INTRODUCTION

As the economy has changed in the past decade, many Career Technical Education (CTE) programs have transitioned from helping students prepare for an entry-level *job* to helping students prepare for a *career*. This has been accelerated by the development and implementation of **programs of study** – or coordinated, non-duplicative sequences of academic and technical courses from secondary to postsecondary where students can participate in dual enrollment courses, earn industry-based credentials and/or acquire postsecondary degrees. All local recipients of Carl D. Perkins Career and Technical Education Act (Perkins) funds must have at least one program of study in place and many states have embraced the program of study as the new baseline for CTE programs.[i]

Core to the program of study design is the *sequence* of courses, which begin with broader, career exploration and industry-specific skills and, over time, progress to narrower, more occupationally-focused skills, and offer multiple entry and exit points for learners at different levels in their education and training. In part this shift is reflective of employers' increased call for individuals with the broad-based "21st century" or transferable "employability" skills, as well as the recognition that CTE shouldn't just be about putting students on limited job track when they are still in high school but rather about preparing them for a range of career options.

Another critical element of program of study is its alignment to rigorous college and career readiness standards. While this seems straightforward, it can often be quite confusing in practice. Over the years, national organizations, individual state or district education agencies, and industry-based organizations all have created standards to define what students must know and be able to do as they participate in and/or complete a CTE program. As a result, the CTE community is faced with almost an overwhelming assortment of CTE standards that vary in quality and specificity from state to state and industry to industry. Needless to say, this further complicates the development and evaluation of high-quality programs of study.

To help galvanize support and agreement around high-quality CTE, the members of the National Association of State Directors of Career Technical Education Consortium (NASDCTEc) released a paper in 2010 articulating a shared vision for CTE to guide the future of education for all students.[ii] The Vision supported the state-led development of a set of CTE standards, known as the **Common Career Technical Core** (CCTC).

Importantly, the CCTC were not developed from scratch. Rather, they are built on the foundation of the National Career Clusters® Framework, which states have been using to organize their CTE programs since the early 2000's. The Career Clusters were developed and validated over the years by consortia of business and industry, secondary and postsecondary educators, and other key CTE stakeholders.

Using the recently-revalidated Career Cluster Knowledge and Skills Statements, the CCTC were developed through a rigorous process, led by 42 states, Washington DC, and Palau, and informed by about 3,500 stakeholders from the CTE community. There are two major components within the CCTC: 12 cross-cutting and cross-curricular Career Ready Practices, and content standards for each of the 16 Career Clusters and their corresponding 79 Career Pathways.
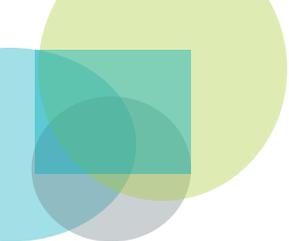
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The CCTC are a new kind of CTE standard. For one, they represent the foundational knowledge and skills students should possess after completing a program of study, which is a major shift from the current approach. Rather than focusing on specific occupational skills, the CCTC focus on skills that will develop over time – potentially over years of instruction within a program of study.

Additionally, the CCTC are not intended to necessarily serve as a replacement for existing standards, but rather as **benchmark standards**. A benchmark standard serves as a common reference point against which other standards, curriculum and programs of study can be compared. As benchmark standards, in practice, the CCTC can serve as an anchor for the patchwork of state, industry and local standards currently in use across the country.

Since the Common Career Technical Core were released, a common question asked has been how exactly do the CCTC relate to industry-based standards? Or, put another way, where do industry-based standards fit into the program of study framework undergirded by the CCTC? And how do industry-based standards contribute to students' mastery of the broader, end-of-program of study CCTC expectations?

Given the importance of industry-based standards to CTE educators, their alignment to well-regarded industry-recognized credentials, and their overall market share within the CTE enterprise, NASDCTEc tackled this question seriously, analyzing 18 sets of industry-based standards using a research-based methodology to determine how well they "align" to the CCTC.

This is not meant to be an exhaustive analysis, but one instructive for state leaders and educators responsible for developing, adopting and implementation CTE standards and programs of study. Importantly, the intent of this analysis is not to judge any industry-based standards or suggest that industry-based standards need to be changed; rather the intent is provide actionable information to state and local CTE leaders as think through how they use industry-based standards within the context of a program of study.

BACKGROUND

In 2013, NASDCTEc commissioned alignment studies between the CCTC and each state's secondary and postsecondary CTE standards. This was the first-ever analysis of state-approved CTE standards.[iii] When approaching the question of how well industry-based standards are reflected within the CCTC, we used the same methodology applied in the state standards' analyses for consistency and clarity.

The alignment analysis process consisted of two stages:
- The use of an automated algorithm to determine the extent to which the CCTC content is represented in the industry-based standards.
- A human-driven quality assurance process to ensure the validity of the automated algorithm results.

In the first stage, the industry-based standards were searched for keyword matches with the CCTC (specifically the 12 Career Ready Practices and Career Clusters deemed relevant). In the second stage, two trained reviewers independently analyzed the keyword matches and made a preliminary
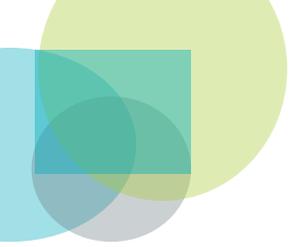
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While the term **alignment** can be interpreted a number of ways within the context of standards, in this instance, we are referring to how well the industry standards address part or all of individual CCTC standards.

From the onset of this analysis, the expectation was that industry standards would fit under the broader CCTC standards as part of a program study, and that it was possible that multiple industry standards could "add up" to one CCTC standard. More generally, we have found that it often takes multiple course-based or industry-developed standards, collectively, to address or align to a single CCTC standard. This reality is driven by the design of the CCTC compared to the design of industry – based and course-level standards

For example, the NAERF standards align to this individual CCTC – *Research costs, pricing, market demands and marketing strategies to manage profitability in food and beverage service facilities* – based on multiple standards, including, but not limited to:

- Identify the types of costs incurred by a food service business and give examples of each.
- Identify tools to help control costs.
- Define profitability and target margin.
- Identify the steps a restaurant or foodservice operation should take to purchase and then promote the use of sustainable food products.

judgment (Aligned, Partially Aligned, Not Aligned). The reviewers then compared and calibrated their results. For more information on the methodology, see Appendix B.

The approach taken was to conduct a mini-alignment study for each set of industry-based standards. In each of these studies, the industry-based standards were analyzed for their alignment to the Career Ready Practices, any relevant Career Cluster (as determined by NASDCTEc and the research firm commissioned to conduct the analysis), and all of the Career Pathways under the selected Career Cluster(s). Rather than look across industry-based standards to see how well they collectively addressed the CCTC, the mini-alignment studies focused on how well each individual set of industry-based standards align to the CCTC.

As noted above, this paper focused on 18 sets of industry-based standards, just a subset of all the industry-based standards available and in use across the country. We selected these 18 industry-based standards to serve as a sample of the broader field of industry-based standards based on:

- The estimated degree of their use in states and schools,
- Their availability (either on their website or made available upon request), and
- Distribution across the 16 Career Clusters (to the extent possible).

Some of the analyses included only one set of industry-based standards, while others bundled multiple sets of standards from the same industry group/association into one. For example, the analysis of the Graphic Arts Education & Research Foundation (GAERF) PrintED standards included seven different standards documents, whereas the analysis of the American Medical Technologists standards only included the Registered Medical Assistant standards. It is important to note that a number of the industry associations, such as NCCER and NATEF, do have additional standards

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documents that were not used in this analysis due to time and budget constraints. Therefore, this analysis is limited to the standards we did review and should not be taken as a blanket statement for *all* standards created by an individual organization.

Again, this is **not an exhaustive list of industry-based standards**, but rather one we **believe is representative of the field** and of the areas of study. Importantly, this analysis should not be generalized or applied to any industry-based standards available; it speaks only to the 18 sets of standards reviewed.

CAREER CLUSTER & CAREER PATHWAYS	INDUSTRY-BASED STANDARDS USED IN ANALYSIS
Agriculture, Food & Natural Resources • Agribusiness Systems • Animal Systems • Environmental Service Systems • Food Products & Processing Systems • Natural Resources Systems • Plant Systems • Power, Structural & Technical Systems	• National Council for Agriculture Education
Architecture & Construction • Construction • Design/Pre-Construction • Maintenance/Operations	• American Welding Society (Level 1) • Home Builders' Institute (Residential Carpentry, Residential Electrician) • National Center for Construction Education and Research (NCCER) (Construction Core, Carpentry, Masonry, Electrician, Plumbing, Welding) • National Institute Metalworking Skills (Machine Level 1)
Arts, A/V Technology & Communications • A/V Technology & Film • Journalism & Broadcasting • Performing Arts • Printing Technology • Telecommunications • Visual Arts	• Adobe (Dreamweaver, Flash Pro, Photoshop) • Graphic Arts Education & Research Foundation (GAERF) PrintED (Advertising & Design, Digital File Prep, Digital File Output, Digital Production Printing, Graphic Communications, Offset Print Operations, Screen Printing)
Business Management & Administration • Administrative Support • Business Information Management • General Management • Human Resources Management • Operations Management	• Marketing & Business Administration Research and Curriculum Center (Marketing Core)
Education & Training • Administration & Administrative Support • Professional Support Services • Teaching/Training	• National Association for the Education of Young Children (NAEYC) (Certified Early Childhood Assistant)
Health Sciences • Biotechnology Research & Development • Diagnostic Services • Health Informatics • Support Services • Therapeutic Services	• American Medical Technologists (Registered Medical Assistant) • National Consortium for Health Science Education • National Highway Traffic Safety Administration (Emergency Medical Technician)

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Hospitality & Tourism • Lodging • Recreation, Amusements & Attractions • Restaurants & Food/Beverage Services • Travel & Tourism	• American Culinary Federation Education Foundation (Culinary Arts Certification, Retail Commercial Baking Certification) • National Restaurant Association Educational Foundation (NRAEF) (ProStart Foundations of Restaurant Management and Culinary Arts) • National Retail Federation (Customer Service, Sales Skills)
Human Services • Consumer Services • Counseling & Mental Health Services • Early Childhood Development & Services • Family & Community Services • Personal Care Services	• National Association for the Education of Young Children (NAEYC) (Certified Early Childhood Assistant)
Information Technology • Information Support & Services • Network Systems • Programming & Software Development • Web & Digital Communications	• CompTIA (A+ Essentials I and II & Strata IT Fundamentals)
Law, Public Safety, Corrections & Security • Correction Services • Emergency & Fire Management Services • Law Enforcement Services • Legal Services • Security & Protective Services	• National Highway Traffic Safety Administration (Emergency Medical Technician)
Manufacturing • Health, Safety & Environmental Assurance • Logistics & Inventory Control • Maintenance, Installation & Repair • Manufacturing Production Process Dev. • Production • Quality Assurance	• American Welding Society (Level 1) • Manufacturing Skill Standards Council (Production, Logistics) • National Institute Metalworking Skills (Machine Level 1) • NCCER (Welding)
Marketing • Marketing Communications • Marketing Management • Marketing Research • Merchandising • Professional Sales	• Marketing Education Resource Center (MarkED) • National Retail Federation (Customer Service, Sales Skills)
Transportation, Distribution & Logistics • Facility & Mobile Equipment Maintenance • Health, Safety & Environmental Management • Logistics Planning & Management Services • Sales & Service • Transportation Operations • Transportation Systems/Infrastructure Planning, Management & Regulation • Warehousing & Distribution Center Operations	• National Automotive Technician's Education Foundation (NATEF) (General Service Technician, Collision Repair)
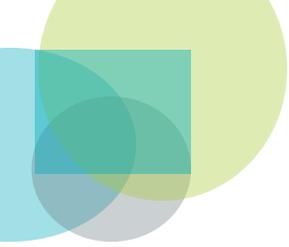
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GENERAL FINDINGS

Career Clusters & Career Pathways

The findings were largely as expected based on the CCTC's scope and design compared to the scope and design of most industry-based standards. Whereas the CCTC represent the expectations for a full program of study – ranging from broader career exploration all the way down to occupation-focused expectations – the majority of industry-based standards analyzed represent occupationally-specific content. As such, the industry-based standards, on average, were not particularly well aligned with the CCTC on whole. Many of the industry-based standards did align well with specific Career Pathways (which are more specialized), without addressing the cross-cutting Career Ready Practices and broader Career Clusters.

In other words, the industry-based standards generally did not include industry-wide expectations but rather expectations for a specific job or skill set required with an industry.

For example, NAEYC's Certified Early Childhood Assistant standards are very well aligned with Teaching & Training and Early Childhood & Education Career Pathways but are not particularly well aligned with either the Education & Training or the Human Services Career Cluster-level standards. This is largely by design – the NAEYC standards focus on early childhood development and other Career Pathways under Human Services and Education & Training are simply outside the scope of that focus.

Similarly, GAERF's PrintEd standards are fully aligned with the Printing Technology Career Pathway standards, but are only partially aligned to Arts, A/V Technology & Communications Career Cluster-level standards. Those Career Cluster-level standards aim to prepare individuals for a wide range of careers in the arts and communication industry, including printing technology but also graphic design, broadcasting, video production and many others. While each of these career fields has occupationally-specific skills, there also require a grasp of industry-specific skills (such as understanding the legal, ethical and environmental demands of working in an arts or communications workplace) and the broader Career Ready Practices, which all learners need to possess.

The analysis also found that industry-based standards developed by consortia are typically more comprehensive and therefore more likely to address both Career Cluster and Career Pathway-level standards. The standards from the National Council on Agriculture Education, for example, are 100% aligned to the Agriculture, Food & Natural Resources CCTC (as well as the Biotechnology Research & Development Career Pathway under the Health Science Career Cluster).

The Marketing & Business Administration Research and Curriculum Center, National Consortium for Health Science Education and Manufacturing Skill Standards Council documents address almost all of the standards within the Marketing, Health Science and Manufacturing Career Clusters, respectively. This is likely because these consortia standards have been designed to cover an array of careers within an industry and therefore include the broader industry-specific knowledge and skills as well as the more specific occupation skills. These consortia all also utilized the National Career Clusters Framework, the foundation for the CCTC, which can help explain the high degree of alignment.

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Career Ready Practices

Following the analysis of the Career Cluster-level standards, it should not be particularly surprising that the industry-based standards generally do not address the Career Ready Practices. The Career Ready Practices were designed to serve as cross-cutting expectations to be embedded in all CTE programs of study for all learner levels while most industry-based standards focus on narrower, occupational-specific knowledge and skills. What is surprising, however, is that the industry-based standards aren't addressing some of these practices within the context of the occupations for which they are preparing students. It's possible the industry associations believe these expectations are implicit or will be addressed by other standards, curricula and/or classroom instruction.

Below is a table of the 12 Career Ready Practices, with the percentage of industry-based standards that fully, partially or did not align to each individual Career Ready Practice. For example, 33 percent of the industry-based standards analyzed did not address communications skills – or six of the 18 sets analyzed.

| CAREER READY PRACTICES (N = 18)	ALIGNED	PARTIALLY ALIGNED	NOT ALIGNED
Act as a responsible and contributing citizen and employee	5%	33%	61%
Apply appropriate academic and technical skills	17%	39%	44%
Attend to personal health and financial well-being	0%	22%	79%
Communicate clearly, effectively and with reason	39%	28%	33%
Consider the environmental, social and economic impacts of decisions	0%	44%	56%
Demonstrate creativity and innovation	0%	0%	100%
Employ valid and reliable research strategies	0%	22%	79%
Utilize critical thinking to make sense of problems and persevere in solving them.	11%	50%	39%
Model integrity, ethical leadership and effective management	17%	56%	28%
Plan education and career path aligned to personal goals	0%	39%	61%
Use technology to enhance productivity	22%	39%	39%
Work productively in teams while using cultural/global competence	11%	39%	50%

Implications for the Field

So what does this all mean? Importantly, these results aren't saying that industry-based standards are "bad" or without utility. Industry-based standards play a very important role in the CTE enterprise and preparing students for a career. But, what the results are saying is that industry-based standards, on average, do not encompass the full range of expectations that should be included within a program of study *because they were not designed to do so.*

The findings from this analysis have three clear implications for state and local leaders as they consider how exactly they are using and/or incentivizing the use of industry-based standards at the local level as they transition to supporting programs of study.

First, CTE leaders and educators must ensure they are addressing the "**Career Cluster standards gap**." Many industry-based standards align well with specific Career Pathway-level standards but do not address the broader Career Cluster standards. Stakeholders must ensure they are providing opportunities for students to be exposed to those more introductory Career Cluster skills, which allow students to understand their industry of study, the range of career and education options, and other universal knowledge and skills that are foundational to any career pathways the students pursue.

Expectations within a Program of Study
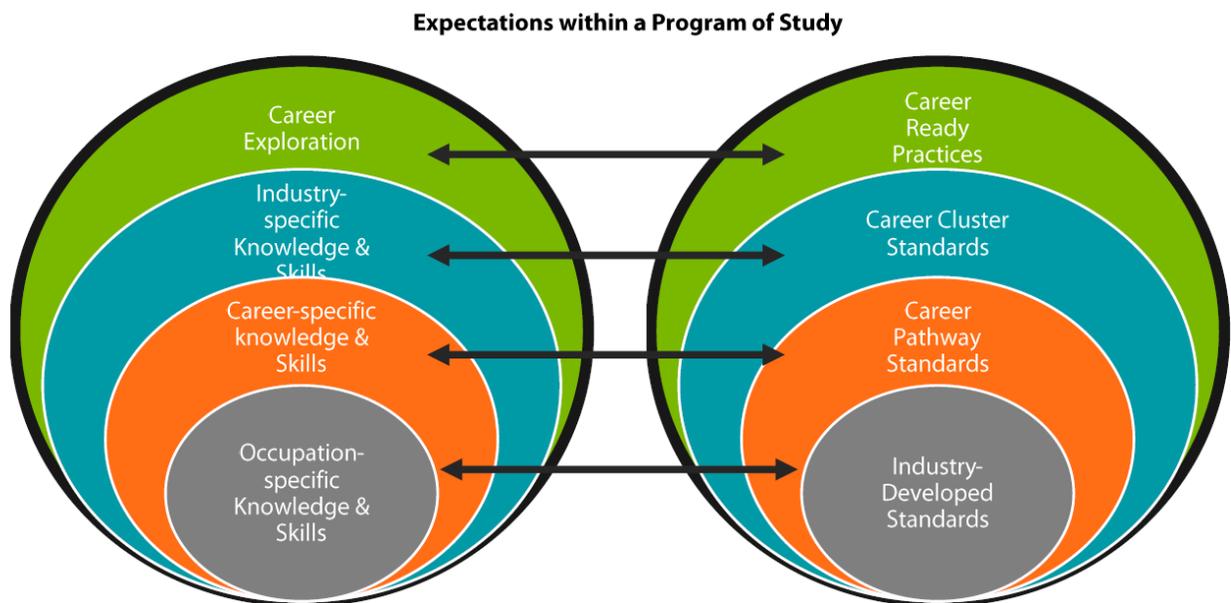
As states consider implementing the CCTC or other standards to support a full program of study, they should focus on making sure any existing program based on industry-based standards also covers the broader Career Cluster knowledge and skills. The Career Cluster-level standards can serve as the foundation for the first course in a program of study sequence or even the first course any CTE student takes at the beginning of their coursework.

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SAMPLE PROGRAMS OF STUDY (NOTE: Not all courses are necessarily a full year)			
COURSE 1	**COURSE 2**	**COURSE 3**	**COURSE 4**
Career/Industry Exploration Course (Industry, Cluster Specific)	*Intro-Level Course (Industry, Pathway Specific)*	*Specialized Course (Pathway, Career Specific)*	*Capstone Course (Career, Occupation Specific)*
Medical Terminology	Diagnostic Medicine	Anatomy & Physiology	Intro to Physical Therapy
Principles of Manufacturing	Quality Assurance Concepts & Techniques	Welding I	Welding II

Another significant implication is around the **Career Ready Practices**. Given the importance employers put on these type of "employability" skills, the finding that industry-based standards alone do not fulfill this need is a critical one. Many states do address these standards in other ways, through their content-level standards or state-required workplace readiness standards, but even those don't typically cover the full breadth of Career Practices as found in an earlier analysis.[iv] Attention must be paid to the availability of professional development and instructional resources that help educators impart these skills to their students across all courses within a program of study.

Finally, having strong standards is an important first step, but local districts and educators **need clear guidance** on how to implement the various sets of state and industry-based standards and build out a coherent sequence of courses and learning experiences. Given the range of standards available to CTE – many of which have utility in the classroom and the workplace – and the ongoing efforts of states and districts to organize their existing *programs* into *programs of study*, it is critical that state leaders offer resources and supports to help local educators on how best to choose and use standards and curricular resources. Model programs of study are one way states can provide guidance, along with offering information on the strengths and limitations of each type of CTE standards available.

It is our intent for this analysis to provide actionable information for states and districts as they review their current standards, courses and programs of study. In particular, **we hope this analysis informs the design and development of comprehensive and coordinated programs of study that include the full range of knowledge, skills and competencies associated with being ready for a career** – from the broad career exploration all the way to the narrower occupational-specific knowledge and skills.
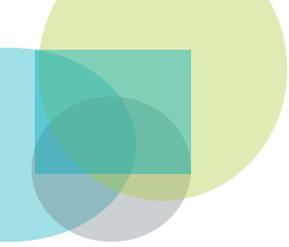
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Appendix A: Findings by Standards

National Council for Agriculture Education (NCAE)
- **Career Cluster:** Agriculture, Food & Natural Resources Career Cluster
- The NCAE standards are fully aligned to the Agriculture, Food & Natural Resources Career Cluster and all of its Career Pathways as well as the Biotechnology Research & Development Career Pathway within the Health Science Career Cluster.

National Center for Construction Education and Research (NCCER)
- **Career Clusters:** Architecture & Construction Career Cluster and Manufacturing Career Cluster (Welding only)
- Combined, the six individual NCCER standards documents used in this analysis partially align to Architecture & Construction Career Cluster and Construction and Maintenance/Operations Career Pathways. These standards do not align to any CCTC standards in the Pre-Design Career Pathway. The Welding standards also partially align to the Health, Safety, & Environmental Assurance Career Pathway and a few other standards within the entire Manufacturing Career Cluster.

Home Builders Institute (HBI)
- **Career Cluster:** Architecture & Construction Career Cluster
- Combined, the two individual HBI standards used in this analysis partially align to a few standards throughout the Architecture & Construction Career Cluster and its Career Pathways.

American Welding Society (AWS)
- **Career Clusters:** Architecture & Construction Career Cluster and Manufacturing Career Cluster
- The AWS standards align to one Architecture & Construction Career Cluster-level standard and are partially aligned to a few standards under the Construction and Maintenance/Operations Career Pathways. The AWS standards also partially align to the Maintenance, Installation & Repair and Health, Safety, & Environmental Assurance Career Pathways within the Manufacturing Career Cluster.

National Institute Metalworking Skills (NIMS)
- **Career Clusters:** Architecture & Construction Career Cluster and Manufacturing Career Cluster
- The NIMS standards are partially aligned to a significant proportion of the Career Cluster and Career Pathway standards under the Manufacturing Career Cluster (although there are no fully aligned standards and fairly weak alignment at the Career Cluster level). The standards are partially aligned to a few of the CCTC standards in the Architecture & Construction Career Cluster within the Construction and Maintenance/Operations Career Pathways.

The Graphic Arts Education & Research Foundation (GAERF) PrintED
- **Career Cluster:** Arts, A/V Technology & Communications Career Cluster
- Combined, the seven individual sets of PrintED standards used in this analysis are partially to Arts, A/V Technology & Communications Career Cluster-level standards, fully aligned to Printing Technology Career Pathway, and partially aligned to Visual Arts Career Pathway. These industry-based standards do not address any other Career Pathways, which is appropriate given the scope of the PrintED standards.
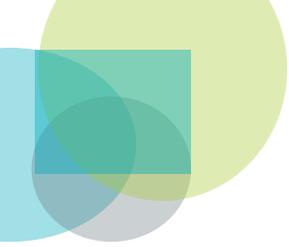
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Adobe
- **Career Cluster:** Arts, A/V Technology & Communications Career Cluster
- The Adobe standards for Photoshop, Dreamweaver, and Flash Professional are not aligned with any of the Career Cluster-level standards and are partially aligned with a few standards in the Journalism & Broadcasting, Visual Arts, Printing Technology, and A/V Technology & Film Career Pathways.

National Association for the Education of Young Children (NAEYC)
- **Career Clusters:** Education & Training Career Cluster and Human Services Career Cluster
- Within the Education & Training Career Cluster, the NAEYC standards were at least partially aligned with a majority of the Career Cluster and Career Pathway standards, with a particularly strong alignment to the Teaching & Training Career Pathway. The NAEYC standards also address, at least partially, all of the standards in the Early Childhood Career Pathway, but are only partially aligned to two Career Cluster-level standards (and no other Career Pathway level standards) within the Human Services Career Cluster.

American Medical Technologists (AMT)
- **Career Cluster:** Health Science Career Cluster
- The AMT standards are minimally aligned to Health Science Career Cluster-level standards and are well aligned to Diagnostic Services and Therapeutic Services Career Pathways. These industry-based standards do not address any of the Biotechnology Research & Development, Informatics or Support Services Career Pathways.

National Consortium for Health Science Education (NCHSE)
- **Career Cluster:** Health Science Career Cluster
- The NCHSE standards were fully aligned with all of the Health Science Career Cluster-level standards and well aligned with all of the Career Pathways, except for the Biotechnology Research & Development Career Pathway, which was not addressed in the NCHSE standards.

National Highway Traffic Safety Administration (NTSA) EMT
- **Career Clusters:** Health Science Career Cluster and Law, Public Safety, Corrections & Security Career Cluster
- The NTSA EMT standards are partially aligned to most of the Health Science Career Cluster-level standards, and address, at least partially, all of the Diagnostic Services Career Pathway standards. These standards also partially align to some of the Law, Public Safety, Corrections & Security Career Cluster-level and the Emergency and Fire Management Services Career Pathway standards.

National Restaurant Association Education Foundation (NRAEF)
- **Career Cluster:** Hospitality & Tourism Career Cluster
- The NRAEF standards are partially aligned to the Career Cluster-level standards and are well aligned to the Restaurants & Food/Beverage Services Career Pathway. These industry-based standards do not address any other Career Pathways, which is appropriate given their scope.
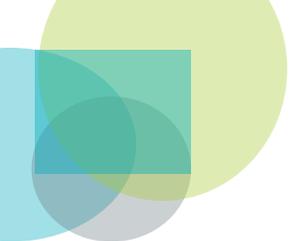
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American Culinary Federation Education Foundation (ACFEF)
- **Career Cluster:** Hospitality & Tourism Career Cluster
- The ACFEF standards are partially aligned to half of the Career Cluster-level standards and are partially aligned to the Restaurants & Food/Beverage Services Career Pathway. These industry-based standards do not address any other Career Pathways, which is appropriate given their scope.

CompTIA
- **Career Cluster:** Information Technology Career Cluster
- Comptia's A+ and Strata IT Fundamentals standards are only partially aligned to the Career Cluster-level standards, with the greatest alignment to the Network Systems and Information Support & Services Career Pathways (although still only partially aligned).

Manufacturing Skill Standards Council (MSSC)
- **Career Cluster:** Manufacturing Career Cluster
- The MSSC standards are very well aligned to Career Cluster-level standards as well as all of the Career Pathways within the Manufacturing Career Cluster. MSSC only fails to align (partially or fully) with one Career Cluster-level standard around career opportunities.

Marketing & Business Administration Research and Curriculum Center (MBA Research)
- **Career Clusters:** Marketing Career Cluster & Business Management & Administration Career Cluster
- The MBA Research Core standards are very well aligned to Career Cluster-level standards as well as all of the Career Pathways within the Marketing Career Cluster. In total, these standards are fully aligned to all but four Marketing standards, to which they are partially aligned. The Marketing Core standards also fully address the Business Management & Administration Career Cluster-level standards and the General Management Career Pathway, but minimally address the other Career Pathways within the Business Management & Administration Career Cluster.

National Retail Federation (NRF)
- **Career Clusters:** Marketing Career Cluster and Hospitality & Tourism Career Cluster
- The NRF standards address all of the Professional Sales Career Pathway standards, as well as a few other standards across the Marketing Career Cluster. The NRF standards partially align to a handful of standards throughout the Hospitality & Tourism Career Cluster but no Career Pathway in particular.

National Automotive Technician's Education Foundation (NATEF)
- **Career Cluster:** Transportation, Distribution & Logistics Career Cluster
- The General Service Technician and Auto Body Collision standards are partially aligned to the two standards under the Facility & Mobile Equipment Maintenance Career Pathway within the Transportation, Distribution & Logistics Career Cluster, and do not address any other standards within this Career Cluster.

Appendix B: Methodology

The alignment analysis process consisted of two stages:

- Automated algorithm to determine the extent to which the CCTC content is represented in the industry-based standards

- Human-driven quality assurance (QA) process to ensure the validity of the automated algorithm results

In the first stage, the industry-based standards were searched for keyword matches with the CCTC (specifically the 12 Career Ready Practices and relevant Career Clusters). In the second stage, two trained reviewers analyzed the top 10 keyword matches as well as the standards' verbs and made a preliminary judgment (*Aligned, Partially Aligned, Not Aligned*). The reviewers then compared results and calibrated their judgments.

Through this process, the reviewers took into account three elements of a standard: the verb(s), the object(s), and modifier(s).

	Verb (Level of Proficiency	Object (Knowledge Domain)	Modifier (Context)
Aligned	✓	✓	✓
Partially Aligned		✓	✓
Not Aligned			

The degree to which the statements in the CCTC standards and Career Ready Practices are represented in the industry-based standards analyzed.

- **Aligned** indicates that the industry-based standards fully address the CCTC standard.

- **Partially Aligned** indicates that the industry-based standards address the CCTC standard in part due to granularity differences and/or terminology differences.

- **Not Aligned** indicates that the industry-based standards are not addressing the CCTC standard.

It is common for multiple industry-based standards to collectively be used to form a judgment of "aligned" or "partially aligned."

For more on the full methodology, see www.careertech.org/cctc-alignment-study

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[i] For more on programs of study, see http://cte.ed.gov/nationalinitiatives/rpos.cfm
[ii] NASDCTEc (2010). Reflect, Transform, Lead: A New Vision for Career Technical Education. www.careertech.org/cte-vision
[iii] NASDCTEc (2013). State of Career Technical Education: An Analysis of State CTE Standards. www.careertech.org/cctc
[iv] NASDCTEc (2013). State of Career Technical Education: An Analysis of State CTE Standards. www.careertech.org/cctc