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The quality of any research journal is dependent on the services of a strong Editorial Board and that is certainly true for the *Journal of Career and Technical Education*. The Board has provided guidance to the manuscript review process and the publication of JCTE and the Editors rely on them to provide quality reviews of several manuscripts each year. We express our appreciation to each EB member for their contributions to JCTE.

NOTES FROM THE EDITORS

The *Journal of Career and Technical Education* can be obtained in both paper and electronic form. The printed journal is mailed to members and other subscribers around the world and is indexed in the Education Resources Information Clearinghouse (ERIC). The electronic journal is available worldwide on the Internet and can be accessed at the following case sensitive URL:

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Prior to Volume 16, Number 2, the *Journal of Career and Technical Education* was published as the *Journal of Vocational and Technical Education.* These issues can be found at the following case sensitive URL:

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It would not be possible to publish a refereed journal such as the *Journal of Career and Technical Education* without a distinguished group of reviewers. I would like to take this opportunity to acknowledge and thank the following colleagues for giving their time and expertise in providing timely reviews of manuscripts.

REVIEWERS AND EDITOR FOR THIS SPECIAL ISSUE

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GUIDELINES FOR AUTHORS

The *Journal of Career and Technical Education (JCTE)* is a non-profit, refereed, national publication of Omicron Tau Theta, the national, graduate honorary society of career and technical education. Manuscripts submitted for consideration by *JCTE* should focus on career and technical education philosophy, theory, or practice. Comprehensive reviews of literature and reports of research and methodology will be considered. All articles should relate to current issues and have direct implications for career and technical educators. It is intended that *JCTE* serve as a forum for discussion of philosophy, theory, practice, and issues in career and technical education. Manuscripts submitted for review should not have been published or be under current consideration for publication by other journals.

Publication Style

The *Publication Manual of the American Psychological Association (*APA*)*, 5th Edition (2001), is the standard of style for *JCTE*. Place figures and tables in the appropriate place in the manuscript. Underlining should not be used anywhere in the manuscript. Statistics and titles in the reference list should be italicized according to APA 5th Edition Style. Manuscripts not adhering to the style manual will be returned to the authors without review.

Figures and Tables

Tables and figures should provide only information essential to understanding the article. Authors should **avoid reporting the same information in both text and tables**. In the preparation of tables and figures, authors should use APA guidelines for format and include the tables and figures in text where they should appear. Tables and figures are to be prepared as a part of the word processing file. Tables **must** be developed in columns **using the table-formatting feature in the word processor** so that they will translate to HTML. Each item in a table should be placed in an individual cell. Do not use tabs to format tables because they will not translate properly. Tables and figures will not be published on oversized or foldout sheets.

Submitting Manuscripts

Manuscripts accepted for publication normally may not exceed 20 pages of printed, double spaced text, including title page, abstract page, tables, figures, and references. Margins should be 1" all around and use Times New Roman 12-point for all text, tables, and figures. **Use the line numbering feature of the word processor to number each line of the manuscript**.

Electronic submissions are preferred, although mailed copies will be accepted. Submit the following:

1. a separate **title page** with the manuscript title, author(s), institution(s), complete address(es), telephone number(s), and the author(s)' e-mail address(es); and

2. one double-spaced copy of the manuscript with the abstract placed immediately after the manuscript title and the lines numbered; author(s) must ensure that all references to the author(s) and their institutions are removed from the manuscript according to APA guidelines to facilitate the double-blind peer review process; the abstract should succinctly describe the manuscript's contents and cannot exceed 960 characters and spaces (150 words).

The manuscript and title page can be submitted via e-mail to jbartii@aol.com, or it can be mailed on a 3.5" diskette or CD to Dr. James Bartlett at the address on page 2. Diskettes become the property of *JCTE* and will not be returned. The electronic files must be in Microsoft Word format. The use of Rich Text Format (rtf) is acceptable.

Review and Publication

JCTE is published twice a year, spring (about June 1st for the hard copy) and fall (about December 1st for the hard copy). All accepted articles will be published in both traditional hard copy and in the electronic journal, which is currently available at the following case sensitive URL:

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The review process for the *Journal of Career and Technical Education* normally requires six weeks to three months. The Editor will notify you as each stage in the review process is completed. The decision of the reviewers will be one of the following:

1. **Accept** (publish as submitted, very minor editorial revisions may be needed-this is very rare for initial submissions);
2. **Accept Conditionally**, with minor revisions (revisions are reviewed by editor, not resubmitted to review panel);
3. **Accept Conditionally with Major Revisions** (revised manuscript will be sent back to the same reviewers for reconsideration);
4. **Reject but Invite Major Revision and Resubmission** (fundamental changes are needed, and the revised manuscript will go back to the same reviewers for reconsideration-this is a very common decision on the initial review and should not be considered as a final rejection); or
5. **Reject** the manuscript for *JCTE* (the manuscript will not be considered again).

The manuscript review process for *JCTE* is a "double-blind" peer review in that the reviewers are not informed of the identity of the author(s) and the author(s) are not informed of the identities of the reviewers. The reviewers of the manuscript are recognized scholars with appropriate professional and educational preparation and are selected for their specific expertise relative to the topic of the manuscript being reviewed. At least one of four reviewers on each manuscript must be a member of the

JCTE Editorial Board. The final acceptance rate for *JCTE* is usually 35-45%. Authors who persevere through requested revisions are generally the authors whose manuscripts are eventually published in selective, refereed journals such as *JCTE*.

Book Reviews/Thematic Issues

Book reviews will also be considered for publication in the *JCTE*. Persons interested in publication of a book review should contact the Editor-Elect (see inside front cover, page 2). A thematic issue of the *JCTE* may be published at least once every two years. Themes for upcoming issues will be announced in both the hard copy and electronic journal.

SUBSCRIPTIONS

The annual subscription rate is $30.00. Checks should be written to: Honor Society of Omicron Tau Theta, Inc. and mailed to the OTT Treasurer. The name and address of the current OTT Treasurer can be found on the OTT web site: http://www.ott.vt.edu.

EARNING INDUSTRY-RECOGNIZED CREDENTIALS IN HIGH SCHOOL: EXPLORING RESEARCH AND POLICY ISSUES

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ABSTRACT

As states develop accountability systems for their high school career and technical education (CTE) programs, the number of students who earn industry-recognized credentials is being considered as a measure of student success and program quality. Using data from a longitudinal study we explored the value of industry-recognized credentials for high school students, and the utility of these credentials as a measure of secondary CTE program quality. We found that teachers and administrators were concerned about the costs of maintaining these programs, and about the cost to students to take the certification exams. We found that few students were earning industry-recognized credentials at these schools, but those who were tended to have a solid career plan. However, the most important finding was the difficulty collecting data, because high schools were not required to record data on students earning industry-recognized credentials. As such, this study is an initial exploration into issues that arise when conducting research or considering policy on industry certification in high school. Recommendations for future research and for CTE accountability policy are provided.

The era of school accountability is upon us. In order to address past inequities and to ensure future achievement of minimum standards, the federal *Improving America's Schools Act of 1994* expected states to establish academic content and performance standards, and to implement assessments that measured student achievement against these standards. By the time the U.S. Congress passed the *No Child Left Behind Act of 2001*, which called for comprehensive accountability systems in public schools, all of the

50 states already had some sort of assessment system for their K-12 schools (Goertz, Duffy, & Carlson Le Floch, 2001).

The accountability systems developed in the 1990s focused on academic competencies such as writing paragraphs or solving algebraic equations. However, career and technical education (CTE) students receive an education with a different focus. While CTE students are required to meet academic standards, the additional work-related competencies that they acquire in high school have often not been assessed with the same rigor. Moreover, without an accountability system for CTE, there is no way to assess or compare the quality of CTE programs. As a result, the trend has been toward developing secondary CTE assessment systems that parallel the academic systems. As states and localities began to develop CTE competencies, standards, curriculum frameworks, and assessments, they recognized that some industries had already produced standards and assessments as part of their efforts to ensure that applicants were certified in the requisite skills for that industry. Many schools, school districts, and states thus adopted industry-recognized credentials (IRC) as a component of their CTE accountability systems.

At first glance, standards and assessments developed by industry seem a perfect match for a related career and technical program in high school: CTE instructors and administrators can be sure that all the skills required by industry are part of the program, and students who earn certification (we use the terms IRC, credential, or certification interchangeably) are theoretically a step ahead of other applicants for employment in that industry. However, there are reasons why IRC are problematic measures of high school CTE student outcomes or program quality, such as the cost of maintaining state-of-the-art facilities, the cost of the certification exam itself, and the lack of certification in program areas common to high school CTE. Some of these barriers can be addressed, while others may be insurmountable in the quest for secondary CTE accountability systems. The purpose of this study is to explore the issues around the use of IRC in high school.

CONCEPTUAL FRAMEWORK

Previous research has shown that CTE engages and motivates students (Gentry, Rizza, Peters, & Hu, 2005; National Research Council, 2004; Scherer, 2002). The framework for this study encompasses a broad conceptualization of CTE as an important tool for engaging secondary students as well as an important program area with significant outcomes—preparation for the world of work that nearly all students will eventually enter. Hopkins (1999) advocated for this expansive view of CTE in which students are exposed to the workplace through three non-exclusive approaches: education for work, education about work, and education through work. Education for work refers to job-specific training. Some argue that such training is best concentrated in the postsecondary phase of students' education. However, others believe that this is an appropriate role for secondary education (Rosenbaum, 2001). Either way, education for work must be premised upon actual workplace needs, and the curriculum must satisfy the broader educational needs of workers, including general education components and education for participation in a democratic society.

Education about work describes a curriculum that assumes that knowledge about the world of work is valid school knowledge. All students need to learn about democratic rights in the workplace, career ladders, and labor markets. Finally, education through work refers to strategies in which students learn school subjects within a work context, or work-based learning. Education about and through work can be infused into academic as well as vocational classes in high school. Teachers can work across subject matter disciplines to integrate their curricula so that students experience real-world uses for curriculum content, such as mathematical equations. Students can participate in internships that use what they have learned in school.

High school CTE programs that offer opportunities to earn IRC adhere to an education for work approach, since they are preparing students for the workplace. Students have the opportunity to learn skills that are assessed by measures external to the high school. IRC bring "real-world" standards and expectations into high school, presumably increasing student engagement in and completion of CTE programs and course sequences that culminate in such credentials. By teaching students about the certification process and its benefits, students are receiving education about work as well: how job tasks and skills are delineated and assessed, and how hiring and promotion are related to obtaining those skills. To the extent that these credential programs include internships and other work-based learning opportunities, they are also an example of education through work. Thus earning IRC seems to fit into the new, more expansive view of secondary CTE.

The Demand for Skill Standards

The decade of the 1990s saw an increase in the development of industry skill standards considered necessary for entry and success in various industries. *America's choice: High skills or low wages!* (Commission on the Skills of the American Workforce, 1990) decried the preparation and quality of American workers. This commission report called upon business, labor, and education representatives to decide upon certification standards for a broad range of occupations. Through the federal *School to Work Opportunities Act of 1994*, the federal government provided seed money for workforce development boards to develop these standards.

The National Skill Standards Board (NSSB) was created in 1994 to build a voluntary national system of skill standards, assessments, and certifications. Skill standards are "statements of knowledge, skills, and abilities required to complete a task, a critical function, or a complex range of multiple tasks and functions" (Manufacturing Industries Career Alliance, 2001). According to the NSSB, nationally-recognized, industry-based skill standards and occupational certifications are beneficial to the certified individuals and to the communities in which they live. For the individual worker, certification provides portable credentials that will be recognized across the country. For cities and communities, "a well-credentialed workforce attracts new businesses/industries seeking to hire and retain trained workers with immediately-transferable skills. Therefore it is a powerful economic development tool" (Workforce Excellence Network, 2002).

During its existence, the NSSB produced skill standards for only a modest number of industries (Silverberg, Warner, Fong, & Goodwin, 2004). However, some industries had

organized well before the 1990s to standardize and certify training nationwide (e.g., the American Welding Society, n.d.). The *America's choice* report, as well as a series of federal legislation in the 1990s and internal industry pressures, increased the trend of industry associations developing their own systems of skill standards, assessments, and certifications. Despite this progress, skill standards systems remain incomplete. In some industries, skill standards have not yet been developed. Conversely, in other fields, there may be multiple skill standards and certifications available, leading to employer disagreement about which standards to use (Gray, Pellock, & Bae, under review). In still other fields, such as automotive repair and information technology, earning an industry-recognized credential is almost indispensable in order to be employed in that field.

Types of Standards and Certifications

Skill standards and certifications do not have a common structure or origin. We describe here the most typical approaches. NATEF (National Automotive Technicians Education Foundation) was founded in 1983 to develop standards for certifying automotive training programs in order to improve the quality of entry-level technicians. NATEF modeled its standards after licensed occupations such as certified nurse assistant (Shoemaker, n.d.), which include a minimum instructional time on task for each of the major divisions of an occupation. NATEF certifies programs and instructors to teach the standards in various auto repair divisions such as suspension and steering or brakes. The auto body industry soon followed suit with their I-CAR (Inter-Industry Conference On Auto Collision Repair) certifications in various collision repair areas such as steel straightening and wheel alignment.

In the information technology (IT) industry, the Computing Technology Industry Association, known as CompTIA, has been developing IT standards, training, and certification programs since the 1980s. It is the largest developer of vendor-neutral IT certification exams, such as A+ for computer service technicians and Network+ for careers in network support or administration. Cisco Systems and Microsoft offer vendor-specific certification programs for networking (CCNA: Cisco Certified Network Associate) and software applications (MOUS: Microsoft Office User Specialist), respectively. Like the automotive exams, IT certification exams were derived from job task analyses and require a minimum number of hours' experience to qualify to take the exam.

At the other end of the spectrum, the American Welding Society offers the opportunity to become certified without requiring instruction by a certified instructor or any minimum time on task. The certificate is "open to anyone with a talent for welding" (American Welding Society, n.d.). To become certified, welders take a performance-based test of procedures used in the various welding industries. Further work experience and seminars are necessary to pursue advanced certification in welding.

A final type of certification relevant to this study is licensure by the state to practice a given occupation. In careers such as cosmetology or nurse assistant, certification is granted after accruing a set number of instructional and applied hours, and after passing written and performance-based exams of proficiency. The state intervenes in these

occupations because the state is responsible for protecting public health and safety, and people in these careers come into close contact with the public.

In addition to these nationwide industry-led efforts and the special case of state licensure, states and localities have developed skill standards and assessments with local business and industry, reflecting regional variations. Some were developed in order to meet accountability requirements set out in the legislation authorizing federal funding for vocational education, the *Carl D. Perkins Vocational and Applied Technology Education Act of 1990* and its 1998 amendment. This legislation set out four core indicators of performance, two of which involved standards, assessment, and certification: student attainment of challenging, state-established academic, vocational, and technical skill proficiencies; and student attainment of diplomas, degrees, and credentials.

Just as states have developed curriculum frameworks, standards, and assessments for academic subjects, some states have also developed CTE curriculum frameworks, standards, and assessments. Kentucky's General Program Standards for Secondary Career and Technical Education (Kentucky Department of Education, 2004) reflect a common way of incorporating industry-recognized credentials into secondary education: state departments of education encourage but do not require high schools to adopt the frameworks, standards, and assessments (Silverberg, et al., 2004). Some states have gone further and required that IRC be an integral part of their career and technical education plans. In 2002, ten states had policies stipulating that high school CTE programs must use these industry-recognized credentials as program drivers, and programs must develop their courses of study based on the industry-based knowledge and skill requirements (Workforce Excellence Network, 2002). However, as noted above, skill standards systems are not fully developed across all industries, and there are competing assessments and certifications available. Aligning secondary CTE programs with industry standards sounds like a reasonable goal, but given the present state of those standards systems, it may complicate the development of secondary CTE accountability systems rather than assist that development (Gray et al., under review).

Research on Industry-Recognized Credentials

Many of the industry-developed skill standards were originally developed for in-service and internal industry use. These training and certification programs were often delivered by community colleges. Thus much of the literature on the use of industry-recognized standards discusses industry and postsecondary contexts (Aragon, Woo, & Marvel, 2004; Bartlett, 2004; Zinser & Lawrenz, 2004). This research concluded that collaboration between industry and postsecondary education has been fruitful in various occupational areas.

Bartlett (2004) wrote that one of the main purposes of occupational certification was to signal to employers of entry-level workers that applicants were ready for employment. He found that automotive repair industry employers valued applicants with certification and a two-year degree most highly, while employers in information technology preferred a two-year degree with work experience. Both positive and negative attitudes towards

certification were found among employers in the industries he examined, but the trend was for employers preferring some postsecondary education over the certification.

There have been no nationwide studies reporting the number of high school students earning IRC. The most recent National Assessment of Vocational Education (NAVE, Silverberg, et al., 2004) suggests a fourfold explanation as to why such information is difficult to collect and why what does exist is of questionable validity. First, the local implementation of state CTE frameworks, standards, and assessments is for the most part voluntary. Second, participation in CTE itself is voluntary for students. Third, not all CTE areas have industry-defined standards. Finally, many states do not have the resources to invest in constant equipment upgrade and instructor professional development.

One recent study examined IT certification programs in both high schools and two-year colleges (Haimson & VanNoy, 2004). This study reported that 13% of all U.S. high schools included a Cisco certification program, the most common IT certification program in high school. IT certification programs are time-intensive, which makes them difficult to offer in high school given graduation requirements and other competing activities. The IT certification program staff surveyed for this study cited a need for more hands-on activities and internships to help students master key skills. One third of the high schools surveyed in this study did not offer all of the classes needed to prepare students for Cisco certification; such certification was expected to be completed at the community college. The study also noted the substantial investments that schools had to make in computer equipment and teacher training. Finally, the authors recommended developing systematic follow-up information on student outcomes.

Standards and their certifying assessments exist or are being developed in many industries. These standards have obvious resonance with secondary CTE educators because they provide industry-based criteria upon which to build and evaluate CTE programs, and because the certification process provides opportunities for their students. But little research has been done on the benefits and challenges of having industry-recognized credential programs in high schools. This article describes student participation in such programs in six high schools located in various communities across the country. Although small in scale, the perspectives presented here reflect the importance of the debate on the use and value of IRC in high schools.

OBJECTIVE OF THE STUDY

The objective of this article is to increase our understanding of the use of industry-recognized credentials in high school, including student participation and the use of these credentials as a measure of secondary CTE program quality. The larger study of which this article is a part examined student outcomes in high schools that blended CTE-based reforms with comprehensive school reform (Castellano et al., under review; Castellano, Stone, Stringfield, Farley, & Wayman, 2004; Castellano, Stringfield, & Stone, 2002; Castellano, Stringfield, Stone, & Wayman, 2003). The goal of the larger study was to ascertain whether students in schools that had incorporated career themes and preparation along with rigorous academics performed better than students in schools without these

sets of reforms. Student outcomes in that study included more than academic achievement; the outcomes also included such CTE measures as earning IRC.

Three research questions are addressed in this study:

1. What were the state and local policies in 2002 for the use of industry-recognized credentials at the high schools participating in the study?
2. Did students from high schools that incorporated career themes and preparation along with rigorous academics earn more industry-recognized credentials than students in schools without these sets of reforms?
3. Did teachers, administrators, students, and employers at these sites find industry-recognized credentials to be valuable, either as a measure of program success or as a means of preparing students for the workplace?

STUDY DESIGN AND SAMPLE

The larger study examined student outcomes in high schools engaged in both innovative CTE programs and comprehensive school reform. By comprehensive school reform, we refer to research-based reform designs of the type funded by the federal Comprehensive School Reform Program (U.S. Department of Education, 2005). As part of a focus on careers and career preparation, staff at three high schools created career-themed academies, pathways, and concentrated vocational programs, respectively. We employed a mixed-method, longitudinal design in order to examine both the reform implementation process and student achievement outcomes. These outcomes were compared to the outcomes at demographically similar comparison schools that were not engaged in reforms. Although it could be argued that virtually all schools are perpetually involved in one or more change efforts (Lee & Smith, 2001), the comparison high schools were not involved in focused, comprehensive school reform efforts of the type and scope present at the study schools.

We sought three sets of feeder patterns (middle school, high school, community college) in which the high schools were implementing CTE-based comprehensive school reforms and demographically similar comparison high schools that were not implementing such reforms. All sites had to serve large percentages of high poverty or minority students who were considered to be at risk of failing to graduate from high school. A more detailed description of the sampling procedure and school selection can be found in Castellano, Stringfield, & Stone (2002).

We deliberately selected high schools that represented four common organizational structures that offer CTE: career academies, comprehensive high schools, regional skills centers, and vocational high schools. The number of high schools organized around career academies grew from 1,500 in the year 2000 to more than 2,500 in 2004, an increase of 67% (Kemple & Snipes, 2000; Kemple, 2004). Comprehensive, Grade 9-12 high schools are the most common organizational structure at about 15,000 nationwide (Lynch, 2000). Many comprehensive high schools collaborate with a regional skills center to provide focused, half-day CTE programs for their students. Nationwide, there are approximately 1,100 regional skills centers serving consortia of high schools (Lynch,

2000). Finally, there are about 250 vocational high schools in the United States, which provide concentrated vocational programs (Lynch, 2000).

Each of the three high schools we selected (one of which came with its regional skills center) helped us choose a comparison school nearby that was similar demographically but was not engaged in CTE-based reforms. At each study school and comparison school, we collected data on three grade cohorts over four years (2001-2004): students who were in 7th, 9th, and 11th grades in 2000-2001. We selected the eldest cohort to serve as the sample for the present analysis, because this was the sample used in the larger study for all outcomes relating to the transition from high school to work and/or postsecondary education (Castellano et al., under review). Most members of this cohort graduated in 2002. A description of all participating high schools follows, using pseudonyms to protect confidentiality.

Academy High School and Comparison-AHS (C-AHS)

Academy High School is located in City A, a large urban center in the West. City A is a hub for trade with Pacific Rim countries. The service, government, and retail trade sectors are the leading employers, although there is also a large manufacturing base. City A's population continues to grow, fueled in large part by immigration from Asia and Latin America (see Table 1).

Table 1. *Academy High School Sample: Descriptive Data*

Study Sites	Total	Ethnicity				Free/ Reduced-Price Lunch	Limited English Proficiency	Special Education
		Latino	African American	White	All others			
	N	%						
City A	> 2 million	46	11	30	13	n/a	n/a	n/a
AHS[a]	600	71	28	<1	1	94	27	3
Class of 2002	102	80	19	1	0	88	55	1
C-AHS[b]	3,500	79	20	<1	<1	71	37	1
Class of 2002	465	80	20	0	<1	85	76	17

Note. All city data are derived from the U.S. 2000 census (U.S. Census Bureau, 2001). The percentages may not add up to 100 due to rounding and/or because individuals self-identified as belonging to more than one group. Unless otherwise noted, all school-level data are from the 1999-2000 school year. All Class of 2002 data are from the 2000-2001 school year.

[a]Data are reported for entire K-12 school. However, the demographics presented reflect those of the high school. AHS = Academy High School. [b]C-AHS = Comparison-Academy High School

Academy High School (AHS) adopted the Urban Learning Centers reform design, which creates articulated communities across all grade levels, K-12, usually housed in one facility. There are three components to this reform design: a) integrating high standards into a thematic, interdisciplinary curriculum; b) including all stakeholders in the decision-

making process; and c) providing learning supports such as social services (Johnson & McDonald, 1996).

AHS was part of a large urban district with over 60 high schools. As an Urban Learning Center, AHS was co-located in a single facility with an elementary school and a middle school. The small number of high school students listed in Table 1 masks the fact that AHS was a K-12 school of almost 3400 students. Only students from the Learning Center middle school could apply to attend AHS. Part of the application required students to commit to applying to colleges and universities in their senior year, as the mission of AHS was to prepare the inner-city youth of this area for postsecondary education.

The comparison school, C-AHS, was a much larger high school in the same neighborhood. In fact, many students from the Learning Center middle school attended C-AHS. This school exhibited elements that commonly lead adolescents to drop out in urban, high-poverty contexts: poor academic preparation, lack of sufficient resources, and distractions such as gang activity that kept students from attending class and studying.

Pathways High School, Comparison-PHS (C-PHS), and Their Regional Skills Centers

Pathways High School (PHS) is located in City P, in an agricultural region of the Pacific Northwest, with the primary local crops being potatoes and wheat. According to the area chamber of commerce, most local jobs involve production agriculture, food processing, and agribusiness. There are also some industrial and manufacturing firms that were developed to support nearby federal facilities. Due to its location, City P is a transportation hub for the Pacific Northwest, with links through air, rail, truck, and barge. City C-P, where the comparison school C-PHS is located, is approximately 75 miles from City P. The economy of City C-P is more strongly agricultural. Table 2 provides U.S. 2000 census data on the population statistics by race and ethnicity for City P and City C-P.

PHS implemented career pathways across the curriculum in 1998. This design included grade-level projects for each grade, all of which involved participation from business and community partners. A student's career pathway at PHS was expressed through electives: an Arts and Communications pathway student might take journalism or drama, while a Health Careers pathway student might opt to take a focused, half-day nurse assistant program at the nearby regional skills center. Because the skills center offered opportunities to earn industry-recognized credentials, they have been included in the present analysis. PHS is the only high school in its small-town district.

C-PHS is also the only high school in its district. Like PHS, C-PHS had collaborated with other small districts in its area to support a regional skills center where students could receive focused CTE instruction. We were able to collect data on the C-PHS Class of 2002 outcomes at the skills center as well as at C-PHS itself.

Table 2. *Pathways High School Sample: Descriptive Data*

Study Sites	*Total*	*Latino*	*African American*	*White*	*All others*	*Free/ Reduced -Price Lunch*	*Limited English Proficiency*	*Special Education*
	N	%						
City P	35,000	56	3	37	7	n/a	n/a	n/a
PHS[a]	2,500	54	4	38	4	50	10	11
Class of 2002	342	40	4	52	4	38	14	9
City C-P	15,000	53	<1	43	1	n/a	n/a	n/a
C-PHS	1,500	68	<1	31	<1	50	24[b]	13[b]
Class of 2002	346	70	<1	28	1	36	13	9

Note. All city data are derived from the U.S. 2000 census (U.S. Census Bureau, 2001). The percentages may not add up to 100 due to rounding and/or because individuals self-identified as belonging to more than one group. Unless otherwise noted, all school-level data are from the 1999-2000 school year. All Class of 2002 data are from the 2000-2001 school year.

[a]PHS = Pathways High School. [b]Limited English Proficiency and Special Education percentages for C-PHS were only available for the entire district in 1999-2000. C-PHS = Comparison – Pathways High School.

Table 3. *Vocational High School Sample: Descriptive Data*

Study Sites	*Total*	*Ethnicity*				*Free/ Reduced-Price Lunch*	*Limited English Proficiency*	*Special Education*
		Latino	*African American*	*White*	*All others*			
	N	%						
City V	200,000	27	20	49	3	n/a	n/a	n/a
VHS[a]	1,500	53	28	17	2	68	10	35
Class of 2002	206	47	32	18	0	27	3	26
City C-V	600,000	14	25	55	8	n/a	n/a	n/a
C-VHS	1,500	29	60	8	3	60	38	30[b]
Class of 2002	283	27	66	5	0	53	33	21

Note. All city data are derived from the U.S. 2000 census (U.S. Census Bureau, 2001). The percentages may not add up to 100 due to rounding and/or because individuals self-identified as belonging to more than one group. Unless otherwise noted, all school-level data are from the 1999-2000 school year. All Class of 2002 data are from the 2000-2001 school year.

[a]VHS = Vocational High School. [b]Special Education percentage for C-VHS is from 2003-2004, the earliest year for which data were available. C-VHS = Comparison-Vocational High School.

Vocational High School and Comparison-VHS (C-VHS)

Vocational High School is located in City V, a medium-sized city in the northeastern United States. City V has a history as a manufacturing center for textiles and metal. As with many industrial cities in the region, the 1980s brought recession and the offshore

flight of industry and manufacturing. Most jobs in City V are in the service sector, in wholesale and retail trade, and in government. C-VHS, the comparison school, is located in City C-V, which is in a different region of the same state. City C-V is a large northeastern city. City C-V enjoys a diversified economy with well-regarded financial, information technology, and health care sectors. Table 3 provides general population statistics by race and ethnicity for City V and City C-V, based on the U.S. 2000 census.

Vocational High School (VHS) is a member of the High Schools That Work national reform network. The goal of this reform design is to improve the academic achievement of high school CTE students by ensuring that they receive rigorous college preparatory subjects along with their CTE programs. The High Schools That Work design calls for common planning time for teachers to collaborate on curriculum integration, and it sets high standards and expectations for all students (Bottoms & Presson, 1995).

VHS was one of four high schools that made up the only district in City V. Students were offered open enrollment to their choice of high school. Three of the high schools were college preparatory in nature, and VHS was the district's vocational technical high school. Renovation of City V's high schools was underway, but VHS was last in line, continuing to operate with outdated equipment and neglected facilities. Demographic data on VHS and its Class of 2002 are found in Table 3. During the time period of this study, VHS was declared a school in crisis by its state department of education, because student academic achievement on the state standardized tests was low and had not shown significant improvement over several years.

C-VHS, the comparison school, is also a vocational technical school located in an urban setting. It offered approximately the same CTE programs as VHS did, in somewhat more modern facilities. C-VHS was also a high school of choice, in that middle school students in this large urban district could apply to attend the district's vocational high school. Such separate high schools for secondary vocational education are common in this region, although as noted above, vocational high schools are increasingly rare in the United States. Historically, VHS and C-VHS had not offered college preparatory-level academic classes, but did so during the time this study was conducted. Figure 1 provides a schematic of the entire study sample.

METHOD

Each research question required different data collection and analysis plans. The first question, regarding state and district policy around IRC, was answered by examining the three state department of education websites and the five district websites that correspond to the schools. In addition, document analysis was performed on the various course catalogs, reports, grant proposals, and other documents gathered during the four years of data collection at the sites. This analysis specifically sought information pertaining to state and district policy about IRC.

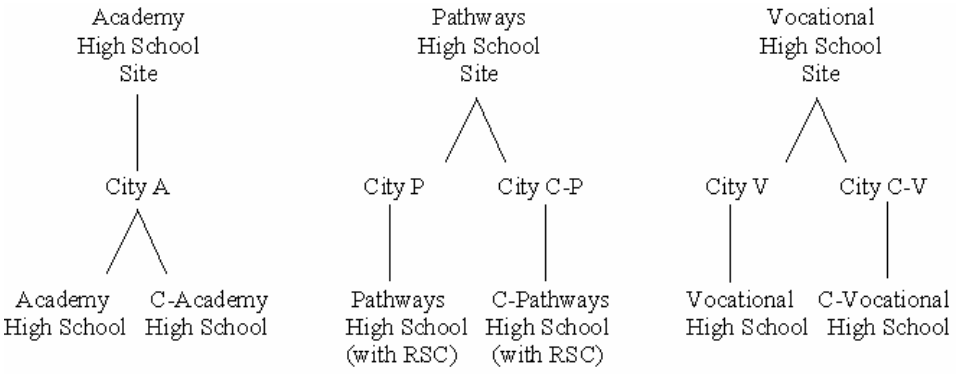

Figure 1. *Schematic of Study Sample. Cities are not named to protect the anonymity of the sites. RSC = regional skills center.*

The second research question concerns the number of students in the class of 2002 who earned IRC at the six high schools (and two skills centers). When we discovered that student credentials earned were not a part of the transcript data supplied to us by any of the five districts, we turned to the schools themselves to provide the data. At the two vocational high schools, the data had been formally collected and recorded as part of student transcripts. However, we were surprised to learn that at the other four of the six high schools, the information had not been collected in a formal manner. At these sites, the vocational director or counselor assisted us by gathering information from each relevant academy leader or department chair, and reporting back to us. Data collected in this manner have inherent flaws, such as the unreliability of memory or casual recording procedures, the self-reported nature of the data, and the inability to know if the data have been collected in their entirety. As an example, of the 23 CTE programs for which we received records on the number of students earning certification, 8 were unable to provide a denominator; that is, they were unable to report the total number of seniors who had been in the program and were eligible to take the certification exam. Therefore the results for those eight programs, shown in the tables below, lack an entry for the total percent of eligible seniors who earned the credential. Such limitations in this analysis are discussed further below.

The final research question addresses the value of students earning IRC in high school from the point of view of the various stakeholders. Over 300 teachers, administrators, and students were interviewed across all of the sites over the five years of data collection. Not all of these participants were asked about the use or value of IRC, so the responses elicited here are not representative of the entire sample of people interviewed. A total of 106 study participants, or approximately 31%, mentioned IRC. Although 31% does not represent a large part of the total interview sample, this relatively low number is not surprising, since earning IRC was only one of many student outcomes examined in the larger longitudinal study.

All interviews were recorded and transcribed. The transcripts were first separated by type (CTE teachers, academic teachers, school and district administrators, counselors,

students, and community members), then coded, and finally analyzed following the case study methods of Yin (1994) and the grounded theory approach of Strauss and Corbin (1990). Coding refers to marking the sections of transcript that correspond to a topic or concept related to the research questions. Interviewee responses could be coded with more than one code. Codes were developed from the interview questions, which in turn derived from the research questions. Following is a relevant question from a teacher interview protocol:

> Is this program nationally certified to grant industry-recognized credentials to students (e.g., Cisco, A+)? Are the students able to meet the standards? What are the benefits to students of this certification? About how many students get certified per year? Out of how many who try?

Often, the topic of IRC arose in the interviews not from such a direct question, but through other questions, such as whether a CTE program had a local business advisory council, or if there were other means of assessing students besides school tests and grades.

The larger research questions of the longitudinal study examined many types of student outcomes at these schools, and the analysis of the entire qualitative dataset utilized 184 codes. For this analysis of IRC, we used two codes primarily: "student credentials" and "local labor market." The coded interview transcripts were entered into a qualitative data analysis software package called HyperResearch©. The resulting database could be queried by code across all interview types, yielding various reports of stakeholder perspectives on IRC. In addition to providing these perspectives on the use and value of IRC, the interviews also served as triangulation for, or a check on, the results of the other two research questions: the web-based policy examination, and the outcomes at these high schools.

Limitations

The data on students earning industry-recognized credentials were gathered two years after the class of 2002 graduated. At four of the six high schools, the data were collected and totaled at the time of our request in 2004 rather than in 2002. Such a method of data collection leaves some doubt as to the accuracy of the outcomes. The reliability of self-report data is questionable, especially when those data were inconsistently or incompletely recorded some time in the past. Despite their limitations, we believe the data are reliable estimates. High school staff with whom we had collaborated over four years worked diligently to collect all records, and teachers did have the information in rollbooks or other sources. In addition, the outcome data are consistent with what we know about the state, district, and school contexts from our other data sources.

Another limitation of this study has to do with changing policy contexts. During the tenure of this study, the three states developed or modified their CTE accountability systems, making the state contexts described here somewhat dated. However, what is a limitation for this analysis can be seen as a potential benefit for practice. States and localities are having to decide what role industry certification will play in their schools. If

these credentials become part of the CTE accountability system, this study shows that record keeping will have to improve, thus addressing the other limitation of this study. In fact, two of the high schools in this study had to begin to keep such records near the end of the study in order to meet new state requirements. In those cases, the results of this study serve as a useful baseline of information.

RESULTS

The three states involved in our study reflect the range of education policy with respect to industry-recognized credentials. For each site, we discuss the state policy on these credentials, and then present the findings on the number of students in the class of 2002 who earned IRC at these schools. Interview data from teachers, students, and administrators provide information on the value placed on these credentials, as well as detailing the context for the results displayed in the tables. In general, teachers and administrators believed that the credentials were valuable to students, but they expressed some concerns about the use of these credentials in high school. While only 11 of the 77 high school students we interviewed mentioned IRC, those who did were very familiar with the credentials and how they could be valuable to them after high school.

In examining the data returned to us by the schools, we found that these high schools had developed various in-house certificates of competency or completion. While these were of some interest, we decided to focus on IRC and did not include in-house credentials in the reported outcomes. Another issue arose around the American Red Cross' First Aid/CPR certificate. At four of the high schools, "all" students in a program or a class cohort were expected to earn a First Aid/CPR certificate. This made it very difficult to determine the exact number of students who actually earned one. In addition, the First Aid/CPR certificate is a general certificate available to all members of the community, not only those who are bound for careers in the health professions. For these reasons, we have not included the numbers of students who earned the First Aid/CPR certificate in the results.

Industry-Recognized Credentials at the AHS Site

The state where Academy High School (AHS) and C-AHS are located has not formally incorporated IRC as an element in its secondary career and technical education system. At the time of our study, the state began an initiative to develop an integrated workforce development system. This undertaking recognized the importance of linking CTE curricula to industry standards, and of giving students the opportunity to earn credentials as a means of assessing student mastery of the standards. However, IRC are not an explicit component of the proposed workforce development system, and were not an accountability component of the previous state plan for vocational education (i.e., high schools were not required to report the number of students earning credentials).

Student Participation and Perceived Value

The three academies at AHS were finance, information technology, and health careers. Many high schools offer certificates in the latter two of these academies, such as A+ or

certified nurse assistant, as described above. However, at AHS, the oft-stated goal was to prepare students to enter four-year colleges and universities. One of the academy leaders reported that their business advisory committees were not interested in technical skill certification at the high school level. These business partners were more interested in so-called "soft skills" training, such as the ability to show up on time and work in teams. According to this academy leader, "They don't care if [students] are certified in insurance." Given employer ambivalence and the postsecondary focus of the school, there was little motivation to include IRC opportunities in the career academies. As this study was coming to a close, however, the teachers in the information technology academy were re-examining that curriculum, and were considering including preparation for industry certification. One issue that surfaced among the decision makers was how to help students pay to take such exams.

At C-AHS, there were no opportunities for students to earn IRC in 2002. A major reason for this was the lack of the continuous funding necessary to keep both the equipment and the teaching staff up to industry-approved standards. C-AHS did not appear to have the personnel, time, or resources needed to pursue programs and opportunities for students such as IRC. This is not an unusual state of affairs in urban secondary education.

Industry-Recognized Credentials at the PHS Site

The state where Pathways High School (PHS), C-PHS, and their respective skills centers are located has taken an aggressive approach to IRC. If there are industry certifications that students can earn while in high school, the vocational office of the state department of education has encouraged high schools to develop their programs to incorporate those certifications. During the tenure of our study, this state began requiring districts to report the number of IRC earned by students. The state has provided financial incentives to schools offering vocational classes that lead to industry-recognized certification or that articulate to postsecondary programs. At PHS, the vocational directors agreed with this focus in principle, but noted that the reality could be more complicated. For instance, one program coordinator felt that schools should not be required to meet industry-level requirements if it would cause their districts financial hardship. He felt that industry standards should not be the sole criterion of high school vocational program quality. Despite a program or district's inability to reach that standard, a program might nonetheless be sufficient to prepare students for work and to be able to meet industry requirements in a postsecondary setting.

Student Participation and Perceived Value

In 2002, students at PHS could earn IRC in information technology. At the end of a blocked sequence of computer engineering courses, students were eligible to take the A+, Network+, and the OCP (Oracle Certified Professional) exams. Only one student took the A+ certification exams in 2002, and he passed. One of the computer teachers said earnestly that the skills of his students were equivalent to those of the people who took and passed such exams. But his students, coming as they did from low-income backgrounds, could not afford to take the exams. The price of these exams, sometimes as much as two hundred dollars, was a major deterrence. The teachers were looking for

scholarships to pay for the exams, so that their students could benefit from the certification, and, one said, "to kind of validate what we're doing."

There were several reasons why PHS did not offer more opportunities for students to earn certificates. Some of the CTE programs at PHS simply did not have industry-recognized skill standards (e.g., commercial photography), and other programs were in areas that required postsecondary education for certification (e.g., floriculture/nursery operator). We heard complaints about the cost of maintaining industry-approved programs. School districts bore the significant costs of upgrading equipment and facilities, especially in the automotive and information technology areas. Given that many students could not afford to sit for the certification exams, school officials did not feel that it was a wise use of scarce funds to continue to keep up with such rapidly changing technology.

Perhaps the primary reason for the paucity of IRC available at PHS, however, was the presence of a regional skills center where students could go if they wanted to concentrate on a specific CTE area. PHS and other area high schools were members of a cooperative that provided focused, half-day CTE programs to students. Of the 17 CTE programs offered by Pathways Regional Skills Center (PRSC) in 2002, 8 offered the opportunity to earn an industry-recognized credential. The number of seniors in 2002 who earned such credentials at either PHS or the regional skills center is shown in Table 4.

As can be seen in Table 4, at PRSC, programs offering state licensure were most prevalent, such as safe food handling and wildfire management. Although the skills center offered opportunities to earn IRC in computer technology, automotive repair, and nurse assistant programs, no seniors from PHS earned these certificates in 2002. The director of the skills center reported that due to increased student demand, more high schools had begun offering A+ certification opportunities on their own campuses. And indeed, PHS offered a computer engineering block of courses leading to certification. This meant that fewer students were likely to choose the skills center program, because they could take it at their home high school.

One student (not from the class of 2002) related to us in his junior year that he planned to get all three IT certifications that were offered at PRSC (see Table 4). He was quite knowledgeable about these certifications. In his junior year, he explained, "I'm going to get A+ certified, and then do those other two, because A+ is like the base of all certifications. So you want to get that one first and out of your way." When we spoke with him the following year, we probed for his sense of the value of these credentials:

> Researcher: And what are you going to do to show future employers and colleges what you can really do? Or are you just going to use the certifications?
> PHS junior, male: Yeah. Because that shows that you know the information and you know what to do and you've had training in it.

This student was confident that the credentials he earned would signal to employers that he had the skills they required. A PHS counselor supported this confidence in the following comment: "[Students are] earning certificates right here in the high school that they can go out into the area with and make some fairly decent money right out of high

school." And indeed, employers in the area were beginning to turn to industry certification as a criterion for employment:

> Researcher: Do employers look for those certifications and hire them, and the other kids are just out of luck? What impact does that certification have?
> Auto Mech Teacher: More and more it's a big deal. In the dealerships, the nicer independent shops, you know, the ones students drive by [and think], "Oh that looks like a nice place," kind of a professional look to it. Usually that's a requirement.

Table 4. *Industry-Recognized Credentials Earned by Pathways High School Seniors, 2002*

CTE Program	Type of Credential	Ratio of Seniors Earning Credential To Total Number of Seniors in Program	Percent of Seniors in Program Earning Credential
At PHS			
Computer engineering	A+	1/7	14%
At PRSC (regional skills center)			
Auto body tech	ICAR[a] Passport	0/5	--
Catering & restaurant management	Food handlers card, HACCP[b] training	7/7	100%
Computer systems tech	A+, Network+, Cisco CCNA[c]	0	--
Cosmetology	State license	0/13[d]	--
Fire science/ Emergency medical technician (EMT)	NWCG[e] wildland and wildland-urban interface firefighting	2/2	100%
Nurse assistant (CNA)	State certification exam preparation	0/7	--
Welding tech	AWS[f]	0/3	--
Total certificates earned: 10			

[a]Inter-Industry Conference on Auto Collision Repair. [b]Hazard Analysis Critical Control Point system of safe food handling. [c]Cisco Certified Network Associate. [d]The number of hours of training required to take the licensing exam exceeded what the skills center program offered. [e]National Wildfire Coordinating Group. [f]American Welding Society.

However, the PHS auto mechanics teacher noted that there was too much content in the NATEF certification program for a high school to be able to present. As a result, he picked from the available units, and expected that students would get more training at the community college. The director of the regional skills center also reported encouraging

students to go on for further training, in order to improve their long-term prospects: "Because when you're 22 or 23, the money that looked good when you were 18 is not as good anymore."

At C-PHS, two CTE programs offered opportunities to earn IRC: auto mechanics and nurse assistant (see Table 5). Unfortunately, the data reported to us by C-PHS did not include the total number of seniors in these programs, making the program performance impossible to interpret. Like PHS, C-PHS also had a regional skills center in its area. It offered 15 CTE programs, 3 of which included preparation for an industry-recognized credential. However, no C-PHS students earned certification in any of the skills center programs. Table 5 shows the number and percent of C-PHS seniors in 2002 who earned IRC.

Industry-Recognized Credentials at the VHS Site

The state where Vocational High School (VHS) and C-VHS are located has a traditionally-structured secondary education system with separate parallel vocational and academic streams. CTE programs are offered at vocational high schools, which are either part of a district or regional in nature. The vocational high schools in the state had been formally recording the number of students earning IRC prior to when we began the study.

Table 5. *Industry-Recognized Credentials Earned by Comparison-Pathways High School Seniors, 2002*

CTE Program	Type of Credential	Ratio of Seniors Earning Credential To Total Number of Seniors in Program	Percent of Seniors in Program Earning Credential
At C-PHS			
Automotive tech	NATEF[a]	0	--
Nurse assistant (CNA)	State certification exam	10	unknown
At C-PRSC (regional skills center)			
Automotive tech	NATEF	0/2	--
Cosmetology	State license	0/11[b]	--
Nurse assistant (CNA)	State certification exam	0	--
Total certificates earned: 10			

[a]National Automotive Technicians Education Foundation. [b]The number of hours of training required to take the licensing exam exceeded what the skills center program offered.

Along the model of its academic curriculum frameworks and exams, the state began to develop CTE curriculum frameworks and assessments for each program. Students who passed the assessment in their CTE program area would receive a Certificate of Technical

Mastery (CTM), certifying a standard of achievement in that area. Where possible, the CTM assessment was to be aligned with nationally-recognized industry standards. The CTM requirements had not yet been implemented in any CTE program area at the time of the graduation of most of the students in our eldest cohort (i.e., 2002). However, many CTE programs had been offering the opportunity to earn credentials long before the state CTM process began.

Student Participation and Perceived Value

VHS students choose their CTE program early in their freshman year, after exploring all of the programs. The class of 2002, most members of which were freshmen in 1998-99, chose from among 18 vocational programs, 3 of which offered opportunities to earn IRC. The number of students who earned such credentials is shown in Table 6.

Table 6. *Industry-Recognized Credentials Earned by Vocational High School Seniors, 2002*

CTE Program	Type of Credential	Ratio of Seniors Earning Credential To Total Number of Seniors in Program	Percent of Seniors in Program Earning Credential
Electrician	C-Tech network cabling specialist	7/7	100%
Cosmetology	State license	14/24	58%
Nurse assistant (CNA)	State certification exam	28/37	76%
Nurse assistant (HHA)[a]	State certification exam	31/37	84%
Total certificates earned: 80			

[a]Home Health Aide.

C-VHS, another vocational high school, had approximately 26 CTE programs in 1998-1999. Seven of these programs offered IRC. The number of students earning these credentials is shown in Table 7. The business and automotive programs did not provide information on the total number of seniors in these programs, making outcomes for those programs impossible to determine. However, the health programs provided more complete information. As with VHS, C-VHS had high percentages of students receiving state certification for nurse assistant and home health aide.

VHS and C-VHS are traditional vocational high schools that have historically received their district's non-college bound student populations and prepared them directly for work. As such, opportunities to earn IRC were better-developed at these schools than at the others. At VHS, we interviewed 25 students, 3 of whom mentioned IRC. These students seemed very aware of the role that these credentials could play in their work life. One cosmetology student, when asked what she planned to do after high school, replied:

VHS junior #1, female: When I get in twelfth grade, I'm going to take my state boards and then I'll get my license if I pass. You have to get your license. And then pretty much I can do whatever from there. But I want to have my own business so I've got to go to college and take business management courses for that.

Table 7. *Industry-Recognized Credentials Earned by Comparison-Vocational High School Seniors, 2002*

CTE Program	Type of Credential	Ratio of Seniors Earning Credential To Total Number of Seniors in Program	Percent of Seniors in Program Earning Credential
Business systems networking	Cisco CCNA[a]	0	--
Microsoft office user specialist (MOUS)	MOUS	0	--
Automotive tech	NATEF[b]	0	--
Power mechanics	OPEC[c]	0	--
Cosmetology	State license	6/19	32%
Dental assistant	Radiography	1/5	20%
Nurse assistant (CNA)	State certification exam	14/15	93%
Nurse assistant (HHA)[d]	State certification exam	10/15	67%
Total certificates earned: 31			

[a]Cisco Certified Network Associate. [b]National Automotive Technicians Education Foundation. [c]Outdoor Power Equipment Certification. [d]Home Health Aide.

A nursing student was asked the same question, leading to the following exchange:

VHS junior #2, female: By the time I finish high school I want to have my license but I would like-, there's a two-year program at the community college, so I'll probably keep studying.
Researcher: To become a registered nurse or something?
Junior #2: You can get your license here for registered nurse, in twelfth grade. And you can have a job while you're in twelfth grade. But if you want to keep going, you could go further and so probably after I get out of here, I'll go for another two-year program.

Many of the same issues that kept the other schools from increasing the number of students earning IRC were also a factor at VHS and C-VHS. For instance, although the automotive program and the instructors were NATEF certified, the exam for student certification was too costly for many students. We learned that the fee to take the state cosmetology license exam had increased, which discouraged students from taking it. Like other schools in the study, these vocational high schools were looking for grant money to offset certification exam fees.

Another factor limiting students' ability to earn IRC was the required reduction in vocational instructional time in order to focus on academic state test preparation. This situation became especially difficult at VHS after the school was declared "in crisis" by its department of education, due to a lack of improvement on state test scores. Given the new academic focus that the declaration required, students at VHS were in danger of not receiving enough vocational instructional time to qualify to take certification exams. While CTE teachers recognized the importance of meeting academic standards, they feared the loss of the school's mission:

> Auto Mech Teacher: The NATEF says that they have to do so many of [the competencies]. But what's happening now is as they take away the time, that aperture kind of starts closing, if you will, because the opportunity, the time, isn't there.
> Electrical Teacher: The part that changed is there's more emphasis on test preparation. We've lost about 45 to 50 percent of our shop time. It makes it much more difficult to get everything we have to accomplish when we're also teaching to the test.

A final consideration in the examination of VHS students earning IRC has to do with the local labor market in City V. The specific CTE programs offered at VHS changed along with changes in this labor market. School staff regularly reviewed regional planning board information to learn about job projections in the area. In 2003, the health care and computer industries had the largest projected job growth in City V. There was a high demand for clinical skills, and the VHS nursing program provided certified workers to fill the demand. In terms of auto mechanics, the high school auto teacher felt that students would be best off with more preparation:

> Auto Mech Teacher: Yeah, there's a lot of work out there. I wish I could say that on the high school level, when they come out, they're ready, you know? I mean, they're ready for entry level is what they're ready for. They really need a little more training. Postsecondary.

Another CTE teacher agreed with the assessment that postsecondary credentials were important in the hiring process as well:

> Drafting Teacher: One of the problems is that we have the community college right down the street, which, if someone's going to hire someone, they're going to hire someone that's 21 or 22 coming out of a technical community college as opposed to someone coming out of this high school.

The local economy in City V was not robust. This was perhaps the worst aspect of the employment situation for VHS students, regardless of the number of credentials they held. As one counselor put it, employers in this city simply were "not hiring."

SUMMARY

The purpose of this article was a twofold examination of the use of industry-recognized credentials. We first described the state policy contexts with respect to IRC in the states where the participating high schools were located, and second, we explored the use and value of these credentials to stakeholders at these schools.

The findings from the policy examinations of the three states in this study reflect the importance of IRC as one element in the development of secondary CTE accountability systems. All three states encourage the use of such credentials as one possible measure of program success. The trend in all three states is toward further specificity of CTE standards, frameworks, or assessments, all of which could incorporate greater use of IRC. However, at this point, IRC are not a mandatory element of these states' CTE accountability systems.

At the high school level, the findings show that the more traditionally "vocational" the high school, the more likely its students were to earn IRC. For instance, at AHS, where the goal was to prepare students for four-year colleges and universities, credential opportunities were non-existent. At the other end of the spectrum, VHS, C-VHS, and the regional skills center for PHS (i.e., PRSC) each reported solid numbers of IRC earned by students in the class of 2002. The dichotomy of vocationally-oriented vs. academically-oriented high school had a greater influence on whether students earned these credentials than did the dichotomy of the larger study, which was CTE-based comprehensive reform high schools vs. high schools with no such reforms.

The value of IRC was not fully agreed upon by all stakeholders. At the local level, teachers and administrators interviewed were concerned about the costs of maintaining facilities and programs, and about the costs to students of taking such certification exams. Teachers and administrators recognized the value of these credentials as signals to employers that their students had the requisite skills for entry-level jobs, but many with whom we spoke also felt that further education remained valuable in the long term. Of the 77 high school students we interviewed, only 11 mentioned IRC when we asked about their current plans and preparation for a career. However, those students who were working towards any of these credentials were also quite knowledgeable about their next steps after high school and appeared to have a plan that included using an industry-recognized credential to signal their qualifications to employers.

CONCLUSIONS AND RECOMMENDATIONS

Given the findings summarized above, we conclude that state departments of education need to examine the conditions under which opportunities to earn industry-recognized credentials are provided in the high schools in their state. There may be systematic differences between high schools that can and cannot provide these opportunities. These differences must be understood before including industry certification as a performance indicator for secondary CTE programs. For example, as the findings here show, schools that are more traditionally vocational tend to provide more opportunities to earn industry-recognized certification than high schools more oriented towards preparation for

baccalaureate and higher degrees. CTE programs in these latter high schools would be less likely to be able to meet accountability requirements that included a high percentage of CTE students earning industry-recognized credentials.

But as also shown in this study, even high schools that have historically been strongly vocational are having trouble maintaining the instructional time necessary for students to qualify to take the exams for industry certification. As all high schools come under increasing pressure to improve academic scores on state tests, time in the school day for other pursuits has diminished. This is likely to reduce the number of CTE programs that are able to provide opportunities to earn industry-recognized credentials, as resources and time are diverted to academic subject requirements.

Other systematic differences could arise between high schools that are more and less prepared to offer certification programs. It is possible that high schools in inner-city areas would be at a financial disadvantage in creating and maintaining CTE programs with the capacity to provide certification opportunities. Students in such schools would likely be unable to afford to take the exams. These hypotheses could not be tested with this study's design, because all participating high schools in this study were in high-poverty areas. However, more research on these and other systematic differences should be conducted before implementation of any policy using these credentials as a performance indicator.

We also concluded that as a group, the students at these high schools were not especially zealous about earning certification. It did not appear to us that such opportunities were a major factor in students' decisions as to whether and which CTE courses to take. Few students were aware of these opportunities, and fewer still were preparing for certification exams. Those students who were pursuing these certifications seemed quite sophisticated in their understanding of their career direction and how to achieve their goals. This suggests that CTE programs with certification opportunities can keep such students engaged in school. But these students were few and far between.

In reflecting on these conclusions, it must be remembered that direct questions about the use and value of industry-recognized credentials were not asked of all of the participants in this study. Therefore the responses elicited here are not necessarily representative of the entire sample of people interviewed. Although not consistently asked of all participants, the perspectives elicited here are important nonetheless, because we currently know so little about how industry-recognized credentials are used and regarded in high schools.

Indeed, the findings in this article are limited in their usefulness due to a drawback that stemmed from and reflects the paucity of our knowledge about participation in industry-recognized certification programs in high schools. In 2002, four of the six high schools in this study did not keep records of the numbers of students who earned certification. Meaningful data was difficult to collect. While this may raise questions about the exact results in this study, a more important implication arises: without good record keeping, using the number of students attempting and earning industry-recognized credentials as an indicator of CTE program quality would be misleading and irresponsible.

Given the scarcity of recorded, reliable information on industry-recognized credential programs in high school, this study should be regarded as an initial exploration into issues that arise upon doing research in this area. Little research attention has been paid to the use of industry certification in high school, its perceived value by teachers, administrators, and students, and whether it is a useful measure of high school CTE program quality. More research on these and other facets of certification at the high school level is needed. Recommendations for considering the use of these credentials for secondary CTE program quality purposes follow.

Schools should improve record keeping. High schools continue to incorporate industry-recognized standards into their CTE programs. The results from this analysis show that if schools, districts, or states wish to consider using industry-recognized credentials as a form of accountability, record keeping and reporting will have to improve. Collecting data for this analysis was difficult because records on such credentials were not systematically kept in 2002. Districts and states must begin to include industry-recognized credentials in their transcripts of student records. In addition to aiding in accountability reporting, recording the receipt of industry-recognized credentials could accomplish several important tasks. First, students who earn these certificates could be recognized at graduation, and their certification would be officially recorded for postsecondary or employer information. Second, recording the number of students earning such credentials would tout additional CTE program outcomes and could help advocate for the continuation of certain CTE programs at the high school level.

States should conduct a pilot reporting requirement. Before adopting industry-recognized credentials as an outcome measure for high school CTE programs, states should pilot a reporting requirement in order to gage the ability of high schools to comply, and to examine the results. States could receive a baseline measure of the use of industry-recognized credentials in high schools and determine whether these credentials fairly measure CTE program quality, or if the budgetary, time, and other constraints make industry-recognized credentials an inadequate measure of secondary CTE program quality.

Until these recommendations are completed, we believe it is premature to use industry-recognized credentials as high school CTE program quality indicators. But we believe that opportunities to earn industry-recognized credentials in high school should not be abandoned. We believe that these opportunities are an important element of Hopkins' (1999) expanded view of career and technical education outlined above. Certification opportunities bring workplace-level skill instruction to high school, and those skills are assessed by measures external to the high school. In some cases, internships or other hands-on opportunities are part of the certification programs. As such, industry-recognized credential programs bring "real-world" standards and expectations into high school, and provide strong education for, about, and through work. What is needed, however, is to be able to account for the efforts and successes that are occurring in high schools that provide these opportunities to earn industry-recognized credentials.

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THE ROLE OF NATIONAL INDUSTRY-BASED SKILL STANDARDS IN THE DEVELOPMENT, IMPLEMENTATION, AND ASSESSMENT OF COMMUNITY COLLEGE CURRICULUM

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ABSTRACT

Using a descriptive survey design, a nationally representative sample of community college career and technical deans were asked to complete a questionnaire that assessed awareness and implementation of industry-based skill standards. For those institutions implementing industry-based skill standards, the questionnaire sought additional information on assessment and credentialing practices. Data were collected across 10 CTE program areas including agriculture; construction/trade; automotive, commercial mechanic, and commercial driver's license; family and consumer sciences; graphic arts; health occupations; hospitality and hotel management; manufacturing; industrial; and business, administrative, and information technology.

INTRODUCTION

During the 1990s, the United States found itself experiencing changes in its industrial mix, technology, and educational legislation (Carter 2005). As a result, new models of delivering skills and credentials were adopted so that the nation's educational system could better prepare students for a globally competitive workforce. According to Carter (2005), ". . . one major change in the U.S. educational system was the increased reliance on, and prestige of, certification" (p. 51). Employers are increasingly hiring employees with certifications as many of today's occupations require workers with skill levels between a high school diploma and a bachelor's degree.

Industry-based skills standards are seen by many as the way to empower individuals entering or returning to the workforce, while positioning United States business and industry to regain a competitive edge in a changing marketplace. According to the former National Skill Standards Board (NSSB), skill standards identify what people need to know and be able to do to successfully perform work-related functions within an industry sector. Specifically, standards define the work to be performed, how well the work must

be done, and the level of knowledge and skill required. Skills standards, therefore, as used in this study, refer to worker performance specifications that have been developed or are being developed by business and industry-based organizations, educational organizations, individual states, or a combination of these.

Skills standards consist of two components: a) a description of the responsibilities needed for competent performance, and b) a description of knowledge and skills necessary to carry out these responsibilities (National Skill Standards Board, 2000). In educational settings, skill standards define a facet of student performance that is measurable and built on the skills learned as students' progress through the educational system and into the workplace (Rahn, O'Driscoll, & Hudecki, 1999). In industrial settings, skill standards help those involved prepare for changes in both work and the economy (Carnevale & Desrochers, 2001; Faulkner, 2002; Wills, 1995). Naquin and Wilson (2002) state that the process for establishing competency standards, assessing them, and certifying outcomes is a component of effective workforce development.

Skills standards function as a quality-warranty, a goal-indicator, and a change-promoter (Naquin & Wilson, 2002; Silvan, 1993). In the context of education, standards clarify expectations of student performance (Rahn, O'Driscoll, & Hudecki, 1999). According to Silvan (1993), the greatest implication of skills standards has been the evaluation of student performance. Advocates believe that skill standards have the potential to a) improve the United States workforce, b) provide uniform measures for the international marketplace, c) provide portability of employment for United States workers, d) increase accountability, and e) meet the needs of business and industry (Bunn & Stewart, 1998). Speculating on the potential for positive impacts of skills standards on public education, particularly CTE, Bunn and Stewart (1998) described six themes related to impact: a) improved communication between education and business and industry, b) improved relevancy of curriculum content, c) improved teaching and learning processes, d) enhanced connections between school and employment for graduates, e) better prepared entry-level workers, and f) improved accountability.

In this study we explored the relationship between industry-based skill standards and CTE community college curricula.

The Role of the Community College in Skill Standards Implementation

Career and technical education (CTE) (formerly known as vocational–technical education) has been a part of the mission of community colleges since their inception. According to Cohen and Brawer (2003) vocational–technical education has been a component of most states' legislation for community colleges from the earliest days. Vocational education in the community college was designed to teach more complicated skills than high school vocational classes—with the intention of "serving students by preparing them for employment and serving industries by supplying them with trained workers" (Cohen & Brawer, p. 233). Community college personnel work with employers to analyze local employment trends and design programs of study.

Carter (2000) reported that the technical complexity in the workplace will rise, which means that people who fill the jobs will be required to have specialized, current skills. Employers in the United States are no longer looking for applicants who simply have computer knowledge, but now seek individuals with specific skills for a specialized field of work. Degrees are becoming less important to many areas of work, with specialized skills coming to the forefront. Community colleges are challenged to examine their programs and determine if these programs are capable of providing this type of professional development. If not, the colleges must decide what is necessary for students to learn, and overhaul programs to deliver the required outcomes. Course development becomes critical and the time in which to do it is shortened.

With the increasing importance of national skills standards and student certification, institutions must focus on building a reputation for developing students for relevant jobs (Boesel, Rahn, & Diech, 1994). Current and future students would then be able to make educational choices based on the performance of an institution and the placement of its graduates. These placement rates, in turn, serve as clear indicators of successful CTE programs.

STATEMENT OF THE PROBLEM

The utilization of skill standards in curriculum development has become an increasingly prominent aspect of the CTE reform movement over the past 10 years. Standards are seen as a way to achieve better accountability within CTE systems, improving their quality as well as their alignment with workplace requirements. While standards are used increasingly in both secondary and postsecondary CTE programs, little research has been conducted regarding the extent to which standards are used by community colleges as a key component of curriculum development, delivery, and assessment (Aragon, Woo, & Marvel, 2004). If CTE policy makers, education leaders, and community college faculty are to make informed decisions about the best approaches to integrating skill standards into CTE programs, more information is needed about current practices.

PURPOSE AND RESEARCH QUESTIONS

The purpose of this study was to examine the extent to which various industry-based skills standards are integrated into CTE community college curricula. This study was guided by the following research questions:

1. To what extent have industry-based skill standards become part of community college CTE curricula?

2. To what extent are industry-based skill standards part of the assessment process in community college CTE?

3. To what extent do credentials, certificates, and diplomas issued by CTE community college programs reflect industry-based skill standards?

This research builds on previous National Center work in skill standards (Bailey, 1997; Bailey & Merritt, 1995; Hoachlander, 1999; Holmes & Rahn, 1998; Merritt, 1996; Rahn, O'Driscoll, & Hudecki, 1999; Stern, Bailey, & Merritt, 1996). Past studies have focused on the integration of academic and industry standards (Bailey; Bailey & Merritt; Hoachlander), setting standards in relation to accountability (Rahn, O'Driscoll, & Hudecki), developing CTE skill standards resources for CTE teachers (Holmes & Rahn), reporting findings from promising states that are setting skill standards (Rahn, O'Driscoll, & Hudecki), and sharing skill standards (National Dissemination Center for Career and Technical Education, 2001). This project develops a more descriptive picture of the approaches by which skill standards are implemented in community college CTE programs

METHOD

Design

This study utilized a descriptive survey design to analyze the status of industry-based skill standards implementation in postsecondary CTE programs. A nationally representative sample of community colleges deans was asked to answer questions addressing the prevalence of skill standards in postsecondary CTE.

Sample

The target population for this study was defined as postsecondary colleges and technical institutes that are members of the American Association of Community Colleges (AACC). These institutions are typically referred to as community colleges, technical institutes, or junior colleges. The population provided a national representation of institutions, and included all types, sizes, geographic locations, and settings (i.e., urban, suburban, or large town, rural). The population included all institutions that were classified as single-campus colleges, variations of multi-campus colleges (i.e., district offices, multi-college districts, institutional systems), and colleges that were on the campus of a university and had either a separate or shared accreditation with their host institution (labeled as "campus type"). After removing duplicate references in the database, the final target population contained 1,015 member institutions. The frame was cross-referenced with the membership directory of the National Council for Workforce Education (NCWE) to verify accuracy of contact information.

Cochran's (1977) sample size formula was used to determine the delivered sample size needed to make estimates on skill standards from the target population of 1,015 community institutions. To determine the delivered sample size needed, alpha was set at .05, acceptable margin of error was set at 5%, and variance was conservatively estimated at .25. The required delivered sample (n = 384) was then adjusted for exceeding 5% of the target population (Cochran). The desired delivered sample for the project was 285 after the adjustment. Adjusting for a projected response rate of just over 50%, the sample population included 552 community colleges. The number of institutions selected from

each state represented the overall total proportion of community colleges in each state within the United States.

Instrumentation

A thorough review of the literature on national industry-based skill standards implementation within CTE program areas was conducted. Additionally, community college CTE curricula were reviewed to establish specific skill standards for program areas. Based on these two inquiries, a list of 64 industry-based skill standards was created. These 64 standards cover 11 program areas, including: agriculture; automotive; construction/trade; commercial mechanic and commercial driver's license; family and consumer sciences; graphic arts; health occupations; hospitality and hotel management; manufacturing; industrial; and business, administrative, and information technology. A questionnaire was created and organized around each of the 11 CTE program areas and their applicable skill standards. However, due to the overlap in skill standards, the program areas of automotive, commercial mechanic, and commercial driver's license were collapsed into a single category resulting in 10 CTE program areas addressed by the survey.

Experts from universities and community colleges in the areas of measurement, skill standards, and survey research design reviewed the instrument for content validity and format. After the review, items were modified, changed, and deleted. A pilot test of the instrument was conducted with CTE administrators who were not part of the sampling frame. Feedback from the experts and the pilot test was used to revise items for the final instrument. Cronbach's alpha was used where appropriate to assess the internal consistency of the instrument.

For each of the 64 standards, nine questions were asked. The nine items on the questionnaire were built around the following five categories:

1. *Skill Standard Awareness (Item 1):* This item asked respondents if they were aware of the stated skill standard.

2. *Implementation of Skill Standard (Items 2, 3):* These items asked respondents if their respective institutions were implementing the stated skill standard or a similar state-level skill standard.

3. *Approaches to Implementation (Item 4):* This item solicited the ways the institution was implementing the stated skill standard. Respondents could select one or more of the following: a) developing curriculum, b) modifying instructional practices, c) marketing the program to business and industry, d) assessing program, e) assessing students, f) developing learning objectives, g) marketing program to students, h) selecting faculty, and i) other.

4. *Approaches to Assessment (Items 5, 6):* These items were developed to identify the methods the institution used to assess student achievement of the stated skill standard

and to identify if the assessments were developed by the skill standard organization. Respondents could select one or more of the following: a) traditional knowledge-based assessment (paper-and-pencil or computer-based), b) performance-based/authentic assessment, c) no student achievement assessment of the skill standard, and d) other.

5. *Certification/Credentialing (Items 7, 8, 9):* These items addressed certification/ credentialing activities associated with the stated skill standard. Item 7 asked respondents to identify any certificates/credentials awarded to students for achievement of the stated skill standard. Requirements for awarding certificates/credentials were then solicited through item 8. Participants could choose from the following list: a) completing a degree/diploma,(b) completing courses with passing a certification exam, c) completing courses without passing a certification exam, d) passing certification exam with no course requirements, and e) other. Item 9 focused specifically on any certification/credentialing exams used at the institution. Choices included the exam is a) a traditional knowledge-based assessment (paper-and-pencil or computer-based), b) performance-based/authentic assessment, c) developed by the skill standard agency, and d) administered by an outside agency.

Procedures

A four-round data collection process based on Dillman's (1978) Total Design Method was used to obtain responses to the questionnaire. Questionnaires were coded and logged into a computerized database to track responses. In round one (the initial mailing), a questionnaire was sent to the career and technical education deans of the 552 institutions in the sample. Round two involved a postcard mailing to CTE deans at those institutions that had not responded to the round-one solicitation. Round three involved a second mailing of the questionnaire to those individuals who had not responded to the first two solicitations. Round four utilized e-mail and phone calls for making final contacts with participants. The multiple rounds of data collection were designed to increase the response rate. They also allowed for a comparison of the responses from early and late respondents.

Of the 552 institutions surveyed, 204 returned surveys—resulting in a 37% response rate. The response rate on this survey compared favorably with a study conducted by AACC, which sent their questionnaire to chief academic officers at more than 1,100 community colleges, and 205 responded, for a 19% response rate (Nock & Shults, 2001).

To verify the representativeness of the respondents to the population, several statistical comparisons were performed. The demographic characteristics of the respondents who provided useable data were compared to the characteristics of the nonrespondents within the sample. Comparisons for geographic region, local setting, campus type, and institution size involved running crosstabs and calculating Pearson's chi-square. Except for "campus type," no statistically significant differences were found between the respondents and nonrespondents within the sample for these demographic comparisons. The comparison between the respondents and the target population also revealed no

statistically significant differences between these two groups on the demographic indicators. Additionally, no statistically significant differences were found between the nonrespondents within the sample and the target population on the demographic indicators. Finally, a comparison of the early and late respondents revealed no statistically significant differences between the demographic characteristics of the two groups except within "campus type."

Data Analysis

The status of national industry-based skill standards integration into community college CTE programs was assessed by measuring the characteristics of a nationally representative sample of community colleges at one point in time. Prespecified variables were used to describe prevalence, or frequencies, as well as the various ways in which industry-based skill standards influence the development of community college curricula. In accordance with the research questions, the examined variables reflect the extent to which industry-based skill standards have become integrated into the community college CTE curricula, assessment processes, and diplomas, credentials, and certificates.

Groupings were used to organize the data and to describe the differences in characteristics among the sampled colleges. Grouping included consolidation of the colleges by region, locale, and student enrollment figures (hereafter referred to as institution size). These are similar groups to those used by AACC for their analysis of community college data. Groupings by college region included three groups: a) East—composed of the New England, Mid-east, and South-east states; b) Midwest—composed of the Great Lakes and Plains states; c) West—composed of the South-west, Rocky Mountain, and Far-west states. Groupings by college locale also included three groups: a) Urban—composed of large cities (≥ 250,000) and midsize cities (< 250,000); b) Suburban and large town—composed of fringes of large cities, fringes of midsize cities, and large towns (≥ 25,000); c) Rural—composed of small towns (250–25,000) and rural areas (< 2,500). The following institution sizes were used: a) ≤ 1,000 students; (2) 1,001–3,000 students; b) 3,001–10,000 students; c) over 10,000 students.

The following parameters were established for reporting data associated with awareness, implementation, assessment, and certification/credentialing.

Parameter 1: Awareness. Awareness of skill standards was based on those institutions reporting offerings in a particular program area. For example, frequency distributions for awareness of manufacturing skill standards were calculated only for those institutions that reported offering manufacturing programs. This parameter was applied to the remaining 9 program areas.

It was recognized that respondents could have awareness of a particular set of skill standards even though the program was not currently offered at their institution. However, the parameter remained as stated above because the questionnaire was designed to direct respondents to the items associated with the next program area if the current program area under investigation was not offered at their institution. For example,

if the institution did not offer a manufacturing program, the questionnaire directed participants to move to the subsequent program area (industrial—non-manufacturing). These guidelines were applied to the remaining sections of the questionnaire by program area.

Parameter 2: Implementation/implementation purposes. Overall, implementation was based on those institutions that reported an awareness of skill standards (parameter 1) for a particular program area. This parameter assumed that institutions could not be implementing a set of standards for which organizational members had no awareness. The specific ways that an institution was implementing skill standards (purposes) were based on those institutions that reported the implementation of skill standards for a particular program area.

Parameter 3: Assessment. Frequency distributions associated with assessment of student achievement and the specific type of assessment methods used were based on those institutions reporting implementation of skill standards for a program area (parameter 2). This parameter assumed that institutions could not assess students on skill standards unless the standards were first being implemented.

Parameter 4: Certification/credentialing. Frequency distributions associated with certification and credentialing were based on those institutions reporting the assessment of student achievement (parameter 3). This parameter assumed that institutions could not offer certifications/credentials without assessment processes in place.

Item 9 asked specifically about the characteristics of any certification/credentialing exams used by the institution. Frequency distributions associated with this item were based on those institutions that reported use of an exam as part the certification/credentialing process.

RESULTS

Out of the 204 institutions responding to the survey, 153 (75.7%) reported the use of skill standards within postsecondary CTE curricula, while 49 (24.3%) indicated skill standards were not currently being used. Therefore, the frequency distributions for each program area, along with all other statistical analyses were calculated for those institutions reporting use of industry-based skill standards only ($n = 153$).

Institutional Participation in Use of Skill Standards

The percentage of institutions (based on $n = 153$) offering each of the 10 CTE program areas is as follows: business, administrative, and information technology (87%), health occupations (82%), automotive/mechanical (73%), construction/trade (67%), manufacturing (67%), family and consumer sciences/childcare (59%), graphic arts (50%), industrial (47%), hospitality/hotel management (46%), and agriculture (37%).

Awareness of Skill Standards. For those institutions that offered specific CTE programs, their representatives were requested to identify their level of awareness of the applicable skill standards. Respondents' awareness of applicable skill standards varied across the 10 program areas. For three of the program areas (manufacturing, construction/trade, health occupations), approximately 72% of the respondents indicated they were aware of the applicable skill standards. For automotive/ mechanical, approximately 80% of the respondents were aware of the applicable skill standards for this field, while only 30% were aware of the standards for the field of agriculture (30%). Out of the remaining five program areas, the percentage of respondents aware of the applicable skill standards ranged from 38% (graphic arts) to 62% (family and consumer sciences/childcare).

Implementation of Skill Standards. Respondents were then asked if the applicable industry skill standards or a similar state-level skill standards were being implemented by the community college. The data revealed that health occupations (99.2%) and automotive/mechanical (94.6%) were the two programs areas in which the largest number of institutions were implementing national skill standards or similar state-level standards. For trades/construction, 76.7% of the respondents indicated their institutions were implementing standards in this program area, with 64.9% of the institutions reporting implementation within the family and consumer science/childcare area. The data revealed that only 16% of the institutions were implementing standards associated with agriculture, while 19.8% reported implementation of graphic arts standards. For the remaining program areas, the number of institutions implementing applicable national- or state-level skill standards ranged from 33.3% (industrial) to 50.9% (manufacturing).

Approaches to Implementation

The survey was designed to solicit the various ways institutions were implementing skill standards into the various CTE curricula areas. Those respondents who stated through an earlier survey item that their institutions were implementing skill standards into a specific program area were offered eight approaches to implementation from which to select (see 'approaches to implementation' within "instrumentation"). Although the survey included 'other' as a category, it was not selected by any of the participants in the study. Respondents were guided to select as many approaches of implementation as applicable for a particular program area. While respondents reported the applicable skill standards were being implemented in all of the eight ways listed, particular skills were implemented more extensively by community colleges in comparison to other types of postsecondary CTE institutions.

Both automotive/mechanical and health occupations had the highest percentage of institutions implementing skill standards across the eight approaches. For those institutions that implement automotive/mechanical skill standards, approximately 73% of those institutions implemented them in all eight ways listed on the survey. Implementation for the purpose of developing curriculum was reported by 81.3% of the institutions, while 59.3% of the institutions used these same skill standards for selecting CTE faculty. Roughly 76% used these skill standards for assessing student performance. All of the above numbers look similar for the health occupations skill standards. For

those institutions that implement health occupations skill standards, approximately 74% of those institutions implemented them in all eight ways. Implementation for the purpose of developing curriculum was reported by 83.3% of the institutions, while 64.6% of the institutions used these same skill standards for selecting CTE faculty. The percentage of institutions using the standards for assessment purposes was 81%.

The program areas of graphic arts, agriculture, and business, administrative, and information technology had the lowest percentages of institutions implementing applicable skill standards across the eight ways. Less than one-fourth (23%) of the institutions implemented skill standards in all of the eight ways. Specifically, 31% of the institutions reported implementing skill standards for the purpose of curriculum development, and 13.8% of the institutions implemented them for the purpose of selecting new CTE faculty members. Twenty-four percent (24%) of the institutions reported using skill standards for student assessment. A similar pattern was found in the agriculture program area. On average, 26% of the institutions implemented agriculture skill standards for all eight purposes listed. Thirty-five percent (35.3%) of those institutions implemented agriculture skill standards for the purpose of curriculum development, while 17.6% used them for selecting faculty. The results of the data analysis revealed that 29.4% of the community colleges used these standards for the purpose of student assessment. Finally, for the program area of business, administrative, and information technology, an average of 30% of the institutions reported implementing the applicable skill standards across all eight ways. The percentage of institutions implementing the standards for the purpose of curriculum development was 39.5%, while the percentage of institutions implementing the standards for the purpose of selecting CTE faculty members was 19.7%. A total of 34.2% of the responding institutions used the business, administrative, and information technology skill standards for student assessment purposes.

Of the remaining five CTE program areas, the percentages of community colleges implementing the applicable standards in all of the eight ways were as follows: manufacturing, 35%; industrial, 32%; construction/trade, 51%; family and consumer sciences/childcare, 44%; and hospitality/hotel management, 42%. Across all 10 program areas, the largest percentage of community colleges was implementing standards for the purpose of curriculum development, while the smallest percentage of community colleges was implementing standards for the purpose of faculty selection.

Approaches to Assessment

Respondents who reported student assessment as a purpose for implementing applicable program skill standards were asked to respond to a follow-up question on the survey about specific types of methods used. Two options were provided: traditional knowledge-based, which involves paper-and-pencil, and/or computer-based methods or performance-based/authentic assessment methods. Although the survey included 'other' as a category, it was not selected by any of the participants in the study. Traditional knowledge-based methods were most frequently reported over performance-based/authentic methods by community colleges in the program areas of industrial (86% vs. 67%); family and

consumer science/childcare (80% vs. 65%); business, administrative, and information technology (77% vs. 67%); and hospitality/hotel management (90% vs. 70%). Many institutions reported equal use of each type of assessment method for all program areas offered. This included manufacturing (76%), trades/construction (84%), automotive/mechanical (89%), agriculture (86%), and health occupations (89%). The one program area for which community college respondents reported higher use of performance-based/authentic assessment over traditional knowledge-based assessment was graphic arts. For this program area, 83% of the community colleges reported using performance-based/authentic assessment, while 67% reported using traditional knowledge-based assessment.

Certification/Credentialing

For each of the 10 program areas, certificates/credentials were found to be part of the skill standards assessment process. Thirty-three percent (33%) of the institutions that had assessment activities within the graphic arts program awarded some type of certificate/credential. For health occupations programs, 83% of the institutions that had assessment activities awarded some type of certificate/credential.

Across all 10 program areas, community college respondents identified degree/diploma completion as the most common means for awarding certificates/credentials for program skill standards. While the majority of community colleges did not offer a certification exam without coursework, some colleges indicated this was an option. A limited percentage of community colleges offered this option for the program areas of trades/construction (5%), automotive/mechanical (6%), family and consumer science/childcare (6%), and health occupations (4%).

Coursework with a certification exam was the second most common option offered by community colleges in the program areas of graphic arts (40%), health occupations (54%), and hospitality/hotel management (40%). Coursework without a certification exam was the second most common option offered by community colleges in the program areas of manufacturing (38%), industrial (44%), automotive/mechanical (46%), agriculture (50%), family and consumer science/childcare (47%), and business, administrative, and information technology (46%). Community college respondents reported equal offering of coursework with and without a certification exam (48%).

Finally, for those institutions in which the respondents stated that their community colleges were using some form of certification/credential exam, the specific nature of the examination was solicited. In addition to the options of traditional knowledge-based and performance-based/authentic, respondents could choose from two other characteristics describing the examination process. These included “developed by skill standards agency” and “administered by outside agency.”

With the exception of graphic arts and agriculture, all of the respondents described the examination procedures at their respective community colleges as using all four options as presented on the survey. This means that many community colleges obtain their

certification/credentialing exams from a skill standards agency. These data also suggest that many community colleges rely on an outside agency to administer these certification/ credentialing exams.

DISCUSSION AND CONCLUSIONS

The purpose of this study was to identify the extent to which national industry-based skill standards were being implemented in community college CTE curricula in 10 program areas. It is important to keep in mind that while the survey was designed to focus primarily on national industry-based skill standards, respondents were also asked about similar state-level skill standards. Therefore it is possible that a respondent would be aware of a state-level standard, but not a national-level standard. With this in mind, the following conclusions were drawn from this study.

Awareness of National Industry-Based Skill Standards. The awareness level of national industry-based skill standards, without a doubt, varies across individuals in various CTE programs and community colleges. While respondents had some awareness of the applicable skill standards for a particular program area, this awareness varied. The program areas in which respondents reported the highest level of awareness correspond to those same fields that can have very rigorous credentialing and certification requirements for employment—including manufacturing, construction, automotive, and health occupations. Carter (2005) has found that the number of certifications for mechanics, repairers, technicians, machinists, welders, carpenters, electricians, and truck drivers rose by 48 percent. Given these rigorous credentialing and certification requirements, it is logical that individuals would be more keenly aware of the standards that impact these fields in order to keep program content and course work up to date. On the other hand, those areas in which awareness of national skill standards was lower, such as graphic arts and agriculture, are also areas of study that do not require rigorous credentialing and certification requirements in order to enter the job market. While this was not part of the study, it seems logical that a relationship exists between the level of national skill standards awareness on the part of each respondent and the level of credentialing and certification required in order to secure a job in a particular program area.

Implementation of Skill Standards. Colleges are implementing both national industry-based and similar state-level standards; however, more institutions implement the national standards (Aragon, Woo, & Marvel, 2004). It is apparent from the data that the level of implementation of skill standards varies across the 10 CTE program areas. However, as with the level of awareness, it does appear that the level of implementation of both national- and state-level skill standards has a direct relationship to the type of certification/credentialing requirements for a particular area of work and whether these certification/credentialing requirements must be met in order to enter the job market.

Those program areas in which the highest numbers of community colleges were implementing skill standards included construction (77%), automotive/mechanical (95%), and health occupations (99%). In fact, nearly all of the respondents who reported awareness of the applicable national- and state-level skill standards for these program

areas also indicated that their respective institutions were implementing them. As a whole, each of the jobs associated with these three program areas require certification and credentialing requirements be met prior to job entry. Therefore, offering strong CTE programs that have adequately prepared students to achieve certification/credentialing requirements is in each community college's best interest and fits into the mission of the institution (Cohen & Brawer, 2003).

It is important to keep in mind that these findings do not imply that other CTE program areas lack certification/credentialing requirements. However, these other program areas, as a whole, do not require that certification/credentialing requirements be met prior to entering the field. In addition, many of these other areas require certification/credentialing associated with tools and tasks unique to a specific organization; therefore, this certification/credentialing process would occur after an individual who has completed a program begins work.

Approaches to Implementation. Community colleges that are currently implementing national industry-based skills standards are doing so for all eight purposes listed on the survey. The majority of community colleges are implementing standards for the purpose of developing curriculum. The purpose least selected for implementing skill standards is that of selecting CTE faculty members. From the distribution of the data in each of the 10 program areas, it is clear that those community colleges that implement skill standards allow them to influence many areas of the instructional process, including curriculum development and student assessment. In addition, skill standards implementation is playing a role in terms of marketing the program to both business/industry and students.

Approaches to Assessment. As noted in the previous section, many respondents report that their respective community colleges are assessing students' achievement of skill standards. The distribution of program areas in which student assessment occurs is split about equally between the use of traditional knowledge-based assessments such as paper-and-pencil or computer-based tools, and performance-based/authentic assessments. Because this section of the survey focused on assessment methods other than those linked directly to certification/credentialing, it is not clear from these survey data what factors cause a program area to utilize one method of assessment over the other. It is logical to conclude that this evaluation selection process is based on the ease of design and implementation, and resources available for assessment purposes. However, more in-depth study is required to confirm this hypothesis.

Certification/Credentialing. All respondents who reported assessment activities at their community colleges also indicated that some type of certification/credential was offered. Again, the frequency with which certifications/credentials were offered by the colleges in the sample varied across CTE program areas. With the exception of agriculture, the percentages of colleges offering some form of certification/credential ranged from 53% in manufacturing to 83% in health occupations, with the remaining programs showing, on average, 70% of the colleges offering certificates/credentials in at least one CTE area. While the reasons are not clear for variations in the percentage of certifications/credentials offered across program areas, as discussed in previous sections,

those variations may be related to entry-level job requirements associated with a particular area of work. Additionally, the variations are likely influenced by the employer demand for employees with advanced training and certification (Carter, 2005).

The main method of certification/credentialing is through the awarding of a degree or diploma offered through community colleges. This is not an unexpected finding, as this method is the main means by which community colleges currently certify/credential their students. It is logical that a community college would build in CTE certification into its existing certification/credentialing process. However, it is also important to keep in mind that course work both with and without a certification exam are common methods for certifying/ credentialing students. Because community colleges do report that they certify/credential with course work alone (no exam involved), questions for future investigation would include "What means of assessment are involved with this model?" and "How is/are standardization of knowledge, skills, and abilities ensured in a particular program area?" The fact that a limited number of community college CTE programs offer certification exams without course work suggests that the community college may be serving as a testing center for administering exams.

Finally, the results of the study support the conclusion that certification/credentialing exams take on different characteristics across CTE program areas. These exams take on both traditional knowledge-based and performance-based/authentic formats. With the exception of graphic arts and agriculture, colleges are using exams developed by skill standards agencies, as well as using outside agencies, to administer the exams.

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THE PERCEIVED INFLUENCE OF INDUSTRY-SPONSORED CREDENTIALS ON THE RECRUITMENT PROCESS IN THE INFORMATION TECHNOLOGY INDUSTRY: EMPLOYER AND EMPLOYEE PERSPECTIVES

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ABSTRACT

The increase in the number of industry-sponsored credential programs raises many questions for career and technical education. This study investigated the perceived influence of industry-sponsored credentials on the recruitment process in the information technology (IT) field. Influence is examined from the perspective of Human Resource (HR) executives and their current IT employees to explore employer and employee differences in the role industry sponsored credentials and traditional education qualifications play in the recruiting process. Surveys were administered to HR executives and IT employees in a sample of large U.S. firms. Results indicated that there were no statistically significant differences between employers and IT employees regarding the perceived influence of industry-sponsored credentials on recruitment. However, significant differences were found in the perceived influence of such credentials on the recruitment process when comparing IT employees with credentials and those without. The results are discussed in terms of their implications for researchers, career and technology education policy makers, and educators.

INTRODUCTION

Worker credentialing and certification have become increasingly important issues in the delivery of secondary and postsecondary career and technical education (CTE). Since the early 1990s, industry credentials and certification have increased in visibility with a substantial jump in the number of credentials available and the number of people seeking certification (Carter, 2005). Industry-sponsored credentials and certification are now well established in a diverse range of fields and occupations including information technology (IT), automotive service, building trades, health care, and hospitality. The increase in the number of certifications offered and their growing attraction to both employers and

employees have created a "parallel universe of postsecondary credentials" (Adelman, 2000, p.1) operating alongside, and sometimes competing with, more traditional postsecondary education qualifications.

A clarification of the terms *credentials* and *certifications* is needed since these terms are often subject to multiple interpretations. For this study, a credential was defined as "a designation, mark, or stamp given to a person, organization, or program that has satisfied a set of standards" (Hale, 2000, p. xx). Certification is "a form of credential awarded by an employer, a vendor, or an association or independent agency" (Hale, 2000, p. xx) requiring "passage of an exam benchmarked to predetermined occupation or professional standards" (Carnevale & Desrochers, 2001, p. 19).

With increasing workplace demands for skills and knowledge validated by certifications and credentials, community and technical colleges are uniquely positioned to prepare individuals to meet the work needs of a complex, diverse, and increasingly global society (Carnevale & Desrochers, 2001). Credential and certificate programs fit with one of the existing missions of two-year postsecondary institutions, which is to provide individuals with access to job opportunities by offering a variety of qualifications recognized and valued by the job market. The movement toward skills certification presents a major opportunity for community colleges (Zeiss, 1999). However, community and technical colleges are also being challenged as rapid changes occur in employment requirements and the job market. An example of this challenge is illustrated by industry-sponsored credentials in the IT area where professional associations, IT companies, and for-profit training providers threaten to bypass traditional education and training systems in developing and administering credential and qualification programs demanded by employers (Adelman, 2000).

Industry-sponsored credentials are recognized as faster, cheaper, and more focused than traditional postsecondary qualifications, such as the associate degree, and consequently, credentials have become "the continuing education currency of choice" for many professionals (Argetsinger, 2001, p. E7). Yet, many questions arise around the issue of how occupation specific credentials compare with the more traditional educational qualifications such as the two-year and four-year degrees. According to Carnevale and Desrochers (2001), a changing economy and job market places a higher value on knowledge and applied skills. Industry-sponsored credentials are good examples of qualifications that are tailor-made for specific skills required in specific employment settings. However, it is not known how individuals who obtain certification on explicit skill sets compare with those who have qualifications that are more traditional in the same job market.

Perhaps no other industry has experienced the level of interest in industry-sponsored credentials and certification programs as the IT industry, which now has well over 200 industry-sponsored credentials and certificates (Carter, 2005). Despite the large number of trends that impact the IT industry, the increasing number of IT industry-sponsored credentials is one of the most significant (Barley, 1999). Certification is well suited to the dynamic nature of the IT industry because certification systems tend to operate outside traditional structures usually associated with education credentials, while being capable of responding quickly to new methods and technologies (Wright, 1997). IT industry-sponsored credential programs (such as CompTIA A+, Microsoft Certified Systems Engineer, Cisco Certified Internetwork Expert, and Certified Novell Engineer)

have the advantage of enabling people to quickly learn a clearly defined set of competencies.

It is important to recognize that certification extends far beyond companies and organizations that create and maintain credential programs. Tittel (2001) described the size of the multi-billion dollar per year *certification aftermarket* of testing centers, IT training companies, publishing companies, practice test vendors, certification authorities, online mentoring, and resource providers. The worldwide market for IT certification training and testing has grown from US$2.5 billion per year in 1999 to an estimated $5 billion per year in 2005 (IDC, 2005). Secondary and postsecondary career and technical education is now recognized as playing a greater role in offering and delivering occupational certification and, consequently, is increasingly influenced by industry-sponsored credential and certification providers (Carnevale & Desrochers, 2001).

Credentials and industry-sponsored certifications are contributing to the creation of alternate career paths for individuals in the IT industry. The explosion in IT job opportunities since the mid 1990s, which has slowed but not diminished in recent years, highlights how the training and career paths of IT workers today are quite different from those of the past (Hilton, 2001). The linear progression of high school diploma to college degree to IT employment is being replaced by alternative postsecondary vocational credentials including industry sponsored certification (Kerckhoff & Bell, 1998). Organizations with IT human resource needs seek pools of human capital where skill competency increasingly outweighs issues of whether employees are drawn from traditional education and training settings. In this scenario, credentials offered by industry or specific vendors are providing organizations with human resources having documented IT skill sets that are immediately applicable to the needs of businesses. Yet, the impact of IT credentials in the recruitment process is largely unknown. This study addresses this issue.

THEORETICAL FRAMEWORK

Existing theory provides a strong conceptual framework for examining the role of industry-sponsored credentials in recruitment for IT positions. Qualifications and credentials have long served as signals for organizations. Signaling theory, originally developed in economics, suggests that employers require information (observable characteristics and attributes of an individual) about potential employees to determine the job positions and salaries offered to the employee (Spence, 1972). Some observable attributes of individuals are unalterable (e.g., age, gender) while others are subject to change usually at the initiative of the individual (e.g., education). Spence (1972) referred to these alterable attributes as *signals*.

Since employers have incomplete information about the knowledge, skills, and abilities of applicants, they use qualifications and credentials as signals for making inferences about missing information in determining the likely suitability and performance of prospective employees (Barber, 1998). The value that organizations place on different qualifications can also act as a signal to applicants. For example, organizational preferences for either externally validated assessment of skills (IT industry-sponsored credentials) or more traditional two- or four-year college qualifications provide applicants with information about what it would be like to be a member of that organization and what type of skills and knowledge it values (Greening & Turban, 2000).

The signaling value and preference of employers toward formal qualifications, certification, and previous experience in the IT industry is not clear. Cegielski (2004) reported that some IT firms acknowledge that industry-sponsored certification is less important than job-related experience. However, other evidence has shown that certification is a requirement not replaced by experience for career advancement in the IT industry (Vaas, 2002). A study published by CompTIA (The Computing Technology Industry Association, 2001) found that 41% of 878 responding IT executives noted that IT certification played an increasingly important role in recruitment. Others have suggested that some employers recruiting IT employees simply look for the appearance of well-known acronyms of industry-sponsored credentials, assuming that their presence on a resume implies well-defined skill levels (Kuncicky & Wynn, 1998). As such, industry-sponsored IT credentials may serve both a functional and symbolic role in recruitment (Segalla, Sauquet, & Turati, 2001).

The focus of industry-sponsored IT credentials on tightly defined workplace standards, with less emphasis on more general education, has raised organizational concerns that employees who only hold certifications lack the broad knowledge base needed to advance new knowledge in the IT industry. Initially, IT industry credential and certification programs were aimed at providing specific skills for individuals already supporting software and hardware systems produced by major vendors in the industry (Koziniec & Dixon, 2001). However, concern has been expressed that employees with one or more credentials or certifications from a single vendor potentially lack the integration skills increasingly needed in the IT industry. In addition, industry-sponsored certification may also be seen as a potential disadvantage because it makes it difficult for employees to understand and connect new products to existing operations, resulting in workers who feel frustrated and less engaged in new innovations. Others who question the value of certification, some of which are easily obtained, argue that employers tend to overestimate the value of these certificates to subsequent job performance (Connolly & Yager, 2000).

Existing research suggests that employer preference for IT credentials appears to differ among organizations. In a study of newspaper recruitment advertisements for entry and mid-level IT positions placed between April 1998 and April 1999, Adelman (2000) found that 21% of advertisements required a college degree. By comparison, 12.5% of job advertisements specifically mentioned IT industry-sponsored credentials as the preferred educational qualification. This figure had risen to 14.3% in a follow-up conducted in March 2000 (Adelman, 2000). This growth trend supports Carter (2005) who reported a 231% increase in the number of IT hardware and software certifications available between 2000 and 2003.

The value of industry-sponsored credentials can also be examined from the perspective of employees. Bird (2001) reported that 77% of IT employees surveyed held an IT related certificate with 85% planning to receive at least one additional certification in the coming year. It is fair to suggest that these IT employees would not invest the time and money to earn credentials unless they anticipate some benefit in return. Although, as Anderson, Barrett, and Schwager (2005) noted, IT employees may also view the earning of industry-sponsored credentials and certifications from a self-improvement and assessment of existing skills perspective. Despite potential reliability concerns, various IT related firms report their own research on organizational results when comparing certified to non-certified IT employees. A study by IDC, Incorporated (1999) reported that 92% of responding managers saw their certified IT employees, when compared with non-

certified IT employees, as possessing greater knowledge, demonstrating increased productivity, improving customer support quality, and expressing higher morale and commitment while concurrently requiring less training. There is also some evidence to suggest that certified IT employees receive higher salaries than employees without certification (Gabelhouse, 2000).

The potential disadvantage for individuals earning industry-sponsored IT credentials is that some people, lured into the job market directly from high school or out of postsecondary programs in which an industry-sponsored credential is earned, may find a comparatively high wage job with a short life cycle. A 1998 article in *Forbes* magazine profiled several young adults who had dropped out of high school or college, started IT companies, and now head multi-million dollar per year IT companies. That the author (McMenamin, 1998) titled her article *"The Tyranny of the Diploma"* is reflective of the perceived glamour, freedom, and high earnings available to young people possessing desired technical skills. Yet, early entry into the IT workforce could subsequently limit continued education and training opportunities while also raising questions of workplace readiness (O'Neil, 1997). The result is that some employees who hold industry-sponsored credentials may find that continued career advancement is difficult because they lack the broad range of desired skills and abilities required for today's occupations such as those detailed in the SCANS (1991) report.

PROBLEM STATEMENT

Despite the rise in popularity and potential impact of industry-sponsored credentials on career and technical education, few studies have examined how perceptions may differ between employees and managers who oversee the recruitment function. Recent research has found conflicting support for the popular industry assumption that certified workers are better able to manage organization IT systems and therefore, employers prefer applicants with certifications. Cegielski, Rebman and Reithel (2003) found no significant difference in the capabilities of certified IT network professionals and non-certified network professionals. More recent research limited to information systems network employees found a significant difference in the perceived value of certification between IT and HR professionals with HR professionals valuing certification to a greater degree than the IT professionals in the same firm (Cegielski, 2004). Thus, given the conflicting status of existing research, this study focused on the impact of credentials and certifications on the recruitment process using a broader set of variables related to the recruitment process.

RESEARCH QUESTIONS

The overarching research question guiding this study was: "Do differences exist in employer and employee perceptions on the influence of IT industry-sponsored credentials on recruitment?" This broad question was further refined into two questions: (1) "Do differences exist between HR executives and IT employees regarding their perceptions of the benefits of industry-sponsored credentials on recruitment?", and (2) "Do differences exist in the perceptions of the role of industry-sponsored credentials on recruitment between IT employees with industry-sponsored credentials and IT employees without industry-sponsored credentials?"

METHOD

Data were collected from HR executives and incumbent IT employees to explore differences in their perceptions toward the influence of industry-sponsored credentials on employee recruitment. The study was conducted in two stages. In the first stage, HR executives provided data on organizational policies associated with recruitment at their firm as well as their individual perceptions of the influence of credentials on the recruitment process. In the second stage of the study, a sample of incumbent IT employees from the same firms provided data on their perceptions on the influence of industry-sponsored credentials on recruitment.

Population

We focused on large firms with stand-alone IT departments. Large organizations have been shown to be more concerned with using objective criteria related to qualifications, academic preparation, and previous work experience in recruiting (Barber, Wesson, Roberson, & Taylor, 1999). Management research commonly uses the number of employees to measure organizational size. For example, studies of training in small businesses commonly use the criterion of less than 500 employees (Sadler-Smith, Sargeant, & Dawson, 1998; Wong, Marshall, Alderman, & Thwaites, 1997). Therefore, we defined a large organization as a for-profit firm based in the United States with 500 or more employees. Organizational size is a major determinant of IT investment and infrastructure to support the IT function (Armstrong & Sambamurthy, 1999). Furthermore, larger rather than smaller organizations are more likely to adopt new information technologies (Pennings, 1988). At the time of data collection for this study, approximately 41.9% of private-sector workers in the US were employed in large firms (Headd, 2000).

Firms were identified from the ReferenceUSA database (2001), which contains more than 12 million listings of organizations either U.S. owned or operating in the United States. All organizations with 500 or more employees were selected resulting in a population of 3,330 firms. Since access to sampling frames of individual IT employees was unavailable, a letter of invitation to participate was sent to the Vice President (or equivalent title for the most senior manager of HR) to all 3,330 firms. A total of 161 executives responded to the invitation with 111 indicating that their firms had policies prohibiting their employees from participating in this type of research. The remaining 50 firms agreed to participate in the study.

A self-administered questionnaire was mailed to these 50 HR executives along with instructions on procedures to recruit their firm's incumbent IT workers for the employee study. The HR executives were requested to forward an e-mail with an embedded link to an independently hosted website containing the IT employee survey. Employee respondents were informed that their organization would know of neither their participation nor their individual responses. At the end of the data collection period, 33 out of 50 HR executives had returned completed questionnaires representing a 66% response rate. Despite this limitation, 245 completed surveys were received from IT employees representing 13 organizations employing 13,326 IT workers. It is impossible to calculate the response rate of IT workers, because it is unknown how many IT employees in each organization received the e-mail invitation from their HR executive who had the responsibility of contacting their IT employees.

Instrument

Two instruments were used in this study. A paper-and-pencil questionnaire was administered to HR executives to determine the existing number of IT employees, the number hired in the past year, the number of current IT vacancies, the characteristics of the firm, and items designed to measure perceptions on the perceived influence of industry-sponsored credentials on the recruitment process. IT employees who participated in the study responded to a self-administered Internet-based questionnaire designed to assess the number and type of credentials and their perceptions on the influence of these credentials on recruitment. Apart from demographic information and firm characteristics, the same questions were asked of both HR executives and IT employees.

Questions on the perceived influence of credentials on the recruitment process were generated from existing literature (Barber, 1998) and examined the potential influence in relation to: (a) the cost of recruitment, (b) the ease of recruitment, (c) the efficiency of the recruitment process, and (d) the ability to identify the level of knowledge, skills, and abilities of applicants. The responses were measured on a 5-point Likert-type scale with only end points labeled, 1 = strongly disagree, 5 = strongly agree. This measurement of the response items was based on a previous study of HR issues in the IT industry (Tu, Ragunathan, & Ragunathan, 2001). The content validity of the instrument was determined with review from an expert panel of five academics and five IT managers.

Data Analysis

Independent sample t-tests were conducted to determine differences in perceptions between HR executives and IT employees, and between IT employees with and without industry-sponsored credentials. In the few instances of missing data, analysis was conducted with the number of completed cases rather than using a case deletion approach.

RESULTS

The following section is divided into five parts: demographics and firm characteristics; importance of credentials to hiring practices; type of qualifications; perceived influence of industry-sponsored credentials on recruitment; and a comparison of IT employees with and without industry-sponsored credentials.

Demographics and Firm Characteristics

The 33 responding HR executives represented firms geographically dispersed across the United States. The average number of IT employees in these firms was 423 employees. The mean number of current IT-related vacancies was 4.8 and the mean number of IT employees hired over the past year was 50.7. According to the HR executives, it takes an average of 7.5 weeks to hire a new IT employee.

In addition to the HR executives, there were 245 IT employee respondents. Almost 90% (89.8%, n = 220) of respondents were male, reflecting but perhaps overstating, the well-documented under-representation of women in the IT industry. The mean number of years of employment in the IT industry was 7.3 years and the mean number of years employed in their current organization was 10.3 years.

Importance of Credentials to Hiring Practice

Most of the HR executive respondents (84.8%, *n* = 28) reported an increasing number of applicants with industry-sponsored credentials responding to IT job advertisements in their organizations. Employers (HR executives) also indicated that they were beginning to use IT industry-sponsored credentials as the qualification of choice for some of their IT positions. Over two thirds of the employer respondents (66.7%, *n* = 22) revealed that they specify IT certificates/credentials for certain IT positions. The majority of employers (62.5%, *n* = 20) rated IT industry-sponsored credentials as either important or very important to their non-managerial level IT employee-hiring decisions. Less than half the HR executives (42.4%, *n* = 14) either agreed or strongly agreed that their organizations require employees to maintain and update their IT related credentials. Yet, two thirds (66.7%, *n* = 22) provided funding for credentials programs facilitated by an outside vendor.

Type of Qualifications of IT Employees

Among the 245 employee respondents, a two-year associate degree was indicated as the highest level of education by 22.1% (*n* = 54), a four-year college degree by 25.4% (*n* = 62), and a master's degree by 8.6% (n = 21). A high school diploma was the highest level of education for 5.3% of the respondents (*n* = 13), while 38.4% (*n* = 94) had some college education. Almost seventy percent (69.4%, *n* = 170) of employee respondents indicated that they had earned one or more IT industry-sponsored credential. The 245 IT employee respondents in the study held a total of 406 IT industry-sponsored credentials (see Table 1).

Table 1. *Information Technology Employee Certifications by Certification Provider*

Provider of IT Certification	Frequency of Certifications
CompTIA	114
Dell	71
Hewlett Packard	66
Microsoft	50
IBM	21
Novell	20
Institute for Certification of Computing Professionals	7
Oracle	6
Sun Microsystems	3
Certified Internet Webmaster	0
Other, including Baan, Synbase, SAP, Adobe	48
Total	406

Note: These 406 industry-sponsored credentials were held by the 245 IT employee respondents. Some respondents held multiple certifications.

Perceived Influences of IT Industry-sponsored Credentials on Recruitment

To determine if certification had an impact on recruitment, both employer and employee respondents were asked to state their level of agreement with the statement that "industry-sponsored credentials determine the needed knowledge and skills for IT jobs". In addition, the potential influence of credentials on various aspects of the recruitment

process was examined by three questions regarding the cost, ease, and time efficiency of recruitment. These results are reported in Table 2.

Both employers and employees perceived one of the main benefits of industry-sponsored credentials to be the identification of an applicant's job related skills and knowledge. Employees were stronger in their belief that industry-sponsored credentials make the recruitment process easier, cheaper, and more time efficient than their HR executives. However, none of the differences between employers and employees related to recruitment were significant.

Table 2. *Comparison of Perceptions of Human Resources Executives and Information Technology Employees*

Items	Human Resources (HR) Executives	Information Technology (IT) Employees	*t*
	M	*M*	
Recruitment benefits of credentials			
Identify an applicant's skill sets and knowledge more easily	3.82	3.58	-1.28
Make the recruitment process easier	3.45	3.60	0.88
Make recruitment cheaper	3.03	3.30	1.59
Make recruitment more time efficient	3.39	3.50	0.70

Note: The means represent those respondents who either agreed or strongly agreed to the above statements on a five-point scale.

Comparison of IT Employees With and Without Industry-sponsored Credentials

A series of independent samples t-tests were conducted to explore differences between the two IT employee groups—IT employees with no IT industry-sponsored credentials and IT employees with one or more IT credentials, with respect to their perceptions on the role of industry-sponsored IT credentials in influencing recruitment (see Table 3). Following a Bonferroni correction for multiple-comparisons two of the four items examining recruitment process influences were found to be significant; that credentials make the recruitment process cheaper and credentials make the recruitment process more time efficient.

DISCUSSION AND CONCLUSIONS

Employers do note that a growing number of applicants for IT positions have industry-sponsored credentials. The majority of HR executives surveyed also stated that industry-sponsored credentials are important in hiring decisions for non-managerial IT

Table 3. *Independent Samples t-tests*

Item	*n*	*M*	*SD*	*t*	df	*p*
Identify knowledge/skills more easily						
No credentials	75	3.52	1.03	-.65	243	.52
Credentials	170	3.61	1.02			
Makes recruitment easier						
No credentials	75	3.55	1.02	-.72	243	.48
Credentials	169	3.64	.98			
Makes recruitment cheaper						
No credentials	75	3.12	.90	-2.20	243	.01*
Credentials	170	3.42	1.01			
Makes recruitment more time efficient	75	3.24	.97	-3.01	243	.002*
No credentials	170	3.64	.92			
Credentials						

Note: Bonferroni corrected significance level = $p < .0125$.

employees. The growing trend towards industry certification can also be seen in that almost 70% of the 245 employee respondents in this study have at least one IT industry-sponsored credential. The results of this research suggest that IT employees believe that industry-sponsored credentials do influence the recruitment process. More specifically, the finding that employees perceive that credentials reduce the cost of organizational recruiting while also increasing the ease and efficiency of recruitment may reflect one of the prime motivating factors for enrollment in industry-sponsored credentials programs.

In the early days of IT industry-sponsored credentials, the vast majority of people who earned certifications were professional IT employees already well established in the industry. The recent trend of an increasing number of people earning credentials with little or no prior experience in the IT industry while expecting to find immediate employment and a high salary has potentially damaged the reputation of industry-sponsored credentials. This was supported in the research of Carter (2005) who found the increase in number of certifications offered in the IT industry from 2000 to 2003 outpaced the rate of job growth. In response, organizations and professional associations with existing or developing credential programs are now urged to pay attention to establishing and maintaining reasonable and realistic expectations about the benefits and outcomes of certification (Hale, 2000).

The finding from this study that employees with industry-sponsored credentials perceive credentials as having a greater influence on recruitment as compared to employees without credentials is perhaps to be expected. Although as Cegielski (2004) found, few IT professionals believe that certification is correlated with ability and none believed that certification was a mechanism suitable for justifying recruitment. This may reflect a situation of cognitive dissonance as employees with credentials justify the effort, time, and cost required to earn and maintain their credentials. Further research in this area would be interesting because an attribution effect may be present in which employees with credentials attribute their recruitment and career success to their industry-sponsored credentials at the expense of other potential explanations. Furthermore, industry-

sponsored credentials remain largely unproven in terms of their relationship to performance measures. This study provides an initial look at how both employers and employees view credentials; however, additional research is needed to look at other outcomes of industry-sponsored credentials from the perspectives of both individual employees and their employers.

Research is also needed to examine how the influence of industry-sponsored credentials may vary by type and provider of certification. For example, is career entry and advancement influenced by the provider of credential? In other words, are students who complete a well-grounded curriculum that integrates preparation for earning an IT-industry-sponsored credential better served than students who take an intensive and focused training program that focuses solely on test preparation for credentials? The answer to such questions would benefit CTE providers, especially in light of the growing presence of industry-sponsored credentials in community and technical colleges. This study has focused on industry-sponsored credentials from one industry, yet it must be acknowledged that credentialing and certification are now major issues in education and training for many occupations and professions. Future research is needed to explore the influence of industry-sponsored credentials in other industries.

Limitations

The principal limitation of this study is the low response rate. The low response rate from the IT employee survey can perhaps be partly attributed to the web-based data collection procedure. The still evolving nature of web-based surveys highlighted many issues that are believed to have influenced the number of respondents in this study. The generalizability of the results is therefore limited. Furthermore, the lack of definition of the term IT employee may have caused confusion given the well-documented difficulties in defining the boundaries of occupations within the IT industry (Powell, 1999). The sample was also limited to the degree to which the ReferenceUSA database provided correct information and the extent to which HR executives extended the invitation to participation to their IT employees.

IMPLICATIONS FOR PRACTICE

It is in the long-term interest of the IT industry, students, and employers, as well as CTE professionals, to have a workforce of professionals well prepared to work within the IT industry and to learn new jobs within future configurations of this dynamic career cluster. Certification should play a role at the secondary, postsecondary, and continuing education levels when students are preparing to obtain or change jobs. However, caution must be exercised in the promotion and delivery of educational programs leading to IT credentials and certifications so that students have a clear understanding as to how these qualifications will be perceived by HR executives, IT managers, and future colleagues. Perhaps this knowledge would influence the decision of some to incur the often considerable expenses involved in obtaining and maintaining IT industry certification. In recent times, calls to avoid the over-glamorization of IT careers (Terranova, 2000) and the fallacies of six-figure salaries for applicants with credentials but lacking in experience (Goff, 2001) have added an important balance to the certification literature. The prevalence of industry-sponsored credentials and certification is likely to continue to grow in importance in a variety of occupations providing additional support for CTE professionals to promote the need for lifelong learning within the context of changing career patterns.

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THE NEGLECTED MAJORITY—REVISITED

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ABSTRACT

Career and Technical Education (CTE) is in a curious position as the nation moves into the 6th year of the No Child Left Behind (NCLB) school reform era. The demand for skilled labor in many occupational sectors is strong and growing. Studies have shown CTE helps increase students outcomes and achievements. This ought to be good news for CTE. However, due in large part to NCLB, secondary CTE is increasingly under pressure as schools try to address the perceived education gaps by adding more academic courses to the school day squeezing out time for electives and especially CTE.

How should CTE professionals best respond to these pressures? A possible road to success is to embrace change and position CTE as a means for helping achieve the goals of high school. In this paper, I examine how high quality CTE can benefit students directly and provide a framework for addressing larger school reform issues.

INTRODUCTION

The American high school, the object of much discussion and debate since the publication of *A Nation at Risk* (Gardner, 1983), is in a curious position today. Despite more than 20 years of reforms and increased graduation requirements, most notably in math and science, we arrive at the threshold of the 21st century with increasing drop out rates and stagnant achievement measures.

According to the Urban Institute's analysis of high school completion (Swanson, 2004), only 68% of young people successfully complete a regular high school credential. In fact, there has been a steady decline in this important measure since the late 1970s. Youth in urban schools fare much worse. Math and Reading scores for 17 year olds have remained flat since the mid 1980s or early 1990s, respectively (National Assessment of Education Progress or NAEP, 2005).

For those who do complete high school, slightly more than a third of white students, less than 20% of black students, and about 10% of Hispanic students will complete college (Hoffman, 2003; Venezia, Kirst, & Antonio, 2003). For those who complete college, their degrees are having less value in the market place—and they are exiting college with an

average of $20,000 in college loan and credit card debt, an amount described as unmanageable (Public Interest Research Group, n.d.).

The intent of this paper is to provide a brief critique of the current state of education reform and present a case for a revitalized Career and Technical Education in American high schools.

WHITHER THE REST?

So, what happens to the other two-thirds of young people who successfully complete high school? Data suggest that most are inadequately prepared for the workplace or continued education although many will attempt college at some point. Fully 65% of recent high school graduates are in college within the first few years after high school according to some surveys. For this and other reasons, this has led to too many colleges chasing many marginal students according to some. Jerome Murphy of the Harvard University School of Education was quoted as saying, "If you have a high school diploma—and can walk and talk—you can graduate from college." "There are a lot of empty seats" (Rubenstein, 1998). However, the attrition rates and attendant costs of such behavior are high. According to Jim Rosenbaum at the University of Chicago, 31% of those who start exit their college experience having earned zero credits (Rosenbaum, 2002).

Indeed, one could make the case that the U.S. has too many college graduates, not too few. Recent projections from the Bureau of Labor Statistics suggest that the US economy will only require about 13% of its workforce to possess a baccalaureate and another approximately 8% to possess more than a baccalaureate (Bureau of Labor Statistics, 2005a). In the most recent U.S. Census (U.S. Census Bureau, 2000), approximately 26% of adults possess such credentials. Arguably, the United States has a 5% “surplus” in higher education, credentialed workers. In fact, the U.S. surpasses all other advanced nations in the proportion of workers with university degrees, according to the Organization for Economic Cooperation and Development. Apparently, our students need college just to reach achievement levels other nations expect of high school age students.

This pursuit of a college credential is driven by the belief that the high school degree holds little value to employers. The college degree has become a proxy for a host of basic qualities: good communication skills, analytic ability and the capacity to keep learning on the job—skills once thought to be the domain of a high school education. This view is supported by critics like Ron Bullock, chairman and chief executive of Bison Gear & Engineering Corporation who has been quoted as saying that high school graduates are not ready for employment in the modern manufacturing plant. His firm manufactures motorized gears and about one in seven of his employees has some kind of engineering degree. His company needs people who can be group leaders, show up for work reliably and exercise initiative. Bullock doesn’t get what he needs from the public schools. But do college graduates get a good return on their investment?

A DIMINISHING RETURN TO THE COLLEGE DEGREE?

Income levels for the average college graduate have stagnated. After adjusting for inflation, the average income of college graduates holding full-time jobs rose by only 4.4% between 1979 and 1997, or at a minuscule annual rate of 0.2% and fell by more than 5% between 2000 and 2004 (Dew-Becker & Gordon, 2005). This figure becomes more abysmal if you exclude medical doctors and lawyers whose incomes have grown dramatically during this time. At the same time, workers with only high-school degrees saw their real income plummet by 15%. The conclusion: the much advertised college wage "premium" for the baccalaureate degree is due primarily to the fall in inflation-adjusted salaries of workers who have not been to college. This is true except for the very wealthy. Those whose earnings place them in the top 99th percentile (earning more than $400,000 per year) saw their earnings rise 87% during this time period; those in the 99.9th percentile (earning more than $1.6 million per year) enjoyed an increase of 181%; and those in the top 99.99th percentile ($6 million per annum) enjoyed earnings growth of 497% (Krugman, 2006).

Many college graduates are finding that their college degree do not land them the high paying, quality job they are seeking. They find themselves in low-paying service jobs and other lines of work not traditionally associated with a college education—an issue highlighted by Hecker (1992). From this perspective, graduation no longer provides reasonable assurance of a "college-level job," e.g., a white-collar job in an organization that provides reasonable pay, good benefits, training opportunities, and the prospect of advancement at least to middle-management or mid-level professional status. In fact, if you don't go on to graduate school or are not among the top graduates at one of the nation's elite colleges, chances are the average of $20,000 in college debt buys no economic advantage. Rubenstein (1998) has shown that the flood of graduates in recent decades has been so great than an increasing proportion have found themselves, within a few years, employed in "non-college jobs" such as those in the retail sales clerks, administrative support, service, precision production, craft or in other jobs that do not require a college degree. In 1995, approximately 40% of people with some college education—and 10% of those with a college degree—worked at jobs requiring only high-school skills. That was up from 30% and 6%, respectively, in 1971. Pryor and Schaffer (1997) found that the proportion of graduates saying that their job did not require college-level skills increased from 24% in 1976 to 44% in 1991 and remained at that level in 1994. Rosenbaum (2002) reported similar results. Of course, the data are subjective, but the fact that the question and the methods remained essentially the same over time provides some confidence that the graduates' opinions reflect real changes.

THE CURRENT AND LOOMING SKILL SHORTAGE

The diminishing returns to college come at a time of increasing need for genuinely skilled workers. The National Association of Manufacturers (2005) has recently reported that 81% of the manufacturers in the country have indicated they are currently facing a moderate to severe shortage of qualified workers—even though manufacturing is suffering serious layoffs. They identified three deficiency areas of public schools in

preparing students for the workplace: basic employability skills, math and science, and reading and comprehension, Meanwhile, many well-paid and rapidly increasing manufacturing jobs remain unfilled, including those requiring two-and four-year technical degrees or short-term skill certificates. Jobs in manufacturing are varied and averaged $54,000 in total compensation in 2000, a salary level 20% higher than the average compensation for all American workers— while 83.7% of manufacturing employees receive health benefits from their employers, more than any other employment field.

Technology plays a key role in the shortage of skilled workers. The cars we drive today have more powerful computer technology than did the Apollo spacecraft that landed men on the moon. Modern auto manufacturing involves computer systems and global satellite positioning equipment. According to a report, Automotive Youth Education System (AYES), the job of an automotive technician today bears little resemblance to the auto mechanic of years past. Today's technician needs advanced technical training and the same kind of critical thinking skills as an electrical engineer. Today's experienced technician is well compensated, with typical income ranging from $30,000 to $50,000 a year and even $100,000 in large metropolitan areas.

The U.S. Department of Labor projects that healthcare occupations will make up 12 of the 20 fastest growing occupations in the 2004-2014 period (Bureau of Labor Statistics, 2005b). The lack of skilled labor in this high growth area is becoming more apparent each year. In the state of California for example, 10,000 new registered nurses will be needed each of the next 10 years. California colleges are producing half that number. This labor shortage has driven salaries for nurses—a two-year degree program in most states—to $70,000 per year in many urban communities and many hospitals are offering signing bonuses to attract employees. In addition to the nurse shortage, hospitals are having difficulty finding the technicians to do the lab work and run X-ray and ultrasound machines.

High tech extends to even janitorial roles. Automatic flush toilets in public restrooms require maintenance of electronic systems. Janitors are confronted with machines that are more complicated and need basic math to dilute industrial chemicals properly and basic reading skills to ensure they are handled safely. The list of occupations requiring essential academic and technical skills grows by the day. Yet the one part of the high school program, career and technical education, where young people can engage in this kind of learning is diminishing.

THE ROLE OF A REVITALIZED CAREER AND TECHNICAL EDUCATION IN 21ST CENTURY AMERICA

School reform is a perennial issue in American education. At the turn of the 20th century, John Dewey (1900, 1916) described reasons to be concerned with educational improvement that are just as cogent in the early years of the 21st century: furthering democratic ideals through a broadly educated citizenry, and obtaining a viable economic future for all of our citizens. Ultimately, what is and isn't included in the high school

curriculum is a direct reflection of those skills and attitudes valued by the society (and therefore necessary for the economy) at any given time in history. As one listens to the current education debate, it is easy to conclude that the K-12 system primary role is to prepare youth to enter college. However, in other times there has been broad recognition of multiple roles of public education such as teaching youth how to get along in life and to perform major adult functions, including employment, family/parent, citizen, scholar, friend, intimate partner, financial manager and planner, and member of society. Still other scholars propose that one of the major roles of education is the transmission of democratic ideals.

In the context of technology changes and economic challenges, it appears to be the most important changes that need to be supported is to increase the academic skills of career and technical education (CTE) students, erase the stigma attached to vocational education, and see that all students meet appropriate academic and industry standards. The goal of CTE should be for all students to finish high school prepared either to enter the workplace (which had come to demand strong academic skills and other "new basic" skills) or to begin postsecondary education. This broader mission challenges vocational educators to teach beyond the confines of specific occupations and, instead, to prepare students for a more demanding world of work.

In moving beyond the traditional CTE approach, the new CTE programs can provide students with education about work, education for work, or education through work. That is, CTE can introduce youth to the workplace and help them develop generalizable workplace skills. CTE programs can prepare youth with occupation-specific workplace skills that provide documented economic benefits after high school. Finally, CTE provides a context through which critical academic skills needed for transition to the workplace or continuing education in math, science and reading can be enhanced.

Education About Work

Education about work, like education through work, is meant to be broad. The curriculum assumes that career and technical knowledge—knowledge about the world of work—is valid school content and belongs in the common core of knowledge that all students should possess. All students need to learn about social aspects of work, such as democratic rights in the workplace, safety, and the prospect of race or gender discrimination. They need to know about career ladders, labor markets, job-seeking skills, and job-keeping skills. They need to understand how to allocate resources effectively, acquire and use information, develop solid interpersonal skills, use and troubleshoot technology, and work with and modify systems used in business and industry.

Murnane and Levy (1996) identified nine "new basic skills" necessary for success in the workplace of the 21st century: reliability, positive attitude, willingness to work hard, ninth-grade-or-higher mathematics abilities, ninth-grade-or-higher reading abilities, the ability to solve semi-structured problems at levels much higher than today's high school graduates, the ability to work in groups, the ability to make effective oral and written

presentations, and the ability to use personal computers to carry out simple tasks such as word processing.

Clearly these are valuable skills, both for preparing for postsecondary education and for the world of work. Murnane and Levy (1996) argued that the majority of these skills are not being taught to most U.S. high school students. A series of commission reports during the 1980s and early 1990s concurred, warning of the economic consequences of the growing shortcomings in the education of young Americans (Commission on the Skills of the American Workforce, 1990; *A Nation at Risk*, National Commission on Excellence in Education, Gardner, 1983; *The Forgotten Half*, William T. Grant Foundation, 1988).

Education Through Work

All students should have the opportunity to learn school subjects with work as the context of their learning. Dewey called this "education through occupations" (1916, p. 309). Stone (1995) described ways in which workplace learning could be harnessed to reduce the achievement gap, especially in urban locations. He pointed to opportunities in urban communities that had work or learning potential, such as rehabilitating homes and buildings and meeting the needs of children and the elderly. Communities abound with work and learning opportunities, and these have power to transform the entire curriculum.

Another strategy for using the context of work to improve academic skills is through curriculum integration. While there are multiple interpretations of this concept and much disagreement about its value, the National Research Center for Career and Technical Education (NRCCTE) at the University of Minnesota recently completed a multi-replication, random assignment study where researchers tested the notion that high school students in a math-enhanced, CTE curriculum will develop a deeper and more sustained understanding of mathematical concepts than those students who participate in the traditional CTE curriculum, without affecting related technical skill development. Approximately 3,000 CTE students in eight states participated. The replications included business and marketing, auto technology, IT, health, and agriculture. Critical to this study was the theory-driven pedagogic model developed for the study and the intensive professional development provided to CTE-math teacher teams. Early findings from the study have shown positive gains in standardized measures of math achievement (Stone, Alfeld, Pearson, Lewis, & Jensen, 2005).

Education for Work

Education for jobs in the economy is a vital aspect of career and technical education. Although many argue that preparation for jobs should be concentrated primarily in the postsecondary phase of students' lives (e.g., in community and technical colleges), many students are developmentally ready to prepare for occupations at earlier ages. If they are to prove beneficial to students, however, secondary CTE programs must provide rigorous academic development and rigorous career development. These programs must also be linked to postsecondary education and training opportunities. For most young people, secondary schools should provide high-quality career guidance and competence in

communication, numeracy, literacy, and computer abilities, all of which lead to more specific preparation at the postsecondary level.

To meet this goal, most of the traditional CTE areas need to more fully infuse new technologies—computerized diagnostics in auto repair, numerically controlled machines in machine shops, and sophisticated medical equipment in health occupations classes. For those changes to occur, staff will need professional development in the new technologies as well. High schools need to provide a more expansive academic and vocational curriculum premised on broad career clusters rather than on preparation for particular jobs. Such programs needed to become better linked to postsecondary occupational education, which, in turn, could provide greater specificity and more direct application to immediate employment. These programs could also point to further postsecondary education and workplace training opportunities over a lifetime.

CTE AS HIGH SCHOOL REFORM

The emergent secondary CTE programs that educate through, about, and for work will have the following features:

- a broader focus on all aspects of an industry as well as occupation-specific training where appropriate,
- attention to student achievement through some form of academic and vocational curriculum integration,
- strong linkages to workplaces while students are still in high school,
- learning activities that link experiences at those workplaces with school learning,
- smaller learning communities with a career focus to help engage students and keep them in school until graduation,
- connections to postsecondary institutions to encourage further education, and
- engagement of students in student organizations (CTSOs). A new study by the NRCCTE shows that participation in CTSOs increases student engagement in school (Alfeld, Stone, Hansen, Aragon, Zirkle, & Connors, forthcoming).

Academic and Vocational Curriculum Integration

The integration concept is not new in the vocational community; its proponents go back nearly a century to John Dewey (1916), who exhorted educators to contextualize learning in U.S. high schools. However, it took a more recent confluence of events to bring curriculum integration back into vogue primarily due to demands by the business community that high schools improve their preparation of students for the requirements of modern work.

The Secretary's Commission on Achieving Necessary Skills (SCANS) report (1991) supported the teaching of the required skills “in context.” That support stemmed from a second event in the ascendance of curriculum integration: the emergence of research in

cognitive science suggesting that students learned better when learning was modeled after "real world" learning outside school (Brown, Collins, & Duguid, 1989).

Curriculum integration holds the promise of opportunity to change an entire high school. Teachers who collaborate with peers outside their discipline can provide students with engaging academic courses that are related to broader themes of adult life or careers. Pedagogy, too, can change, as academic courses presented students with applications of traditional bodies of knowledge and vocational teachers incorporated rigorous methods and deeper understanding of various technologies. Indeed, formal and informal tracks themselves could become obsolete, as students became oriented around career themes, regardless of their next step after high school (i.e., postsecondary education or work).

Strong Linkages to Workplaces

Cooperative, or co-op, education (Stone, 1995), school-based enterprises or SBE (Stern, Stone, Hopkins, McMillion, & Crain, 1994), and youth apprenticeships (Hamilton, 1990) are common ways of providing work-related learning. In co-op programs, students receive training in the context of a paid job. In SBEs, students are involved in either on-site or off-site work-related experiences such as running a store, producing goods or services for sale, or even building a house. Students enroll in related classes (e.g., business management or construction) and may decide how to re-invest the income generated by the enterprise, but usually they are not paid. In comparison with outside jobs, effective SBEs often provide more opportunities for students to perform a range of tasks and to work in teams. Through youth apprenticeships "schools provide integrated academic and vocational education that is linked to employer-provided paid work experience and training at a work site" (Corson & Silverberg, 1994, cited in Urquiola et al., 1997, p. 120).

Work-related experience programs such as these are beneficial in the lives of young people because most high school students want or need to work. The effects on students of part-time work of less than 20 hours per week can be positive (Stone & Mortimer, 1998; Warren, LePore, & Mare, 2001). In addition, when work-related experiences are coordinated with school learning, students have the opportunity to learn from and contribute to authentic achievements in a work setting.

An additional advantage of providing work-related experiences to students is that it can engage students who are at risk of dropping out (Pauly, Kopp, & Haimson, 1994). Programs that begin before grade 11 are more likely to succeed in keeping young people engaged in high school, because many students begin to disengage from school in the middle school years. Beginning a program in grade 9 or 10 provides students with longer preparation time, so that their work-related experiences can make substantive contributions to the workplace rather than being mere busywork or observation.

Smaller Learning Communities

Career academies have existed since the 1970s, but their focus shifted in the late 1980s from a dropout prevention strategy to a high school reorganization model that prepares all students for both work and postsecondary education (Kemple & Snipes, 2000). In a study of career academies, Kemple and Snipes reported a 15-fold increase in the number of such academies during the decade of the 1990s, with many more planned. Most career academies incorporate the main elements of the new vocationalism: a broad career focus, links to postsecondary education and business, and curriculum integration (Benson, 1997). Kemple and Snipes defined a career academy as a program that (a) is organized as a school within a school, where students stay with a group of teachers for a period of 3 or 4 years; (b) offers students both academic and vocational curriculums, usually integrated around a career theme; and (c) has established partnerships with businesses to build connections between school and work.

Career Pathways

Some high schools have reorganized their curriculum around clusters of occupations that share similar skills and knowledge, although they may differ in the length of education and training required (Pucel, 2001). These career pathways or majors replace the traditional college preparatory, vocational, and general tracks. For example, a cluster such as Engineering, Manufacturing, and Industrial Technology can provide students with a broad introduction to many occupations, such as machinist or engineer.

Career pathways form the context for integrated activities such as senior projects and other interdisciplinary activities. Career pathways are also intended to provide a rigorous, coherent program of study that includes high-level academics in addition to technology applications and work-based learning. Schools that choose to develop career pathways must have strong connections with business, industry, and institutions of postsecondary education; such connections enable the school to provide internships and other applied experiences for their students.

The Office of Vocational and Adult Education (U.S. Department of Education, 2002) has identified 16 career clusters that high schools can choose from, depending on local labor market opportunities. Some states have developed their own clusters. Many districts and a few states have mandated that high schools incorporate pathways into their curriculum. To date, no studies on the effects of career pathways have been conducted, but several are under way that will provide more information in the near future.

The evidence from these career-themed high school organizational structures suggests that academies, and pathways are possibly productive ways for secondary CTE to position itself for the future. The research base, while mixed, shows positive outcomes in many measures of high school achievement and in reducing the need for remediation at the postsecondary level. The elements of these structures are pedagogically and theoretically sound. One possible reason for success might be the focus on all students, not simply those not deemed "college material." Another reason is that career academies,

and pathways restructure the school. In the best of cases, students feel that their teachers care, their peers care, and they all share a common interest and goal. These affective factors are likely to increase student engagement and can improve achievement as well. Such reforms may also affect students' perceptions of their life chances.

How much of the improvement in student outcomes is attributable to caring relationships and how much to CTE? This is a difficult question to answer, because the two are confounded in the best examples of these schools. The students are not the only ones involved in positive relationships. Teachers, too, have developed professional communities around career themes and have become responsible to each other. It is useful to recall students' reports to Crain et al. (1999) that they found their high school experience (in career themed high schools) useful in developing a career identity and in becoming proficient at something. Non-career-related high school reorganization along the lines of academies or magnets would be unlikely to produce this result (cf. Ready, Lee, & LoGerfo, 2000).

Connecting to Postsecondary

One of the more intriguing efforts of the early 1990s to connect young people to post high school technical education was called Tech Prep. Tech Prep represents a vertical integration of curriculum (different than the horizontal integration described earlier) that links the final two years of secondary education with the first two years of postsecondary education (or apprenticeships), leading to a degree or certificate. A common core of required proficiency in math, science, and communications is presented in the context of technical preparation in specified occupational fields, and job placement is often included.

The goal of Tech Prep is to attract students by eliminating repetition between high school and community college courses and by showing students a clear path to postsecondary education and technical occupations. Tech Prep also allows community colleges to teach the more advanced courses thought to be necessary for highly technical occupations, on the assumption that students had taken the foundation courses in high school.

Other efforts to encourage youth to continue their formal learning beyond high school include dual or concurrent credit by identifying or creating courses that carry both high school and college credit. The state of Washington has been a leader in this effort since the early 1990s. Some states have backed off these efforts, unable to negotiate the tricky finances of such arrangements. Another model is the middle college high school initially started as a strategy to keep high ability but high risk students in school. In this model, a high school was physically located on a community college campus putting youth into a more adult environment.

IMPLEMENTING THE NEW CTE

Elements of all of these reform efforts exist across the United States. In some schools, all are present and functioning. The challenge in any high school reform is bringing it to

scale. The following are four, modest recommendations for accomplishing this important task.

1. Make Connections

The first connection is within schools through collaboration across departments and especially with traditional academic areas. High school CTE teachers have a programmatic and arguably a moral obligation to ensure their students are adequately prepared to engage the world of work and the world of continuing education. This means their students must exit high school in command of basic skills and knowledge in math, science and communications. Ensuring this can only accomplished by cross-disciplinary teams. It is essentially impossible for CTE teachers, regardless of how hard-working or well intended to improve basic skills and scores on their own. By contrast, whole schools, working in coordinated fashion, have an excellent chance of achieving this goal.

The high school programs must connect to their postsecondary counterparts. Students need to see clear pathways to continued occupational development. High school CTE teachers must work with community college instructors to coordinate curriculum, business partnerships, and even the joint use of labs or shops were appropriate.

The high school CTE must be connected to the world outside of school. If it is a health pathway, a health academy, or an LPN program, the school personnel and the programs must create and maintain deep connections with the occupational arena that provides the content and context for a meaningful education.

2. Provide Joint Professional Development

Most secondary school teachers, whether in CTE or the academic track, are not prepared to work with students on improving basic skills. Nor do many high school teachers have training in team teaching and the development of integrated curriculum. Opportunities for shared professional development need to be provided for both CTE and academic teachers. This is an excellent way to introduce faculty members to each other and to the many similar goals and challenges they face. Joint professional development also furthers cross-departmental communication and collaboration.

3. Provide Pre-Professional Training

Although joint professional development will help to address the immediate problem, an important component of the long-term solution lies in how we prepare teachers for the complex, integrated curriculum of reformed high schools. Teacher education programs are the first opportunity to create the ways of thinking necessary to make these reforms work. Building skills in team teaching, curriculum integration, and contextual teaching and learning will assure a future teacher workforce that will be capable of implementing these promising reforms.

4. Incorporate Career-Based Learning into More Secondary Schools

Academies, magnets, and pathways, as well as some of the reform designs reviewed here, provide students with opportunities for education through, about, and for work. Educators are learning to integrate careers with academic subjects as a hook to retain students in school, to improve their academic skills, and to help them make the transition to college. All schools should consider this means of helping students to meet the higher standards expected and to identify their own goals for adult life.

FINAL THOUGHT

While it is clear that today's labor market entices students with the promise of economic rewards for obtaining a college degree, not all high school students possess the crucial skills, abilities or desire to succeed in academic coursework at the college level. Not only are some students unlikely to profit from a college experience, but the belief that they can compensate for poor performance and lack of adequate preparation in high school by attending college may result in a failure to make the proper back-up plans and obtain the necessary training for entering a career (Rosenbaum, 2002). For the majority of all high school graduates who will not earn a college degree, unrealistic hopes can result in the needless wasting of valuable time and resources. A better strategy for this group of students is to receive training and preparation during high school for entrance into careers with decent wages and opportunities for advancement, a role for work-based education.

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