomponents from each of the four dimensions are briefly discussed below.

### Self-Knowledge: Interests and Self-Efficacies

**Interests.** Interests are useful for predicting and understanding academic and vocational outcomes. Domain-specific interests have been shown to predict domain-specific academic achievement throughout elementary, middle, and high school, as well as during postsecondary education (Schiefele et al., 1992). For example, middle school students who are interested in the academic subject of mathematics are more likely to pursue and experience higher achievement in mathematics-related activities (Fouad & Smith, 1996; Köller, Baumert, & Schnabel, 2001). Interest in specific occupations contributed to higher expectations for achieving later success and more positive work-related attitudes in high school seniors (Jung & McCormick, 2011). Vocational interests predict high school and college students' choice of college majors (Diemer, Wang, & Smith, 2010) as well as their career goal intentions (Hulleman, Schrager, Bodmann, & Harackiewicz, 2010). Interest in work tasks predicts employee job knowledge (Van Iddekinge et al., 2011a), effort (Fisher & Noble, 2004), and performance (Nye et al., 2012).

<sup>12</sup> Some of these assessments include the ACT Interest Inventory (ACT, 2009), Strong Interest Inventory (Donnay, Morris, Schaubhut, & Thompson, 2005), Self-Directed Search (Holland, Fritzsche, & Powell, 1994), Work Values Inventory (Super, 1973), Work Aspect Preference Scale (Pryor, 1983), Inventory of Work-related Values (Bobek & Gore, 2001), Career Decision-Making Self-efficacy Scale (Betz, Klein, & Taylor, 1996), Parental Career-related Behaviors (Dietrich & Kracke, 2009), Perception of Barriers Scale (McWhirter, 1997), Decisional Process Inventory (Hartung, 1995), Organizational Culture Profile (O'Reilly, Chatman, & Caldwell, 1991), Career Adapt-Abilities Scale (Savickas & Porfeli, 2012, ), and the Job Search Attitude Inventory (Liptak, 1994).

**Self-Efficacies.** Self-efficacies, or beliefs in one's ability to accomplish academic- or career-related tasks have been shown to repeatedly and robustly predict diverse outcomes. Throughout individuals' education journeys, academic self-efficacy has been empirically shown to be one of the most important factors influencing academic achievement (Multon, Brown, & Lent, 1991), expectations (Chemers, Hu, & Garcia, 2001), and retention (Robbins et al., 2004). Starting in middle school, career goal self-efficacy has been shown to predict career choice readiness (Hirschi, 2011) and to later influence individuals' career aspirations (Ali & Saunders, 2009) and career engagement (Hirschi, 2013). During the job search process, an individual's job search self-efficacy is positively related to job interviews and job offers (Saks, 2006).

### **Environmental Factors: Supports**

Several researchers (e.g., Lent, Brown, and Hackett, 2000; McWhirter, Crothers, & Rasheed, 2000) have pointed to the importance of contextual supports for promoting positive career outcomes and empowering individuals to overcome perceived barriers. Supports available in the immediate context of family, school, or workplace represent potential resources individuals can access. Parental supports have been found to positively influence education and career outcomes, especially during childhood and adolescence (e.g., students' aspirations, school engagement, general well-being, and life satisfaction; Hill et al., 2004; Lokes, Gingras, Philippe, Koestner, & Fang, 2010). In the context of school settings, general school and classroom support increase students' engagement from elementary school (Marks, 2000) through postsecondary (Van Ryzin, Gravely, & Roseth, 2009) and enhance students' academic achievement and retention (Robbins et al., 2004; Roseth, Johnson, & Johnson, 2008). At the workplace, coworker support and organizational support contribute to increased work performance and career and job satisfaction (Cole, Walter, Bedeian, & O'Boyle, 2012; Maurer & Chapman, 2013; Rhoades & Eisenberger, 2002).

### **Integration: Goals, Decision Making, Congruence**

**Goals.** Setting goals leads to better outcomes. For example, Lent, Brown, & Hackett's (1994) choice goal predicts choice behaviors (Cunningham, Bruening, Sartore, Sagas, & Fink, 2005). In the field of educational and vocational psychology, empirical studies have shown that career goals promote career exploration and planning during high school (Rogers & Creed, 2011; Rogers et al., 2008). Academic goals predict GPA and retention in college (Robbins et al., 2004).

Other goal concepts are mastery goal or learning goal orientation, which focuses on learning and self-improvement, and performance goal orientation, which represents demonstrating ability and not appearing worse than others (Ames, 1992; Dweck & Leggett, 1988). The goal intention to learn (learning goal orientation) increases students' interests in coursework during high school and college (Church, Elliot, & Gable, 2001; Spera & Wentzel, 2003). Further, learning goal orientation contributes to increased career exploration and decision-making behaviors during college (Creed, Fallon, & Hood, 2009). For employees, both learning and performance goal orientations predict increased feedback-seeking behavior (Anseel et al., 2013; Van der Rijt, Van den Bossche, van de Wiel, Segers, & Gijssels, 2012).

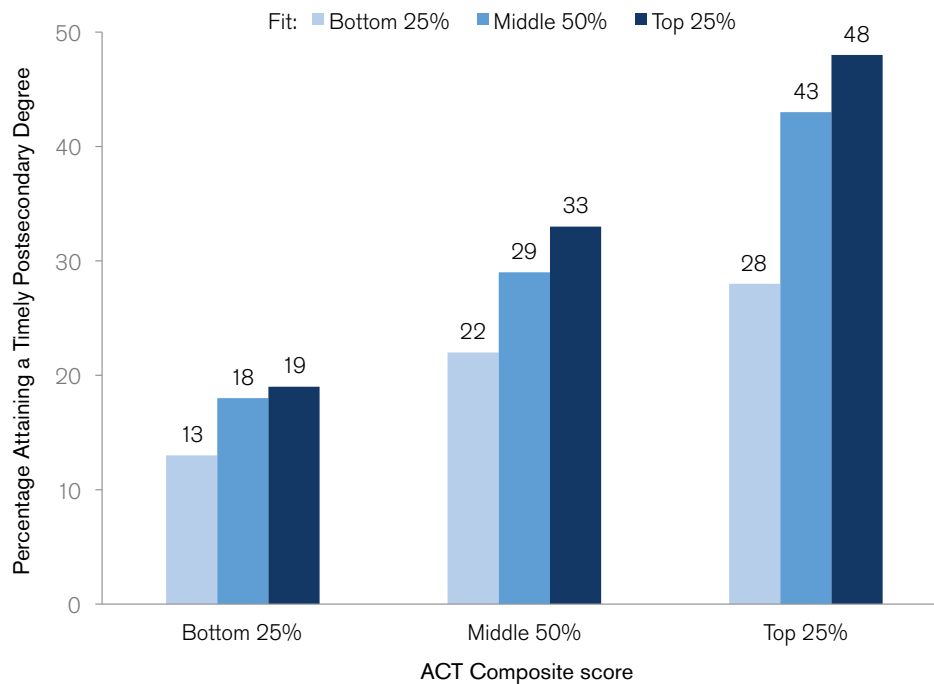


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**Decision Making.** The importance of the career decision-making process has made this component a major focus of inquiry in theory and research, as well as central to career development and guidance. The concept has been studied from a variety of perspectives, such as cognitive, social cognitive, mathematical, and social learning. Research on career decision making has generally examined college major choice, career or vocational choice, and choice as it relates to different roles (Gati, 1984; Lent et al., 1994; Phillips & Strohmer, 1982). Individuals who perceive themselves as efficacious in their decision-making ability are more engaged in career exploration and planning activities during high school (Ochs & Roessler, 2004) and to have lower career indecision and greater career-choice commitment during college and in the workforce (Choi et al., 2011; Metz, Fouad, & Ihle-Helledy, 2009; Wang, Jome, Haase, & Bruch, 2006). Moreover, a growing theme in the literature on decision making is the notion that effective career decision making will be related to better person–environment fit and academic and career satisfaction. For example, a more informed decision-making process among unemployed people was shown to increase the certainty of career decisions and, in turn, to increase reemployment job satisfaction and employment quality and decrease turnover intentions (Koen et al., 2010).

**Congruence (Fit).** Extensive research has also been conducted on the component of Congruence (Fit). Evidence is clear that the degree of similarity, or compatibility, between personal characteristics and environmental characteristics is related to a range of education and work outcomes. For example, the fit between individuals and their college majors is related to persistence in those majors (Allen & Robbins, 2008; Tracey & Robbins, 2006) and satisfaction with college (Bowman & Denson, 2014). For college students entering the workforce, perceived fit with potential work opportunities predicts positive job attitudes (Saks & Ashforth, 2002). Meta-analyses show that fit with one's job, in terms of the characteristics of the person and those of the job or the tasks performed in the job, relates to increased work commitment, satisfaction, and decreased intentions to quit (Kristof-Brown, Zimmerman, & Johnson, 2005; Resick, Baltes, & Shantz, 2007). Fit with one's organization is also associated with greater commitment, performance, and satisfaction and is also related to positive coworker relationships and decreased stress (Greguras & Diefendorf, 2009; Kristof-Brown et al., 2005; Oh et al., 2014; Van Hooft, Born, Taris, & Van der Flier, 2006).

Research using the ACT Interest Inventory supports these relationships between person–environment congruence and success-related outcomes. A series of investigations suggest that interest–major congruence is related to college GPA (Tracey & Robbins, 2006) and other college stability and success outcomes, such as college or major persistence (Allen & Robbins, 2010; Tracey & Robbins, 2006), degree attainment (Allen & Robbins, 2010), and retention (Allen & Robbins, 2008; Leuwerke, Robbins, Sawyer, & Hovland, 2004; Tracey & Robbins, 2006). While the Allen and Robbins (2010) study shows that interest–major congruence has a direct effect on timely degree completion, it also shows that both academic achievement and interest–major fit contribute to degree attainment. Figure 9 illustrates the probability of attaining a college degree in a timely manner for students with different levels of academic achievement (measured by ACT Composite score) and different levels of interest–major fit. Degree attainment increases as both ACT Composite scores and level of interest–major fit go up. Importantly, this is the case even for those students whose ACT scores are in the bottom 25% percentile.



**Figure 9.** Percentage of Students Attaining a Timely Postsecondary Degree by ACT Scores and Interest–Major Fit

Research at the workforce level suggests that interest–occupation congruence is associated with higher self-reported earnings (Neumann, Olitsky, & Robbins, 2009) and desirable work attitudes and outcomes (Swaney et al., 2012). Furthermore, interests examined using the ACT Interest Inventory revealed a fairly stable pattern and similarities across racial/ethnic groups and for both genders, supporting the applicability of interest–environment congruence across diverse populations and a range of outcomes (Tracey & Robbins, 2005).

### Managing Career and Education Actions: Role Clarity

Role clarity is yet another example of an important navigation subcomponent supported by research. A clear and thorough understanding of work roles enables employees to perform their job tasks and work responsibilities more effectively (Carver & Scheier, 1998). Organizations that provide reliable, accurate, and complete information to employees are more likely to increase their employees' job knowledge (Kammeyer-Mueller & Wanberg, 2003). Role clarity leads to higher levels of self-efficacy, social acceptance, job satisfaction, work commitment, and intentions to remain in the job (Bauer, Bodner, Erdogan, Truxillo, & Tucker, 2007).

## Summary

Education and career navigation is essential to providing a more holistic view of individuals, focusing on acquiring, combining, and using knowledge about the self and environmental factors to purposefully and actively achieve goals. The education and career navigation framework is grounded in extensive theoretical, empirical, and intervention research support, as well as information

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from standards, assessments, and experts. This navigation framework includes components and subcomponents that are important across the K–Career continuum, although their relative importance can vary depending on individual circumstances. Research clearly shows that navigation contributes to a wide range of education and work outcomes and helps individuals progress throughout their education and career journey.

## Toward an Integrated Framework of Education and Work Readiness

JEREMY BURRUS AND KRISTA MATTERN

It is important not only to identify factors within each broad domain that are important for success but also to understand how these factors work together across domains to jointly influence education and work readiness and success. In this section, we discuss the interrelation of these broad domains to influence on education and work readiness and success. A holistic model of education and work success requires specification of the theoretical and empirical relationships among these broad domains. Although much work is left to be done, extant research and theory have identified points at which the constructs located in the core academic skills, cross-cutting capabilities, behavioral skills, and education and career navigation skills domains are related to each other, as well as points at which they have potential to be complementary. Most of the relevant research and theory has focused on individual differences or traits such as cognitive ability, personality, and interests rather than behaviors and skills.

### Relationship among Traits Relevant to Readiness

#### Interests and Personality

From both a theoretical and empirical perspective, vocational interests provide some of the clearest relations among these diverse constructs. For instance, the finding that highly extraverted people are more interested in social occupations than are introverted people is both logical and confirmed by meta-analyses (e.g., Ackerman & Heggstad, 1997; Barrick, Mount, & Gupta, 2003; Larson, Rottinghaus, & Borgen, 2002). These studies found an even stronger relationship between extraversion and enterprising interests ( $r_s = .35$  to  $.48$ ). Extraversion is linked to dominance and persuasiveness, and enterprising interests are related to occupations typically associated with influence and persuasion (e.g., sales). Conscientiousness, the personality dimension that is most predictive of success both at school (Poropat, 2009) and at work (Sackett & Walmsley, 2014), is related to both conventional ( $r_s = .19$  to  $.25$ ) and enterprising interests ( $r_s = .22$  and  $.27$ ; see Barrick et al., 2003, for an exception). In addition, meta-analyses have consistently demonstrated that openness is related to artistic ( $r_s = .24$  to  $.48$ ), investigative ( $r_s = .21$  to  $.42$ ), and social interests ( $r_s = .12$  to  $.31$ ). This seeming relationship of openness to generalized interest may have important implications for development.

#### Interests, Cognitive Ability, Knowledge

Interests have weaker empirical relationships with general cognitive ability (i.e., fluid intelligence) than they do with personality, with social, enterprising, and conventional interests demonstrating small negative relationships (e.g., Ackerman, 2000; Ackerman, Bowen, Beier, & Kanfer, 2001). The relationship of interests to cognitive ability and knowledge is, however, larger for specific abilities and specific interests. Once again, these relationships follow a logical structure. For example, realistic and investigative interests have significant relationships with numerical and spatial abilities, and artistic interests have significant relationships with music and verbal ability and with knowledge

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of the humanities (Ackerman, 2000; Ackerman et al., 2001; Ackerman & Heggestad, 1997). Furthermore, realistic and investigative interests have significant relationships with knowledge of physical science (Ackerman, 2000; Ackerman et al., 2001).

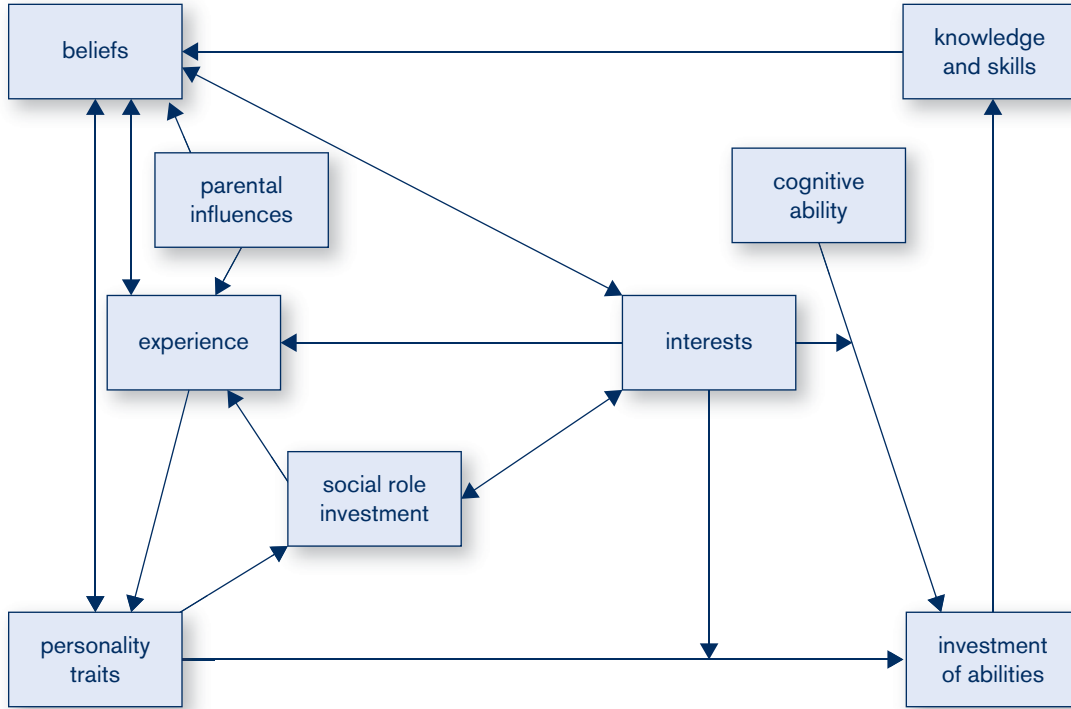
Interests are more strongly related to self-assessments of ability than to measures of cognitive ability. For example, in a meta-analysis consisting of samples of college students (and older), Lent, Brown, and Hackett (1994) found that interests were correlated with self-efficacy at .53. In a study of elementary and middle school students, Tracey (2002) examined the relation of interests (e.g., I like doing math problems) and competency beliefs (e.g., I'm good at doing math). Interests were highly related to their corresponding competency beliefs. Correlations ranged from .59 to .83, and all correlations but the enterprising interest/competence relationship for middle school students reached at least .70. These correlations approached the square root of the reliabilities of the assessments ( $\alpha = .63$  to  $.85$ ), suggesting almost complete overlap of interests and competency beliefs. As with the openness–interest relationship, this has implications for development.

### **Personality, Cognitive Ability, Knowledge**

In general, personality shows small to no relationship to general cognitive ability and knowledge (Ackerman, 2000; Ackerman et al., 2001; Ackerman & Heggestad, 1997) and predicts performance incrementally over cognitive ability (especially conscientiousness; e.g., Schmidt & Hunter, 1998). Openness, sometimes referred to as intellect (e.g., Digman, 1990), is an exception, however, because it has been shown to be significantly related to cognitive ability (Ackerman et al., 2001; Ackerman & Heggestad, 1997; Kanfer, Wolf, Kantrowitz, & Ackerman, 2010). It is more highly related to crystallized intelligence than to fluid intelligence, suggesting that it in some way may motivate the acquisition of knowledge (Ackerman et al., 2001; Ackerman & Heggestad, 1997). Consistent with this supposition, openness relates positively to measures of knowledge, such as knowledge of physical science, biology, humanities, and civics (Ackerman et al., 2001). In contrast, extraversion tends to be negatively related to these knowledge measures (Ackerman et al., 2001). Finally, we might predict that conscientiousness is related to knowledge, given the fact that conscientiousness predicts academic performance (e.g., Poropat, 2009) and learning (e.g., Colquitt & Simmering, 1998).

### **Development of Education and Work Readiness: Investment and Reciprocal Influence**

As interests, cognitive ability, and patterns of behavior develop concomitantly, they may also mutually influence each other's development. Figure 10 provides a graphical display of this thesis. Investment theory addresses some of these issues (e.g., Ackerman, 1996; Cattell, 1971; Schmidt, 2014; Von Stumm & Ackerman, 2012). Originally introduced by Cattell (1971), the investment theory of intelligence proposes that one has an allowance of general cognitive ability that one can choose to "invest" in the development of specific abilities, skills, and knowledge. Research suggests such investments are often determined by interests (e.g., Ackerman, 1996). For example, a person who is interested in mathematics will develop mathematical knowledge by investing his or her cognitive ability into studying mathematics.



**Figure 10.** Graphical Display of Reciprocal Development of Interest, Cognitive Ability, and Personality

Cognitive ability and interests reciprocally influence each other such that people tend to become more interested in what they are good at or what they think they are good at (e.g., Barak, 1981; Tracey, 2002). Although self-rated abilities are significantly correlated with actual abilities, the relationship is not strong (Mabe & West, 1982). As such, beliefs influence the development of interests in two ways: first, beliefs about need fulfillment influence initial interest development (for example, the belief that being around other people when one is working can help satisfy the need to belong and may influence the development of social interests); second, beliefs about one's own abilities influence subsequent interest development (e.g., Savickas, 1999).

Personality may also influence the development of abilities, skills, and knowledge in several ways. First, those who are highly conscientious put more effort into learning and thus develop more abilities, skills, and knowledge. Again, we would predict that the decision of where to invest one's effort would be determined by interests. Second, those who are introverted tend to develop more knowledge than those who are extraverted (e.g., Matthews, 1997; Schmidt, 2014). Third, some personality traits may guide the investment of cognitive ability (von Stumm & Ackerman, 2012). Traits such as openness and typical intellectual engagement (TIE) "capture individual differences in the desire to comprehend and engage in intellectual problems" (von Stumm & Ackerman, 2012, p. 843). Such traits have also been shown to be positively correlated with acquired knowledge (von Stumm & Ackerman, 2012). Interestingly for the purposes of the current discussion, whereas von Stumm and Ackerman refer to TIE as a personality dimension, Schmidt (2014) refers to TIE as simply a very broad form of interests (an interest in learning about many things).

Research suggests that personality change can result from changes in roles, expectations, and demands. Similar to the investment of abilities, *social investment* is defined as "investment in,

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and commitment to, adult social roles" (Lodi-Smith & Roberts, 2007, p. 68). Clearly, personality, interests, and cognitive ability are major determinants of at least one's work role. People tend to choose occupations they feel fit their personality and interests, and their choices are constrained by their levels of academic and cross-cutting cognitive skills. According to neo-socioanalytic theory (Roberts & Wood, 2006), investment in work roles should lead to changes in personality traits. As one's role changes, it is likely to impact one's identity (how one views him- or herself) and reputation (how one is viewed by others), which can then influence personality. For example, the transition from college to the workforce would influence one's identity and reputation. Consistent with this prediction, one meta-analysis found that work investment is related to changes in conscientiousness, agreeableness, and emotional stability (Lodi-Smith & Roberts, 2007).

### **Theoretical Functional Differences**

The notion of investment (both ability and social investment) suggests that cognitive ability, personality, and interests function differently but collectively facilitate the navigation of education and career decisions. Cognitive ability is a major determinant of what one knows and is able to do. More specifically, it may represent an upper limit on how much one is ultimately able to know and do. Academic skills, as reflected in the concept of crystallized intelligence, can be considered a subset of cognitive ability. Personality, at least its behavioral components, is what one actually does. In a broad sense, it also partially serves to motivate general behavior. For example, a conscientious person will be motivated to work hard *in general*, and a person who is high in openness will be motivated to learn facts *in general*. Interests serve to determine specific activities surrounding what one is willing and/or prefers to do. They direct attention to particular activities and partially determine the intensity with which one engages in those activities (Rounds & Su, 2014). Whereas conscientious people may be motivated to work hard in general, a person with investigative interests will be motivated to work hard in specific investigative tasks. To be sure, these are oversimplifications of the functions of these three broad constructs. However, given the state of research and theory on the interaction of these three areas, such a simplification represents a solid starting point in furthering our investigation.

### **Predicting Success at School and Work**

As each of these constructs appears to have different but complementary functions, it would follow that each provides important but somewhat different information for predicting success at school and at work. Because a more complete review of this issue is included in Mattern et al. (2014) and earlier in this report, we provide only a brief summary here. Where these constructs are correlated, they can be expected to predict some of the same outcomes (e.g., investigative interests and science skills may both predict success in a science class) but are less likely to provide incremental validity. Where they are less correlated (e.g., skills related to conscientiousness and core academic skills), they may tend to predict different outcomes but also have the potential for providing incremental validity for the same outcome. This can help us understand results found in the literature to date but also to anticipate how these constructs can be used together to increase readiness in the future.

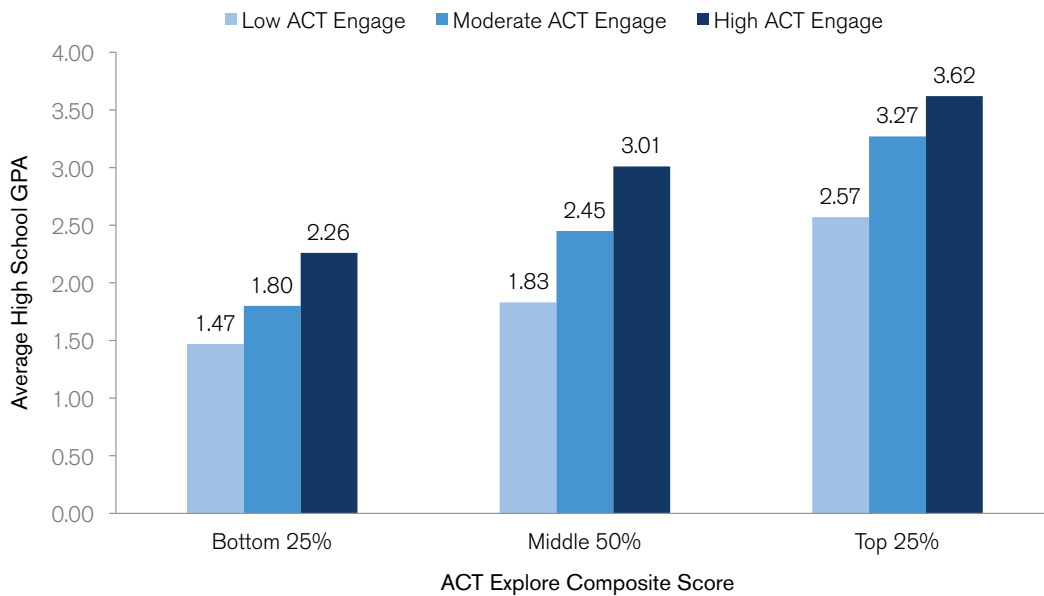
### **Success at School**

Meta-analyses have demonstrated that cognitive ability and academic achievement, interests, and personality all predict grades in school (e.g., Nye, Su, Rounds, & Drasgow, 2012; Poropat, 2009; Richardson, Abraham, & Bond, 2012; Robbins et al., 2004). For example, Poropat (2009)

found that cognitive ability tests strongly predicted grades at each level of schooling. He also found that personality predicted grades at the earlier levels of school (primary, secondary), with conscientiousness predicting grades just as well as cognitive ability in college. Conscientiousness also predicts college GPA incrementally over ACT or SAT test scores and HSGPA (Richardson et al., 2012). Further, in their meta-analysis, Nye et al. (2012) found that interests predicted college grades and were even stronger predictors of grades when they were congruent with students' majors. Finally, one longitudinal study of over 400,000 high school students found that, of the variance accounted for in college GPA, 50% was explained by ability, 23% by personality, and 27% by interests (Su, 2012, as cited in Rounds & Su, 2014).

In addition to predicting grades, cognitive ability and academic achievement have been shown to predict college persistence and graduation. For example, ACT and SAT test scores are positively correlated with persistence and graduation at both two- and four-year colleges (Mattern & Patterson, 2014; Radunzel & Noble, 2012). As with the prediction of grades, interests and personality-related variables also predict persistence, perhaps more so. The Nye et al. (2012) meta-analysis found that interests predict persistence and do so more strongly when they are congruent with a student's major. Su (2012) found that ability, personality, and interests explained 66%, 12%, and 22%, respectively, of the variance accounted for in persistence. Furthermore, several variables related to personality and interests were related to persistence in the Robbins et al. (2004) meta-analysis, with academic goals and academic self-efficacy predicting incrementally over cognitive predictors.

ACT research has shown that personality, behaviors, and interests can provide incremental validity in the prediction of school performance. Casillas et al. (2012) found that personality and academic behaviors as measured in middle school students by ACT Engage predicted HSGPA above and beyond academic achievement as measured by ACT Explore (see Figure 11). Furthermore, Allen and Robbins (2010) found that academic discipline as measured by ACT Engage and interest-major congruence predicted timely degree attainment in college incrementally over prior test scores and college GPA.



**Figure 11.** Average HSGPA by ACT Explore and ACT Engage Scores (from Mattern, et al., 2014)



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## Success at Work

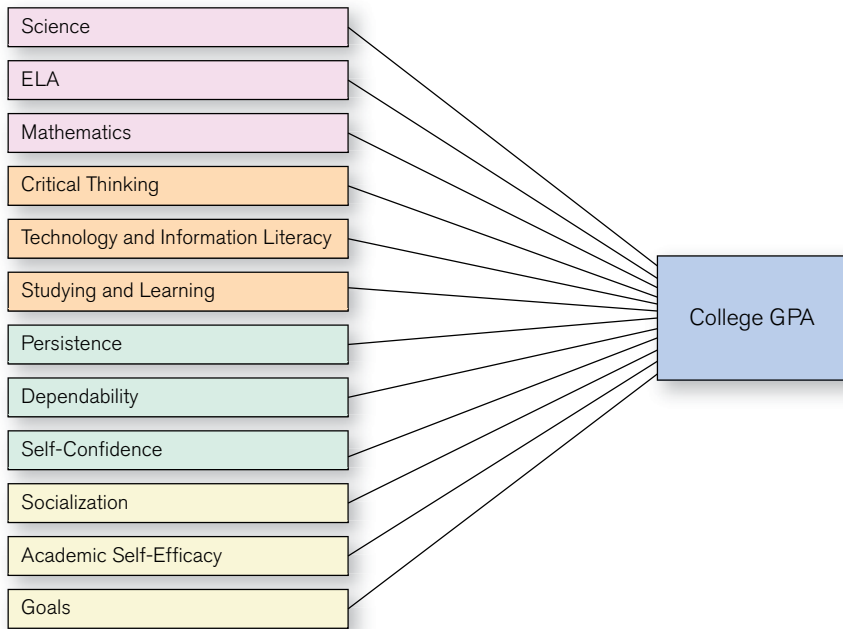
Research findings on job success parallel those for school success. Meta-analytic results indicate that cognitive ability is the single best predictor of job performance, although conscientiousness, integrity, and interests do provide incremental validity over cognitive ability (Schmidt & Hunter, 1998). Other constructs shown to be predictive of job performance based on meta-analytic results include interest–job congruence (Nye et al., 2012), self-esteem, and self-efficacy (Judge & Bono, 2001). Also, although income is only tangentially related to job performance, Su (2012) found that ability, personality, and interests explained 12%, 5%, and 83%, respectively, of the variance accounted for in income.

Personality- and interest-related constructs seem to be particularly useful in predicting important on-the-job behaviors that often do not fall under the typical job performance umbrella. For example, the intention to leave one's job is predicted by personality incrementally above cognitive ability, and further, interests predict the intention to leave above both cognitive ability and personality (Van Iddekinge, Putka, & Campbell, 2011b). Relatedly, job satisfaction is predicted both by personality (Judge & Bono, 2001) and by interest–job fit (Kristof-Brown, Zimmerman, & Johnson, 2005). Finally, meta-analytic results have consistently demonstrated that personality predicts important workplace behaviors such as helping coworkers, being cooperative, and putting forth extra effort (e.g., Chiaburu et al., 2011).

## Models of Education and Workplace Success

The research presented thus far overwhelmingly underscores the fact that a multitude of characteristics are related to success in both school and the workplace. Of course, some factors are more highly related to success than others, and some may be relatively more important for particular outcomes or at certain points in time. One challenge that remains is determining how to pare down the number of factors to a manageable few for a particular purpose by focusing on those that are important while at the same time being inclusive enough to provide meaningful, personalized feedback to the individual as it relates to his or her level of readiness. We have begun to articulate important constructs from each of the four broad domains as they relate to major education and career transitions (e.g., middle school to high school, high school to college, college to work). Empirical findings and theoretical support have guided the inclusion of specific factors in the model. For example, Figures 12 and 13 present the knowledge and skills that will best equip students as they transition from high school to college in terms of earning good grades as well as persisting through graduation (note that college success can be operationalized in a multitude of other ways; we focus on these two outcomes for illustrative purposes). The proposed models underscore that college success is multidimensional and that some knowledge and skills will be more or less important for specific indicators of college success.

For example, take our model predicting college GPA (Figure 12). From the core academic skills domain, we highlight that knowledge and skills in all three content areas—ELA, mathematics, and science—are important predictors of college GPA. ACT has extensive evidence that scores in ELA, mathematics, and science predict grades in college (e.g., Radunzel & Noble, 2012). Research also indicates that many of the cross-cutting capabilities are related to performance in college, in particular studying and learning (Hattie, Biggs, & Purdie, 1996; Liu et al., 2014), thinking skills (Higgins, Hall, Baumfield, & Moseley, 2005), metacognition (Haller, Child, & Walberg, 1988; Mevarech & Amrany, 2008; Oladunni, 1998; Schweizer, Wustenberg, & Greiff, 2013), and technology and information literacy (Huffman & Huffman, 2012; Tien & Fu, 2008; Wentworth & Middleton, 2014). As for the behavioral skills domain, research has shown that persistence, dependability, and self-confidence are positively related to college grades (Robbins et al., 2004; Robbins et al., 2006).

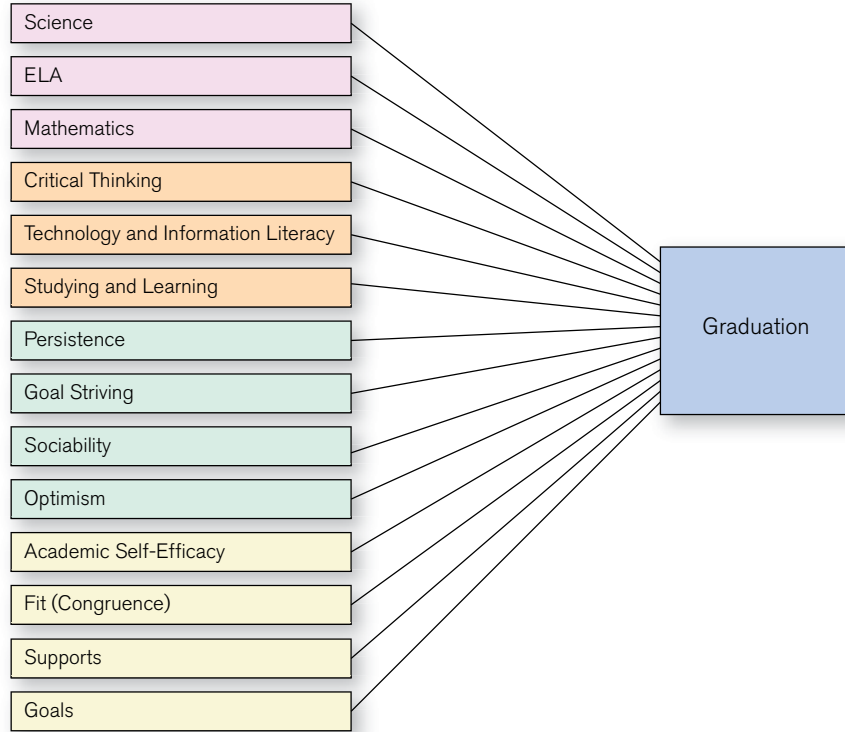


**Figure 12. Holistic Model of Education Success—College GPA**

From the education and career navigation domain, socialization, academic self-efficacy, and goals are important constructs related to college grades (Brady-Amoon & Fuentes, 2011; Brown et al., 2008; Robbins et al., 2004).

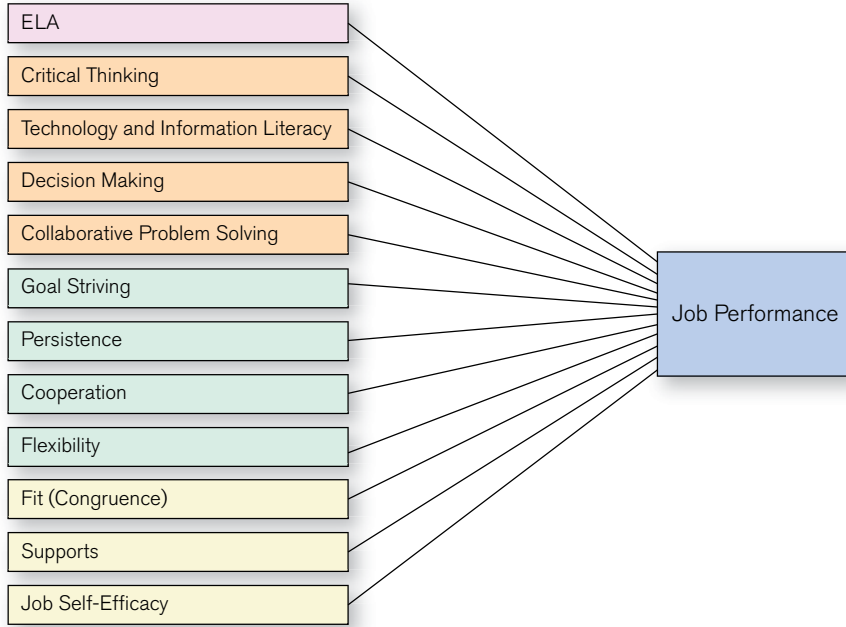
When we operationalize education success as graduating college, we find that many of the same constructs are important predictors, but there are subtle differences, particularly for the behavioral and navigation domains (Figure 13). From the behavioral domain, research indicates that persistence remains an important predictor, with research supporting the addition of goal striving, sociability, and optimism into the model (Lounsbury et al., 2004; Taylor, Scepansky, Lounsbury, & Gibson, 2010; Robbins et al., 2004; Robbins et al., 2006). As for the navigation domain, academic self-efficacy and goals were again identified as important predictors of education success, specifically college graduation (Baier, 2014; Robbins et al., 2004). Additionally, fit and supports were identified as important predictors of college graduation (Tracey & Robbins, 2006; Robbins et al., 2004). The high degree of overlap between the two models highlights that these two outcomes are not independent. Predictors of college success are also often interrelated, and the development of knowledge and skills in all the key college readiness areas will best position students for later success. If students fail to acquire the academic skills to pass their courses, it's unlikely that they will persist in college. On the other hand, if even the highest-performing students are not motivated or interested in their studies, it is unlikely that they will persist in college through degree completion.

A proposed model of work success was also developed. As is the case for education success, work success can be operationalized in various ways. We chose to focus on job performance here because there is a stronger empirical foundation to draw from to inform our model development than for other indicators of work success. As shown in Figure 14, research shows a strong connection



**Figure 13. Holistic Model of Education Success—Graduation**

between English language arts skills and job performance. In particular, performance on ELA measures such as the ACT WorkKeys Reading for Information and Listening for Understanding tests is predictive of subsequent job performance (ACT, 2007). This corroborates other empirical findings showing that oral communication skills have a large impact on performance in many business settings (Crosling & Ward, 2002; Di Salvo & Larsen, 1987; Maes, Weldy, & Icenogle, 1997; Ramsey, & Sohi, 1997). Empirical findings for cross-cutting capabilities for the prediction of job performance support the importance of critical thinking (Heimler, Rosenberg, & Morote, 2012), technology and information literacy (Lira, Ripoll, Peiro, & Zornoza, 2013), decision making (Danner et al., 2012), and collaborative problem solving (DeChurch & Mesmer-Magnus, 2010; DeDreu & Weingart, 2003; LePine, Piccolo, Jackson, Mathieu, & Saul, 2008). As for important behavioral skills related to job performance, empirical findings support the inclusion of goal striving (Whetzel, McDaniel, Yost, & Kim, 2010), persistence (Timmerman, 2004; Whetzel et al., 2010), cooperation (Christiansen & Robie, 2011; Judge et al., 2013), and flexibility (Judge et al., 2013) in a model of job performance. From the navigation domain, important predictors of job performance include fit (Kristof-Brown, Zimmerman, & Johnson, 2005), supports (Rhoades & Eisenberger, 2002), and job self-efficacy (Bauer et al., 2007). It is important to note that many of the constructs highlighted in the model of education success also appear in the model of work success; however, there are also differences between the models. For example, some constructs manifest differently depending on the setting (e.g., academic self-efficacy and job self-efficacy). These findings highlight the importance of considering both the transition and outcome of interest when developing models of success.



**Figure 14. Holistic Model of Work Success—Job Performance**

As another way of illustrating how the constructs in our education and work readiness framework manifest and/or are defined differently at different transitions/time points, Table 9 shows examples of knowledge and skills from each of the four broad domains included in the ACT holistic model of education and work readiness. Within each domain, the examples highlight knowledge and skills for a particular dimension and grade ranges in K–12. These examples illustrate the rich and more holistic information that can be provided based on a multifaceted and longitudinal understanding of readiness.

**Table 9.** Examples of Knowledge and Skills by Broad Domain

| Broad domain                           | Subject  | Substrand                   | Example knowledge and skills  |
|--|--|-----------------------------|---|
| Core academic skills                   | Mathematics                                    | Linear Equations            | Grades 6–8: Solve routine linear equations having integer or decimal answers<br><br>Grades 9–10: Solve non-routine linear equations and systems of two linear equations<br><br>Grades 11–12: Use matrices and their inverses to solve systems of multiple linear equations  |
| Broad domain                           | Capability                                     | Substrand                   | Example knowledge and skills  |
| Cross-cutting capabilities             | Technology and Information Literacy            | Keyboarding                 | Grades 5–6: Type combinations of alphanumeric and modifier keys to execute shortcuts<br><br>Grades 7–8: Identify the common formatting components of keyboard shortcuts<br><br>Grades 9–10: Create keyboard shortcuts for frequently executed actions   |
| Broad domain                           | Component                                      | Subcomponent                | Example knowledge and skills  |
| Behavioral skills                      | Getting Along Well with Others (Agreeableness) | Cooperation: Collaboration  | Grades 3–5: Listen to other group members and sometimes accept ideas that are not your own<br><br>Grades 6–8: Listen to other group members' ideas and discuss them with the group<br><br>Grades 9–12: Listen to all group members' ideas and attempt to find commonalities in the discussion   |
| Broad domain                           | Dimension                                      | Subcomponent                | Example knowledge and skills  |
| Education and career navigation skills | Environmental Factors                          | Education-Related Knowledge | Grades K–5: Explore the similarities and differences between your elementary school subjects and subjects students take during middle school<br><br>Grades 6–8: Explore high school education paths (e.g., college preparatory, vocational, career academy) and the benefits of each path for achieving goals<br><br>Grades 9–10: Analyze multiple postsecondary education options to gain a broad perspective on the range of choices available to you |

## Summary

This report documented the development of a holistic framework that provides a more complete description of education and work readiness. Development of this framework was based on research conducted at ACT over the last fifty years, emerging knowledge in this area, a comprehensive review of relevant theory, education and work standards, empirical research, input from experts in the field, and a variety of other sources. During our review, it became clear that a holistic framework for education and work readiness should include knowledge and skills in at least four broad domains: core academic skills, cross-cutting capabilities, behavioral skills, and education and career navigation skills. The research evidence presented throughout the report supports the notion that all four of these broad domains are important for understanding academic and workplace success. The report also begins to build an integrated view of education and work readiness and provides some examples of how these domains and their specific constructs relate to important outcomes. A better understanding of how these domains work together has implications for understanding readiness and for providing students with better, more meaningful feedback. For example, many students struggle academically yet are motivated to persist and eventually earn a college degree. In contrast, other students who are academically prepared but not invested in college drop out in the first semester. If we focus solely on academic constructs, or assessments currently in place in schools (e.g., ELA and mathematics), or on constructs easiest to measure with traditional methods, we will continue to define readiness in a narrow and constrained manner.

We hope the reader will take away a few central findings and ideas from this report and other research conducted by ACT on college and career readiness. Preparation for college, careers or life requires skills and competencies from multiple domains. Academic skills, whether focused solely on math and reading, or more broadly to include science, are clearly essential to most definitions of postsecondary success, but alone they are not sufficient to ensure success. The specific skills needed in a domain like math may differ somewhat across majors or occupations, and our assessments and benchmarks need to be sensitive to these complexities even when one size fits all is more convenient for accountability. We invite the reader to examine the complexities associated with behavioral skills, how their manifestations change with growth and development over time, and how important behavioral skills are for success in any environment or context. Finally, we hope the reader recognizes the role that cross-cutting cognitive skills play in learning, self-direction, and a positive predisposition to lifelong learning, as well as how important education and career navigation skills are to progressing along the continuum from school to college to career. It is our belief that a holistic examination of college and career readiness such as this can improve outcomes that lead to education and workplace success. ■

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## Appendix: Domain-Specific Framework Development Methodology

### Development of the ACT Core Academic Skills Framework

The purpose of the achievement framework is to identify, describe, and organize the cognitive knowledge and skills in key foundational areas. To accomplish this goal, we began by examining existing assessment data and standards at ACT. We then sought to compare our current practices to best-practice recommendations from leading academic and business voices. This involved a comprehensive review of empirical literature connecting mathematics, science, and ELA to college and career success. Within each academic subject area, we also convened and consulted with leading subject-matter experts who identified optimal existing standards and guided their integration into a holistic framework. Experts participated in panels and developed reports summarizing current research and filling gaps we identified in the extant literature.

Having developed an understanding of current research in mathematics, science, and ELA, as well as how ACT assessments related to this research, we sought to deepen our understanding of standards and progressions within each of these areas. The process proceeded as outlined in the initial overview—that is, we began by reviewing the ACT College and Career Readiness Standards (CCRS), evaluating the core academic domains, and examining relationships between developmental skills and readiness. The CCRS was then compared with leading national and international standards, including the Common Core State Standards, the NRC Framework for K–12 Science Education, and the Australian Curriculum. Similarly, these academic standards were checked against career-related resources such as O\*Net and proprietary ACT job analysis and assessment data.

From these resources and analyses we developed the framework outlined in this paper. We are currently drafting rational standards and benchmarks based on this framework. Ideally, we prefer to develop standards and through an analysis of actual—not expected—student performance. Unfortunately, such empirical data do not currently exist for many of the constructs of interest; therefore, the approach we have taken is to establish a set of standards linked by hypothesized learning progressions that can then be validated empirically.

One insight that emerged early in this process was the realization that the skills taught in the traditional academic subjects areas are simply not enough (Pellegrino & Hilton, 2012). Despite their foundational importance, skills like reading and mathematics are not the primary concern of today's employers (Casner-Lotto & Barrington, 2006). Proficiency in these basic skills is perhaps better regarded as a starting point rather than a final outcome.

This finding necessitated a division that called attention to how cognitive skills fall into two distinct categories: core academic skills and cross-cutting capabilities. Core academic skills are knowledge and skills that are associated with traditional academic disciplines such as literature and rhetoric, mathematics, and biology. Skills in these areas are primarily developed in a single academic discipline and serve as the bedrock of the US education system. Cross-cutting capabilities (CCCs) are skills that facilitate the real-world acquisition and application of traditional content knowledge and skills. More broadly, they serve to enhance students' ability to effectively learn and participate in the twenty-first century global economy. CCCs are not normally considered specific to any particular discipline and are easily overlooked by instruction and assessment focused solely on core academic content. Our treatment of this division should call attention to an important point made here: core academic skills are necessary, but they are not sufficient.

## Development of the ACT CCC Framework

The goals of the CCC framework were to identify, describe, and organize knowledge and skills using the following guiding principles:

1. Enhance students' ability to learn and use core academic knowledge by drawing attention to the additional skills needed to perform tasks in real-world settings.
2. Enhance transfer by drawing attention to common knowledge and skills that appear across more than one academic subject, such as information literacy and critical thinking.
3. Focus on skills consistently identified as areas of weakness by professors and employers.
4. Supplement the large core academic subject areas with small skill sets that provide high value in college and career settings.
5. Provide a clear and detailed articulation of these often hard-to-define skills.
6. Provide a framework for development of K–Career assessments.

Many organizations have created new frameworks aimed at accomplishing these same goals. These have also been referred to as “21st Century” or “Employability” skills frameworks (Binkley et al., 2012; Partnership for 21st Century Skills, 2012; US Department of Education, 2014). Such frameworks have drawn attention to a wide range of potential CCCs. To increase the focus on vital skills and enhance the clarity of the framework, we attempted to identify the skills most critical for education and workplace success. We also attempted to minimize overlap with other parts of the holistic framework and to clearly identify any overlap that did occur.

Potential skills for inclusion were evaluated based on six criteria:

1. The skill must be predominantly cognitive in nature; that is, it must be the outcome of an accumulation of knowledge.
2. The skill must be teachable and easily observable.
3. There must be evidence that the skill has foundational value in a wide range of college and career environments.
4. The skill must have a distinct empirical literature base and expert consensus that can inform definition and assessment.
5. It must be possible to write standards and progressions that articulate and relate specific levels of the skill from kindergarten through career. If the skill does not span the full continuum, it must have clear connections to other skills that precede or follow.
6. The skill must be a significant addition to the holistic framework. If it includes skills covered by other areas, it must integrate or apply them in new and valuable ways.

### Omitted Skills

Because the ultimate goal of the framework is to inform K–Career assessment development and help guide individuals toward success in a cumulative, long-term manner, we needed to identify skills that were describable in terms of specific performance levels at particular transitions. For this reason, we were unable to include skills, like creativity or leadership, that, although no doubt important, are difficult to define in terms of detailed cognitive proficiency levels with associated observable evaluation criteria. Fortunately, the behavioral skills section of the framework touches on many things that fell into this category.



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In addition, we omitted many relatively advanced employability skills such as managerial skills, business fundamentals, and project management because they are strongly associated with workforce needs and difficult to connect to K–12. Project management was considered because it is a key workforce skill, but most of what is usually defined as project management is simply unrealistic to expect students to apply in an academic setting. Basic aspects of project management are naturally part of writing and creating with technology and are included in those areas. Time management is a related skill that is commonly cited, but we believe it is adequately covered by specific behavioral skills and studying and learning strategies.

## **Development of the ACT Behavioral Skills Framework**

The ACT behavioral skills framework was developed through a comprehensive review of existing literature, behavioral standards, and personality and behavioral assessments, and through consultation with experts in developmental, personality, and industrial/organizational psychology.

### **Literature Review**

The literature review included examination of over 1,000 references, including general behavioral research, child and adult development, and studies focused on K–12, postsecondary, and workforce populations. Identified articles were divided into content areas and prioritized for review and inclusion into a knowledge base that informed which HEXACO facets to advance based on theory and empirical evidence.

### **Behavioral Standards**

Searches for published behavioral standards focused on K–12, postsecondary, and workforce development populations were conducted by searching for terms such as “student behavioral learning objectives,” “college behavioral standards,” and “behavioral expectations workplace” in national and international departments of education, postsecondary institutions, and workforce organizations. These searches allowed for the identification of behavioral objectives, expectations, frameworks, and standards that schools, universities, and organizations had laid out with the goal of outlining acceptable or effective behaviors they considered necessary for their students or employees to succeed. The search yielded materials representing 49 states, several private national organizations, and six foreign countries plus the European Union for a total of approximately 8,800 standard statements. These standards were then evaluated for comprehensiveness (including breadth and depth of behavioral descriptions), and the more comprehensive ones were thematically analyzed by content experts, with emphasis on mapping their content onto HEXACO. Based on this process, nearly 3,000 standards were analyzed and incorporated into the ACT behavioral skills framework.

### **Assessments**

Thirty-three multidimensional assessments of behavior, spanning 192 constructs and over 3,400 items, were identified from the literature search. The constructs tapped by these assessments also were thematically analyzed for fit within HEXACO.

### **Behaviors Generated by Subject Matter Experts**

ACT researchers worked with over 400 subject matter experts who could provide insight into how behavior is connected to success at school and work. We asked education (e.g., teachers, student-advising staff) and workplace management professionals (e.g., supervisors and human resources managers) to describe behaviors commonly exhibited at school and work. This effort resulted in capturing over 3,700 examples of teacher- and manager-observed behavior relevant to education and workplace success.

### **Expert Input**

ACT researchers also consulted academic researchers with deep knowledge of personality and behavior across age groups and settings as exemplified by their publications. These experts provided feedback and insights on the development, structure, and content of the behavior framework. Experts also provided guidance on the developmental appropriateness of the framework for children, adolescents, and adults.

## **Development of the ACT Education and Career Navigation Framework**

The education and career navigation framework is a comprehensive structure designed to facilitate identification and organization of the knowledge, skills, and other factors needed to help make informed, personally relevant decisions and build actionable, achievable plans. The framework was developed through (1) a comprehensive review of theoretical, conceptual, and empirical research literature relevant to career planning and development across a variety of scientific disciplines, (2) a thematic content analysis of existing US (at the state and national levels) and international standards across the life span (K–12, postsecondary, and workforce), (3) a thorough review of assessments that have been developed to measure a wide range of navigation constructs, (4) an investigation of real-world navigation-related challenges, resources, and practices among subject matter experts (e.g., K–12 school counselors, college career advisors, human resource career-planning professionals) through focus groups and surveys, and (5) consultation with experts in this broad domain. Each of these is further described below.

### **Literature Review**

Drawing from a wide range of available theoretical, empirical, and intervention literature in areas of psychology (counseling, vocational, applied, industrial/organizational), human and student development, and career development, over 1,000 references were examined. Relevant literature across K–12, postsecondary, and workforce populations indicated which navigation constructs are salient for different groups, how these constructs develop over time, which constructs are positively influenced by intervention, and which predict positive outcomes. Key navigation-related concepts and findings that pertain to gender, race/ethnicity, disability, socioeconomic status, and education level were also identified.

### **Standards**

A total of 5,308 existing US and international standards that include navigation concepts within K–12, postsecondary, and workforce populations were identified and analyzed. The standards identified for K–12 included the 50 United States, the District of Columbia, and 20 other countries.

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For postsecondary, standards were identified for two US states and 10 other countries. Workforce standards included two sets from the United States and four sets from other countries. These standards were analyzed using a content analysis program (Clarabridge), which allowed for identifying common themes across standards, building classification models showing the extent to which particular content was the focus of standards for different populations, and examining the degree of overlap between the type of content in existing standards and the content incorporated into the ACT navigation framework.

### **Assessments**

One hundred eighty unidimensional or multidimensional education and career navigation–related assessments were identified. Constructs measured by these assessments were analyzed to determine the extent to which various constructs have been assessed, which constructs have been used with specific populations, ways in which constructs function within different theories or models, and the more detailed aspects of certain constructs, all of which informed which constructs were included in the navigation framework.

### **Subject Matter Experts**

Focus groups and online surveys were conducted to identify the navigation-related challenges, resources, and methods practitioners experience in education and work settings. This effort was carried out to identify the knowledge and skills subject matter experts consider important for individuals to navigate their education and work, and what behaviors contribute to success. Data from subject matter experts were analyzed for important construct themes and specific knowledge and skills within and across K–12, postsecondary, and workforce. These were incorporated into the navigation framework.

### **Expert Input**

ACT researchers consulted well-known and widely published academic researchers with relevant expertise in different areas of navigation, age groups, settings, and special populations. Regular consultation meetings and formal expert panels were conducted throughout the framework development process. These experts provided feedback on the development, structure, and content of the navigation framework.

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