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Closing the Skills Gap through Technical Excellence

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To address the skills gap and reward achievement, technical assessment publisher, NOCTI, began an initiative to define technical excellence in career technical education (CTE) programs and to recognize the nation's top CTE students through a digital Technical Badge of Excellence (TBOE). Analysis of standard setting methods and NOCTI student test data from U.S. high schools determined the excellence criteria. NOCTI has assessments in over 100 different technical areas and, because difficulty varies, normative standard-setting methods were most appropriate, as they account for test difficulty and locate students at a high position relative to the tested group. Additional criteria were implemented to assure the validity of the selection and subsequent awarding of the digital badge. Thus, top CTE students nationally can be located using normative standard setting methods, which will provide a source of skilled workers for global employers and help to close the skills gap.

Keywords: career technical, digital badge, skills gap, standards, workforce.

Introduction and Conceptual Framework

Developed countries face an imbalance between the supply of and demand for skilled workers, which is often termed the skills gap. During a fall 2014 visit by one of the authors to the French Ministry of Education, there was discussion of the nature of the skills gap within the European Union (personal communication October 13, 2014[1]). For example, France has had unemployment at or above ten percent for the past five years even though many jobs remain unfilled, especially jobs for technical workers and engineers. The situation is similar in the U.S.; American businesses face a growing skills gap whereby companies frequently cannot find workers with the needed skills to fill available jobs. One source of skilled workers in the U.S. is career technical education (CTE). Traditional CTE prepares high school students for positions in the trades, business and technical areas. However, employers cannot always locate those individuals qualified to fill positions vacated by retirement of their skilled workers. The goal of this research is to develop such a technique to assist employers in all corners of the globe.

According to the National Skills Coalition (2016), up to fifty-four percent

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[1] Personal communication with Guy Waiss, Head of the service of the budget, conversation with author Hodes, October 13, 2014, at the French Ministry of Education, Paris, France.

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of the jobs in the U.S. are classified as requiring "middle" skills; however, only forty-four percent of the workers have adequate training or education in those skills. This is the basis for the skills gap that many perceive to be widening (Yang, 2016). Unlike its many neighbors in industrialized nations around the world, the U.S. lacks a central organization and a consistent preparation system for technical workers and, by the metrics of the Organisation for Economic Co-operation and Development (OECD) (2013), is seen as having a system that results in underachievement of many. This paper is the result of a two-pronged analysis. First, there was an analysis of the methodology by which standards are developed; second, longitudinal data from a sample of recent technical test data were analyzed. The result is recognition of a standard of technical excellence, in the form of a digital badge, that when earned by the nation's CTE students will locate a pool of those best prepared to fill critical needs of business and industry affected by the skills gap.

The main purpose of this research was to develop theoretical and statistical methodology to locate the top CTE students based on current standard setting methods. The ability to perform such an analysis will benefit global organizations who have demand for skilled workers. In addition, the access to and transparency of a digital badge can be a type of credential for the student to present to potential employers. The availability of the TBOE may provide motivation for the student.

In most cases, the basis for standards is the consensus of knowledgeable subject matter experts (SMEs) regarding what is required for a worker to be judged "competent" (Perie & Zieky, 2006; Livingston & Zieky, 1982). That consensus usually results in establishing some set of expectations for competence along with an accountability system to verify that competence (Cizek & Bunch, 2007). Unfortunately, the flaw in this kind of consensus building is that it can set the bar too low, establishing minimal expectations that result in mediocrity rather than helping individuals maximize their potential. Many believe that CTE preparation does, in fact, result not only in competent workers, but also in their high achievement and success, and NOCTI believes there is a way to define that high achievement through a TBOE.

Literature Review

A recent report by Imperatore and Hyslop (2015) states that career technical education (CTE) is critical to U.S. global competitiveness, but the U.S. has been displaced as the global leader in educational attainment, signifying a need for more quality assurance in education (OECD, 2013). In addition, the basic skills of U.S. high school students are considered weaker than their international counterparts. OECD also notes the tendency for job credentials in the U.S. to be less centrally organized than other countries. The positive aspect of the lack of central control is that educational programs in regional labor markets are able to be more responsive to changing needs, but

this type of system means that many occupations are based on inconsistent standards or none at all.

The No Child Left Behind (NCLB) legislation has dominated U.S. education policy since it was signed into law in 2001. Although NCLB is being replaced by the Every Student Succeeds Act (ESSA) as of the 2017-18 academic year, NCLB legislation imposed increased accountability measures for student achievement. However, states developed their own definition of student proficiency in four core academic areas (NCLB, 2001). For CTE, states set performance levels, as required by legislation; the Carl D. Perkins Career and Technical Education Act of 2006 (Perkins IV) requires local education agencies to use these performance indicators to assess both technical and academic achievement. Each state's performance indicators are negotiated – and increased–annually through a dialogue with the U.S. Department of Education's Office of Career Technical and Adult Education (OCTAE). To promote excellence in CTE, educators must look critically at the performance levels set for accountability purposes and determine if those match the actual requirements their students need to succeed in today's skill-based economy.

Educators need to embrace the standards under which they operate in schools and training programs and determine how those standards can benefit students. Educators want their students both to be successful and to strive for excellence. This is the job of the career technical educator—to prepare students for the future and more importantly, mentor them as they acquire the higher level of skills for high-demand, high-wage careers that will sustain them over a lifetime. After all, CTE is results-driven education with a high return on investment for the individual as its goal (Imperatore & Hyslop, 2015).

The Skills Gap

Many employment sectors are experiencing a skills gap among current employees as well as a worldwide worker shortage, as many companies with a need for skilled workers have global interests (U.S. Department of Education, 2015; Yang, 2016). A high demand exists for skilled workers versed in new technologies (Simpson, 2016). On the other hand, many job seekers lack the skills required for the jobs available. At the same time, unemployment is high for youth under age 24 (Wyman, 2015). The National Association for Business Economics Business Conditions Survey (January, 2016) reported that thirty percent of their respondents indicated a skilled labor shortage during the fourth quarter of 2015. The defense sector has expressed concern over the lack of interest in "technologically-focused education" (Givhan, Trias, & Allen, 2011). In manufacturing, sixty-seven percent of U.S manufacturers surveyed reported a moderate to severe shortage of qualified workers (ACTE, 2013a). To help meet this need, CTE students have the opportunity to earn industry-recognized credentials upon program completion, such as the stackable credentials available under the National Association of Manufacturers (NAM)-endorsed Manufacturing Skills Certification System. A similar situation exists in health care, a sector that is a key employer in many states; shortages are predicted for

many types of medical professionals, most of which require a certificate or some sort of job credential for an entry-level position (ACTE, 2013b).

Regionally, the ten counties in southwestern Pennsylvania are experiencing not only a skills gap, but also a shortage of workers as retirements occur (L. Topoleski, personal communication, July 21, 2015[1]). In Kentucky, the skill level of the workforce is the biggest concern among employers; only eight percent of the Kentucky employers surveyed were satisfied with the skill level of the workforce (Blackford & Musgrave, 2015). Many more examples exist that show how excellence in CTE can benefit the student while serving the needs of the job market, which is CTE's main challenge.

What is Excellence?

The word *excellence* is frequently used in the media, but not always well defined; success emphasizes winning, but excellence requires the implementation of a learning environment. In *The Heart of the Order* (Boswell, 1989), Washington Post columnist Thomas Boswell differentiates between success and excellence as the following:

> "Success is tricky, perishable, and often outside our control; the pursuit of success makes a poor cornerstone, especially for a whole personality. Excellence is dependable, lasting and largely an issue within our own control; pursuit of excellence, in and of itself, is the best of foundations" (page xi).

Certainly success is an important goal for our students, but the pursuit of excellence in a student's CTE career and educational endeavors must be part of the educational climate. Data generated by CTE programs aggregate student performance to identify the high and low performing programs of study (Imperatore & Hyslop, 2015), but the problem at hand is to promote and recognize excellence in individual achievement.

As educators promote excellence in themselves and their students, they must also understand the newest standards within which they must work. Although high school GPAs and graduation rates have improved since 1990 (U.S. News and World Report, 2011), increased graduation requirements and proficiency standards have given new urgency to understanding standards. Sets of standards used for accountability often are codified, where others, such as those set by school-sponsored organizations, are not. The following paragraphs will discuss both types of standards as contributing to the complete picture of student achievement. In addition, several important methodologies and guidelines are included as they provide structure and the basis for alignment important to standard implementation.

[1] Personal communication with Linda Topoleski, conversation with author Hodes, July 21, 2105, at the Digital Badges Forum for Pittsburgh Employers, Pittsburgh, PA.

Development of Standards

Standards are developed at many levels to benefit public health, welfare and trust (Cizek & Bunch, 2007). Although many standards were developed to ensure quality and protect the public, they tend to be minimal. Regardless, standards have become important in education and the workplace as they set performance expectations for individuals and organizations. The International Organization for Standardization (ISO) convenes groups of experts to develop its standards. The ISO/IEC 17024:2012 standard, for example, contains uniform principles and requirements bodies certifying individuals against specific requirements, and includes that certifying bodies develop and maintain a "certification scheme for persons" (Frost, 2012). However, standards used for occupational credentials are not always the result of a uniform process or system. OECD (2013) feels that a standardized occupational credentialing system in the U.S. would bring CTE programs into alignment and require them to become more data driven, which would assist student transitions.

Apprenticeships

Apprenticeship standards from the U.S. Department of Labor (2016) combine education and work and are written to safeguard the welfare of apprentices, promote apprenticeship opportunity, and to extend the application of such standards. Apprenticeships are a way to close the skills gap (Wyman, 2015), as they learn a specific trade while earning an income during a supervised period in the workplace. Policymakers in the U.S. have tried to incentivize apprenticeships. The Obama Administration made $100 million dollars available for apprenticeship grants with a tax credit for employers who hire an ex-apprentice (Nicholson, Frank, Conrad, Steinberg, & Fortwengel, 2015). The federal code states that there must be a formal apprenticeship agreement and a written plan containing program standards for the specific occupation or industry. Additionally, there is an option for time-based or competency-based apprenticeship:

> "The term of apprenticeship, which for an individual apprentice may be measured either through the completion of the industry standard for on-the-job learning (at least 2,000 hours, a time-based approach), the attainment of competency (competency-based approach), or a blend of the time-based and competency-based approaches (hybrid approach)" (U.S. Department of Labor, 2016).

Upon successful completion of an apprenticeship, an appropriate certificate is issued by the Registration Agency.

In the European Union, apprenticeships are integrated into a national system of training and made available to those ages 15 and older who have completed their compulsory education. Apprenticeships are contractual and the standards are usually developed by the consensus of different associations,

professional committees and authorities. Apprentices may take an exit exam that has both a theoretical and a practical component. Ninety percent of apprentices take this exam. The main criteria were developed by the Union Européenne de l'Artisanat et des Petites et Moyennes Entreprises (UEAPME) (Linderholm & Parker, 2000), an employers' organization that represents trades and subject matter experts.

Continuous Improvement

Several popular standards-based, process-oriented methodologies have been used in the U.S. for organizational improvement in a culture of continuous improvement (Fast, 2015). Summarized by Aumiller (2008), Six Sigma begins with problem recognition and development of a plan or project to rectify the problem. A team undertakes this project using a five-phase process: define, measure, analyze, improve, and control. Successful implementation of the project is heavily dependent on support of senior leadership.

Congressional enactment of the Malcolm Baldrige National Quality Act (MBNQA) of 1987, Public Law 100-107, mandated the development of a common framework of quality processes and outcomes to be used as the basis for improving the quality of American business and manufacturing practices. The concept of quality improvement applies to both small and large companies, to service industries, manufacturing, and to the public sector (including education), as well as private enterprise. Aumiller (2008) describes application of the Baldrige criteria to high-performing school districts.

The Baldrige Criteria for Performance Excellence evolved from Demming's Total Quality Management (TQM) movement of the 1980s (Aumiller, 2008). The Baldrige Criteria have seven categories (with two category types: process and results) and eleven core processes that reflect a personal philosophy of continuous improvement. The goal is to improve the quality of organizational performance practices, capabilities, communication, and results. The seven categories are: leadership; strategic planning; student, stakeholder, and market focus; measurement, analysis, and knowledge management; faculty and staff focus; process management; and organizational performance results. The first six categories focus on organizational processes, and the last is concerned with the organizational results. Aumiller (2008) found that use of the Baldridge Criteria can improve schools and enables them to face upcoming challenges.

Standards in Education

In the era of educational reform, educators look to standards at all levels to define excellence. In education, the goal is to prepare students for the challenges of the real world. Today's workplace requires higher levels of skill and education than ever before, whether individuals directly enter the workforce after high school or spend an interval in postsecondary or higher education prior to workforce entry. There has been an increasing emphasis on

the use of educational standards, which leads to a need to understand how standards are derived. All standard-setting methods require judgment (Perie & Zieky, 2006; Livingston & Zieky, 1982); standards are determined by groups of individuals who are experts in the level of knowledge and skill, or outcomes, in a specific academic or occupational content that successful students should be able to demonstrate proficiently at certain points in their education.

Test developers in the U.S. operate under the *Standards for Educational and Psychological Testing* that were developed to "promote sound and ethical use of tests and to provide a basis for evaluating the quality of testing practices by providing a frame of reference to assure that all relevant issues are addressed" (Kubiszyn, 2007, p. 947). These standards guide the development, validation, and use of educational (and psychological) tests and are the result of professional consensus of individuals, as well that of three organizations: the American Educational Research Association (AERA), the American Psychological Association (APA), and the National Council on Measurement in Education (NCME).

Improving student outcomes and competencies have become most important goals for educators, which they have addressed through development of standards. The Common Core State Standards Initiative (2015) developed standards for English and math that are more focused, coherent, and rigorous (Yaffe, 2013), while at the same time they are fewer, clearer, higher, and aligned with college and work expectations, to help ensure that all students are prepared to optimize their potential upon high school graduation. This recent set of standards was developed through the National Governors Association Center for Best Practices (NGA Center) and the Council of Chief State School Officers (CCSSO) with input from existing state standards, experienced teachers, content experts, states, leading thinkers, and public feedback. The Common Core State Standards (CCSS) were launched in 2009 by state leaders, e.g., governors and departments of education, who recognized that consistent, real-world learning goals could ensure that all students are graduating high school prepared for college, career, and life. Although the reauthorization of the Elementary and Secondary Education Act, also known as Every Student Succeeds Act, makes the CCSS optional, as of 2016, the CCSS were being used by at least 45 states.

Standards can be set by individual teachers using mastery learning. One such example is Bloom (1977), who theorized that nearly all students could attain mastery of any learning task if provided with enough time and "favorable learning conditions"; he advocated mastery learning based on instructional objectives, a technique shown to increase student achievement for subject matter mastery (Dolan, Ford, Newton, & Kellam, 1989). Mastery learning is the opposite of minimum competency testing done for accountability purposes in an educational system. It uses individually-paced instruction (as opposed to the usual group-paced instruction) where students have multiple opportunities to take the test. A formative practice test is given early in the instructional sequence so that teaching can be differentiated according to student needs. A mastery level is determined; often 80 percent is used as a minimum level to

indicate mastery, but the percentage cut-off needs to be determined by professional judgment of the teacher or group of experts with consideration for the importance and difficulty of the learning objectives (Guskey & Anderman, 2014). In some cases, a perfect score on a safety test is required before a student is allowed onto the shop floor.

Career Technical Standards

Spearheaded by the National Association of State Directors of Career Technical Education Consortium (NASDCTEc, 2012a), CTE has developed its Common Career Technical Core (CCTC). This is an initiative to establish rigorous, high-quality standards for CTE across the U.S. The programmatic standards were developed by a diverse group of teachers, business and industry experts, administrators, and researchers. State and industry standards were included in the development process. The CCTC includes a set of standards for each of the 16 Career Clusters and their corresponding Career Pathways that describe what students should know and be able to do after completing a defined program of study.

Concurrent with rising standards, ACTE state profiles (ACTE, 2015) show that many states have increased their graduation requirements within the past few years. In addition, those in some career technical areas have developed rigorous standards for their area. One such example is the new curricular standards of The National Council for Agricultural Education (2015) that are cross-walked with five other sets of standards in major academic content areas.

The Presidential Scholars Program, which annually recognizes at least two students from each state, has been expanded with plans to recognize 20 CTE students at the end of the 2015-16 academic year (Rodriguez, 2015). Each state may nominate up to five CTE students who will be evaluated based on academic rigor, technical competence, employability skills, ingenuity, and creativity.

Several states have standards for recognition of high-achieving CTE students. In Pennsylvania, students who achieve the highest level (advanced) on their technical skills assessment (NOCTI or other approved assessment) receive the Pennsylvania Skill Certificate, an honor that can be shared with a potential employer to document a student's technical skill level (PA Department of Education, 2015). Indiana has a Technical Honors Diploma for students who complete their career pathway and a rigorous academic program with at least a B grade point average (GPA) (Berry & Wild, 2015).

Standards for Job Credentials

Telger and Foster (2011) discuss the industry-wide technical standards used in education to develop student assessments that result in job-ready credentials for high school students. NOCTI is one such test developer; several industry partners are involved with NOCTI for student credentialing, including the Manufacturing Skills Standards Council (MSSC), American Culinary

Federation (ACF), Plumbing Heating and Cooling Contractors (PHCC), Home Builder's Institute (HBI), an affiliate of the National Association of Home Builders (NAHB), Electronics Technicians Association (ETA) and the International Sign Association (ISA). Using national standards to develop capstone assessments provides an opportunity to give students a competitive edge that validates specific knowledge and skills in a specialty area in the workplace.

Job credentialing is an important step in preparation of the workforce. Those with a job credential or license realize lifetime benefits as they tend to earn higher pay, are more likely to be employed, and have a better chance at a secure retirement (Wyman, 2015). NOCTI has been issuing job credentials for over 50 years, and the 2014-15 academic year has been the first year of full implementation of another innovation—a digital SkillBadge. Digital badges are a newcomer on the educational scene, but students who were surveyed during a badge pilot test felt the badge motivated them to learn, even when the content was difficult. Recipients of the NOCTI SkillBadge must score at least a seventy percent on their NOCTI test, which is given at the conclusion of a program of study; students also received a college credit recommendation.

All of NOCTI's assessments have been evaluated for rigor by the National College Credit Recommendation Service (NCCRS, 2013). The result was both a digital SkillBadge and a college credit recommendation, encompassing all assessments developed using NOCTI's process. At the conclusion of the 2014-15 academic year, a little more than 29,000 SkillBadges were earned by students. Data on use of the badges are still being collected, and it is too soon to tell if the new SkillBadge and college credit recommendations have lifetime benefits for the student. However, raising the bar and enabling students to strive for excellence by earning a higher credential should both be obvious advantages when entering the workforce.

Standards from Student Organizations

CTE programs have specialized organizations. Student organizations sponsored by specific curricula or program areas are considered co-curricular. As such, they promote different dimensions of student growth in the socio-emotional and psychomotor domains that often fit into the classification of "21st century employability skills" such as self-evaluation strategies, self-monitoring skills, oral communication, and collaboration (Huang, Leon, Hodson, La Torre, Obregon & Rivera, 2010). Other high school honor societies linked to the core curricular areas can encourage students to reach a higher level of achievement through academic performance and leadership. The criteria for membership in these societies involve a minimum overall GPA, usually a 3.0/4.0 as well as a minimum GPA in the specific content area.

Methodology

Career technical student organizations (CTSOs) are co-curricular; in other

words, they are considered part of the curriculum. Research shows that students involved in CTSOs were found to be better engaged in the classroom and participated in positive activities that develop the 21st Century employability skills of leadership, work ethic, positive attitude, self-efficacy, and competence (Kosloski, 2014; Alfeld, et al., 2007). In addition to the work of the CTSOs, the *Framework for 21st Century Learning* is a set of guidelines being incorporated into CTE to enhance academic content (Association for Career and Technical Education, National Association of State Directors of Career Technical Education Consortium and Partnership for 21st Century Skills, 2010), with the goal of putting more students on the path to success. One source of data for the research presented herein was the criteria for recognition and awards for the high-achieving students.

Criteria for honors awarded by CTSOs require demonstration of excellence in both academics and leadership. Table 1 summarizes the standards for honors bestowed by various CTSOs, often required co-curricular activities. Recognition of other performance factors is also considered, such as community service or leadership.

Table 1. High School Career Technical Service Organization Honor Award Standards

Organization/ Area	**Criteria**	**Website**
DECA (Retail/ Business)	Emerging Leader Honor Award: student must be a DECA member at a local and national level, and be a senior with an overall cumulative grade point average of 3.2/4.0 for the seven previous semesters.	www.deca.org
FBLA (Retail/ Business)	Students participate in business career readiness activities and can qualify for scholarships and leadership development.	fbla-pbl.org/
FCCLA (Family, Career and Community Leaders of America)	Competitive scholarships, such as the Prestige scholarship, for high school seniors nationally affiliated FCCLA. Must take the SAT/ACT exam; apply to a degree-granting institution offering associate's or bachelor's degrees in any field of study; outstanding leadership in FCCLA, family, school, and community.	www.fcclainc.org/
FFA (Agriculture)	The American Degree: based on sales and management of profits, plus outstanding leadership skills, community service; "C" GPA or better.	www.ffa.org
HOSA (Healthcare)	Compete in several competitive events (complete list is available on HOSA website.)	www.hosa.org
Skills USA	Students who participate in career readiness activities may qualify for scholarships and leadership development.	skillsusa.org/
Technology Honor Society	Maintain at least a 3.0/4.0 GPA overall and in technology education classes, plus leadership and service.	tsaweb.org

Standard Setting Methodology

Standard setting is an art and a science relying on both expert opinion and numerical computations (Cizek & Bunch, 2007; Wiersma & Jurs, 1990). Standards also are set with public safety in mind; the criteria for a driver's license consider the competencies necessary for safe performance while behind the wheel of a car and the lifeguarding test must determine who has the knowledge and skills to act quickly to save a life. Various standard setting methods provided input for this research.

Many organizations set standards using groups of experts. The CCTC was developed for CTE with input from educators, business and industry and state leaders, and experts who had knowledge of high-quality state and industry standards. Also important, the CCTC was developed using a well-documented process (NASDCTEc, 2012b). Worthy of mention is the difference between a set of standards and a framework. Imperatore and Hyslop (2015) discuss how elements of a framework are not necessarily documented or well researched, nor are they developed by a panel of experts in the same manner as a set of standards.

Standard-setting oversight is available through several accrediting bodies. One of those bodies is the American National Standards Institute (ANSI, 2015), operating with a goal to "strengthen the U.S. marketplace position in the global economy while helping to assure the safety and health of consumers and the protection of the environment." ANSI accredits qualified organizations to develop standards in their technical area of expertise by administering consensus-based procedures with a group of experts. Requirements state that the standards development process shall not be dominated by any single interest and that standards-setting groups must have balanced interests and document evidence of their consensus.

Another such body is the International Certification Accrediting Council (ICAC). ICAC is "dedicated to assuring competency, professional management, and service to the public by assessing certification, and credentialing programs" (ICAC, 2014). Both ANSI and ICAC utilize an internationally recognized set of standards; ISO 17024. As previously mentioned, ISO 17024 standards seek to assure conformity and requirements for bodies operating certification of persons in any workplace.

Engaging in the accreditation process is a way to assure a competent workforce and serve the public with higher standards for licensing, certification, and credentialing programs. The third-party expert review provides valuable feedback, which is used to increase the rigor of the program and ensure adherence to industry standards.

The purpose of standard setting is to assist decision making and categorize individuals while considering the need and rationale for the standard (Cizek & Bunch, 2007). As mentioned earlier, standard setting requires judgment by groups of expert individuals (Perie & Zieky, 2006; Livingston & Zieky, 1982). In education, standards for performance on tests or assessments are set using cut scores or performance levels. Wiersma and Jurs (1990) and Cizek and

Bunch (2007) summarize the main standard setting methods. Professional judgment is a heavily used method that relies on the teacher's knowledge of the subject matter and what a score indicates for the future of a student. For example, teachers may require a perfect score on a safety test prior to students entering a lab, shop, or other work area, but a lower score might indicate a need for remediation.

Two well-known categories of standard-setting methods are norm referenced and criterion referenced. First, norm referencing involves placing the test takers within a larger group of individuals who took the same test. The position of an individual within that group, possibly represented as a percentile rank, can determine whether the tested person passes or fails. The other main method, criterion referencing, compares test performance with standards to determine whether the individual can be considered competent (NOCTI, 2015).

Popular criterion-referenced methods require content experts to review each item, which is labor intensive. The Nedelsky method was developed for use with multiple-choice tests and is based on a qualified panel of SMEs who determine a passing score by examining each test item to eliminate the distractor that a minimally competent test taker would also be able to eliminate. The Angoff method also begins with the panel of SMEs who examine each test item to determine the percentage of minimally competent test takers who would answer the item correctly. Simple computations on the panel's judgments determine the cut score for both of these methods (see Wiersma & Jurs, 1990).

Methods that promise to eliminate the labor-intensive nature of Nedelsky and Angoff are the Holistic and Direct Consensus methods (Cizek & Bunch, 2007). Holistic standard-setting methods comprise procedures that look at student performance on an entire test or whole sets of examinee work; one or more judges render a single (holistic) verdict about each work sample. Judges form an overall impression of the student's performance level. The judgments are expressed as a rating, which may be dichotomous (such as Pass/Fail) or ordinal (such as Below Basic, Basic, Proficient, and Advanced) as required for accountability.

The Direct Consensus method was developed to produce a recommended performance level more quickly without the time burden of other methods. An intact test is reorganized into sections (sub-areas), and entire sections are reviewed and judged by the experts to determine a passing cut score for each. Thus, Direct Consensus also relies on experts, but it allows them to directly express their views on an acceptable cut score for a test portion whereas other methods look at individual items. However, this method can be used only if a test has logical sub-areas.

In terms of norm referencing, Wiersma and Jurs (1990) discuss the difference between standards and norms. A norm is similar to a grade-level equivalency derived from the average of students' actual performance at a given point in their education. A norm must be calculated from a large current representative group. Norms have been developed for human development, such as walking alone at age one plus or minus two months. The norm for a

national test or a developmental reference point must be based on a representative sample from across the country.

A cut score can be set using normative data. At one time, a passing score for licensing certain medical specialties was to achieve above one standard deviation below the mean of the tested group (Grosse & Wright, 1987). Also, the percentile can be used to determine position within the distribution of test takers, and standards can be set based on that position. For example, an award criterion might be a test score at or above the 90^{th} percentile on an assessment of interest.

Establishing a CTE Standard of Excellence

CTE produces competent, highly skilled workers, many of whom graduate from high school with a job credential. NOCTI has been recognizing high-achieving students (e.g., those scoring at or above 70%) with a digital SkillBadge and a college credit recommendation. How can the bar be raised even further for our students and how can we motivate them toward building the foundation for higher achievement and success? NOCTI is leading the way with issuance of a higher-level credential—a Technical Badge of Excellence. Criteria for this badge will be similar to that of many honor societies (see Table 1), using a 3.0 overall technical course GPA to be verified by school officials as well as being identified through test scores.

To determine the criteria for an individual, data were analyzed from several years of NOCTI tests to determine an appropriate percentile rank. The 80th, 85th, and 90th percentiles were investigated. For example, using a national sampling of test results from high schools in the 2014-15 academic year, the overall percentages of students at the 80th percentile was 20.62 percent, 15.93 percent at the 85th percentile, and 9.26 percent at the 90th percentile.

The 85th percentile generally identifies students across all technical specialties who are at or above the top 15 percent of their testing group. The 90th percentile identifies very few testers for the more difficult tests tend to have a smaller tested population. Since the 85th percentile is very close to one standard deviation, the normative method of one standard deviation from the mean will be used to identify the individuals who excel in their technical area. Using this position awards approximately the top 15-16 percent of test takers while compensating for test difficulty.

To ensure that the score was not the result of a student simply "having a good testing day", an additional criterion for the Badge of Excellence would require that no score on any of the test's standard areas (or subscales) be less than a half of a standard deviation below the test mean. Adding the second criterion decreases the number of students recognized to approximately seven percent depending on test difficulty, while adding more exclusivity to the TBOE. The criteria defined above will identify the top CTE students across the nation.

Results and Findings

The potential for TBOE was based on position within distributions from a sampling of 2014-15 academic year test results from high schools in the U.S. In Table 2, the number of students with a total test score of one standard deviation above the mean was compared to those with a total score one standard deviation *and* the qualifier that no one standard area on the test should have a score less than a half standard deviation below the mean. These criteria in the two right hand columns identify the top NOCTI-tested CTE students nationally.

Table 2. Comparison of the criteria for the NOCTI Badge of Excellence

Test code	Number of students	Test mean	Standard deviation (sd)	Mean +sd	Students at mean + sd	Percent of students	Students with no standard < sd/2	Percent of students with no standard < sd/2
2051	20	33.02	8.17	41.19	3	15%	0	0
3073	20	45.19	8.84	54.03	2	10%	0	0
4010	233	73.39	12.2	85.59	32	14%	17	7%
4016	3447	75.2	12.56	87.76	371	11%	195	6%
4043	2635	69.75	13.42	83.17	386	15%	343	13%
4081	4005	65.05	12.01	77.06	613	15%	269	7%
4101	374	62.97	14.85	77.82	59	16%	36	10%
4158	1031	74.3	9.85	84.15	134	13%	123	12%
4973	614	58.79	13.38	72.17	81	13%	15	2%

Source: NOCTI 2015

Conclusion

Standards exist at the national, state, and local levels and impact both education and the workplace; they are developed by groups of experts who agree on the importance of certain performance or qualities to be met. Processes such as Baldrige and Six Sigma provide tools educators can use to improve their own practice. As curricular standards increase in rigor, competence must be defined and those high-achieving students recognized. Standards help us to define that excellence.

NOCTI tests are designed to indicate an individual's readiness to enter a specific job, which benefits employers seeking skilled workers. Although relatively new on the scene, NOCTI's digital SkillBadge has been shown to motivate students and demonstrate a higher level of job readiness. It is hoped that the TBOE will provide further motivation, but that is a topic for another research inquiry.

Acceptance of badges also is growing among employers because badges represent a specific skill set (Friedman, 2016). The college credit recommendation associated with the digital SkillBadge also recognizes the higher-achieving students and facilitates their transition to higher education and/or the workplace. As a third tier, the TBOE will provide further recognition for the top CTE students and, for employers, helps identify the

most highly skilled CTE completers for prospective employers. Where the Presidential Scholars program has recognized a few top CTE students in each state, the NOCTI Badge of Excellence will accomplish this for many more students.

Yang (2016) states that "proven skills trumps all." Today's global workplace needs a higher level of skill and education than it did in the past century. To give our students increased confidence and a competitive edge, we need to strive to do our best and help them achieve excellence beyond the levels set by many standards. If employers understand the value and the skills represented by each test, the results from the TBOE analysis can be used as a recruiting mechanism as well as a way to fill the skills gap.

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