



Research Report
ETS RR-13-22

Synthesizing Frameworks of Higher Education Student Learning Outcomes

Ross Markle

Meghan Brenneman

Teresa Jackson

Jeremy Burrus

Steven Robbins

November 2013

ETS Research Report Series

EIGNOR EXECUTIVE EDITOR

James Carlson
Principal Psychometrician

ASSOCIATE EDITORS

Beata Beigman Klebanov
Research Scientist

Heather Buzick
Research Scientist

Brent Bridgeman
Distinguished Presidential Appointee

Keelan Evanini
Managing Research Scientist

Marna Golub-Smith
Principal Psychometrician

Shelby Haberman
Distinguished Presidential Appointee

Gary Ockey
Research Scientist

Donald Powers
Managing Principal Research Scientist

Gautam Puhan
Senior Psychometrician

John Sabatini
Managing Principal Research Scientist

Matthias von Davier
Director, Research

Rebecca Zwick
Distinguished Presidential Appointee

PRODUCTION EDITORS

Kim Fryer
Manager, Editing Services

Ruth Greenwood
Editor

Since its 1947 founding, ETS has conducted and disseminated scientific research to support its products and services, and to advance the measurement and education fields. In keeping with these goals, ETS is committed to making its research freely available to the professional community and to the general public. Published accounts of ETS research, including papers in the ETS Research Report series, undergo a formal peer-review process by ETS staff to ensure that they meet established scientific and professional standards. All such ETS-conducted peer reviews are in addition to any reviews that outside organizations may provide as part of their own publication processes. Peer review notwithstanding, the positions expressed in the ETS Research Report series and other published accounts of ETS research are those of the authors and not necessarily those of the Officers and Trustees of Educational Testing Service.

The Daniel Eignor Editorship is named in honor of Dr. Daniel R. Eignor, who from 2001 until 2011 served the Research and Development division as Editor for the ETS Research Report series. The Eignor Editorship has been created to recognize the pivotal leadership role that Dr. Eignor played in the research publication process at ETS.

Synthesizing Frameworks of Higher Education Student Learning Outcomes

Ross Markle, Meghan Brenneman, Teresa Jackson, Jeremy Burrus, and Steven Robbins
Educational Testing Service, Princeton, New Jersey

November 2013

Find other ETS-published reports by searching the ETS ReSEARCHER
database at <http://search.ets.org/researcher/>

To obtain a copy of an ETS research report, please visit
<http://www.ets.org/research/contact.html>

Action Editor: John Sabatini

Reviewers: Lydia Ou Liu and Brent Bridgeman

Copyright © 2013 by Educational Testing Service. All rights reserved.

CRITERION, ETS, the ETS logo, GRADUATE RECORD EXAMINATIONS,
GRE, LISTENING. LEARNING. LEADING., TOEFL, and TOEIC are
registered trademarks of Educational Testing Service (ETS).

ISKILLS is a trademark of ETS.



Abstract

The public, education, and workforce sectors all have expressed interest regarding the key knowledge, skills, and abilities that enable individuals to be productive members of society. Although past efforts have attempted to create frameworks of student learning outcomes, the results have varied due to different perspectives and goals. Thus, the purpose of this paper was to gather and review relevant higher education frameworks, determine their commonalities and create domains, and identify the assessments that Educational Testing Service (ETS) has developed in each of the domains. After a thorough review of the relevant frameworks, seven key domains were identified: creativity, critical thinking, teamwork, communication, digital and information literacy, citizenship, and life skills. Also discussed were the issues of education versus work contextualization and the assumption of foundational quantitative reasoning and literacy skills informing these seven domains.

Key words: student learning outcomes, higher education standards, higher education, creativity, critical thinking, teamwork, communication, digital and information literacy, citizenship, life skills

Table of Contents

	Page
Purpose.....	3
Method	3
Selection Criteria	3
Frameworks Reviewed	5
Results: The Critical Domains	12
Creativity	12
Critical Thinking.....	14
Teamwork	15
Effective Communication	16
Digital and Information Literacy	17
Citizenship	18
Life Skills.....	20
A Note About Quantitative Skills.....	21
Existing Educational Testing Service (ETS) Assessments.....	22
The <i>ETS</i> [®] Personal Potential Index (PPI).....	25
Comparable Efforts.....	26
Future Directions	28
Frameworks From Education and Work Perspectives: Portfolio Versus Stacked, Badges Versus Certificates?	29
Conclusion	31
References.....	32
Appendix.....	37

List of Tables

	Page
Table 1. Frameworks of Learning Outcomes.....	6
Table 2. A Summary of the Seven Critical Domains and Use in Educational Testing Service (ETS) Products and Assessments.....	13
Table 3. Alignment Between Burrus et al. (2013) O*NET Domains and Critical Domains.....	26
Table 4. Comparison of National Research Council (NRC) Domains and Critical Domains ...	28

In 2006, the Commission on the Future of Higher Education, under the guidance of then Secretary of Education Margaret Spellings, released *A Test of Leadership: Charting the Future of U.S. Higher Education* (U.S. Department of Education, 2006). The report painted the picture of a changing landscape where colleges and universities increasingly face international competition; low rates of access and degree attainment; and questions about the knowledge, skills, and ability of their graduates. Among other recommendations, this report called for institutions to demonstrate better what students have learned and can do as a result of their college experience.

Another source of pressure comes from within higher education. In 2006, the National Association of State Universities and Land-Grant Colleges and the American Association of State Colleges and Universities published the *Toward a Voluntary System of Accountability Program (VSA) for Public Universities and Colleges* (McPherson & Shulenburg, 2006). The Voluntary System of Accountability (VSA) was reportedly designed to increase the quality of higher education, both to be more transparent for its constituents, but also as a responsibility accordant with its vital role in American societal and economic success. The VSA provided a framework of methods and assessments to gather data across institutions in three core educational outcomes: critical thinking, analytical reasoning, and written communication skills.

Although some have argued that the VSA was merely a response to calls from the Spellings Report (even though the project was underway before the commission's; Miller, 2008), other efforts to define and measure key areas of student learning have come from within academe. For example, the Association of American Colleges and Universities (AAC&U) also began the Liberal Education and America's Promise (LEAP) initiative in 2005. Seeking to "recalibrate college learning to the needs of the new global century" (AAC&U, 2007, p. vii), LEAP focuses on defining key student learning outcomes, disseminating best practices in instruction, and encouraging quality assessment among its members. For institutions of higher education and the organizations that represent them, measuring student learning serves the function of ensuring quality, both internally and to their constituents.

Finally, calls for better evidence of student learning have come from employers. Several recent reports have stated that, despite high rates of unemployment, employers claim they cannot find sufficiently skilled workers (Deloitte & The Manufacturing Institute, 2011; ManpowerGroup, 2012). This skills gap is seemingly a result of employer dissatisfaction with

the products of higher education. A study by the Conference Board, Corporate Voices for Working Families, Partnership for 21st Century Skills, and the Society for Human Resource Management surveyed more than 400 employers across the United States, asking their perceptions of those currently entering the workforce (Casner-Lotto & Barrington, 2006). The survey did not focus exclusively on college graduates but referred questions to those entering the workforce with high school diplomas, 2-year degrees, and 4-year degrees. Respondents emphasized the need for more applied skills, such as oral and written communication, teamwork, and professionalism, over basic academic knowledge in areas such as English, math, and science. Additionally, over 25% of respondents indicated that college graduates were deficient in several key skills, such as leadership and written communication.

A study conducted for the AAC&U by Hart Research Associates (2010) sampled over 300 executives from a wide array of organizations to determine their perceptions of the needs of college graduates. Of those surveyed, 88% said that graduates need higher levels of learning and skills than they had in the past. Only 28% of respondents agreed that 4-year colleges and universities are doing a good job of preparing students for the modern workforce. Thus, the workforce sector is vested in defining and measuring student learning so that it can ensure a sufficiently skilled supply of new employees.

These three sectors—public, education, and workforce—all pose different questions to higher education as they weigh the high cost of a degree. Are students acquiring the key knowledge, skills, and abilities to function as productive members of society? Are college graduates ready to enter and succeed in the workforce? Though differing in origin, each of these questions has led members of these respective sectors to discuss the focus of higher education, resulting in a litany of proposed frameworks for student learning.

Literature that seeks to define student learning in higher education comes from diverse perspectives and targets diverse goals. Organizations in education, government, public policy, and industry all have a vested interest in the direction of higher education. These interests vary from societal good to human capital development to self-determination and autonomy. These frameworks take many forms. Some, such as the VSA (McPherson & Shulenburg, 2006), simply mention key areas, such as broad general education outcomes, on which higher education should focus. Others, such as the Conference Board study (Casner-Lotto & Barrington, 2006), conduct surveys of key constituents to determine what factors are important to them.

As a result of varying motives and methods, research in this area has come to a range of conclusions. Should higher education focus on the traditional liberal arts education or gear toward work-relevant competencies? Should the framework for higher education be broad, leaving room for local determination, or specific as to ensure continuity across graduates? These are just some of the questions that arise. Ultimately, this multitude of efforts to create common understanding across higher education has led to some confusion.

Purpose

We began this project with three goals:

1. *To gather and review outcomes frameworks relevant to higher education, considering the social, educational, and occupational perspectives.* This focus on higher education is a key consideration of this paper. Though preparing students for the workforce is and always will be an important role of many educational systems, a framework of outcomes designed to define what a student should learn and have achieved in college is different than one that seeks to certify the competencies necessary for entering the workforce.
2. *Determine commonalities among these frameworks.* Our team thoroughly reviewed the relevant literature to identify and define common areas of learning. Our review yielded seven key domains that largely represent these established frameworks.
3. *Identify assessments that Educational Testing Service (ETS) has developed in each of these domains and the extent to which the assessments align with the definitions presented here.* By consulting with representatives from across ETS, we have identified both operational assessments and research tools that have been designed to assess many, but not all, of these domains. This alignment will be discussed in the final section of the report.

Method

Selection Criteria

Using several relevant frameworks, the research team assembled them in two ways. First, we looked at the domains—broad, high-level skills—within each framework. By comparing and contrasting these across all domains and determining those factors that were included in a majority (at least four of seven) of the frameworks reviewed, we were able to identify the seven

critical domains presented below. Next, we examined the operational definitions—the learning outcomes used to define each domain. By analyzing these, we were able to identify the knowledge, skills, and abilities that define the critical domains.

Given the three goals stated above, we used three criteria to select relevant frameworks: population criterion, scope criterion, and specificity criterion. For the purpose of this paper, the population criterion referred specifically to frameworks targeted at higher education. For the scope criterion, we focused on frameworks that span across disciplines and are appropriate for all institutions of higher education. Finally, the specificity criterion included only those frameworks that provided operational definitions of the knowledge, skills, and abilities discussed in the framework. A more thorough discussion of each criterion is below.

Frameworks targeted toward higher education (population criterion). Many previous efforts to identify key skills have focused on either basic work requisite skills or general education outcomes. For example, the National Work Readiness Certificate was developed using work-contextualized cognitive test items representing the ability to use applied mathematics, applied reading, and information location as part of workplace task performance. It is widely used within the community college and career technical training sectors as it is most appropriate and specific to work training readiness and workplace success. From another perspective, several educationally focused frameworks have been created to understand higher education readiness and success by either focusing on primary and secondary education (e.g., the Common Core State Standards) or spanning all levels of education (e.g., National Research Council [NRC], 2008, 2010, 2011, 2012).

Much of the debate about the value of postsecondary education, as well as questions of degree quality, has focused on 4-year (i.e., bachelor's) degrees. Thus, we only considered frameworks that explicitly targeted a bachelor's level education or, in the case of workforce examples, the expected skills of those holding a 4-year degree.

Multidisciplinary and trans-institutional (scope criterion). Given the emphasis on assessment and accountability over the past several decades, many individual institutions of higher education have developed frameworks of learning outcomes for their students. Similarly, professional organizations and fields vary in the requirements and expectations of their members. Thus, we considered only educational frameworks that were intended to go beyond any one institution or field of expertise. For example, a recent study by Shultz and Zedeck (2012)

outlined characteristics that were indicative of effectiveness in the law profession. Similarly, the U.S. Department of Labor, Employment and Training Administration (USDOL-ETA, n.d.) published a competency model specifically for advanced manufacturing. Although these frameworks may provide valuable insight for some key skills, we chose to focus on those that were identified as vital across fields.

Specific in the learning outcomes or competencies expected (specificity criterion).

Many efforts that outline key skills for learners and workers stop short of providing operational definitions of these skills. In reviewing the literature, we saw this embodied in several ways. Efforts that commonly use the term *21st century skills* (e.g., NRC, 2008, 2010, 2011, 2012) have thoroughly reviewed the scientific literature and often refer to skills such as critical thinking, communication, and teamwork, among others that we discuss here. Similarly, surveys of employers (e.g., AAC&U, 2010; Casner-Lotto & Barrington, 2006; Hart Research Associates, 2010; Manyika et al., 2011) broadly refer to these same skills. In both cases, however, operational definitions that include supporting learning outcomes or competencies—statements about specific knowledge, abilities, and dispositions inherent to these domains—were lacking. For the purposes of this report, such specificity was necessary to generate a common understanding among all groups, as well as to inform potential future work in curriculum and assessment development.

Frameworks Reviewed

Given these criteria, we identified seven frameworks for consideration (see Table 1). We had considered organizing these frameworks according to the sector of the publishing organization (i.e., policy/government, education, workforce), but the work itself is rarely as discrete as such segmentation would suggest. Though many of the published reports around these efforts come from a single entity, the frameworks themselves are often vetted, if not developed in collaboration with, members of other sectors. The AAC&U's LEAP framework was developed with significant input from employers. The Assessment & Teaching of 21st Century Skills (ATC21S) framework was initiated by a consortium of corporate partners—Cisco, Intel, and Microsoft—but conducted in collaboration with the University of Melbourne and other institutions of higher education.

Table 1***Frameworks of Learning Outcomes***

Framework	Abbreviated title	Author/impetus
Framework for Higher Education Qualifications	QAA-FHEQ	Quality Assurance Agency for Higher Education
European Higher Education Area Competencies	Bologna	European Commission: European Higher Education Area
Liberal Education and America's Promise	LEAP	Association of American Colleges and Universities
Frameworks for Learning and Development Outcomes	CAS	The Council for the Advancement of Standards in Higher Education
The Degree Qualifications Profile	DQP	The Lumina Foundation
The Assessment & Teaching of 21st Century Skills	ATC21S	Collaboration among Cisco, Intel Microsoft, the University of Melbourne, and others
ETA Competency Model Clearinghouse's General Competency Model Framework	USDOL-ETA	U.S. Department of Labor, Employment and Training Administration

With that said, many of the frameworks are written to meet the goal of the sponsoring organization. For example, the framework put forth by USDOL-ETA, though informative for higher education, is designed to represent the skills of employees and not the knowledge, skills, abilities, and mindset of a well-rounded *citizen* (a term frequently used by Lumina's Degree Qualifications Profile, LEAP, and others). Similarly, the Degree Qualifications Profile (DQP) outlines the abilities of degree holders, not necessarily prospective employees. However, as we ultimately seek to synthesize these models, these different perspectives will strengthen the final product, as the domains that are common across all three sectors will have been determined with broader endorsement.

Quality Assurance Agency for Higher Education—Framework for Higher Education Qualifications (QAA-FHEQ). In 1997, the National Committee of Inquiry into Higher Education released their Dearing Report (see Dearing, 1997), which indicated a great need to create a national framework for higher education qualifications (Quality Assurance Agency [QAA], 2008). In response, the Framework for Higher Education Qualifications (FHEQ) in England, Wales, and Northern Ireland was developed by the QAA (2008). In 2001, the FHEQ published the first edition of the framework and completed an updated second edition in 2008. This framework has been designed to meet the standards of the Bologna Declaration on the

European Space for Higher Education as well as align with the Framework for Qualifications of the European Higher Education Area (QAA, 2008).

Briefly, the purposes of the FHEQ, as described in *The Framework for Higher Education Qualifications in England, Wales and Northern Ireland: August 2008* (QAA, 2008), are the following:

- to provide important points of reference for setting and assessing academic standards to higher education providers and their external examiners,
- to assist in the identification of potential progression routes, particularly in the context of lifelong learning, and
- to promote a shared and common understanding of the expectations associated with typical qualifications by facilitating a consistent use of qualifications titles across the higher education sector (QAA, 2008, p. 6)

The FHEQ is a “qualifications framework” (QAA, 2008, p. 7) with five levels. These levels are numbered 4–8 (following Levels 1–3 as indicated by the National Qualifications Framework and the Qualifications and Credit Framework), with Level 4 referencing higher education certificates, Level 5 indicating foundation degrees and/or diplomas of higher education, Level 6 including bachelor’s degrees, Level 7 referring to master’s degrees, and the highest FHEQ level, Level 8, including doctoral degrees (QAA, 2008). Each level has specific qualifications and skills associated with it. A qualification descriptor provides a statement of specific outcomes an individual should demonstrate as well as a global description of the abilities one should possess at that level (QAA, 2008).

European Higher Education Area Competencies—The Bologna Declaration and the Tuning Project. In 1999, the Bologna Declaration was signed by higher education officials from 29 European countries in an effort to create a greater level of trust and transparency throughout the European education systems (Education, Audiovisual, and Culture Executive Agency [EACEA], 2012). This began multiple proceedings, both formally and informally, to assist with these reforms, the most notable of which was the Tuning Project. Funded by the European Commission (the executive body of the European Union), the Tuning Project was developed through the efforts of faculty members (Adelman, 2009). The term *tuning* refers to the development of a framework that ascertains specific learning expectations for students in each

area of study. In turn, clear expectations are set for each subject area while academic autonomy is retained (Marshall, Kalina, & Dane, 2010).

While the initial Bologna Declaration sought to create a system based on two cycles—undergraduate and graduate—and to specify requirements to transition from the first to the second (EACEA, 2012), the Tuning Project assisted with the design, development, implementation, and evaluation of each cycle (Tuning Educational Structures in Europe, n.d.). Thus, while similar, the Bologna Declaration and Tuning Project had different objectives. The Bologna Declaration led to the development of the National Qualifications Framework, which attempts to articulate the differences between qualifications in each cycle (EACEA, 2012). In the Tuning Project, the goal is to provide qualifications on the institutional and pan-European field levels. The Tuning Project provides faculty members and institutions with the information to adequately describe “cycle degree programs at the level of subject areas” (e.g., biology, sociology; Adelman, 2009, p. 48).

To do this, faculty members are assigned the task of developing reference points and statements of learning outcomes, levels of learning, and desired competencies in particular disciplines using a methodology that ensures all statements are transparent and comparable (Adelman, 2009). The Tuning Project asserts that uniformity is not ideal in degree programs, but rather the ability to find points of convergence, reference, and common understanding between them. Tuning articulates what a specific curriculum/program intends to do, but does not attempt to map one specific pathway (Adelman, 2009; González & Wagenaar, 2003).

Association of American Colleges and Universities—Liberal Education and America’s Promise (LEAP). In 2005, LEAP was established and has since served as an advocate for liberal education. Working with hundreds of higher education institutions at all levels (i.e., community colleges, colleges, and universities), LEAP provides information about “key outcomes of a quality education” (AAC&U, 2011, p. 1) and indicates how well institutions are assisting students in reaching the desired outcome through research and reports (AAC&U, 2011). In addition to this research, LEAP has established several partnerships with colleges and universities to create the Campus Action Network (e.g., individuals from campuses across the country work together to discuss best practices in the field) and has formed the National Leadership Council (composed of business persons, academics, and policy leaders who advocate for all students to have access to opportunities in key education outcomes; AAC&U, 2011).

Central to the LEAP initiative are the views set forth in *College Learning for the New Global Century* issued by the LEAP National Leadership Council in 2007 (AAC&U, 2011). The report argued the importance of focusing on key education and learning outcomes and offered recommendations for achieving these results (AAC&U, 2011). Using the report and research as a guide, LEAP has denoted four domains that are considered “the essential learning outcomes”: knowledge of human cultures and the physical and natural world, intellectual and practical skills, personal and social responsibility, and integrative and adaptive learning (AAC&U, 2011, p. 7).

In addition to the Essential Learning Outcomes framework, the LEAP National Leadership Council has proposed a new framework for excellence that includes seven principles:

1. Aim high—and make excellence inclusive
2. Give students a compass
3. Teach the arts of inquiry and innovation
4. Engage the big questions
5. Connect knowledge with choices and action
6. Foster civic, intercultural, and ethical learning
7. Assess students’ ability to apply learning to complex problems (AAC&U, 2011)

LEAP has emphasized the importance of developing a partnership between educators, students, and society to reach this level of excellence (AAC&U, 2011).

The Council for the Advancement of Standards in Higher Education (CAS). In 1979, the Council for the Advancement of Standards in Higher Education (CAS) began with the purpose of creating, developing, and disseminating standards in higher education to educators and their institutions (Strayhorn, 2006). Specifically, CAS aims to support and enhance the quality of programs and services in the field of learning and development (CAS, n.d.). In an effort to meet these goals, delegates from 36 professional higher education associations, represented by a range of organizations in the United States and Canada—including both for- and not-for-profit organizations—serve as members of the CAS Board of Directors (CAS, n.d.).

CAS has developed standards of professional practice for a range of areas in the realm of education and has created 16 learning and development domains, including intellectual growth, effective communication, realistic self-appraisal, enhanced self-esteem, clarified values, career choices, leadership development, healthy behaviors, meaningful interpersonal relationships, independence, collaboration, social responsibility, satisfying and productive life styles,

appreciation of diversity, spiritual awareness, and achievement of personal and educational goals (Strayhorn, 2006). These domains are used to organize CAS's frameworks and are further described in the report, *Frameworks for Assessing Learning and Development Outcomes* (Strayhorn, 2006). Each framework is designed to help educators and practitioners assess students and evaluate procedures in a particular domain (e.g., intellectual growth) that are centered on both student learning and development (Strayhorn, 2006). For each domain, the framework includes an introduction, theoretical context, related variables and indicators, examples of both quantitative and qualitative methods, tools available in the public domain, and related materials, such as websites, references, and readings (Strayhorn, 2006, p. 12).

The Lumina Foundation—Degree Qualifications Profile (DQP). In 2000, the privately funded Lumina Foundation for Education began its mission to enroll and graduate more students from college, with a specific focus on increasing the enrollment and graduation rates of four groups of students: low income, first generation, persons of color, and adult learners (Lumina Foundation, 2012). By 2025, the foundation has set a goal to increase the proportion of Americans who hold high-quality degrees and credentials to 60% (Adelman, Ewell, Gaston, & Schneider, 2011). Toward this end, the Lumina Foundation developed the DQP.

The DQP provides a framework to describe what students, at any educational level, should know and have the ability to do with a particular degree (Adelman et al., 2011). Levels of achievement are defined for associates', bachelor's, and master's degrees. Thus, the profile demonstrates how students should perform at increasingly challenging levels (Adelman et al., 2011). Regardless of one's field of study, the DQP provides descriptions for five areas of learning: broad, integrative knowledge; specialized knowledge; intellectual skills; applied learning, and civic learning (Adelman et al., 2011). The descriptors and outcomes are the end result of a review of over a decade of research across all levels of U.S. higher education to define the expected learning outcomes that are necessary for success at work, citizenship, and global participation (Adelman et al., 2011). The Lumina Foundation has noted that in practice these areas overlap and should be integrated.

The Assessment & Teaching of 21st Century Skills (ATC21S). In 2009, Cisco, Intel, and Microsoft officially sponsored the international research project ATC21S, led by the University of Melbourne in Australia and in cooperation with the countries of Australia, Finland, Singapore, and the United States (ATC21S, 2012a). The goal of this partnership is to prepare

students for the 21st century workforce by enhancing educational systems with the incorporation of skills such as collaboration and digital literacy in curricula through assessment.

The ACT21S reports that few nations describe their national curriculum in detail, but many have set high goals for their educational system, often mentioning 21st century skills but rarely providing more information than a reference to the skills (Binkley, Erstad, Herman, Raizen, & Ripley, 2009). Thus, ATC21S developed a five phase plan, ranging from defining the current state of education to creating public domain resources to build a foundation that will enable 21st century skills to resonate with all students throughout the world (ATC21S, 2012b).

Phase 1 of the five phase plan is relevant to the purpose of this paper. During this phase the project's five working groups reviewed the existing literature and frameworks and produced white papers that have informed the development of a new framework to guide the creation of large-scale assessments of 21st century skills. The outcome of this synthesis is the KSAVE framework. KSAVE refers to the knowledge, skills, attitudes, values, and ethics associated with the important skills, which KSAVE identifies for success in the 21st century (Binkley et al., 2009). The KSAVE framework uses 10 skills, grouped into four categories. The categories and skills (skills provided in parentheses) include: ways of thinking (creativity and innovation, critical thinking, problem solving, decision making, learning to learn, metacognition), ways of working (communication, collaboration [teamwork]), tools for working (information literacy, information and communication technologies [ICT] literacy), and living in the world (citizenship—local and global, life and career, personal and social responsibility). For each of these skills, the KSAVE framework provides reference to the knowledge requirements, the abilities and skills associated that guide curriculum, as well as the behaviors and aptitudes related to a particular skill (Binkley et al., 2009).

United States Department of Labor, Employment and Training Administration (USDOL-ETA). In the last few decades, the USDOL-ETA has recognized a clear need to focus on and develop a competency model to assist in the determination of the necessary requirements for workers, based on the needs of employers and businesses (Ennis, 2008). To meet this end, the USDOL-ETA developed the ETA Competency Model Clearinghouse's General Competency Model Framework. The competencies included in this framework are represented by nine tiers, organized in a hierarchical, or stackable, fashion, with general competencies at the bottom and job-specific competencies at the top. The arrangement of the competencies from bottom to top are

as follows: personal effectiveness competencies, academic competencies, workplace competencies, industry-wide technical competencies, industry-sector technical competencies, occupation-specific knowledge areas, occupation-specific technical competencies, occupation-specific requirements, and management competencies.

The tiers at the lower levels (i.e., personal effectiveness competencies, academic competencies, workplace competencies) represent foundation competencies. These foundational competencies are broad competencies, such as initiative (personal effectiveness competencies), mathematics (academic competencies), and teamwork (workplace competencies) that can be applied across many industries (Ennis, 2008). Tier 4 (industry-wide technical competencies) and Tier 5 (industry-sector technical competencies) refer to competencies specified by a particular sector or representative of an industry. The final group of the USDOL-ETA framework includes Tiers 6–9 and focuses on competencies and knowledge specific to an occupation (Ennis, 2008).

Results: The Critical Domains

As a result of reviewing these frameworks, we identified seven common critical domains. Each domain is presented and described below, including supporting language from the source frameworks. See Table 2 for a concise summary of these results.

Creativity

The ability to generate new ideas is an important competency for postsecondary students to exhibit. At the same time, it is also essential for students to apply these ideas and solutions in a real-world context. Taken together, creative thinking is presented here. Indeed, these concepts were discussed broadly in the literature that was reviewed, with five of the seven frameworks addressing similar concepts. When considering all of the frameworks reviewed, creative thinking can be defined as

- generation of new ideas,
- novel integration of existing ideas, and
- application of new ideas in a real-world setting.

First, students must be able to generate new ideas. This commonly held definition of creativity was emphasized by several of the frameworks reviewed here. In defining its “creative thinking” outcome, LEAP includes “thinking, reacting, and working in an imaginative way”

(Rhodes, 2010, p. 3). Idea generation is also directly referenced in outcomes in both the ATC21S and Bologna frameworks.

Table 2

A Summary of the Seven Critical Domains and Use in Educational Testing Service (ETS) Products and Assessments

Domain	Components	Domain measured in ETS products				
		EPP	Criterion	TOEFL/ TOEIC ^a	iSkills	PPI ^b
Creativity	The generation of new ideas					
	Novel integration of existing ideas					
	Application of new ideas in a real-world setting					X
Critical thinking	Thinking critically					
	Solving problems	X				
	Synthesize information					
Teamwork	Sense-making					
	Fulfill roles within a team					
	Treat group members with respect					X
Effective communication	Motivate group members					
	Effectively communicate multiple types of messages					
	Communicate across multiple forms	X	X	X		X
Digital & information literacy	Effectively deliver messages to varying audiences					
	Accessing and finding information					
	Analyzing and evaluating information				X	
Citizenship	Using and managing information					
	Applying technology effectively					
	Civic knowledge					
Life skills	Participating in civic processes					
	Action and organization toward change					
	Respect for others					
Life skills	Ethics and integrity					
	Independence, self-directed learning					
	Time management					X
Life skills	Goal setting					
	Adaptation, flexibility					

Note. EPP = ETS[®] Proficiency Profile, PPI = ETS[®] Personal Potential Index.

^aThe TOEFL[®] and TOEIC[®] programs assess communication skills for similar populations, but these assessments deal specifically with assessing English learners. ^b Issues of methodology, audience, use, and intended population must be considered when using the PPI.

Second, creativity does not simply refer to idea generation, but the novel integration of existing ideas. One criterion of the Lumina DQP stated that students should produce “creative or practical work that draws on specific theories, tools and methods from at least two academic fields” (Adelman et al., 2011, p. 11). Similarly, LEAP refers to “the capacity to combine or synthesize existing ideas” (Rhodes, 2010, p. 3).

Third, creativity includes the application of ideas in a real-world setting. LEAP recommends frequent and extensive practice of creative thinking “across the curriculum, in the context of progressively more challenging problems, projects and standards of practice” (AAC&U, 2007, p. 3).

Critical Thinking

Critical thinking, problem solving, and decision making are important features of the primary, secondary, and postsecondary curriculum in many parts of the world as evidenced by the attention given to these competencies on large-scale assessments (e.g., National Assessment of Educational Progress [NAEP] and Program for International Student Assessment [PISA]). Taken together, critical thinking, problem solving, and decision making incorporate one’s ability to reason effectively, use systems thinking and evaluate evidence, solve problems, and clearly articulate the result of the inquiry and exhibit. There is a great deal of consistency when looking across frameworks for the inclusion of critical thinking, problem solving, and decision making as all seven of the frameworks addressed similar concepts. When considering all of the frameworks reviewed, critical thinking, problem solving, and decision making can be defined as

- thinking critically,
- solving problems,
- synthesizing information, and
- sense-making.

Thinking critically and synthesis of information refers to one’s ability to understand the importance of evidence, interpret information, and draw conclusions based on the best analysis (Bologna, CAS, Lumina DQP, QAA-FHEQ, USDOL-ETA). Second, problem solving and decision making refers to one’s ability to ask questions that clarify various points of view and lead to better solutions (Bologna, CAS, Lumina DQP, QAA-FHEQ, USDOL-ETA). Finally,

sense-making refers to one's ability to determine the deeper meaning or significance of what is being expressed (QAA-FHEQ, CAS).

In addition to agreement across frameworks on the inclusion of core descriptors for critical thinking, problem solving, and decision making, some frameworks expand on these definitions. For example, the ATC21S also emphasizes the importance of an attitudinal disposition, which includes being trustful of reason, open and fair in deed, flexible, and honest, as well as inquisitive and well informed.

Teamwork

Our review of the frameworks clearly conveyed the prevalence of team-based work in both academic and professional settings. To this end, teamwork and collaboration have become crucial domains for higher education. However, explicitly defining the necessary facets of collaboration could be the focus of entire fields of study. Thus, it was no surprise that various frameworks discussed this domain have great variance in manner and depth. Nevertheless, five of the seven frameworks reviewed referenced the need for teamwork, with the common tenants across them including the following:

- Fulfill roles within a team.
- Treat group members with respect.
- Motivate group members.
- Possess leadership skills.

Although several frameworks refer broadly to the ability to function as a productive team member (Bologna, CAS), key behaviors emerge from more extensive definitions. Several models (e.g., CAS, LEAP, USDOL-ETA) refer to effective communication, including receiving and providing feedback as part of one's role within a team. Students must also uphold obligations, completing tasks that are assigned to them (CAS, LEAP, USDOL-ETA).

Second, students must treat other members of groups with respect. When conflict arises, students must be adept at managing those situations (Bologna, CAS, USDOL-ETA). They should also appreciate both demographic and experiential diversity in their teams (ATC21S, Bologna).

Third, five of the seven frameworks reviewed mentioned the need for students to be able to motivate or inspire action in others. LEAP suggested that students should motivate teammates

by expressing confidence about the importance of the task and the team's ability to accomplish that goal (AAC&U, 2011). According to the Bologna competencies, students must have the "ability to motivate people and move toward common goals" (Lokhoff et al., 2010, p. 63).

Finally, we note that leadership skills were mentioned in four of the seven frameworks reviewed. Just as with teamwork, leadership is a well-studied and often debated topic. However, one might intuit that leadership is a vital outcome for some or even many, but not all, graduates of higher education.

Effective Communication

All seven reviewed frameworks devoted significant attention to communication in its various forms. In the aforementioned Conference Board Survey (Casner-Lotto & Barrington, 2006), both oral and written communication were among the most needed skills mentioned by employers saying that these competencies (95% and 93%, respectively) were "very important."

Communication can be defined as a student's ability to

- effectively communicate multiple types of messages,
- communicate across multiple forms, and
- effectively deliver messages to varying audiences.

Across more than 80 individual outcomes that referred to communication, one unique core tenant was the importance of quality communication. At times this was mentioned very directly: "writes coherently" (CAS, Strayhorn, 2006, p. 46), "speaks effectively" (CAS, Strayhorn, 2006, p. 46), and clearly expresses the findings of inquiry (ATC21S, Binkley et al., 2009). Other frameworks were more explicit in defining quality communication. The USDOL-ETA framework outlined several fundamentals of proper writing mechanics and speaking. Similarly, LEAP provided entire rubrics for both written and oral communication. Overall, students must be able to both speak and write well.

Stating the need for quality communication seems exceedingly simple, but these frameworks also stated that students must be skilled in multiple forms of communication. The QAA-FHEQ framework stated that students must "effectively communicate information, arguments and analysis in a variety of forms" (QAA, 2008, p. 17). Additionally, the ATC21S included the ability to communicate, in written or oral form, and comprehend various meanings in diverse situations and for different purposes (Binkley et al., 2009).

This outcome also pointed to the need to consider the recipient of communications. One Bologna competency emphasized the “ability to communicate with non-experts of one’s field” (Lokhoff et al., 2010, p. 63), while several CAS standards pointed to the ability to influence others. Tailoring a message for a specific audience is frequently referenced implicitly, through mention of persuasion (via writing, speaking, and other forms of expression), and explicitly, through the mention of expert and nonexpert audiences.

A final consideration worth mentioning, although not a central facet of communication, is the adoption of a second language. Four of the seven frameworks—ATC21S, LEAP, Bologna, and the Lumina DQP—referenced the use of other languages. Indeed, although this is not universally agreed upon as a fundamental outcome of higher education, its repeated mention speaks to the expanding nature of our definition of communication.

Digital and Information Literacy

Over the past several decades, information literacy has become an increasingly vital skill. Through the Internet, students now have access to an incredible wealth of information that varies in reliability, accuracy, and intent. Thus, the ability to effectively gather, manage, and evaluate that information becomes increasingly vital. This was represented in our review, with each of the seven frameworks indicating the importance of information literacy. In short, it can be defined through four widely accepted outcomes:

1. Accessing and finding information
2. Analyzing and evaluating information
3. Using and managing information
4. Applying technology effectively

Accessing information was discussed by five of the seven frameworks reviewed (ATC21S, Bologna, LEAP, QAA-FHEQ, USDOL-ETA). Specific characteristics of information gathering included efficiency, thoroughness, and the use of multiple resources. In particular, the use of technology in gathering information was mentioned repeatedly.

The ability to effectively analyze and evaluate information was even more thoroughly emphasized, mentioned in at least 15 individual learning outcomes across seven different frameworks. In general, the frameworks emphasized the ability to “critically review, analyze, synthesize, compare and interpret information” (USDOL-ETA, n.d., p. 6).

However, simple gathering and analysis of information is insufficient in the eyes of these models, with each of the seven frameworks stressing the need to use information in decision making (e.g., “uses complex information to make decisions,” CAS, Strayhorn, 2006, p. 88), problem solving (e.g., using information to support critical thinking, creativity, and originality, ATC21S, Binkley et al., 2009), and communicating (e.g., “incorporates multiple information resources in different media or languages in projects, papers or performances,” Lumina DQP, Adelman et al., 2011, p. 13). Several frameworks also mention that, as information is used, it should be done so legally and ethically (ATC21S, LEAP, Lumina DQP).

Nearly all of the frameworks included some mention of digital literacy, but they varied significantly in the depth with which it was discussed. In some cases, elements of technology were fused into other domains. Conversely, ATC21S and USDOL-ETA both extensively discussed the use of technology. Aside from its inclusion in other critical domains (i.e., using media and electronic communication, using technology to support information gathering), we have identified only one outcome that was consistently represented across frameworks: applying technology effectively.

Citizenship

Citizenship has long been a desired outcome for institutions of higher education. Stemler (2012) found that many institutions include citizenship in their mission statements. Some have placed the responsibility of developing citizens on colleges and universities (Chickering, 1999; Colby, Ehrlich, Beaumont, & Stephens, 2003), even though academe has struggled to find a common definition for citizenship (Curtis-Tweed, 2004; da Silva, Sanson, Smart, & Toumbourou, 2004). Citizenship, however, might not seem like a requisite skill for the workforce, certainly not on the order of communication or teamwork skills. Nevertheless, six of the seven frameworks mentioned citizenship to some extent. Overall, discussions of citizenship tended to focus on five main points:

1. Civic knowledge
2. Participating in civic processes
3. Action and organization toward change
4. Respect for others
5. Ethics and integrity

The most fundamental and often mentioned of these outcomes is civic knowledge. ATC21S contains six different civic knowledge outcomes, including such topics as civil rights; the constitution; the functions of state, local, and federal governments; democracy; and current events. As with many of its outcomes, the Lumina DQP focused on students' application of this knowledge in communicating with others in both oral and written formats. Even the USDOL-ETA framework suggested that some employees possess "knowledge of laws, legal codes, court procedures, precedents, government regulations, executive orders, agency rules, and the democratic political process" (USDOL-ETA, n.d., p. 14).

The second citizenship facet focuses on participation in civic and social processes. Interestingly, the nature of this activity varies both within and across frameworks. ATC21S referred to participation in community and neighborhood activities, including successful integration with organizations in the public domain, volunteering, and democratic decision making at all stages of government (Binkley et al., 2009). Similarly, the CAS standards referred to community service. However, Bologna referred only to the "ability to act with social responsibility and civic awareness" (Lokhoff et al., 2010, p. 64).

Five of the seven frameworks also emphasize the need for students to be oriented toward civic change. The Lumina DQP stated that a degree holder "collaborates in developing and implementing an approach to a civic issue, evaluates the process and, where applicable, weighs the result" (Adelman et al., 2011, p. 20). The collaborative nature of this outcome is a common theme in this area, mentioned by ATC21S and LEAP, which stated that students should "collaboratively work across and within community contexts and structures to achieve a civic aim" (Rhodes, 2010, Civic Engagement Value Rubric, Capstone 4, Civic Contexts/Structures, p. 1).

Finally, six of the seven frameworks included a prosocial component that differs from work in a team context, thus warranting distinction from the interpersonal skills included in the teamwork domain. This respect for others includes treating people fairly and with respect (ATC21S, CAS, USDOL-ETA), respecting and acknowledging others' rights (ATC21S, Bologna, CAS), appreciation of diversity in the community (ATC21S, CAS, LEAP, Lumina DQP), and a sense of belonging within a community (ATC21S, CAS).

Life Skills

The term *life skills* is often used to refer to strategies employed to facilitate success, such as when institutions develop a life skills course to foster competencies, such as study skills and time management. Here, we have adapted the term to include several factors that were consistently mentioned across these seven frameworks. Generally speaking, life skills refer to one's ability to organize and manage his or her work in a way that promotes success. These received significant mention throughout these models, with six of the seven frameworks considering at least some portion of the key elements we identified. These key facets of life skills included the following:

- independence, self-directed learning,
- time management,
- goal setting, and
- adaptation, flexibility.

The most widely mentioned facet within this domain was the need for students to work independently and to direct their own learning or work environment. Subsequent behaviors include initiating and working independently (ATC21S, LEAP, Bologna, CAS, QAA-FHEQ, USDOL-ETA), the identification of educational and professional development needs (ATC21S, LEAP, CAS, QAA-FHEQ, USDOL-ETA), awareness and use of effective learning styles (ATC21S, CAS), and continued pursuit of learning (ATC21S, LEAP, Bologna, QAA-FHEQ, USDOL-ETA).

Another key skill is time management, often simply and directly stated as the efficient use of time and management of workload (ATC21S, Binkley et al., 2009), “ability to plan and manage time” (Bologna, Lokhoff et al., 2010, p. 63), or “manages time effectively” (CAS, Strayhorn, 2006, p. 3). Time management was also included in the USDOL-ETA framework.

The ability to set goals was also referenced in four of the seven models. Just as with time management, the specificity with which goal setting was discussed varied significantly across reports. ATC21S included varying goal targets (short, medium, long-term), as well as the need to prioritize goals. The CAS standards contained several outcomes referring to goal quality—that they should be clear and realistic.

Lastly, four of the seven frameworks emphasized the need for adaptability and flexibility. Given the sizable emphasis on organizational skills, it is interesting to note that students also

need to be able to succeed when tasks diverge from preset plans. As with time management, this skill was often simply stated (Bologna, QAA-FHEQ). However, the ATC21S and USDOL-ETA frameworks expanded somewhat, claiming that students need to function in various roles, responsibilities, schedules, and circumstances (ATC21S, Binkley et al., 2009); perceive opportunity ambiguity and changing concerns (ATC21S, Binkley et al., 2009); and “treat unexpected circumstances as opportunities to learn” (USDOL-ETA, n.d., p. 4).

A Note About Quantitative Skills

One area that was surprisingly absent from our findings was quantitative skills. Only three of the seven frameworks that we reviewed—LEAP, the Lumina DQP, and USDOL-ETA— included explicit mention of any quantitative domain. Even when explicitly mentioned in the Lumina DQP, the use of quantitative skills occurred in the context of communication and critical thinking:

[A degree holder] translates verbal problems into mathematical algorithms, constructs valid arguments using the accepted symbolic system of mathematical reasoning, and constructs, as appropriate to his or her major field (or another field), accurate calculations, estimates, risk analyses or quantitative evaluations of public information and presents them in papers, projects or multi-media events. (Adelman et al., 2011, pp. 13–14)

Similarly, other frameworks, such as ATC21S, alluded to quantitative skills through the use of data in communication or critical thinking, but did not go so far as to define or emphasize the quantitative skills that should be a target of higher education or necessary in the workforce.

There are several potential explanations for this absence. The most likely hypothesis is that numeracy is an assumed skill for those graduating from college. Reading is also excluded from our critical domains, but one could easily intuit that any person graduating from college would be able to read. Thus, we certainly do not want to deemphasize the importance of quantitative literacy. Mathematics is an important part of education, as evidenced by its presence on nearly every assessment of achievement or potential. Nevertheless, to include quantitative skills among our critical domains would not have been an accurate representation of the frameworks that were reviewed.

However, comparing these core skills (e.g., literacy, numeracy) and the more complex, demonstrated competencies described in this paper helps articulate a key difference in a framework that is used to define the outcomes of higher education versus one that identifies skills necessary for the workforce. By definition, an outcome is a terminal point and not an underlying skill or ability. Demonstrations of outcomes contain complex applications and interactions of basic skills, an act that, in and of itself, is sought by higher education. However, in identifying those who are most likely to succeed in the workforce, measuring the individual underlying traits may be more valuable for a variety of reasons, such as ease of assessment and, similarly, more direct observation.

Existing Educational Testing Service (ETS) Assessments

In the next section, we address our third and final goal—reviewing existing work at ETS and the extent to which it aligns with our critical domains (see Table 2 for a summary). Although a thorough review of all of the relevant research done at ETS is beyond the scope of this report, we hope to evaluate two key aspects of extant work. First, to what extent has ETS developed assessments in these areas for higher education? That is, has this domain been researched? Have assessments been developed? Have these assessments been used operationally? Second, we will briefly evaluate the extent to which, at a conceptual or theoretical level, work at ETS aligns with our critical domains as they are defined.

Creativity. The most relevant work in creativity was led by Randy Bennett and Donald Rock (1995, 1998), who sought to expand the scope of the *GRE*[®] General Test. Based on previous works by Frederiksen and colleagues (Frederiksen, 1959; Frederiksen & Evans, 1974; Frederiksen & Ward, 1978), they developed *generating explanation* (GE) items, which asked examinees to develop as many plausible explanations for a given scenario. These items would then be scored by human raters according to several criteria (e.g., uniqueness, appropriateness). Ultimately, the GE assessment showed promising results, with substantial reliability of scores, low relation with GRE general scores, lower gender and racial/ethnic gaps, and incremental validity in predicting graduate school success.

One difficulty in the GE assessment involves its scoring. The criteria for a valid response were evaluated in these studies by human scorers, though the work of Bennett and Rock sought to automate this process. The cost of manually scoring assessments is high, both in time and resources, and may be prohibitive in some contexts. Additionally, while the GE assessment

appears to sufficiently address the idea generation components of creativity, it fails to address the application or contextual understanding components that are included in this domain.

Critical thinking. ETS's most direct effort to measure critical thinking in higher education has been the *ETS*[®] Proficiency Profile (EPP; formerly the Measure of Academic Proficiency and Progress [MAPP]). Used to measure general education, EPP assesses several specific critical thinking outcomes. According to the most recent user's guide (ETS, 2010), the EPP assesses students' ability to

- evaluate competing causal explanations,
- evaluate hypotheses for consistency with known facts,
- determine the relevance of information for evaluating an argument or conclusion,
- determine whether an artistic interpretation is supported by evidence contained in a work,
- recognize the salient features or themes in a work of art,
- evaluate the appropriateness of procedures for investigating a question of causation,
- evaluate data for consistency with known facts, hypotheses, or methods, and
- recognize flaws and inconsistencies in an argument.

When comparing these outcomes to the four key points identified in our synthesis (thinking critically, solving problems, synthesize information, sense-making), it is clear that EPP addresses students' ability to evaluate information and arguments critically, as well as making sense of the critical points or themes from a given piece of information. Two areas identified here that are not addressed by EPP are solving problems and synthesizing information.

Several components of the GRE also address aspects of critical thinking, similar to the EPP, mirroring many of the claims above. According to the GRE website, The GRE revised General Test "analytical writing measure tests your critical thinking and analytical writing skills" (ETS, 2013, para 1). Thus, the GRE General Test may also serve as an important reference for assessing critical thinking. However, it should be noted that the GRE General Test differs in both population (graduate education) and function (prediction, rather than outcomes assessment) from many of the other assessments discussed here.

Effective communication. Assessing communication can certainly take many forms. Additionally, the outcomes identified here—effectively communicating multiple types of

messages, communicating across multiple forms, and effectively delivering messages to varying audiences—cover a wide range of skills and abilities.

Indeed, ETS has developed several assessments in this domain. The EPP includes a multiple-choice writing skills section that assesses students' ability to identify appropriate grammar usage and organization of information.

Both EPP and *Criterion*[®] represent part of ETS's established history of assessment in writing skills and proficiency, which also includes a great deal of work with GRE and TOEFL. To be sure, ETS has been an industry leader in assessing communication in this way. However, in reviewing these frameworks, it was clear that the definition has expanded and will continue to do so. Students must not only be able to write, but also do so in contexts that range from social media to research publications. Additionally, several frameworks emphasized the importance of multiple forms of communication, particularly oral, that ETS has not assessed on a broad scale in this context. Although such integrative tasks take place in the TOEFL assessment, this program deals specifically with assessing English learners. Thus, the complex issues in communication uncovered here, such as the ability to consider one's audience, require greater focus in the improvement of existing assessments and the development of new ones. These areas provide several future directions to guide research and development efforts.

Digital and information literacy. When considering the ability to access, evaluate, and apply information, as well as to effectively apply technology, ETS's most relevant effort in higher education is clearly the *iSkills*[™] assessment. Developed in collaboration with institutions of higher education, as well as experts in the field, iSkills assesses the ability to

- evaluate the usefulness and sufficiency of information for a specific purpose,
- create, generate, or adapt information to express and support a point,
- communicate information to a particular audience or in a different medium,
- define an information problem or formulate a research statement, and
- access, summarize and integrate information from a variety of digital sources.

In comparing these competencies to those continually described in the literature, we see a great deal of alignment. The iSkills assessment not only addresses the key components of information literacy, but also includes a technological context that was prevalent in the frameworks we reviewed. Although any assessment that considers technology needs to be

consistently maintained for modernity and relevance, this assessment seems to be well aligned with the aims of higher education and its constituents.

Teamwork, citizenship, and life skills. The remaining three areas—teamwork, citizenship, and life skills—have not been assessed operationally by ETS. Although considerable research has emerged from within ETS in the teamwork (e.g., Wang, MacCann, Zhuang, Liu, & Roberts, 2009) and citizenship areas (e.g., Coley & Sum, 2012), as well as the life skills areas such as time management (e.g., Liu, Rijmen, MacCann, & Roberts, 2009), the organization has yet to develop such efforts to the same extent as the other domains discussed here.

Assessment in these areas is challenged in two ways. First, there is an issue of complexity. In each of these cases, as well as several others, the broad domain is not inherently characterized by one trait, skill, or behavior. These areas often contain components of knowledge, interpersonal skills, and attitudes that would require a wide variety of assessments, which points to the second issue in this area.

These domains are certainly less traditional than the others identified here, most of which weigh heavily in the cognitive ability domain upon which ETS has focused for much of its existence. However, the importance of and demand for noncognitive skills continue to increase, as represented by a host of research, policy reports, and surveys, as well as our findings here. These attributes require varying types of assessment that can range from self-report personality measures to situational judgment tests to direct observations of behavior and skill. Ultimately, no one assessment can sufficiently address these complex and multifaceted domains.

The ETS[®] Personal Potential Index (PPI)

The ETS[®] Personal Potential Index (PPI) was developed by ETS in order to assess a wide range of cognitive and noncognitive skills in potential graduate students. Here, prospective students are rated by faculty and other referrers on several key behaviors designed to indicate such areas as creativity, communication, teamwork, resilience, planning and organization, and ethics and integrity. Certainly, these skills and abilities relate directly to our findings, but to include this as an assessment of these skills may be premature. Whether the PPI is a suitable assessment of these attributes depends on issues of methodology (use of behavioral observation), audience (graduate faculty), use (admissions rather than achievement), and intended population (entering graduate students). Further research should explore how the PPI and its underlying framework could be used to assess the achievement and potential of degree recipients.

Comparable Efforts

The unique perspective of this report synthesized the frameworks of learning outcomes and competencies relevant to higher education. However, we are aware of three key recent initiatives that are highly important for this work and the effort to improve the quality and preparedness of college graduates in general. Here, we discuss these efforts—a recent ETS research project using the Department of Labor’s Occupational Information Network (O*NET) and a separate initiative conducted by the National Research Council (NRC)—and how they relate to, inform, and possibly support our findings here.

ETS O*NET Project. In 2012, members of the Center for Academic and Workforce Readiness and Success at ETS began analyzing data from the Department of Labor’s O*NET database (Burrus, Jackson, Xi, & Steinberg, 2013). O*NET surveys thousands of subject matter experts, job incumbents, and hiring managers to collect and maintain information on the knowledge, skills, abilities, and work styles required for over 900 occupations. The authors conducted both descriptive and principal component analyses of worker characteristics and ultimately endorsed a model with five domains: problem solving, fluid intelligence, communication skills, teamwork, and achievement/innovation. Table 3 demonstrates the alignment between the Burrus et al. (2013) domains (along with example descriptors from the O*NET database) and those endorsed here.

Table 3

*Alignment Between Burrus et al. (2013) O*NET Domains and Critical Domains*

Critical domain	O*NET domain	Example O*NET worker requirement/characteristic
Critical thinking	Problem solving	Judgment and decision making, complex problem solving, critical thinking
Life skills	Achievement/innovation	Persistence, initiative, independence
Teamwork	Teamwork	Cooperation, social orientation, dependability
Effective communication	Communication skills	Oral communication, written comprehension, speech clarity

In some cases, there is clear and direct alignment. Teamwork and communication are clearly mentioned in both frameworks. Other concepts are unique to each approach. Burrus et al. (2013) identified a broad, general factor of *fluid intelligence*. Conversely, we identified citizenship, which does not appear in their framework. The remaining concepts from our findings—critical thinking, creativity, information and digital literacy, and life skills—are certainly apparent in the findings of Burrus et al. (2013), but not directly apparent at the level of their components. For example, our findings yielded a general domain of critical thinking, which is partially defined by the ability to problem solve, while their framework presents problem solving, which is partially defined by the ability to think critically.

Overall, these findings suggest significant overlap between these two efforts, but not unanimity. Differences between the findings presented here and those presented by Burrus et al. (2013) could be attributed to several factors, such as methodology, but a likely explanation may be the source material. Whereas our approach considered both educational and workforce perspectives, with slightly more influence coming from the former, O*NET is strictly an occupational source.

National Research Council (NRC)—21st century skills. The NRC (2008, 2010, 2011, 2012) has recently focused on the definition, assessment, and development of 21st century skills. These efforts mirror the current report in several ways. Namely, they seek to synthesize literature to provide common definitions of the key skills needed to succeed in the workforce. Also, the focus on 21st century skills denotes a shift from the previous, subject-focused domains to the competencies that promote the application of knowledge across disciplines.

However, the NRC efforts differ from this one in several key ways. First, they focus on skills that span the educational spectrum. One of the primary efforts here is to address the recent pressure and resulting frameworks relevant to higher education, specifically. As such, several of the frameworks that we considered (e.g., Bologna, LEAP, Lumina DQP) were excluded from their review. Moreover, the skills that they outline are derived from a review of scientific literature and do not focus on specific outcomes or competencies, as we have done here.

Nevertheless, their resulting domains provide a valuable comparison for those presented here. Table 4 compares findings of the most recent NRC report to ours and finds significant congruence. Here, we see a high degree of alignment between the NRC findings and the critical domains presented here. Only positive core self-evaluation from the NRC framework and

citizenship from the critical domains are not matched between the two sets of skills. Thus, despite differences in the focus and scope of these efforts, the two findings are largely in agreement.

Table 4

Comparison of National Research Council (NRC) Domains and Critical Domains

	NRC domains	Critical domains
Cognitive	Cognitive processes and strategies	Critical thinking
	Knowledge	Information & digital literacy, effective communication
	Creativity	Creativity
Intrapersonal	Intellectual openness	Life skills
	Work ethic/conscientiousness	
	Positive core self-evaluation	N/A
Interpersonal	Teamwork and collaboration	Teamwork
	Leadership	

Future Directions

In addressing the steps that should result from this work, we have identified four key areas that should be considered. Although each of these has direct implications for ETS, there are also broader considerations for educational research and assessment development as a whole:

- First, we must consider whether the target population of entry-level, bachelor’s equivalent learners is appropriate.
- Second, from a research and development standpoint, we should consider how assessments in previously unaddressed domains might be constructed, and whether this meets the needs of various constituencies. This includes identifying the complex interplay among knowledge, skills, ability, behavior, and attitudes, then using this understanding to determine the most appropriate assessment method.
- Third, the critical domains have not been presented in a hierarchical or sequential fashion, and we should consider the sequence of each domain for various populations.
- Fourth, we should consider the need to structure these skills for various purposes and uses (education, workforce, policy sector).
- Finally, it is important to determine how assessments in these domains might be used, as well as the implications of those uses.

Consider populations and impact. Throughout this report, we have referred to higher education and assumed that the key population of interest was those seeking traditional, 4-year bachelor's degrees. Certainly, much of the criticism and doubt around higher education has targeted the rising costs associated with this level of education. However, as the role and need for higher education has increased in recent decades, this certainly has not been exclusive to the bachelor's degree. Over 40% of currently enrolled college students attend community colleges (Knapp, Kelly-Reid, & Ginder, 2012), and educational certificates are a rapidly growing form of postsecondary education that provide many with an established credential (Carnevale, Rose, & Hanson, 2012). The O*NET system of classifying occupations is based on education and knowledge, as well as skill and ability requirements (i.e., occupation zones). Using the zone system, it is clear that frameworks are a composite of general or foundational skills required of all workers and tailored or specific skills, knowledge, and ability required specific to the occupational zone or the job itself.

Our focus was on 4-year college graduates, who we expect to demonstrate work-ready skills and behaviors, general education outcomes and acquired knowledge, and college major or degree-specific outcomes or knowledge. Indeed, according to the literature that we reviewed here, traditional higher education needs to seriously consider the skills their graduates need as well as their level of preparation for the workforce. However, this does not limit the need or merit of studying similar issues at other levels of postsecondary education, such as the associate's degree, master's degree, and doctoral or professional degree.

Frameworks From Education and Work Perspectives: Portfolio Versus Stacked, Badges Versus Certificates?

One observation is that the frameworks we have reviewed reflect a combination of education, work-ready, and civic/life outcomes. It is hard to disconnect the framework from its use or purpose, primarily whether it is education or work contextualized. From a traditional learning outcome perspective, accreditation and other institutional accountability measures geared toward aggregate general learning outcomes is a mature market that ETS has historically addressed through its portfolio of EPP, Major Field Test (MFT; a content-based, field-specific test) and iSkills solutions. Other outcomes tied to student success (e.g., credit-bearing course credit, degree attainment) are emerging as the costs of failed postsecondary experiences become

evident. Certainly many of the noncognitive domains identified in the NRC framework would inform student readiness and success.

Recently, the emergence of open educational resources and massive open online courses has generated great attention from those who work in and study higher education. The ultimate role of these movements remains unclear, but they hold the potential to unlock a world of learner-driven education—where students manage their own programs of study, learn from many different places, and are not necessarily educated and certified by the same organization—rather than the traditional, institution-driven model where students attend one institution under one program of study in order to receive their degree.

Practically, this suggests a greater focus on individual certification and verification of specific courses or learning goals. Whether third party verification of an educational degree, *per se*, becomes an emergent need and opportunity must be monitored. Although not their explicit intent, frameworks of learning outcomes, such as the Lumina DQP, could inform an interesting approach to creating stacked educational certificates that demonstrate an array of critical knowledge and skill domains. Regardless of one's field of study, the Lumina DQP provides descriptions for five areas of learning: broad, integrative knowledge; specialized knowledge; intellectual skills; applied learning; and civic learning (Adelman et al., 2011). ETS should consider the viability of an approach such as Lumina's, as it demonstrates how core assessment capabilities can be individualized and integrated into a broader portfolio of credentials.

The work-ready agenda also is evolving amid increased economic uncertainty and competition. This climate requires college graduates and adults to compete for high-skill and livable wage jobs that are in flux as technology changes the workplace. It may be that either a competency-based set of proficiencies or credentials, targeting those jobs that traditionally require a 4-year or graduate degree (O*NET Zones 4 and 5), are a viable option to help individuals and workers connect from a talent supply perspective. The Department of Labor and National Association of Manufacturing have endorsed a more ladderized framework for jobs requiring an associate's degree (Zone 3) that may also be extended to higher skill occupations. In this framework, the foundational cognitive and behavioral skills required of all jobs underlie the demonstration of job-specific knowledge, skills, and assessments. Less clear is what employers will recognize as indicators for preferential hiring, and as Carnevale and Hanson (2012) pointed out, even the notion of a credential versus a certificate is complicated and a cause for confusion.

Allocation of resources and innovative assessments. In addition to the frameworks identified here, a wealth of research (e.g., Barrick & Mount, 1991; Poropat, 2009; Richardson, Abraham, & Bond, 2012; Robbins et al., 2004; Robbins, Oh, Le, & Button, 2009) has shown the critical role that noncognitive factors play in both academic and workforce success. However, traditional forms of assessment have focused on cognitive ability. Recent literature reviews (Kyllonen, 2012; NRC, 2012) have discussed innovative assessment methods and their applicability in these domains. Methods such as situational judgment tests, forced-choice items, and anchoring vignettes are designed to address many of the issues (e.g., response bias, misrepresentation, cultural bias) that have been attributed to the Likert-type or self-report items that have long been used in this area.

In the near future, the skills that we wish to measure may not be accessible through our traditional means of assessment. Thus, we need to explore these innovative item types as well as their practical applicability in the various settings where they may be applied. Many of the hurdles in introducing and scaling innovative assessment center around issues of cost for item generation and form construct equivalence (e.g., situational judgment tests), automation in delivery and scoring (e.g., behavioral interviewing and skill demonstration), and nonproctored high stakes testing on demand (e.g., use of biometrics in web-based delivery).

Conclusion

Debates over higher education's mission and societal role have waged on for several decades. In addition, many have proposed frameworks for what college graduates should know and be able to do. Here, we have synthesized works from several perspectives and hopefully identified several domains that can be used to further to mold curriculum, identify assessments, and improve the quality of higher education. Certain issues, such as the comparison and contrast between higher education outcomes and workforce readiness, will continue to be topics of conversation but may be answered by approaches such as this. Nevertheless, as we seek to increase the quality of college graduates, we must first better understand the targets of the learning that we seek to instill.

References

- Adelman, C. (2009). *The Bologna process for U.S. eyes: Re-learning higher education in the age of convergence*. Washington, DC: Institute for Higher Education Policy.
- Adelman, C., Ewell, P., Gaston, P., & Schneider, C. G. (2011). *The degree qualifications profile*. Indianapolis, IN: Lumina Foundation.
- Assessment and Teaching of 21st Century Skills. (2012a). *Our global team*. Retrieved from <http://atc21s.org/index.php/about/team/>
- Assessment and Teaching of 21st Century Skills. (2012b). *Timeline*. Retrieved from <http://atc21s.org/index.php/about/timeline/>
- Association of American Colleges and Universities. (2007). *College learning for the new global century*. Washington, DC: Author.
- Association of American Colleges and Universities. (2010). *The quality imperative: Match ambitious goals for college attainment with an ambitious vision for learning*. Washington, DC: Author.
- Association of American Colleges and Universities. (2011). *The LEAP vision for learning: Outcomes, practices, impact, and employers' views*. Washington, DC: Author.
- Barrick, M. R., & Mount, M. K. (1991). The Big Five personality dimensions and job performance: A meta-analysis. *Personnel Psychology*, 44(1), 1–26.
- Bennett, R. E., & Rock, D. A. (1995). Generalizability, validity, and examinee perceptions of a computer-delivered formulating-hypotheses test. *Journal of Educational Measurement*, 32, 19–36.
- Bennett, R. E., & Rock, D. A. (1998). *Examining the validity of a computer-based generating-explanations test in an operational setting* (Research Report No. RR-97-18). Princeton, NJ: Educational Testing Service.
- Binkley, M., Erstad, O., Herman, J., Raizen, S., & Ripley, M. (with Rumble, M.). (2009). *Defining 21st century skills* (White Paper 1). Retrieved from <http://atc21s.org/index.php/resources/white-papers/>
- Burrus, J., Jackson, T., Xi, N., & Steinberg, J. (2013). *Identifying the most important 21st century workforce competencies: An analysis of the Occupational Information Network (O*NET)* (Research Report No. RR-13-21). Princeton, NJ: Educational Testing Service.

- Carnevale, A. P., Rose, S. J., & Hanson, A. R. (2012). *Certificates: Gateway to gainful employment and college degrees*. Washington, DC: Georgetown Center on Education and the Workforce.
- Casner-Lotto, J., & Barrington, L. (2006). *Are they really ready to work?* Washington, DC: Partnership for 21st Century Skills.
- Chickering, A.W. (1999). Personal qualities and human development in higher education: Assessment in the service of educational goals. In S. J. Messick (Ed.), *Assessment in higher education* (pp. 13–33). Mahwah, NJ: Lawrence Erlbaum.
- Colby, A., Ehrlich, T., Beaumont, E., & Stephens, J. (2003). *Educating citizens: Preparing America's undergraduates for lives of moral and civic responsibility*. San Francisco, CA: Jossey-Bass.
- Coley, R. J., & Sum, A. M. (2012). *Fault lines in our democracy: Civic knowledge, voting behavior, and civic engagement in the United States* (Policy Information Report). Princeton, NJ: Educational Testing Service.
- Council for the Advancement of Standards in Higher Education. (n.d.). *CAS general standards 2012*. Retrieved from <http://www.cas.edu/getpdf.cfm?PDF=E864D2C4-D655-8F74-2E647CDECD29B7D0>
- Curtis-Tweed, P. (2004). Moral and civic responsibility and the commercialization of higher education. *Journal of Moral Education*, 33, 211–217.
- da Silva, L., Sanson, A., Smart, D., & Toumbourou, J. (2004). Civic responsibility among Australian adolescents: Testing two competing models. *Journal of Community Psychology*, 32, 229–255.
- Dearing, R. (1997). *Higher education in the learning society: The report of the National Committee of Inquiry Into Higher Education (the Dearing report)*. London, UK: The Stationery Office.
- Deloitte, & The Manufacturing Institute. (2011). *Boiling point? The skills gap in U.S. manufacturing*. Retrieved from http://www.themanufacturinginstitute.org/~/_media/A07730B2A798437D98501E798C2E13AA.ashx

- Education, Audiovisual, and Cultural Executive Agency. (2012). *The European higher education area in 2012: Bologna process and implementation report*. Retrieved from [http://www.ehea.info/Uploads/\(1\)/Bologna%20Process%20Implementation%20Report.pdf](http://www.ehea.info/Uploads/(1)/Bologna%20Process%20Implementation%20Report.pdf)
- Educational Testing Service. (2010). *ETS® Proficiency Profile user's guide*. Princeton, NJ: Author.
- Educational Testing Service. (2013). *Introduction to the analytical writing measure*. Retrieved from http://www.ets.org/gre/revised_general/prepare/analytical_writing
- Ennis, M. R. (2008). *Competency models: A review of the literature and the role of the Employment and Training Administration (ETA)*. Washington, DC: U.S. Department of Labor.
- Frederiksen, N. (1959). *Development of the test "formulating hypotheses": A progress report*. Princeton, NJ: Educational Testing Service.
- Frederiksen, N., & Evans, F. R. (1974). Effects of models of creative performance on ability to formulate hypotheses. *Journal of Educational Psychology*, 66, 67–82.
- Frederiksen, N., & Ward, W. C. (1978). Measures for the study of creativity in scientific problem-solving. *Applied Psychological Measurement*, 2(1), 1–24.
- González, J., & Wagenaar, R. (Eds.). (2003). *Tuning educational structures in Europe: Final report phase 1*. Bilbao, Spain: Universidad de Deusto.
- Hart Research Associates. (2010). *Raising the bar: Employers' views on college learning in the wake of the economic downturn*. Washington, DC: Author.
- Knapp, L. G., Kelly-Reid, J. E., & Ginder, S. A. (2012). *Enrollment in postsecondary institutions, Fall 2011; financial statistics, fiscal year 2011; and graduation rates, selected cohorts, 2003-2008: First look (provisional data)* (NCES 2012-174rev). Washington, DC: U.S. Department of Education, National Center for Education Statistics.
- Kyllonen, P. C. (2012, May). *Measurement of 21st century skills within the Common Core State Standards*. Paper presented at the Invitational Research Symposium on Technology Enhanced Assessments (TEA), Washington, DC.
- Liu, O. L., Rijmen, F., MacCann, C., & Roberts, R. D. (2009). The assessment of time management in middle school students. *Personality and Individual Differences*, 47, 174–179.

- Lokhoff, J., Wegewijs, B., Durkin, K., Wagenaar, R., Gonzalez, J., Isaacs, A. K., . . . Gobbi, M. (2010). *A guide to formulating degree programme profiles including programme competences and programme learning outcomes*. Spain: Universidad de Deusto.
- Lumina Foundation. (2012). *Lumina Foundation fact sheet*. Retrieved from http://www.luminafoundation.org/publications/Lumina-Fact_Sheet.pdf
- ManpowerGroup. (2012). *Talent shortage survey: Research results*. Retrieved from http://www.manpowergroup.us/campaigns/talent-shortage-2012/pdf/2012_Talent_Shortage_Survey_Results_US_FINALFINAL.pdf
- Manyika, J., Lund, S., Auguste, B., Mendonca, L., Welsh, T., & Ramaswamy, S. (2011). *An economy that works: Job creation and America's future*. Retrieved from http://www.mckinsey.com/Insights/MGI/Research/Labor_Markets/An_economy_that_works_for_US_job_creation
- Marshall, D. W., Kalina, M., & Dane, W. (2010). *Tuning educational structures: A guide to the process (version 1.0)*. Retrieved from <http://www.tuningusa.org/TuningUSA/tuningusa.publicwebsite/b7/b70c4e0d-30d5-4d0d-ba75-e29c52c11815.pdf>
- McPherson, P., & Shulenburger, D. (2006). *Toward a voluntary system of accountability program (VSA) for public universities and colleges*. Washington, DC: National Association of State Universities and Land-Grant Colleges.
- Miller, M. A. (2008, July/August). The voluntary system of accountability: Origins and purposes. *Change: The Magazine of Learning*, 40(4), 8–13.
- National Research Council. (2008). *Research on future skills demands: A workshop summary*. Washington, DC: The National Academies Press.
- National Research Council. (2010). *Exploring the intersection of science education and 21st century skills: A workshop summary*. Washington, DC: The National Academies Press.
- National Research Council. (2011). *Assessing 21st century skills: Summary of a workshop*. Washington, DC: The National Academies Press.
- National Research Council. (2012). *Education for life and work: Developing transferable knowledge and skills in the 21st century*. Washington, DC: The National Academies Press.

- Poropat, A. E. (2009). A meta-analysis of the five-factor model of personality and academic performance. *Psychological Bulletin*, *135*(2), 322–338.
- Quality Assurance Agency. (2008). *The framework for higher education qualifications in England, Wales and Northern Ireland: August 2008*. Mansfield, UK: Author.
- Rhodes, T. (2010). *Assessing outcomes and improving achievement: Tips and tools for using rubrics*. Washington, DC: Association of American Colleges and Universities.
- Richardson, M., Abraham, C., & Bond, R. (2012). Psychological correlates of university students' academic performance: A systematic review and meta-analysis. *Psychological Bulletin*, *138*(2), 353–387.
- Robbins, S., Lauver, K., Le, H., Davis, D., Langley, R., & Carlstrom, A. (2004). Do psychosocial and study skill factors predict college outcomes? A meta-analysis. *Psychological Bulletin*, *130*(2), 261–288.
- Robbins, S. B., Oh, I. S., Le, H., & Button, C. (2009). Intervention effects on college performance and retention as mediated by motivational, emotional, and social control factors: Integrated meta-analytic path analyses. *Journal of Applied Psychology*, *94*(5), 1163–1184.
- Shultz, M., & Zedeck, S. (2012). Admission to law school: New measures. *Educational Psychologist*, *47*(1), 51–65.
- Stemler, S. E. (2012). What should university admissions tests predict? *Educational Psychologist*, *47*(1), 5–17.
- Strayhorn, T. L. (2006). *Frameworks for assessing learning and development outcomes*. Washington, DC: Council for the Advancement of Standards in Higher Education.
- Tuning Educational Structures in Europe. (n.d.). *What is tuning?* Retrieved from <http://www.unideusto.org/tuningeu/>
- U.S. Department of Education. (2006). *A test of leadership: Charting the future of U.S. higher education*. Washington, DC: Author.
- U.S. Department of Labor. Employment and Training Administration. (n.d.). *Building blocks for competency models*. Retrieved from <http://www.melvinhenry.org/generic-model.pdf>
- Wang, L., MacCann, C., Zhuang, X., Liu, O. L., & Roberts, R. D. (2009). Assessing teamwork and collaboration in high school students: A multi-method approach. *Canadian Journal of School Psychology*, *24*(2), 108–124.

Appendix
List of Acronyms

Acronym	Definition
AAC&U	Association of American Colleges and Universities
ATC21S	The Assessment & Teaching of 21st Century Skills
CAS	Council for the Advancement of Standards in Higher Education
DQP	Degree Qualifications Profile
EACEA	Education, Audiovisual, and Culture Executive Agency
EPP	ETS Proficiency Profile
ETA	Employment and Training Administration
ETS	Educational Testing Service
FHEQ	Framework for Higher Education Qualifications
GRE	<i>Graduate Record Examinations</i> [®]
LEAP	Liberal Education and America's Promise
MAPP	Measure of Academic Proficiency and Progress
MFT	Major Field Test
NAEP	National Assessment of Educational Progress
NRC	National Research Council
O*NET	Occupational Information Network
QAA	Quality Assurance Agency
QAA-FHEQ	Quality Assurance Agency for Higher Education—Framework for Higher Education Qualifications
PISA	Program for International Student Assessment
PPI	Personal Potential Index
USDOL	The U.S. Department of Labor
USDOL-ETA	The U.S. Department of Labor, Employment and Training Administration
VSA	Voluntary System of Accountability