The
Knowledge, Skills
And Abilities

Your Students Need to Know!

A Research Project
Commissioned by
Career Education Colleges & Universities
Looking at Future Skill Demands

May 2019

Dr. Wallace K. Pond, Ph.D.

Skills Demand Project
Commissioned by Career Education Colleges and Universities (CECU)

Wallace K. Pond, Ph.D.
www.WallaceKPond.com

Executive Summary

This research project was designed to determine where there are gaps in the knowledge, skills, and abilities (KSAs) that career college graduates have relative to industry-identified entry-level requirements, both generally, and in each of the eight identified industries. The project included multiple, extensive real time interviews with representatives in each of the eight industries reviewed, as well as reviews of industry reports and surveys, training programs, and industry-related literature. The industry specific data reflect baseline In Demand KSAs, New KSAs, Future KSAs, and Missing KSAs (defined later in the report). The industries were chosen based on the volume of graduates that career colleges produce in those career fields. The research revealed the following findings:

- Industry needs are changing more rapidly and more fundamentally than at any previous time, complicating the ability of schools to "keep up" with changing requirements. (The CECU Employer Engagement Working Group is investigating more productive school-industry partnership models and there are strategies schools can employ to address the challenge addressed later in this report).
- Fortunately, industry is ready and willing to deepen partnerships with career colleges to better meet evolving in demand skills (curriculum, equipment, real-world experience).
- There is a "new" set of universal knowledge, skills, and abilities across all industries that falls under the title of "New Foundational Skills" that covers three domains: Human Skills, Digital Skills, and Business Enabler Skills. In demand KSAs follow this paradigm.
- Processes for new program development and program revisions would be more effective if they were more agile, fast, and reflected greater industry input. This has implications for a potential new and innovative school-accreditor-industry partnership.
- Current accreditation requirements sometimes inhibit innovation and delay necessary program revisions and updates.
- Virtually all vocational-technical fields require entry level (after graduation) and continuous, on going training for employees. That training is not currently being provided by career colleges, but rather by industry. This is a significant, potential opportunity for sector schools.
- The expansive growth of industry-delivered training, even ab-initio training, presents a potential threat to the career college diploma/degree program model.
- There are potentially significant changes on the horizon such as hybrid job positions, wholesale industry disruptions (autonomous vehicles, machine learning, cyclical/perpetual education and training) that could have major implications for industry and career colleges.

- There seems to be a competitive advantage for schools that build the deepest industry relationships to meet in demand skills needs.
- While the current pace of change and resulting KSA gaps present risks to the career college value proposition, there is no other sector of higher education that is as industry focused and whose programs are more job focused. There is a solid foundation on which to address identified challenges and opportunities.

The project also identified recommendations that career colleges can follow to address the identified challenges such as:

- Redesigning and deepening industry partnerships
- Shortening curriculum review and revision periods
- Aligning program learning outcomes with industry provided KSAs
- Designing programs for the future rather than the present, with curriculum "placeholders" that can be quickly revised
- Embedding faculty in industry and industry in the school
- Redesigning internships/externships to be closer to actual work experience

The tables for each of the eight industries are a place to start in terms of evaluating gaps in in demand KSAs in existing curriculum, industry partnerships, faculty knowledge and skills, etc., but each institution must have their own vibrant, dynamic relationships with employers and industry organizations that drive program development and revision. A rubric to support this process is at the end of the report.

Introduction

For several years there has been a discussion within industry, government, and post-secondary education about the growing "skills gap," primarily within vocational and technical fields. That discussion has become more urgent as millions of jobs go unfilled across industries as varied as healthcare and transportation. A related, and equally important discussion has also experienced increased urgency, which deals with "in demand skills," which is the basis of this report.

Skills Gaps vs. In Demand Skills

> *"Education is willing to be a partner, but there is a gap between curriculum and industry needs and between instructors' currency and industry reality."* PAC Member

In the context of hiring, "skills gap" generally means that available applicants do not have the basic skills or credentials for the job, i.e., Mobile Applications Programmer or ICU Nurse. *In demand skills*, for the purposes of this project, refer to applicants who have basic qualifications, training, or even licensure for a position, but do not have *specific* knowledge or skills required by the employer to be fully effective on the job. An example might be a Health Information Technologist who has basic billing and coding skills, but does not have database administration skills or a diesel mechanic with overhaul skills that cannot perform digital diagnostics. This applies broadly to knowledge, skills, and abilities (KSAs) and may also include gaps in "soft," non-technical areas.

To help CECU member schools better understand the industry perspective and needs relative to in demand KSAs across the highest volume fields, this project researched current and anticipated needs via multiple, extensive interviews of both industry and professional organization representatives and a review of industry reports, surveys, training programs, and industry related literature. In the interest of candor and transparency, interview subjects were offered anonymity. However, some individuals have offered to accept outreach by member schools. Their information is listed at the end of the report. The research was conducted over a multi-week period in March and April of 2019.

> *"We are at a place in which "tradespeople" can no longer just be folks who couldn't or wouldn't go to university. The complexity of the work we are doing requires technicians who are competent STEM thinkers."* HVACR industry representative

It is important to understand that this report simply reflects what industry and professional organizations communicate as in-demand and future KSAs for entry-level workers. Those KSAs may or may not be the responsibility of educational institutions. Moreover, the industry feedback applies to a broad cross section of entry-level employees. There is undoubtedly a great deal of diversity from one career school graduate to another and between schools in terms of curriculum, instruction, faculty, industry partnership, and learner outcomes.

The project was limited to the following industries, which represent the highest percentage contributions to the workforce from CECU member institutions:

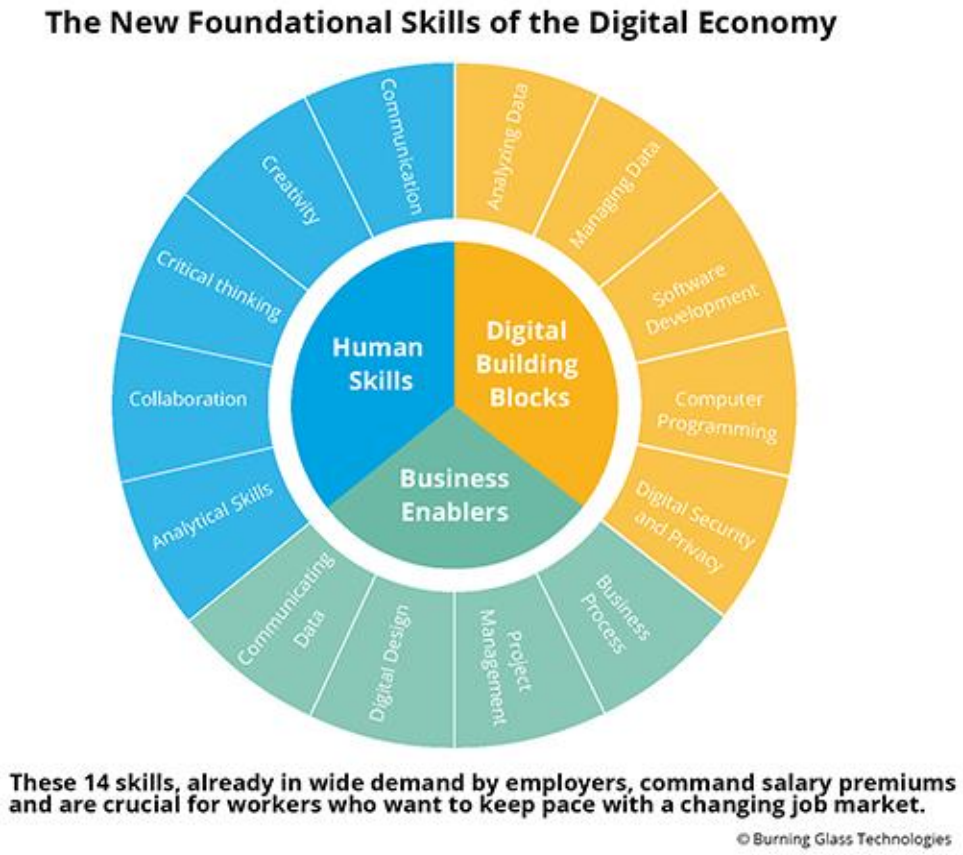
- Healthcare
- HVAC(R)
- Cosmetology
- Transportation/Logistics/Materials Moving
- Information Technology
- Manufacturing
- Culinary Arts
- Automotive/Diesel Mechanics

The industries represented in the study generally include multiple individual jobs within an industry category, but overall reflect disciplines in which career colleges graduate between approximately 30% and 90% of the practitioners in the field. The scope of this report does not allow for in-depth analysis of each discreet job within an industry. As such, each category reflects industry perspectives that apply generally across the career field.

Common Demands Across Industries

Not surprisingly, despite vast differences in the nature of disparate career fields, the research identified common gaps between industry needs and graduate entry-level knowledge, skills, and abilities, with a common concern that the equipment used in schools is often outdated relative to what employees will use in the field. Some gaps are technical in nature, particularly relating to digital and computer technologies, while others are "low tech," but equally important soft skills and personal traits.

A clear trend is that the digital economy is requiring what Burning Glass and the Business-Higher Education Forum have identified as fourteen "New Foundational Skills," which transcend all industries and jobs in three main domains: Human Skills, Digital Skills, and Business Enabler Skills. All 14 skills do not apply in all workplace contexts, but the framework of soft/relationship skills, digital-technical skills, and application of those skills to enable business outcomes, have implications for all curriculum development efforts across all career-focused programs, both because they are documented employer needs, but also because they translate into greater employability and higher compensation for the graduates that possess those skills.



The research for this project also suggests that many in-demand skills are not necessarily "new." In other words, in some cases, what interviews with industry representatives revealed is that skills that were in demand, even years ago, are still often inadequate or missing in entry-level graduates entering a wide variety of fields today. In fact, the items in the table below have at least some application in each of the eight industries studied.

Technical In Demand Skills	**Soft Skills and Personal Traits**
Automation-Tech/Human Interfaces	Writing/Communications
Use of ERP Computer Applications	Customer Relations
Data Management	Dependability/Accountability
Programming	Prioritization and Critical Thinking
Computation	Social/Emotional Intelligence
Environmental Compliance	Problem Solving
Design/Installation	Show Up and Be Drug Free[1]

Due to the extremely rapid pace of change in vocational-technical and health science fields, the research suggests that regardless of the training that graduates initially receive in

[1] This comment was made more than any other during my interviews.

school based programs, their long term employability in their chosen field will require continuous re-training over time. Based on employer and professional organization feedback and reports, the on-going training is currently primarily taking place within industry, but there is no reason that such updated training could not be offered by career colleges in partnership with employers and professional organizations.

> *"We simply find that not only the quantity but the quality of what's being produced out there by the educational system doesn't necessarily meet our needs."*
> Transportation/Logistics industry representative.

In fact, in order to be viable, the future school model might have to include regular post-graduate training opportunities with curriculum that comes directly from industry. Such training might be either a benefit offered to alumni or a revenue opportunity, depending on how it is structured. Regardless, it is essential that career colleges think of technical training as an ongoing endeavor and determine what their role will be in delivering that training in a post-graduation context.

The industry level data is provided across four domains: In Demand KSAs, "New" KSAs, Future KSAs, and Missing KSAs.

In Demand KSAs	New KSAs	Futures KSAs	Missing KSAs
Baseline knowledge and skill requirements, which may be a combination of long-standing and evolving KSAs	Relatively recent, but not necessarily cutting edge knowledge and skill requirements	Skills, knowledge and abilities that are very likely to be required in the future based upon impending changes in industry	Required knowledge and skills, either baseline or relatively new, that industry reports graduates should have, but are often missing

Of course, there is some blurring of the lines between current, new, and future, but every report was validated by at least two industry representatives. Schools can be confident that each table broadly reflects the industry perspective on necessary KSAs.

The industry level reports also include quotes taken directly from industry representatives, as well as "wildcards," which are phenomena that industry experts believe could significantly influence or change how a given field operates, and thus, what employees must know and be able to do to be successful in those fields. These are "things to think about" and be prepared for as potentially new curriculum or learning outcome requirements. An example from the first report on healthcare is "eCommerce." What this means is that it is possible that healthcare providers will end up serving customers/patients through eCommerce portals that would require that clinical site employees have the knowledge and abilities necessary for both back office and customer facing functions related to internet retail.

Industry Level Reports

Healthcare

As with most industries, technology and automation continue to impact virtually all clinical and non-clinical practitioners. The industry perspective is that all employees must be able to interface with ever-more complex technology, while preserving an ethic of care and working effectively as part of clinical care teams. They also identified a paradox in the need for increasingly technical specialist skills combined with the attitude of a "generalist." There are differences in employer needs based on clinical setting such as rural vs. urban, acute vs chronic/rehabilitative care, skilled nursing, etc., but the research revealed commonalities across clinical contexts.

In Demand KSAs	**"New" KSAs**	**Future KSAs**	**Missing KSAs**
Interdisciplinary and Team Care	AI, "Big Data" Protocols	Automation	Management capabilities
Patient Saftey/QA	Digital communications	Robotics	Patient Safety/QA
Cultural Awareness	Monitoring equipment	Programming	Cultural Awareness
Gerontology	Integrative care	eCommerce	Modern Equipment
"Hands on" clinical proficiency	Wellness	Wearable health data devices	

"Clinical practice is requiring that clinicians at all levels have the skills and the confidence to make more and more decisions on their own."

"The current environment requires that most practitioners have some level of "management" skills in addition to clinical skills."

Wildcards:

- eCommerce
- Programming of medical equipment
- Ability to use "old" analogue equipment

HVACR

The industry view is that HVACR requirements are moving beyond purely technical skills to a need for STEM skills and knowledge so that technicians actually understand the science behind the work they do and the decisions they make. On the other hand, as with other industries, HVACR employees still needs basic soft skills and professionalism in the workforce. It appears that HVACR technicians will have to expand their skills beyond maintenance and repair to include design and installation decisions as well as networked equipment (Internet of Things).

In Demand KSAs	**"New" KSAs**	**Future KSAs**	**Missing KSAs**
Hands on experience with contemporary equipment	Design skills	Automation	Customer relations
Tool Recognition	Environmental requirements	Networked equipment (Internet of Things)	Computational skills
Critical thinking and diagnostics	Programming and digital controls	Self-monitoring equipment	Knowledge of varied environments and climates
Dependability and professionalism	Flammable refrigerants	eCommerce	Familiarity with modern equipment
Air flow measurement			

"It's important to teach students for all environments, not just the one the school is in."

"We have kids who come out of school and can't hook up a refrigerant gauge. The curriculum is often too theoretical."

Wildcards:

- Self-monitoring and self-reporting HVACR equipment
- Autonomous fleet vehicles
- Ability to use and repair "old" analogue equipment

Cosmetology

Although cosmetology is not typically thought of as a "high tech" field, the reality is that increasing use of computer simulations, chemistry, neurocosmetics, and "green" approaches have resulted in increased demands on graduates in the workplace and thus expanded requirements in school curricula as well. The industry view is that cosmetologists are becoming "higher level" employees that must also have high-level customer service, retail, and simulation skills as well. In some spa settings, cosmetology is being combined with health and wellness and cosmetologist are working along side healthcare practitioners.

In Demand KSAs	**"New" KSAs**	**Future KSAs**	**Missing KSAs**
Customer service	Environmentally friendly-sustainability practices	Augmented reality	Environmentally friendly/non-toxic practices
Active listening	Computer applications/tablets	Genetically based treatments	Active listening
Creativity	Neurocosmetics	Injectibles	Retail sales
Computer applications	Cosmetology as wellness		Stamina
Product knowledge	Laser treatments		

"Salons make a big part of their profits on product sales and employees need to be able to sell those products to their clients. It's not just about cutting hair and esthetic treatments."

"The biggest new technology is simulations where the client can see what a treatment will look like before actually doing it."

Wildcards:

- Scope of practice
- Blurring of lines between cosmetology and "medical" practices

Transportation/Logistics/Materials Moving

Transportation includes a broad array of jobs from trucking and fleet management to warehousing, which itself includes a range of positions from forklift driver to logistics specialist. This is one of the fastest growing industries in the U.S. due to the related growth in eCommerce and logistics. The industry view is that many positions are becoming hybridized, with the result that employees need a cross section of skills with very high critical thinking and reasoning ability. An example would be a truck driver who also must be a logistics partner, using scheduling, loading and routing software or a warehouse foreman who must drive a forklift and monitor automated inventory equipment and computers.

In Demand KSAs	**"New" KSAs**	**Future KSAs**	**Missing KSAs**
Equipment Operation	Automation	Autonomous vehicles	Critical thinking/Falt trees
Maintenance	Human-tech interface	Blockchain	Tooling, machine repair
Troubleshooting	Robotics	Drone operations	Interfacing mechanical to electronic
Customer service	Driver-assist technology	Electric vehicles	Familiarity with modern equipment
Interface between low tech and high tech	Hazardous materials and environmental compliance		Work prioritization
Use of ERP computer applications	Fleet data management		High risk driving and equipment ops

"We have a lot of heavy equipment in our work. We need equipment operators who also have at least basic maintenance skills so they can fix simple things themselves."

"Because our drivers have to be licensed, they also have to have clean records and be drug free. It doesn't do us any good for a school to send us someone who doesn't meet those minimum qualifications."

Wildcards:

- Autonomous driving and flying vehicles
- Fleet data management

Information Technology (Networking/Programming/Devices/Telecom/Support/Business Services)

As one might expect, information technology fields are experiencing a high rate of innovation and change that has significant implications for entry-level employees and the schools where they earn their initial credentials. It is also the one career category that crosses all others. The industry perspective is that it is basically impossible for schools to fully keep up with industry because industry cannot keep up with itself. However, it is clear that there are concerns about the degree to which current IT programs do not provide the appropriate perspective to students. For example, industry reports that entry-level graduates in networking programs tend to be oriented toward local server networks rather than cloud based systems. Similarly, graduates of software-focused programs are oriented more toward algorithms for traditional programming languages rather than machine learning programming. IT, more than other industries, is shifting from higher education degrees to industry certificates and badges as a marker of employability. Due to the breadth and depth of information technology as an industry, this section of the report is the most expansive.

In Demand KSAs	**"New" KSAs**	**Future KSAs**	**Missing KSAs**
Bridging old and new technology (digital transformation)	Internet of Things	Edge computing	Writing and communications
Mobile app development (with augmented reality)	Blockchain and BC app development	Quantum computing	Understanding business processes and objectives
SEO and SEM marketing	Virtual and Augmented Reality	5G protocols	Project management
Data: • Management • Visualization • Analysis • Engineering	Programming for AI and machine learning		Problem solving
Security			AI programming
Cloud Computing			Fundamental Principles
UI/UX			
Robotics			
3D Printing			
Wireless			
Customer service			

"Most of the entry-level people we work with have zero idea of how what they do connects to the business or customers."

"Success in IT fields is becoming less about discreet skills and more about understanding principles."

Wildcards:

- Ethics and risks of machine learning
- Legacy technology

Manufacturing

As with other fields, manufacturing needs employees who can bridge lower tech, manual processes and labor with higher tech, often automated processes such as manually placing raw materials in machinery for laser cutting and finishing. In some cases, human beings must work along side robots in a "co-bot" setting in which the manufacturing process is split or shared between both. This requires that humans often engage in manual tasks while also monitoring or even directing machines to complete tasks that require "strength," precision, repetition, or would simply not be safe for humans. Manufacturing is also requiring increased critical thinking and design skills, particularly relating to custom manufacturing and quality assurance.

In Demand KSAs	**"New" KSAs**	**Future KSAs**	**Missing KSAs**
Combining low tech, hands on, with high tech	Machine learning	AI programming and computer driven design	Writing and communications
Automation – "Co-bot" environments	Virtual and Augmented reality (training and design)	Simulated manufacturing	STEM
Robotics	3D printing		People skills and ability to work in teams
Machine monitoring, and maintenance			Problem solving
ERP applications			AI programming
Custom manufacturing			Show up and be drug free

"As our workforce continues to be more diverse, we need people who can work well together in teams that are also more diverse than ever."

"The manufacturing that is still being done in the U.S. is typically of a higher level in terms of customization, just in time, quality assurance, etc. That also requires a higher level employee."

Wildcards:

- Value proposition of U.S. based manufacturing
- Shift in skill set from "middle" skill to highly skilled workers
- Computer driven design through machine learning

Culinary Arts

Employment in culinary arts continues to be a unique combination of creative arts, science, teamwork, and hard physical labor. Technology is making its way into the professional environment, but at a slower pace than in other fields. The industry perspective is that entry level employees need to be better prepared for the physical demands of the typical production kitchen as well as the need for speed, accuracy, teamwork, and a willingness to work ones way up the kitchen and restaurant hierarchy. Creativity is a plus, but production kitchens need graduates that are skilled technicians.

In Demand KSAs	**"New" KSAs**	**Future KSAs**	**Missing KSAs**
Physical stamina and speed	Technology for tickets, safety, cost control, food safety	Automation	Teamwork
Accuracy	Food prep for delivery	Robotics	Speed and timing
Better hot line experience	Food allergies and sensitivities		Problem solving
Financial literacy for the business	Customer facing kitchens (performing)		Patience with "low end" kitchen work
Customer service	Food as medicine		Culinary math
Vegan menus and production			

"Even graduates who have had internships in the field are rarely prepared for the demands of an actual production kitchen. The internships/externships need to be more realistic with students given more realistic tasks and experience."

"F&B and hospitality companies that are large enough are starting to build culinary training into their corporate operations as a way of getting the employees they need with the skills they want. We just see it as a cost of doing business."

Wildcards:

- Automation
- Industry training rather than culinary school training
- Shift away from dining-in

Diesel and Automotive Mechanics/Collision Repair

Diesel and automotive mechanics may be experiencing the most rapid technological changes of all the industries reviewed in this report. It also appears to be the industry most active in meeting its own training needs with multiple, simultaneous initiatives sponsored by both large companies and professional organizations such as Automotive Service Excellence, BMW, Toyota, Carquest/Advance Autoparts, ATA Technology and Maintenance Council, and National Automotive Service Technicians among others. It may be that trade schools can only provide the basics with technicians being "finished" in industry-led, and sometimes proprietary training. It is the industry view that career colleges have not kept up with the real-world demands of automotive and diesel mechanics and they are prepared to spend significant sums on building and delivering their own training infrastructure.

In Demand KSAs	**"New" KSAs**	**Future KSAs**	**Missing KSAs**
Maintenance tasks	Smart systems/networks	Autonomous vehicles	Dependability and professionalism
Communications	Computer applications/tablets	Cyber Security	STEM
Critical thinking and diagnostics	Digital vehicle inspections	Electric powertrains	Customer service
Customer service	Software patches	Self-repairing composites	Familiarity with modern equipment
Interface between low tech and high tech	Materials science/composites		Willingness to continue training
Desire for ongoing training	Hybrid power plants		

"Less than 35 or 40% of catastrophic engine failures will involve a technician overhauling an engine and putting it back in the tractor. We don't need overhaul skills. We need diagnostics, maintenance, and 'part swappers'."

"I recently walked into an engine lab in a school where I am a PAC member. The engine on the stand has been out of production for almost ten years."

"We are at a place now where technicians will have to keep training regularly for the rest of their careers."

Wildcards:

- Proprietary restrictions on maintenance and repair
- Vehicle data management

Summary and Key Recommendations

1. The pace of change across all industries is so great, particularly related to evolving technology, that it is unrealistic to think that school based programs can provide fully up to date curriculum, equipment, and instruction at all times. As such, the industry view is that at the very least, programs must provide graduates very solid fundamental skills regardless of the field, with the reality that virtually all graduates will require some level of initial training in the workplace as well as continuing training over time. Some industries such as HVAC, Automotive Mechanics, and Healthcare, budget substantial sums for training of entry-level employees. Examples of fundamental skills include terminology, tool/equipment recognition and use, basic systems and computer applications, basic theoretical foundations, computational skills, and safety, along with a host of soft skills such as punctuality, written and spoken communications, critical thinking, ability to work with others and follow directions, and an openness to lifelong learning.

> *"We know that schools cannot teach everything and that their equipment and instructors will not always be up to date, but graduates need to know the difference between calipers and pliers and they need to have basic hands on skills with the equipment they will use on the job."* HVACR industry representative

2. Career colleges would benefit from deeper, more productive outreach to industry. Of the more than a dozen conversations I had, only one person reported having been asked about "in demand skills" from the education side. The traditional PAC model of one (if that) meeting per year is not adequate. Educational institutions need to have "embedded" relationships with industry in which stakeholders from both education and industry are regularly, directly involved in the other's world. Curriculum itself must be viewed as a dynamic and flexible process rather than a static product and it should be driven by industry as much as by faculty or academic SMEs.

3. Industry is asking for things that schools often cannot do under current accreditation rules. Therefore, to meet industry requirements, accreditors need to:
   - Provide schools the flexibility to update curriculum on the fly in partnership with industry without regard to arbitrary percentages of content.
   - Support new program approvals in a fraction of the currently required time.
   - Allow schools to hire the best instructors rather than instructors with the "right" academic credentials.
   - Allow flexibility with the Carnegie model for determining credit and shift to a competency-based model so that schools can deliver programs that will achieve desired graduate outcomes rather than artificial contact hours and seat time.

Three Key Strategies for Improving the Readiness of Graduates in All Fields

1) Deeper Industry Involvement and Partnership (with ground level, continuous input in new programs and for program revisions)
   - Should happen at least annually in each program
   - Curriculum should be based, in part, on in-house industry training
   - Industry placement of faculty and institutional roles for industry

2) More Extensive and Realistic Internship/Field Experiences
   - Internships should better reflect the real world the graduate will work in
   - School labs need to better reflect workplace environments
   - More hands on training using industry equipment in industry settings

3) Curriculum Based on Fundamental Principles
   - New Functional Skills
   - Industry based principles that are foundational for future training (scenario based education, i.e., here is a real world problem, how would you solve it?)
   - STEM/Computation/Critical thinking

Related Issues

The research for this report determined that there are numerous issues related to changing industry realities and requirements that have implications for career colleges as they revise existing programs and plan for new ones. Those include:

- New functional skills
- Hybrid jobs
- Disruptions to existing industries and jobs
- Cyclical or ongoing nature of training
- Differences in geography or other contexts

New Functional Skills

Regardless of the industry, changes across society and the workplace have fundamentally changed what is required for the success of employees and the organizations they work for. As such, all career programs in all disciplines must ensure that graduates:

- Are facile in the technologies relevant to their fields
- Can work with others in highly diverse environments
- Are enablers of the *business* in which they work

Hybrid Jobs

Most vocational-technical programs are currently designed as stand-alone programs to train students for specific jobs, e.g., LPN, welder, computer programmer, etc. However, the research conducted for this project suggests that going forward more and more jobs will actually combine the skills and outcomes of what are now multiple, discreet positions. In fact, based on current industry trends in areas such as transportation, healthcare,

manufacturing, and IT among others, employees are already filling "hybrid" positions, for which they were trained on the job or through other industry credentials. Going forward, career college programs may not lead to gainful employment if the structure of those programs does not change. Examples might be application developers that are also data managers, truck drivers that are also logistics technicians, or Licensed Practical Nurses that also manage patient data.

Disruptions to Existing Industries and Jobs

This report is based on industries as they exist and are understood today. There are inevitable disruptions in play now and on the horizon that will dramatically change how people work and thus how they are educated before entering any given industry. One of the most currently talked about industry disruptions on the horizon is related to autonomous vehicles. Another is machine learning automation of even "middle" level tasks. A structural challenge with academic programs today is that the development, approval, and implementation cycle is markedly slower than the pace of change in industry. As a result, programs today generally experience elements of obsolescence *before* the programs are even launched. Career colleges must fundamentally alter the current program development process so that it is driven by industry needs, is based on a generalist as well as a specialist focus, and happens in a fraction of the time it currently takes to launch new programs or revise existing programs. See the note above about the role of accreditors.

Cyclical Education and Training

Surprisingly, even in 2019, virtually all career college programs are designed with a beginning and end, at which point students graduate and go into the workforce. This is completely counter to the real world construct of immediate entry-level training by the employer to address in demand KSAs, followed by continuous, on-going training to ensure sustained employee viability. In the current career college structure, the life-long training and education needs of graduates are fully surrendered to industry, further compromising the value proposition of the student-graduate and employer relationship with educational institutions. In other words, the current school model is based on a "one and done" approach, whereas the real world is based on a cyclical model of never-ending education and training. The future viability of career colleges may be more at risk from this reality than any other reason.

Urban vs. Rural and other Context Differences

The research behind this report revealed that there are significant differences in training at the school level and practice in industry based on different contexts such as urban vs. rural and north vs. south. The size and comprehensiveness of the educational institution is also a factor. For example, a small HVAC program in South Texas is likely to focus more on air conditioning than on radiant heat and graduates are likely to face skill deficits for employability in Northern climes. Similarly, LPNs and RNs who practice in small, rural hospitals are likely to have an expanded scope of practice and be seen more as generalists than clinicians with the same credentials who practice in large, urban or suburban hospitals. Private practice nurses are more likely to have back office and customer facing responsibilities than those in acute care facilities. Representatives across different industries noted that educational institutions shouldn't train students solely for the

environment in which the school is located. The curriculum should include the full spectrum of realities across the country that a highly mobile workforce will encounter. As an example, a representative of the trucking industry noted that they often get entry-level drivers who have never driven a truck in the mountains, in high winds, or in snow, and learn for the first time in real conditions, hauling a load on the open road, which is not necessarily the safest way to get such experience. There are similar examples in healthcare, IT, etc.

In short, to ensure viability going forward, in addition to the topics related to industry relationships and dynamic curriculum, career colleges must be cognizant of concepts such as hybrid jobs, industry disruptions, and "cyclical" training among other identified areas. If not, the current industry trend toward in-house training could render many current vocational-technical programs obsolete.

Greatest Opportunity

The greatest risk for career colleges is also the greatest opportunity: ongoing training after graduation (and the shift in ab-initio training to industry as well). Although this is happening in essentially every career field, the greatest scale opportunities are in Healthcare, IT, and Automotive/Diesel Mechanics, where industry is spending *hundreds of millions of dollars* annually on training for employees who have already been to school! As noted previously in this report, almost none of that training is being provided by career colleges. It is either being delivered in-house or is contracted out to "corporate" training companies and professional organizations.

This opportunity is three-fold:

- One, it is another avenue for building school-industry relationships, partnerships, and credibility.
- Two, it is a financial opportunity that is similar in scale to the current credit-based program models for ab-initio education in career colleges.
- Three, it is a means to establish life-long relationships with graduates who are "repeat customers," often sponsored by third party payers.

It is essential, therefore, that career colleges do two things:

1) Ensure that credit-bearing programs broadly meet the needs of employers at the point of student graduation—comparing existing program learning outcomes with the industry feedback in this report would be a good place to start.
2) Engage industry as an ongoing training partner for the cyclical, post-graduate training that is now required in effectively every career field represented by career colleges today.

Rubric for Program Review/Revision

The tables for each of the eight industries are a place to start in terms of evaluating existing curriculum, industry partnerships, faculty knowledge and skills, etc., but each institution must have vibrant, dynamic, and ongoing relationships with employers and industry organizations that drive program development and revision.

Themes

- Develop/revise curriculum for the future, not the present (future state comes from industry)
    - Put "placeholder" courses in the curriculum that can be revised in real time
    - Align learning outcomes to reflect local and national skill demands and employment opportunities
    - Focus on transferable principles rather than just discreet skills
- Allow industry to create curriculum rather than just respond to it
- Review all programs at least once per year
- Develop/expand opportunities for real world experience
    - Internships/externships
    - Apprenticeships
    - Use of industry labs and locations for instruction
- Ensure faculty currency with industry standards
- Invite industry partners into faculty and other educational roles
- Focus on baseline in demand and missing KSAs first
- With industry feedback, prioritize most critical KSAs and New Foundational Skills

Update	**NF Skills**	**In Demand KSAs**	**New KSAs**	**Future KSAs**	**Missing KSAs**
Curriculum					
Faculty					
Labs-Equipment					
Field-Real World Experience					
Industry Partnership & Involvement					

Resources

General

https://www.burning-glass.com/research-project/
https://www.burning-glass.com/research-project/new-foundational-skills/
https://www.burning-glass.com/research-project/hybrid-jobs/
https://www.burning-glass.com/wp-content/uploads/Blurring_Lines_Hybrid_Jobs_Report.pdf
https://hbr.org/2016/04/hybrid-jobs-call-for-hybrid-education
http://www.bhef.com/publications

Healthcare

https://www.aha.org/front
http://www.ashhra.org
https://www.morganstanley.com/ideas/online-healthcare-shopping?cid=dm-5028437:236413971:438969389:113400607&dclid=CJqsyormk-ECFU-tTwod7_gJhg
http://www.aone.org/resources/primary-care-workforce-needs.pdf
https://www.ruralhealthweb.org/

HVACR

http://www.acca.org
http://careersinhvacr.org/Portals/_Appleseed/documents/Supply%20ReportExecutive%20Summary%20Labor%20Report.pdf
https://www.acca.org/members/industry/schools

Cosmetology

http://www.pba.org
http://www.in-cosmetics.com

Transportation/Logistics

https://www.trucking.org/
https://www.trucking.org/Technology_Council.aspx

Information Technology

https://www.comptia.org/resources/it-industry-trends-analysis
https://www.comptia.org/resources/assessing-the-it-skills-gap

Manufacturing

https://www.nam.org/
http://www.themanufacturinginstitute.org/
https://www.burning-glass.com/wp-content/uploads/Skills_Gap_Different_Skills_Different_Gaps_FINAL.pdf
https://www2.deloitte.com/us/en/pages/manufacturing/articles/future-of-manufacturing-skills-gap-study.html

Culinary Arts

https://www.acfchefs.org/
https://www.thebalancecareers.com/chef-skills-list-2062369

Automotive and Diesel Mechanics
https://asashop.org/
https://www.ase.com/Home.aspx
https://www.trucking.org/Technology_Council.aspx
https://diesel.org/