Working Stronger and Smarter:

A handbook on theory and techniques for developing employability skills for technicians.

SRI Education™

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Authors

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Executive Summary

In this era of rapid technological change and global job competition, employability skills—the non-technical skills and attitudes key to career success such as teamwork and communication—are particularly important to sustaining any career (Baruch & Bozionelos, 2011; Levy & Murnane, 2004; Merriam, Caffarella, & Baumgartner, 2007). This is particularly true for technician fields, which are changing rapidly due to automation and information technologies (Amadeo, 2018). Yet, employers report that many early-career technicians fail to demonstrate these employability skills. They are calling on both educators and their own managers to do more to cultivate these skills.

Sometimes referred to as 21st-century skills and essential skills, employability skills support an individual's "market fitness and ability to be in charge of his/her own career" (De Fruyt, Wille, & John, 2015, p. 277). Relevant competencies include: **intrapersonal skills** that support goal-setting, continual learning, and sustained engagement on tasks; **Interpersonal/teamwork skills** that support productive interactions with others and flexible adaptation to workplace organizational roles and structures; and **applied competence** to solve problems and think critically (Hogan, Chamorro-Premuzic, & Kaiser, 2013; U.S. Department of Education, 2019).

The lack of focused attention on employability skills stems from multiple problems. These include: Persistent misconceptions that technician work does not require advanced interpersonal/teamwork or communication skills; a shortage of work-based opportunities to learn about modern technician occupations; continuing stereotypes about who may find technician careers fulfilling—which results in a lack of social strategies to support workplace diversity; and, beliefs that employability skills are rooted in personality and upbringing, and difficult to improve. In addition, while such skills have been described

as "generic" and "transferrable," such skills do not consistently transfer between school and work, or even between different workplaces, suggesting that greater system-level education and coordination is needed (Jackson & Hancock, 2010; Leveson, 2000).

To counter such perceptions and challenges, this handbook synthesizes practical ideas from technician education and workplaces that both educators and employers can use to create better solutions for developing employability skills. This handbook takes the perspective that (1) employability skills remain malleable across a lifetime, (2) employability skills take time to develop, and (3) educators and employers should endeavor to coordinate how they develop these skills, using an expanded range of learning principles and methods.

This exploratory study scanned past reports from both education and workplace studies, and conducted a set of in-depth interviews with technician workforce experts over 18 months. In total, we reviewed 273 articles and conducted interviews with 40 educators, employers, and recent graduates from technician programs. To examine how skill expectations and instruction aligned or differed across technician fields, both the scan and interviews focused on two contrasting fields—information technology and advanced manufacturing, and the related fields of computer science and engineering. This study aimed to answer questions about what drives the demand for employability skills, which skills are most important for technicians, what learning principles and instructional practices support their development, and what approaches to employability skills development can support improved diversity in technician fields.

The current state of employability skills development in technician fields

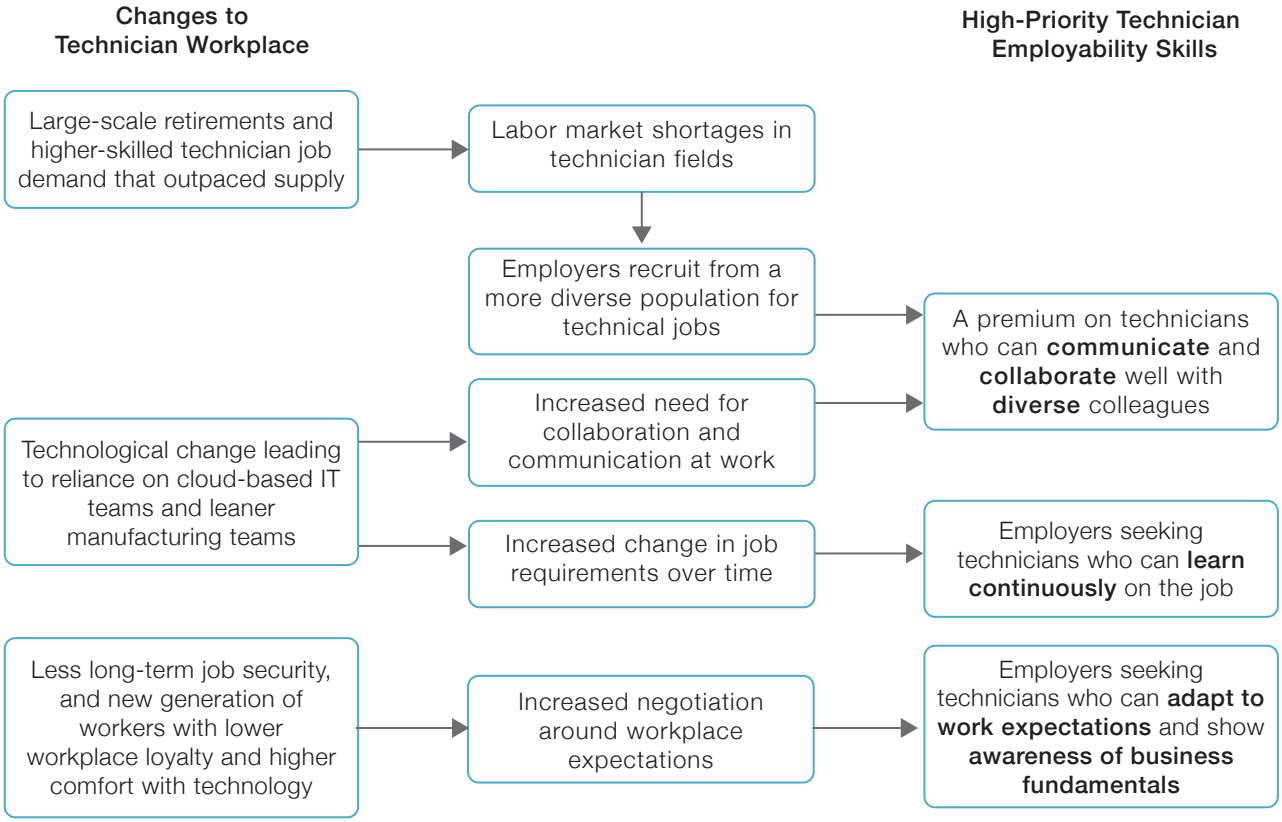
This section summarizes the handbook's answers to these questions.

What forces are shaping current demand for employability skills?

Several themes emerged in both articles and interviews:

- **Changes in the technician workplace are driving the rising importance of five high-priority employability skills.** Three trends emerged as driving the need for employability skills (Exhibit 1): large-scale retirements, technological change, and less long-term job security. These trends lead to secondary changes in the work

Exhibit 1. Logic model of how changes in the technician fields drive five high-priority employability skills



context that require workers to collaborate with coworkers who are more diverse and/or distant than in prior generations, to adapt to new tools and technologies for getting work done, and to assume a greater role for defining and negotiating their job roles and responsibilities. All these changes put pressure on the technicians to show strength in five core employability skills: interpersonal/teamwork skills, communication skills, lifelong learning, adaptability to workplace expectations, and awareness of business fundamentals (such as knowing what societal mission a company serves and how an individual technician's job contributes to that mission).

- **Technician students and entry-level workers often have weak employability skills.** Articles routinely cited the mismatch between the skills graduates of any level of education have and the skills employers seek. Many educators and industry interviewees described gaps in employability skills development as an emerging crisis. They said too many technician candidates arrive at both job interviews and job sites lacking the expected employability skills for today's entry-level technicians.

- **The U.S. social system for cultivating employability skills is changing and inequitable.** Consistent with critical theoretical perspectives on employability skills (e.g., Moreau & Leathwood, 2006), our interviewees blamed multiple structural factors for the perceived gaps in employability skills: the lack of direct attention to these skills in American families and schools, the persistent intergenerational poverty in certain populations that interferes with learning opportunities, and the cultural biases that discourage most people—but especially women and underrepresented minorities—from pursuing and staying in technician careers. Factors contributing to a weakened system for developing employability skills include: a narrow focus of U.S. business on shareholder profits rather than community, a narrow focus on academics in K-12 and technical skills in community colleges, and a culture focused on technical proficiency over social, communicative proficiency. This handbook takes the view that it is going to require more than effort by individual students and working adults to improve their own employability skills; it is going to take structural change, which requires both educators and employers to realize that it actually is their job to cultivate such competencies in those they teach and manage.

- **Employability skills take time and practice to develop and are not currently supported at all stages of career preparation.** In reviewing the literature and the findings from the interviews, it became clear that developing such skills takes time. This insight is critical for educators and employers to understand. While it may be sometimes appropriate to use proficiency or lack of proficiency in employability skills as a tool for selection into programs and jobs, there also needs to be a greater appreciation that such skills can be cultivated through modeling, coaching, direct instruction, practice, role-playing, and reflection. Part of the challenge is that employability skills are complex. For example, someone with strong communication skills may lack confidence, while someone with high confidence may lack communication skills. Also, there are multiple types of employability skills, and key lessons are often learned through experiences that highlight one skill at a time. For example, learning to work on teams is a multifaceted skill set that particularly takes time, with clear phases and stages in which learners move from initial resistance to greater reliance and interdependence. Educators and employers need to set reasonable expectations for growth and identify ways that they can provide focused coaching and feedback.

- **Technician educators and employers are divided about the degree to which employability skills are malleable and how to best address employability skills gaps.** This research found the interviewees were divided on how to address the employability skills development problem. About half the educators and employers

indicated that they often felt there was little they could do to shape someone's work ethic or social skills, and they admitted that they often used perceived weaknesses in these two areas as a way to eliminate candidates from consideration for internships, jobs, and promotions. Those who believe that these skills are fixed traits (in particular work ethic, interpersonal/teamwork skills) might be less likely to commit to practice or to working with early-career technicians to support improvement in these areas. The other half, particularly those leading programs to expand opportunities for underrepresented groups in information technology and advanced manufacturing, cautioned against expecting individual learners to develop employability skills on their own. They stressed that employability skills unfold through interactions in social settings. They called for greater awareness about how every worker and manager plays a role in supporting not only his or her own growth in employability skills but also the growth of others.

- **Successful recent graduates of technician programs attribute their success to having circumvented the systematic lack of support for employability skills development.** The tone was less urgent and more hopeful from the small cohort of recent technician graduates interviewed for this research, but their interviews also underscored their good fortune to have found critical career mentors in their families, schools, and workplaces. They described specific ways that mentors helped them to realize their own potential to excel in technical job tasks, to learn to interact effectively with others, to understand and adapt to organizations, to identify new learning goals, and to envision their personal career pathways for their working lives. Future research needs to focus on those who do not graduate to learn more about what supports were lacking in their lives and what techniques and programs can support the development of early foundational competencies that lead to employability skills.

Which employability skills matter most for technicians?

Analysis of articles and interviews revealed that there were five employability skills that technician educators and employers most highly valued and emphasized (Exhibit 2).

Exhibit 2. The essential five high-priority employability skills for technicians

Capacity to build **relationships**	**Personal Qualities** for career success	**Business Fundamentals** and knowing your business value
1. Interpersonal/teamwork skills	3. Orientation to lifelong learning	5. Situational awareness
2. Communication skills	4. Adapting to workplace expectations	

Which learning principles develop employability skills for technicians?

Analysis showed seven core learning principles were helpful to develop these five high-priority technician employability skills (Exhibit 3).

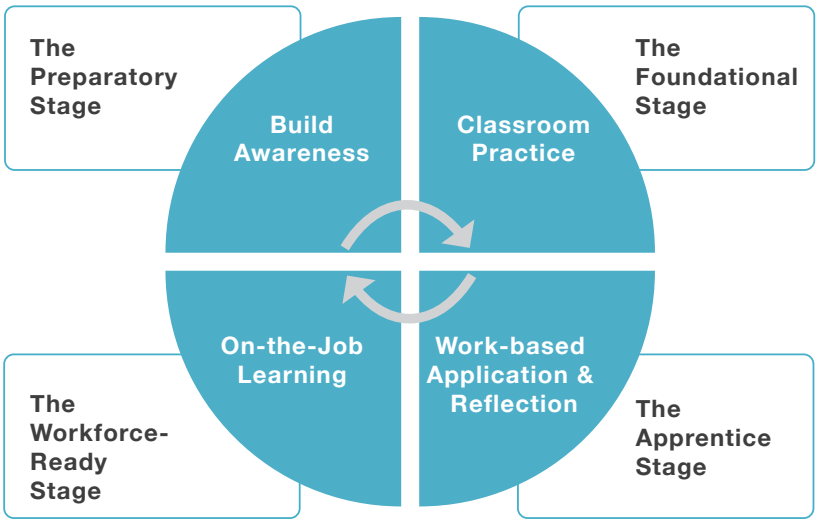
Exhibit 3. The seven principles of teaching employability skills to technicians

Explain	Practice	Support	Reflect	Play	Grow	Confront misconceptions
Explain key concepts and processes	Have learners apply skills in realistic, challenging team projects	Cultivate reliance on others and respectful feedback	Foster reflection and discussion	Refine skills through role-playing, rotation of roles, "making," and online learning	Recognize and encourage growth	Confront prior misconceptions about employability skills

Which instructional practices develop employability skills for technicians?

Analysis established a set of specific practices that technician educators and employers use to develop employability skills. For simplicity, the research team organized these practices into a developmental framework that extends from secondary school into the workplace (Exhibit 4).

Exhibit 4. The four developmental stages of learning employability skills



What development approaches can can support improved diversity in technician fields?

Educators and employers noted the increasing diversity in technician fields required focused attention on employability skills. They focused on two levels of change: (1) establishing new cultural norms and structural supports for more diverse participation in technician fields, and (2) providing targeted interpersonal and communication techniques to help technicians who are historically underrepresented to achieve success. These approaches are summarized in Exhibit 5.

Exhibit 5. The five focused essential employability skills supporting historically underrepresented populations in technician fields

Capacity to build **relationships**	**Personal Qualities** for career success	**Business Fundamentals** and knowing your business value
1. Interpersonal strategies to manage stereotyping/bias	3. Orientation to lifelong learning as a way to strengthen technical confidence	5. Situational awareness of the importance of advancing cultural change in technician fields
2. Communication strategies to support awareness/ sensitivity	4. Understanding cultural differences in workplace expectations	

Why a handbook?

In conducting the research, we found that the challenges that both educators and employers faced in developing employability skills related to underlying cultural beliefs and institutional structures. Since change in both of these areas is complex and daunting, we decided to summarize our findings in the form of a handbook that focuses practitioners on what they can do in the near term. For example, both educators and employers described the challenges of becoming more comfortable and competent in cultivating employability skills, particularly among learners who come from high-stress backgrounds where appropriate communication, interpersonal, and workplace adaptability strategies may not have been modeled. They mentioned feeling uncomfortable with addressing personal habits and attitudes, as opposed to teaching academic or technical content. Further, both educators and employers discussed the time constraints of their work, and both described how difficult it can be to discern progress or growth in employability

skills in a short span of time. As another example, both employers and educators described the challenges of helping learners experiencing self-doubt about technician work stemming from a lack of past opportunity or exposure, such as learners from populations that have been historically underrepresented in technician fields, including women, African Americans, and Hispanics. Even though technician educators and employers are recruiting from a more diverse population of technicians than ever before, we found that they still need support to build awareness about misunderstandings that may be unconsciously informing their judgments about who is a "fit" for technician work and to help them update their approaches for modeling the norms for communication and teamwork. Reviewing the range of challenges they faced, we concluded they could benefit from practical interventions that could provide immediate results, assessments that could capture small increments of progress, and tools that learners could continue to use outside the classroom to refine their learning of employability skills.

How to read this handbook

The reasons why employability skills are becoming more critical for technicians are reviewed in the Introduction. A detailed description of the five high-priority employability skills for technician fields appears in Chapter 1, and a detailed description of the learning principles and the special considerations for historically underrepresented populations appears in Chapter 2. Specific practices to develop these skills according to a developmental framework appear in the subsequent four chapters. Practices most useful to build awareness of the importance of these skills (Preparatory Stage) are listed in Chapter 3; techniques that provide realistic practice using these skills (Foundational Stage) are listed in Chapter 4; ways to bridge classroom and workplace application (Apprentice Stage) are listed in Chapter 5; and, approaches that continue and deepen development (Workforce-Ready Stage) are in Chapter 6. A summary of key insights from this work that can inform next steps in research, policy, and practice appears in the final Conclusions chapter.

- A **technician instructor or administrator** may use Chapters 1 through 6 as a source of ideas to enrich a current course or to understand how to help students who might demonstrate gaps in employability skills. Professional development experts may use these chapters to develop ways to support educators in feeling more comfort and competence to do this work.
- A **technician employer** may review Chapters 1 through 6 to understand the types of preparatory experiences that might be offered on site or coordinated with local

education systems and the practices that can support employees with gaps in these skills and a desire to improve them.

- A **workforce development and education researcher** may use the logic model in the Introduction to understand how change in technician fields drives the demand for these skills to engage education and workforce partners in their specific regional or state contexts. They may use the developmental framework in the Introduction to clarify the specific employability skills needs to target in the context of their research project. They may use the overview of instructional practices in Chapters 1 through 6 to brainstorm and co-design solutions. They may find it helpful to review the appendices that describe the research methods used to conduct this work (Appendix A) and that list the research studies that informed this handbook's key recommendations on instructional practice (Appendix B).
- A **workforce development policymaker** may use the logic model in the Introduction to understand how change in technician fields drives the demand for these skills. A policymaker may use the developmental framework in the Introduction and the instructional resources in Chapters 1 through 6 to inform the design of specific policy incentives and resources that can support the development of these skills at all levels of education and workforce development.

Introduction

The technician employability skills challenge

In this era of rapid technological change and global job competition, employability skills—the non-technical skills key to career success such as teamwork, communication, and work ethic—are particularly important to sustaining any career (Baruch & Bozionelos, 2011; Levy & Murnane, 2004; Merriam et al., 2007). This is particularly true for technician fields, which are changing rapidly due to automation and information technologies (Amadeo, 2018).

This is particularly true for technician fields, which are changing rapidly due to automation and information technologies (Amadeo, 2018). Yet, as those who employ technicians hire more briskly and broadly than ever to fill vacant positions left by retiring Baby Boomers, they are finding that many early-career technicians—and even some of the educators and employers who prepare them—have failed to respond adequately to the rising importance of employability skills for success in technician careers. Interviewees for this research described graduates of the community college programs who can fix machines but fail to engage courteously and confidently with their coworkers, managers, and customers. They described new employees who fail to show up on time or appear unwilling to learn continuously on the job. Employers said technician educators focus narrowly on the

> Don't send me network engineers who can't read and write. They may be great network engineers, but I can't use them for anything else. I can't use them in a team. I can't use them for anything but "here's a list of things that I want to have done on the network." And at an entry-level, I'm going to be spending a lot of time sitting with them to have them do that. And that's not good value for my money…
>
> – IT Educator 16[1]

[1] *Part of our work over the last 18 months included interviews with educators and employers in the field of advanced manufacturing and information technology (IT). Because our interviewees are anonymous, we are crediting their quotes using a code using the interviewee's field and unique number.*

> All the technical stuff, I can teach you. I can't teach you personal skills. I can show you personal skills, but you have to work at it if you're not good at it.
>
> – Advanced Manufacturing Employer 12

> I am the nerd that would rather be in the back working on the technical problems than dealing with the social aspects.
>
> – IT Educator 6

technical skills alone. Educators said employers also focus too much on the technical and fail to grasp how much they need to support the development of these skills for technicians by supporting classroom instruction and work-based learning programs. Both admitted to using perceived deficiencies in employability skills to determine who gets recommendations, who gets hired, and who gets fired.

Not only does a narrow focus on technical skills ignore the changing realities of technician work, it presumes that the next generation of technicians will somehow be able to learn critical employability skills on their own. As technician work changes, many technical skills learned in formal education and on the job quickly become obsolete, while the employability skills remain relevant and timeless: supporting the team, making personal connections, understanding the larger business environment, learning on the job, and showing sensitivity to diversity. Given the importance of such skills, both educators and employers need help to develop more comfort and competence around developing them.

Sometimes referred to as 21st-century skills and essential skills, employability skills support an individual's "market fitness and ability to be in charge of his/her own career" (De Fruyt, Wille, & John, 2015, p. 277). Relevant competencies include: **intrapersonal skills** that support goal-setting, continual learning, and sustained engagement on tasks; **interpersonal/teamwork skills** that support productive interactions with others and flexible adaptation to workplace organizational roles and structures; and **applied competence** to solve problems and think critically (Hogan, Chamorro-Premuzic, & Kaiser, 2013; U.S. Department of Education, 2019). Technicians draw on these skill sets throughout their working lives.

Historically, employability skills have developed with help from lucky life circumstances—such as observing how successful family members handle challenges at work and gaining access to informal learning opportunities through friends. However, depending on luck for developing employability skills no longer meets the needs for a productive technician workforce and has never been an equitable approach. Developing employability skills takes time, support, and attention from secondary school through college and into the workplace. For example, many interviewees acknowledged these skills were malleable and grew over time, beginning in childhood (35% of information technology interviewees

> If an individual's parents are hard-working, you see that often in their children. Number one is how they are raised. Then there are individuals who were given everything and might prefer to stick their hand out instead of working very hard.
>
> – Advanced Manufacturing Employer 17

> Some people might not be cut out for this kind of work: I'm not sure there's a specific type or background that does develop these skills. Some of it is genetic—[some people are] more outgoing, more sensitive to others' feelings.
>
> – IT Employer 9

said this, 41% of advanced manufacturing), and many emphasized the important developmental contribution of experiences outside school, such as opportunities to volunteer, participate in student clubs or sports, and work part-time jobs.

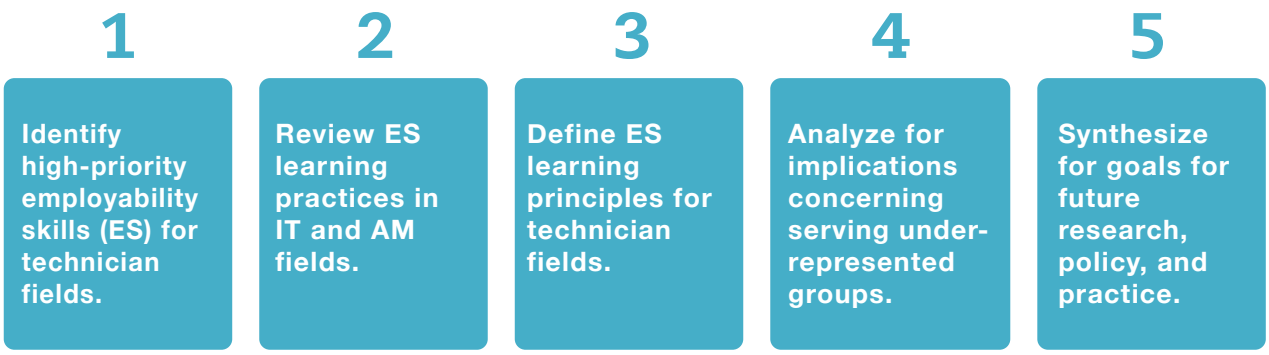
Ensuring that technicians have opportunities to learn and practice employability skills throughout their training and early careers requires a unified effort among educators, employers, policymakers, and researchers. However, this study revealed several specific obstacles to integrating employability skills within existing training and recruiting programs. First, unlike technical skills, employability skills are often perceived as soft and ill-defined, and highly influenced by personality and home life, which makes them seem difficult for technician educators and employers to teach. Second, recruits who may not have an extensive work history, sometimes fail to appreciate how much time and practice it takes to develop employability skills such as timeliness, attendance, and persistence, thinking they should instead focus on building only technical skills. Third, little is understood about how employability skills develop (De Fruyt, Wille, & John, 2015), how to integrate them within an already crowded technical curriculum, and how to assess these skills and provide feedback. Fourth, while there are a wide range of promising coaching and support approaches, they vary widely in the level of involvement and planning required of educators. Fifth, many technician educators and employers need guidance on how to develop their own awareness and proficiencies in employability skills. Finally, given how much time it takes to develop such skills, supporting them requires a coordinated, cross-institutional approach; one that cannot be limited to the K-12 education system, higher education, or employers.

A research approach focused on describing employability skills beliefs and practices

To build an understanding of the beliefs and practices around how technicians' employability skills develop, this exploratory study reviewed research literature and conducted a set of in-depth interviews with technician workforce experts. This resulting handbook presents findings from a literature scan conducted over 18 months of 273 research and practitioner articles (including 38 review articles). These articles focused on how to teach nine categories of employability skills (comprising 46 subskills) in the two technician fields of information technology and advanced manufacturing and the related fields of computer science and engineering. This handbook also presents the findings from 40 interviews with community college educators, industry partners who hire and train early-career technicians, and recent community college graduates in technician fields.

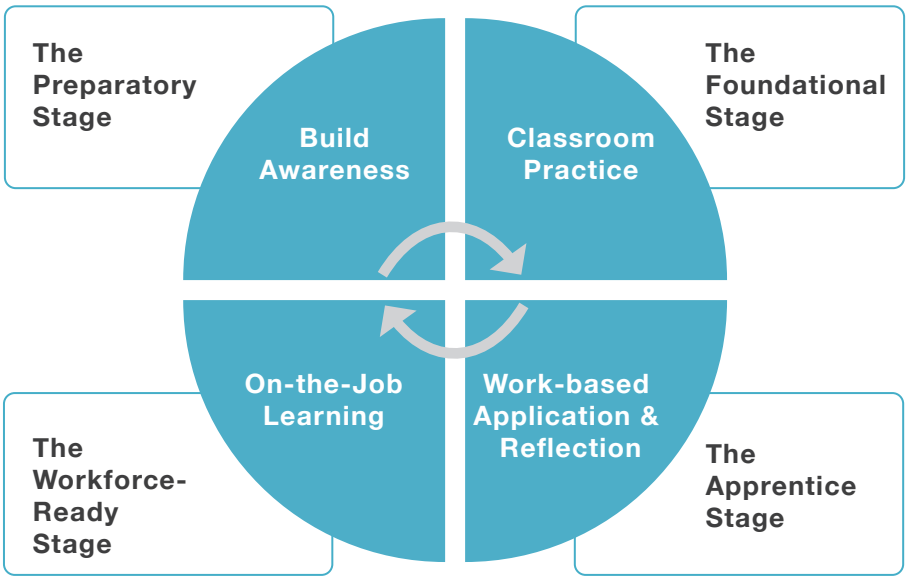
In five phases (Exhibit 6), the research team analyzed these data. For the literature review, we employed rigorous qualitative methods to summarize findings (Sandelowski & Barroso, 2006). For the interviews, we used a grounded theory approach (Tie, Birks, & Francis, 2019). Key parts of the analysis involved comparing how interviewees and the literature prioritized employability skills and instructional techniques, and cross-sectionally analyzing learner needs and instructional approaches at different levels of education and workforce training—from secondary school through college and into the workplace. (For more on methods, see Appendix A)

Exhibit 6. Five-phase analysis approach



The result was a theory of how employability skills develop and a set of methods for supporting that development over time for a general population and for populations historically underrepresented in technician fields, namely, women, Hispanics, African-Americans, and people from high-stress backgrounds (see Exhibit 7).

Exhibit 7. The four developmental stages of learning employability skill



Limitations

This handbook should be read as a contribution to the theory and practice of employability skill development, particularly in the two technician fields of information technology and advanced manufacturing. It offers an organized listing of developmental concerns and instructional and assessment techniques and, where available, information about the level of research evidence regarding the efficacy of the relevant techniques. As a general caveat, very little of the research reviewed for this study employed rigorous designs, so there is ample opportunity for future operationalization and testing to establish evidence supporting both this overarching developmental framework and the recommended practices.

Historical context

The current research draws on nearly three decades of work to define employability skills and develop methods for cultivating them. This work began when the U.S. Secretary of Labor appointed a commission to determine the five core categories of competency that would help young people succeed in the workplace (U.S. Department of Labor, 1991). Since then, researchers and education program developers have generated more than a dozen frameworks, lists, and definitions relating to employability skills.[2] The current study is not intended to present another framework, but instead, to offer ways for educators and employers to prioritize these skills, become aware of some ways that such skills can improve diversity in technician fields, and also to broaden the range of instructional techniques they use for supporting employability skills development.

Attention to these skills particularly accelerated in the research literature after the 2008 recession, when policy leaders focused on aligning the education and workforce development systems with employer needs (Bird, Foster, & Ganzglass, 2014). During that era of policy change and government investment, both technician educators and employers generated fresh research and deeper practitioner know-how into employability skills development (see history of policy in Exhibit 8).

This study aimed to answer questions about what drives the demand for employability skills, which skills are most important for technicians, what learning principles and instructional practices support their development, and what approaches to employability skills development can support improved diversity in technician fields.

2 *These include: Association for Career and Technical Education, 2010; MHA Labs, 2019; Mozilla Foundation, 2015 [for a crosswalk of multiple frameworks]; Nagaoka et al., 2015; National Association of State Directors of Career Technical Education Consortium, 2012; National Network of Business and Industry Associations, 2014; National Research Council, 2012; New World of Work, 2019; Occupational Information Network (O*NET), 2019; Organization for Economic Cooperation and Development, 2013, 2005; Partnership for 21st Century Learning, 2019; U.S. Department of Education, 2019; U.S. Department of Labor, 2019a.*

Exhibit 8. Timeline of federal investment and policy in career technician education

2011	• U.S. Department of Labor invested $200 million in the Trade Adjustment Assistance Community College and Career Training (TAACCCT) Grant Program to reskill workers whose jobs had been outsourced
2014	• President Barack Obama signed into law the Revitalize American Manufacturing and Innovation Act, which led to the Manufacturing USA program that establishes assistance for 14 industry sectors to collaboratively invent technology and improve training • Congress approved the redesigned Workforce Innovation and Opportunity Act, which encourages states to align workforce development and education systems with labor market demand
2015	• Congress strengthened the workforce alignment requirements in the Elementary and Secondary Schools Act (ESSA)
2018	• Congress renewed and updated the Carl D. Perkins Act supporting secondary career technical education
2018	• Career technical education becomes a targeted area of research in the U.S. Department of Education's Institute of Education Sciences.

The current state of employability skills development in technician fields

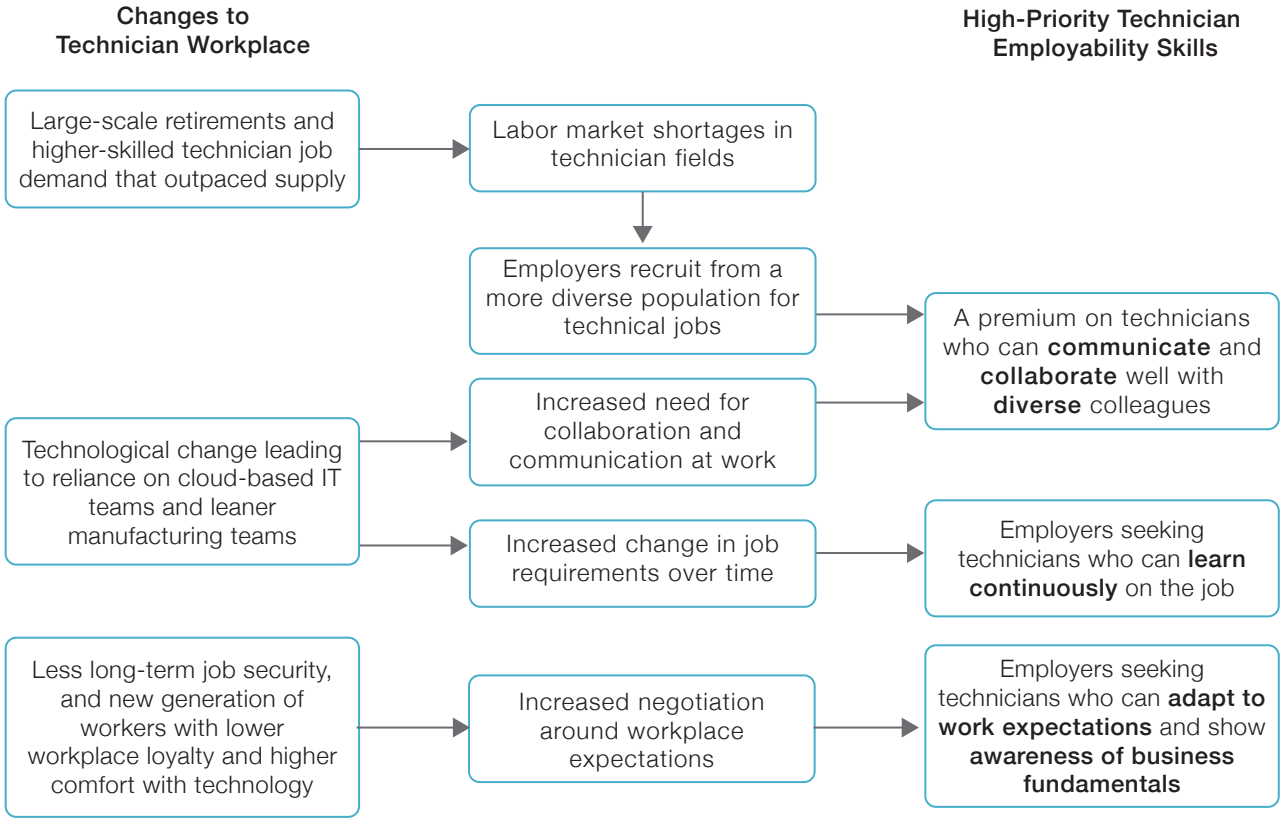
This section summarizes the handbook's answers to these questions.

What forces are shaping current demand for employability skills?

Several themes emerged in both articles and interviews:

- **Changes in the technician workplace are driving the rising importance of five high-priority employability skills.** Three trends emerged as driving the need for employability skills (Exhibit 9): large-scale retirements, technological change, and less long-term job security. These trends lead to secondary changes in the work context that require workers to collaborate with coworkers who are more diverse and/or distant than in prior generations, to adapt to new tools and technologies for getting work done, and to assume a greater role for defining and negotiating their job roles and responsibilities. All these changes put pressure on the technicians to show strength in five core employability skills: interpersonal/teamwork skills, communication skills, lifelong learning, adaptability to workplace expectations, and awareness of business fundamentals (such as knowing what societal mission a company serves and how an individual technician's job contributes to that mission).

Exhibit 9. Logic model of how changes in the technician fields drive five high-priority employability skills



- **Technician students and entry-level workers often have weak employability skills.** Articles routinely cited the mismatch between the skills graduates of any level of education have and the skills employers seek. Many educators and industry interviewees described gaps in employability skills development as an emerging crisis. They said too many technician candidates arrive at both job interviews and job sites lacking the expected employability skills for today's entry-level technicians.
- **The U.S. social system for cultivating employability skills is changing and inequitable.** Consistent with critical theoretical perspectives on employability skills (e.g., Moreau & Leathwood, 2006), our interviewees blamed multiple structural factors for the perceived gaps in employability skills: the lack of direct attention to these skills in American families and schools, the persistent intergenerational poverty in certain populations that interferes with learning opportunities, and the cultural biases that discourage most people—but especially women and underrepresented minorities—from pursuing and staying in technician careers. Factors contributing to a weakened

system for developing employability skills include: a narrow focus of U.S. business on shareholder profits rather than community, a narrow focus on academics in K-12 and technical skills in community colleges, and a culture focused on technical proficiency over social, communicative proficiency. This handbook takes the view that it is going to require more than effort by individual students and working adults to improve their own employability skills; it is going to take structural change, which requires both educators and employers to realize that it actually is their job to cultivate such competencies in those they teach and manage.

- **Employability skills take time and practice to develop and are not currently supported at all stages of career preparation.** In reviewing the literature and the findings from the interviews, it became clear that developing such skills takes time. This insight is critical for educators and employers to understand. While it may be sometimes appropriate to use proficiency or lack of proficiency in employability skills as a tool for selection into programs and jobs, there also needs to be a greater appreciation that such skills can be cultivated through modeling, coaching, direct instruction, practice, role-playing, and reflection. Part of the challenge is that employability skills are complex. For example, someone with communication skills may lack confidence, while someone with high confidence may lack strong communication skills. Also, there are multiple types of employability skills, and key lessons are often learned through experiences that highlight one skill at a time. For example, learning to work on teams is a multifaceted skill set that particularly takes time, with clear phases and stages in which learners move from initial resistance to greater reliance and interdependence. Educators and employers need to set reasonable expectations for growth and identify ways that they can provide focused coaching and feedback.

- **Technician educators and employers are divided about the degree to which employability skills are malleable and how to best address employability skills gaps.** This research found the interviewees were divided on how to address the employability skills development problem. About half the educators and employers indicated that they often felt there was little they could do to shape someone's work ethic or social skills, and they admitted that they often used perceived weaknesses in these two areas as a way to eliminate candidates from consideration for internships, jobs, and promotions. Those who believe that these skills are fixed traits (in particular work ethic, interpersonal/teamwork skills) might be less likely to commit to practice or to working with early-career technicians to support improvement in these areas. The other half, particularly those leading programs to expand opportunities for underrepresented groups in information technology and advanced manufacturing,

cautioned against expecting individual learners to develop employability skills on their own. They stressed that employability skills unfold through interactions in social settings. They called for greater awareness about how every worker and manager plays a role in supporting not only his or her own growth in employability skills but also the growth of others.

- **Successful recent graduates of technician programs attribute their success to having circumvented the systematic lack of support for employability skills development.** The tone was less urgent and more hopeful from the small cohort of recent technician graduates interviewed for this research, but their interviews also underscored their good fortune to have found critical career mentors in their families, schools, and workplaces. They described specific ways that mentors helped them to realize their own potential to excel in technical job tasks, to learn to interact effectively with others, to understand and adapt to organizations, to identify new learning goals, and to envision their personal career pathways for their working lives. Future research needs to focus on those who do not graduate to learn more about what supports were lacking in their lives and what techniques and programs can support the development of early foundational competencies that lead to employability skills.

Chapter 1. The Five High-Priority Competencies for Technician Education

The research team identified five high-priority employability skills emphasized in our interview data and the research literature. To identify the high-priority employability skills for technicians (Exhibit 10), the research team used a structured process of iterative coding interview data and analyzing prior research (See Appendix A for specific methods). This chapter describes how and why technician educators and employers value these selected competencies.

The high-priority employability skills are mutually reinforcing and complementary. For example, the personal quality of work ethic, which includes elements of reliability and conscientiousness, is often mentioned as a foundational component of teamwork and collaboration. The personal quality of work ethic, which also includes elements of persistence, complements the personal quality of willingness to learn as well as problem solving. Further, differences between the contexts and rituals of the two different technician fields studied affect some of the field-specific expectations for each of these competencies. These differences are noted below.

Exhibit 10. The essential five high-priority employability skills for technicians

Capacity to build **relationships**	**Personal Qualities** for career success	**Business Fundamentals** and knowing your business value
1. Interpersonal/teamwork skills	3. Orientation to lifelong learning	5. Situational awareness
2. Communication skills	4. Adapting to workplace expectations	

Capacity to Build Relationships

Among the principal topics that came up in interviews about relationship skills were interpersonal/teamwork skills—important in increasingly collaborative work settings—and communication skills, which encompass the ability to communicate and understand others both face to face and through varied synchronous and asynchronous communication channels. This skillset is particularly important when managing a more culturally diverse set of employees and colleagues. A total of 77% of information technology interviewees characterized these two skills as "most important," and 80% of advanced manufacturing interviewees did. Interviewees listed many benefits of helping technicians develop strong interpersonal/teamwork and communication skills; conversely, they pointed to the downsides of being a "pure technologist." They said that while the technical experts effectively complete tasks, they often cannot use their interpersonal/teamwork and communication skills to help accomplish the "longer term mission" of the business. Miscommunication and misunderstanding create perceptions that someone is not "fitting in" or meeting the "expectations of their employers and peers." So, while technical proficiency was considered an essential baseline skill, employers hire and promote those technicians with the capacity to listen and present themselves well. Several interviewees mentioned that technical skills will get you hired but that lack of these two employability skills will get you fired. Job interviews emerged as a particularly important opportunity for technicians to apply their interpersonal/teamwork and communication skills. Employers often said they used special interview techniques to screen out candidates lacking these skills. Some thought the screening techniques necessary because in their view interpersonal/teamwork and communication skills are harder to develop. The research literature also underscored the importance of interpersonal/teamwork and communication skills and the challenges of cultivating them. American computer science and engineering educators repeatedly described having to help their technician, computer science, and engineering students—particularly recent high school graduates—adopt constructive attitudes about and strategies for teamwork and different forms of communication. The techniques they and the interviewees have used to develop these skills are discussed in Chapters 3 through 6.

Interpersonal/Teamwork Skills

Strong working relationships with colleagues, clients, and others were consistently described by all the interviewees as among the most important employability skills for technicians. Interpersonal/teamwork skills comprise the capacity to connect with others and build trust. About 17% of the research articles included in our literature review on employability skills focused on interventions to support teamwork (49

articles). While a generation ago, the hands-on nature of technician skills might have excluded much focus on interpersonal/teamwork skills, most technical careers today require considerable interaction with coworkers, managers, clients, and customers.

These skills are important not only for team productivity, but also client relations. "We hear over and over again: 'I have to feel comfortable that I can put them in front of a client. If I don't feel comfortable, I'm not going to hire them'" (IT Educator 13). Some employers noted that teamwork—while important at all levels—becomes more important as people advance in their careers. Industry interviewees described bad experiences when weaknesses in interpersonal/teamwork skills were overlooked, leading to situations where they had to "clean up the mess" left by a team member. Though several employers repeatedly expressed confidence that they could help employees develop technical skills, many expressed doubt about their ability to improve interpersonal/teamwork skills.

Communication Skills

About 17% of the articles reviewed focused on developing communication skills (45 articles). The importance of communication skills in particular came through as interviewees described the wide variety of these skills that technicians need to master (Exhibit 11). These skills have increased in importance also because of greater reliance on remote communication technologies, such as videoconferencing. More interaction is taking place across different locales and cultures than ever before. Two distinct subcategories of communication skills emerged in both the interview data and literature: communication skills that convey technical knowledge and proficiency (e.g., technical writing, translation of technical terms) and communication skills that demonstrate interpersonal sensitivity (e.g., listening, face-to-face communication skills, nontechnical and nonbiased communication skills). Work-related activities like interviews and presentations typically require some combination of both.

Exhibit 11. Frequently mentioned forms of communication relevant for technicians

When comparing the interview data for two technician fields, there was some divergence in emphasis of these two types of communication skills between the fields. Information technology interviewees emphasized both technical and empathetic

communication skills, while advanced manufacturing interviewees more frequently emphasized the empathetic communication skills. On closer inspection, both forms of communication are important for both fields, but these data reflected subtle differences in the most common forms of communication used in each of these work contexts.

- In information technology, technicians staff help desks, set up or secure networks, or collaborate on software development, so they frequently need to master both forms of communication simultaneously. For example, information technology technicians on help desks need to skillfully manage customer frustration and anger while also providing useful technical guidance.
- In advanced manufacturing, where technicians work within a specific community of coworkers day after day, interviewees described the utility of empathetic communication skills for resolving conflicts, listening to others, and providing feedback with respect and consideration for the feelings of the recipient.

The Personal Qualities for Career Success

> There are massive skill gaps on the technical side, and we recognize that technology is changing so quickly that no one can have all the technical skills. Everyone will be learning on the job.
>
> – IT Employer 15

> Just because I'm making parts doesn't mean I shouldn't learn how to weld, do drawings, etc. I should want to be well rounded.
>
> – Advanced Manufacturing Educator 6

When asked what predicted long-term career success, interviewees frequently mentioned the influence of positive personal qualities, such as "willingness to learn" and "work ethic," or they mentioned the converse: the barriers to career success created by negative personal qualities, such as fear of making mistakes and argumentativeness, and timidity in confronting difficult situations. A common theme regarding the personal qualities was how essential they are to the smooth functioning of any workplace. Interviewees used a wide range of terms to describe the capacity to adapt to workplace expectations and willingness to learn (Exhibit 12). Despite the importance placed on these personal qualities, the research team found—whether consulting the literature or interviewing technician experts—that it was challenging to elicit specific techniques for developing them. Many interviewees, if not most, cited the general influences of childhood upbringing and experiences in school or work as the core formative factors; only one interviewee mentioned the value of "intentional" school-based programming. Still, on closer review the research team did

Exhibit 12. Frequently mentioned terms for personal qualities for technicians

gather various activities that are believed to prepare learners. Educators and employers discussed exploring methods of developing willingness to learn, such as emphasizing the importance of letting students and employees make mistakes in a supportive "culture of candor." Also, as with interpersonal/teamwork and communication skills, employers discussed screening interviewees for willingness to learn and adapting to workplace expectations, and one workforce education program reported administering a baseline "work ethic" test to applicants to determine those immediately ready for work and those requiring further training. One industry representative cited the desire to hire those with an orientation to lifelong learning as a reason that some employers have a preference or bias in favor of hiring workers with 4-year degrees. The techniques used for ferreting out those with the better dispositions toward adapting to workplace expectations and lifelong learning are also reviewed in Chapters 3 through 6.

Orientation to Lifelong Learning

> The big foundational skill is not being afraid to make a mistake.
>
> – Advanced Manufacturing Employer 14

An orientation to lifelong learning encompasses the qualities of curiosity, humility, a willingness to learn new things, and the skills to pursue independent learning. This quality has increased in importance since change has become the byword of the modern job. Employers made clear that they are not interested in employees who think that being ready for the workplace means they are finished with learning. As one information technology educator put it: "IT is learning to learn" (IT Educator 7). And advanced manufacturing requires "utility players" who are willing to learn different functions and roles as needed. There were some distinctions between fields in how much willingness to learn was emphasized. Willingness to learn was particularly favored by information technology interviewees, with many mentioning the rapid changes common to the field (71% of IT interviewees called for the willingness-to-learn skill set compared with 24% of advanced manufacturing interviewees). There was a dearth of literature around cultivating a willingness to learn in technician and technical fields. We identified five articles: two articles on using problem-based learning classroom interventions to cultivate self-directed learning skills, one reporting on a survey of recent technology graduates rating willingness to learn as an important skill, and two policy articles on the need to support more opportunities for lifelong retraining to keep up with rapid changes in the workplace. To address this gap, the research team augmented its literature review to incorporate theories of growth mindset and self-directed learning.

Adapting to Workplace Expectations

> Probably the hardest thing to find is a person who is going to show up every day.
>
> – Advanced Manufacturing Employer 17

> It's very difficult to motivate a person into a learning cycle if that's not something that someone has an interest in doing.
>
> - IT Employer 16

When it comes to the skill of adapting to workplace expectations, employers—particularly those in advanced manufacturing—reported little patience with employees who arrive late, leave early, check smartphones during the workday, or fail to call in when ill or unable to get to work. Adapting to workplace expectations has been defined as a combination of pro-social interpersonal/teamwork skills, including courteousness and cheerfulness, initiative, and dependability (Petty & Hill, 2005). It is seen as a quality that serves not only in the workplace but in dealing with

life problems: "Quite frankly, those who tend to be most successful are those who can manage their personal and life situations. Those who learn to balance and manage those things are those who tend to be more successful" (Advanced Manufacturing Educator 7).

The personal quality of adapting to workplace expectations was emphasized more by advanced manufacturing interviewees, who also stressed conscientiousness and punctuality. This emphasis is consistent with the time-pressed culture of the manufacturing production workplace, where many different tasks need to be completed on deadline (41% of advanced manufacturing interviewees called for this employability skill or conscientiousness compared with 12% in IT). With respect to adapting to workplace expectations, rather than describing interventions to develop it, three research articles focused on measuring the presence of positive attitudes about "work ethic" in workers with different background demographics or job roles. To address this gap, the research team augmented its literature review to incorporate theories about the importance of addressing attitudinal differences among different generations (Strauss, Howe, & Markiewicz, 2006) and building understanding of how notions of "work ethic" can promote bias and stereotyping. We also incorporated some practical literature focused on techniques to improve time management skills and support work-based learning.

Knowing Your Role and Understanding Business Fundamentals

> I think the first thing you look for in an employee is they're embracing what we do as a business and understanding their part in that.
>
> – Advanced Manufacturing Educator 6

Some interviewees (18%) from both information technology and advanced manufacturing articulated the importance of ensuring that technicians arrive at the workplace with a basic knowledge of business fundamentals, that is, an understanding of the overall business or mission of the company or organization. Such knowledge is included in the Labor Department's employability skills framework but not in the Education Department's. Interviewees mentioned a particular subcategory of knowledge of business fundamentals, "situational awareness." This type of awareness reflects two types of understanding: how a business mission impacts society and how a technician's day-to-day work relates to the functions of other company departments (Department of Labor, 2019). The Labor Department framework's definition of business fundamentals also emphasizes two other forms of knowledge: "business ethics," which focuses on respecting team members, following rules, and acting in the best interest of the company, and "market knowledge," which includes awareness of market trends, competition, maintaining customer relations, and recognizing major industry challenges.

> A lot of the curriculum does not have business at its core, and we need more of that. I've been pushing that. If you don't understand the business model, there is no way to know where you should be heading and how the business should be function. People cannot comprehend why the marketing department does what it does, why manufacturing does what it does, etc.
>
> – IT Educator 12

In the technician interviews and research, the emphasis was on situational awareness of a business's mission in society and how a technician's day-to-day work contributes to a company's business. For the latter, they used phrases like knowing "what is happening upstream and downstream from what you do" (Advanced Manufacturing Educator 6) and understanding "the business and the value they are going to bring to it" (IT Employer 15). As one interviewee described it, understanding the larger business mission prevents workers from entering the workforce like "a million kayaks going off in a million different directions" (IT Employer 15). They described understanding the business mission as a key driver of motivation to work in a technical field. Rather than seeing one's job as merely "building boxes or circuit boards," the technician grasps the larger story of why those boxes or boards are important to society: "These boxes are going to help people in a hurricane, or the circuit board [is] going to go on a spaceship to Mars" (Advanced Manufacturing Educator 6).

Lacking an understanding of the day-to-day aspect of situational awareness was seen as contributing to practical problems in the workplace, such as poor decision making, communication, and collaboration. Not understanding how one's work affects other aspects of a business impacts decisions about daily time management and problem-solving strategies. When early-career technicians fail to understand how their work fits within the larger goals of the organization, they cannot communicate technical information well to nontechnicians, think critically about their role, or evaluate the risks and benefits of taking different actions on the job (IT Employer 15), which can limit their capacity to advance in their careers. When they need to interact with a director or vice president, "They can't imagine what that person is looking for" (IT Educator 11). Not understanding the societal mission of a company primarily was seen as having negative effects on recruitment to a technician field. Employers said they needed to do a better job communicating their business missions to workforce education partners, parents, and students.

Unfortunately, very little insight emerged from the interviews about how to develop an understanding of business fundamentals, but some interviewees connected this with interpersonal/teamwork skills, suggesting that those who work well on a team are aware of what happens upstream and downstream from their work. Once again, the job interview emerged as a key point where employers look for technician candidates

to demonstrate their understanding of both the societal and functional aspects of business fundamentals. The team found only 12 research articles that touched on developing knowledge of business fundamentals in technician education, usually in tandem with developing other employability and technical skills. Nearly all the articles focused on project-based interventions for advanced or postgraduate students transitioning to the workplace, and all focused on the information technology field. Given the dearth of literature on business fundamentals for technician fields, the team also reviewed additional literature on how communicating societal impacts of a technical business can support recruitment to these fields.

Interviewees in both technician fields consistently emphasized both the societal and day-to-day aspects of situational awareness. However, the one cybersecurity educator interviewed for this study also mentioned the importance of one of the other subcategories of business fundamentals—knowledge of business ethics. Business ethics are a critical and fundamental employability competency for the cybersecurity field because cybersecurity technicians handle sensitive information for clients, customers, and the business every day.

Chapter summary

As this chapter has shown, progress in developing the five high-priority employability skills has varied widely. For some skills, technician educators and employers will have many tools and resources, but for others, they will need to test what works. The process of testing may be assisted by understanding the wide range of learning principles that can be used to develop these skills. The next chapter provides an overview of the seven learning principles for developing employability skills.

Chapter 2. The Seven Learning Principles for Developing Employability Skills

This chapter will describe seven learning principles that technician educators and employers use to develop the five high-priority employability skills and will discuss the focused approaches to the five high-priority employability skills that can support workplace diversity. Using the data from the literature and interviews in the current study, the research team adapted the seven principles from a review of learning science research (National Research Council, 2012) and extended the five skills to focus on supporting diversity.

As expected, technician educators and employers relied mostly on two traditional principles—explaining basic concepts of employability skills and then having learners practice those skills in team projects. However, a few educators and employers reported positive results using the other five principles, which provide promising options for technician educators to develop employability skills. The list of the learning principles shown in Exhibit 13 presents the learning principles in the sequence of the frequency of their use by technician educators and employers. The remainder of the chapter provides some examples of how technician educators and employers have applied these principles to developing one or more of the five high-priority employability skills. The chapter closes with a discussion of special considerations for populations historically underrepresented in technician fields, discussing ways to extend the five core employability skills to help educators make the required cultural and structural changes to address stereotype and bias, and help them to prepare all learners to be successful in diverse workplaces.

Below is a summary of the key findings of how technician educators and employers use these learning principles teach these employability skills. These principles are presented in the order of how frequently educators and employers mentioned using them.

Exhibit 13. Instructional techniques associated with each learning principle

Learning principle and description	Examples in interviews or literature
Explain  **Explain key concepts and processes**	Define or emphasize the employability skills, processes Teach course lesson or use special curriculum on these competencies Cite results from a survey, focus group, or theoretical framework to identify core desired subskills
Practice  **Have learners apply skills in realistic, challenging team projects**	Use work simulations Use project-based or experiential learning Use interdisciplinary teams Use group case study analysis and presentations Use service learning
Support  **Cultivate reliance on others and respectful feedback**	Use direct mentoring Cultivate a culture of candor Emphasize a culture that values practice over time Include tools for providing multiple forms of formative feedback
Reflect  **Foster reflection and discussion**	Use reflection about what was learned after team activities Regularly use peer ratings and group grades (e.g., whole team gets single grade)
Play  **Refine skills through role-playing, rotation of roles, "making," and online learning**	Find ways to help students consider different perspectives: Rotate team roles, engage in role-playing Use different teaching modalities (e.g., "making" and online learning)
Grow  **Recognize and encourage growth**	Stress that intelligence is malleable and can be improved Repeatedly use measures to emphasize growth and progress Embrace mistakes as important for learning Foster skills of self-directed learning driven by personal interests, goals, and passions
Confront misconceptions  **Confront prior misconceptions about employability skills**	Bring in employers to explain the rewards of good employability skills When possible, involve employers as clients who provide project feedback Acknowledge that historically underrepresented groups face stereotypes and bias that require cultural, structural change and targeted self-advocacy strategies

Explain and Practice

Our research indicated that educators and employers relied on the two most traditional instructional principles of explaining the key employability skills concepts and having learners practice these skills in team project activities. Both educators and employers tended to use these two principles together. Most focused on using these principles to develop interpersonal/teamwork and communication skills.

- **Classroom instructors** reported using two approaches to embody the principles of explain and practice. Most often, they integrated modules and activities into regular lab activities and team-based projects that required specific team and communication process performances. Second most often, they described creating courses on technical writing, ethics, and speech skills. In both cases, instructors created writing and presentation templates based on actual activities in engineering and technician environments. They also reported some experimentation with creating online courses to coach individual learners in communication skills.
- **Employers** reported using onboarding activities such as formal training and extended mentoring around performance in work tasks and team activities over the first few weeks and months of work.

Support

Some educators and employers discussed the importance of cultivating a culture of candor around these skills. They discussed the importance of downplaying negative framings of judgments about employability skills when providing feedback. They stressed positive approaches that presented the learner with the specific skill gap—usually as reported by other team members—and discussed the importance and positive results of addressing it. Both educators and employers practicing this approach emphasized that the culture must go two ways between learners and their instructors or managers. Instructors and managers need to discuss their own fallibility in employability skills and model a willingness to receive feedback and improve.

- **Classroom instructors** often cultivated candid feedback by discussing their own experiences with realizing and addressing their own employability skills gaps.
- **Employers** discussed the importance of preparing managers to engage in informal, respectful, and continuous forms of “two-way” communication to coach employees.

Reflect

Both educators and employers in literature and the interviews emphasized the importance of providing regular opportunities to receive feedback and to reflect on what worked and didn't work with employability skills.

- Classroom instructors used various methods: rubrics, scheduled team check-ins, reflective whole-group discussions, whole-team grading, and occasional private coaching.
- Employers sometimes recommended focused professional development courses on employability skills for employees, and discussed setting up a routine of mentoring for employees from managers before, during, and after projects.

Play

Some literature and interviews promoted the value of giving technicians-in-training an opportunity to play different roles, particularly to hone communication skills and interpersonal/teamwork skills, but also to increase situational awareness of business fundamentals. Playing different roles improved engineers' and technicians' capacity to understand the wider business culture in which they will work, or are already working, and to see what aspects of their technical tasks were most important to support others. They got a better sense of how to communicate about their technical activities to different audiences and across different settings (e.g., internal to company, external to company). Offering opportunities to take on multiple roles in a technical project was seen as serving various purposes. For example, it provided a method of engaging learners in different ways (Kolb, 1984). It also provided some techniques to help learners understand different perspectives, permitting students to discover "what they didn't know they didn't know" about employability skills.

- Classroom instructors described ways to assign team members specific responsibilities and how to vary those roles during the course of a team project. They also described exercises that provided details on the roles to help participants focus on tasks in new ways.
- Employers described onboarding programs that often included focused role-playing exercises.

Grow

Both literature and several interviewees emphasized the importance of finding ways to help learners see how they were developing or refining their existing employability skills, and embracing the value of learning from mistakes. Both the literature and interviews revealed that many enter engineering and technician fields under the misconception that they will not have to engage in interpersonal/teamwork or communication activities. Further, it also was not uncommon for both educators and employers to reveal negative judgments about technicians perceived as "resistant" to feedback. For more complex, attitudinal employability skills, such as work ethic and orientation to lifelong learning, for example, some interviewees discussed using observed weaknesses in those skills as a way to screen or reject candidates for internships or job opportunities. For these reasons, developing and supporting growth mindset toward employability skills seemed particularly important.

Educators and employers could use support in developing a more proactive approach in supporting a growth mindset to employability skills and self-directed learning. For example, reluctance to show curiosity or work hard has been traced to a common misconception about human intelligence as being a "fixed" trait as opposed to a malleable one that improves through effort. People who hold this misconception often believe that the most intelligent people should not need to work hard or keep learning and that the need for focused effort is a sign of lower intelligence. This often leads to effort avoidance and fear of failure. Much research has identified practices that educators can use to dispel this misconception (Dweck, 2012; 2015), and several interviewees discussed using such methods. To support self-directed learning (Zimmerman, 1998, 2000), educators and employers can encourage learners to set personal goals and make plans to achieve those goals and monitor progress in independent ways.

- Some **classroom instructors** discussed conveying how common challenges are around employability skills are, and providing learners with regular feedback highlighting improvement over time. Specialists in preparing students for job interviews stressed the importance of setting personal goals for career growth and development and monitoring them.
- **Employers** also shared stories of their challenges and described how a supportive mentor or cultivating a resilient attitude toward negative experiences—such as being fired for poor employability skills—helped them focus on improving their employability skills. They also discussed the importance of developing and showing a personal passion for the work through independent learning.

Confront Misconceptions

Technician educators and employers face high degrees of skepticism from their students and new hires regarding the importance that nontechnical skills have on job success. To address such skeptics, some researchers in engineering the technical fields have conducted studies of program graduates, working professionals, and online job advertisements to characterize how frequently the employability skills of communication are used on jobs in these fields. For example, findings from these studies have characterized the higher-than-expected need to use communication skills and developed lists of the specific forms of communication frequently used in technical fields (e.g., listening to coworkers and clients, conveying directions through written or spoken words, giving briefings to colleagues and superiors, and recording technical documentation). Such skills might be required between 25% of the time or more in a technical job (Koong, Liu, & Liu, 2002). Particularly challenging is the complexity of the communication environment in information technology, where technicians need to interpret user problems or develop solutions drawing on input from multiple stakeholders (Jiang, Klein, & Means, 2000). Interviewees described the many problems caused by technicians who believe that their technical skills alone will yield success.

- **Classroom instructors** discussed the need to confront the misconception that technical skills alone matter, and recommended bringing industry representatives into their classrooms to rate the quality of students' presentations and to discuss the importance of employability skills to job success.
- **Employers** who had achieved success in confronting such misconceptions told stories of taking employees aside and providing direct input about the importance of such skills and the need to improve them. Often, simply receiving that input resulted in a change in behavior.

Special Considerations for Historically Underrepresented Groups

Educators and employers focused on increasing diversity in technician fields focused on two levels of change: (1) establishing new cultural norms and structural supports for more diverse participation in technician fields, and (2) providing targeted interpersonal/teamwork and communication techniques to help technicians who are historically underrepresented to achieve success. Each of the learning principles most relevant to these two tasks will be discussed below.

Changing Culture and Structures

> You have to set a culture inside the faculty [members] themselves. There are always a couple outliers. One faculty I've been struggling with is someone with a sign on his door, "Don't ask here, go to the help desk." We find that faculty from other places might not have the same relationships with students that we do. It can take a year or two to develop.… Also, I see faculty in the class unwilling to talk about professionalism. They think their only task is the technical piece that they should be getting across.
>
> – IT Educator 17

> Those who are underprivileged have fewer guidelines and boundaries to learn those soft skills; and those raised in a privileged environment have more experience with those guidelines and boundaries.
>
> – Advanced Manufacturing Employer 15

> The unfortunate thing is that some kids are not lucky, but they don't have anyone out there supporting them.
>
> – Advanced Manufacturing Employer 13

The interviewees drew on multiple learning principles to change culture and provide more structural support for diverse technicians. For example, information technology interviewees endorsed efforts to establish a classroom or workplace culture of respectful communication and using varied learning approaches, such as role-playing and online learning, to help everyone understand the different experiences and perspectives of women and people of color. Interviewees also identified the need to educate both technician instructors and employers about the importance of changing cultural norms and providing structural supports. Such discussions can be uncomfortable, but interviewees focused on explaining the importance of such changes and providing faculty and management with opportunities to practice using tools and techniques to try. For example, advanced manufacturing interviewees discussed partnering with educational organizations that provide employability skills courses focused on the specific needs of diverse learners and engaging both instructors and managers in experiential forms of learning to help them develop more sensitivity about the challenges that diverse technicians face all along—from their initial decision to enter technician fields to the end of their careers. Educators working with industries located in communities shaped by structural racism and historic economic disparity described having to engage in repeated cycles of educating new corporate leaders about the level of community outreach and institutional commitment needed to correct these structural problems.

Providing Targeted Interpersonal and Communication Techniques

Educators and employers described the need to provide more targeted strategies to prepare underrepresented technicians for the experiences they will face. Often they stressed the importance of role playing exercises and practice around how to communicate with confidence and how to self-advocate for more opportunity and responsibility in the technician workplace. Interviewees who had succeeded in technician fields despite being from an underrepresented group emphasized the importance of helping technicians develop communication skills to manage situations involving stereotypes and bias. They also saw value in using the learning principle of confronting misconceptions about women and "women's work" that persist in the wider culture of home, media, and K-12 schools. Synthesizing these insights, the research team extended the top five employability skills to reflect ways to support workplace diversity (Exhibit 14).

Exhibit 14. The five focused essential employability skills supporting historically underrepresented populations in technician fields

Capacity to build **relationships**	**Personal Qualities** for career success	**Business Fundamentals** and knowing your business value
1. Interpersonal strategies to manage stereotyping/bias	3. Orientation to lifelong learning as a way to strengthen technical confidence	5. Situational awareness of the importance of advancing cultural change in technician fields
2. Communication strategies to support awareness/ sensitivity	4. Understanding cultural differences in workplace expectations	

Chapter summary

This chapter has provided some examples of how educators and employers have used the seven learning principles to develop employability skills. The next four chapters will show in more concrete detail how educators and employers support the development of these skills over time by putting these principles into action.

The following chapters follow a consistent form. First, each chapter lists the observable behaviors that indicate learners may need support in proficient usage of one or more of the five essential employability skills at the developmental level discussed in the chapter. Then, the chapter lists specific examples of instructional techniques to improve each of the five employability skills. Finally, each chapter features a discussion of special

considerations for historically underrepresented groups and spotlights a specific illustrative case (or cases) of a program that addresses the needs of the developmental stage.

The instructional techniques presented in the developmental chapters reflect a research synthesis of both practice and learning theory. Many of the suggested instructional techniques, but not all, came from research literature. Specific citations for research-based techniques may be found in an annotated bibliography for each chapter in Appendix B. The techniques that did not come from research literature came from either practitioner interviews or were generated by a researcher through application of a learning principle.

Further, the instructional techniques listed in the subsequent chapters reflect the research team's decisions about ways to leverage the learning principles to address specific challenges in developing employability skills in technician fields, as follows:

First, the research team recommends that technician educators engage in more frequent and focused use of the learning principle of "Confront Misconceptions." This research found very little use of this important principle. Using this particular learning principle can help address the persistent problem of technicians believing that employability skills are not as important as technical skills in these fields. To promote greater use of this learning principle, the research team recommends that technician instructors confront misconceptions when explaining what the specific employability skills are. This approach is reflected by the intentional blending of these two learning principles, an approach that is recommended in all subsequent instructional practice chapters and reflected in the icon to the right.

Confront Misconceptions and Explain

Second, the research team found that practitioners varied in how much they believed that individuals can continue to develop and grow in their proficiency in using employability skills. To foster greater acceptance that growth can take place throughout a technician's lifetime, the research team recommends focused use of reflection techniques around formative assessments of employability skills. The merging of the two learning principles of "Reflect" and "Grow" is recommended in all subsequent instructional practice chapters and reflected in the icon to the right.

Reflect and Grow

Chapter 3. The Preparatory Stage: *Becoming Aware of Employability Skills*

This chapter discusses where educators and employers may begin, providing insights and techniques on when and how to raise basic awareness of employability skills. For this phase of development, we draw primarily from interviewees who discussed the levels of awareness about employability skills that they wanted to see before high school graduation—but do not consistently see in either college graduates or working adults.

People develop employability skills long before they enter the workforce, but—according to many educators and employers interviewed—college-age and early-career technicians often don't appear to appreciate the critical importance of these skills and have had limited experience with them. To address this gap, educators and employers call for a greater focus on employability skills during middle school and high school, as well as continuing to develop these skills in the postsecondary years. They want educators to convey the importance of these skills for all kinds of careers, but particularly technician careers that sometimes are perceived—incorrectly—as not requiring skills such as writing, speaking, and negotiating with team members.

Many of the development techniques discussed in this chapter focus on approaches that interviewees from college and industry recommended for use in secondary-level academic courses, career technical education classes, dual enrollment courses, informal education activities, student clubs, and youth employment programs. However, these approaches may be used by college instructors and managers at any point in a technician's career to raise basic awareness of the importance of employability skills.

The most relevant literature concerning building basis awareness of the importance of employability skills comes from the K-12 applied research into 21st-century skills and social-emotional learning. The term "21st century" captures the skill sets young people need to develop today to prepare for future jobs and lives in which demands are constantly changing. Frameworks of 21st century skills usually include the employability skills of collaboration, communication, critical thinking, and problem solving. The literature on social-emotional learning includes related readiness skills and mindsets. For example, the skill set of emotional regulation prepares for effective interpersonal/teamwork skills, the growth mindset prepares for lifelong learning skills, and the skill set of self-regulated learning prepares for work ethic.

Raising Awareness About Relationship Skills

Interpersonal/teamwork skills

Starting points: Some signs that a learner of any age might need focused basic education and training on interpersonal/teamwork skills may include consistent display of ineffective behavior in group activities, such as aggression (e.g., personal attacks and persistent criticism) or passive-aggression (e.g., excluding team members, avoiding interaction). These behaviors may stem from weakness in the affective skills of emotional self-regulation, weak cognitive skills of understanding the different perspectives on a team, and/or a general lack of understanding about the central importance of interpersonal/teamwork skills in work and life.

Idea for raising learner awareness:

- **Confront misconceptions and explain:** In school and work, it is important to clarify that success in any career depends on being good at working well on teams. To set a foundation, testimonials by industry professionals or leaders are helpful. To familiarize learners with core concepts, one interviewee said he offers his employees Dale Carnegie courses; he recommended that high schools consider using these courses to teach students about themselves and how to relate to people.

- **Practice:** Although many education settings incorporate team projects and collaborative learning, such activities usually take place under adult supervision and structures that limit each learner's capacity to hone the skills to becoming an effective team member (e.g., learners engage in them half-heartedly to win short-term extrinsic rewards, such as teacher approval or a good grade). To develop greater intrinsic engagement in

developing interpersonal competence, encourage and incentivize learners to work through team conflicts independently and to participate in informal activities where they can take on greater leadership roles (e.g., part-time jobs, farming and environmental stewardship, sports, performing arts, civic or military service activities).

- **Support:** Rather than reward only those who succeed easily in teamwork, encourage and recognize learners who face conflict and show effort and growth in resolving term challenges, both in school and informal activities. Provide teams with tools to help them give constructive feedback to each other during and after teamwork and to help each team member understand personal strengths and growth areas related to collaboration.

- **Play:** To build intercultural sensitivity and skill, look for opportunities to engage learners in interacting with team members from different generations and backgrounds (such as socioeconomic status, family background, and home language).

- **Reflect and grow**: Include reflection and assessment during and after collaborative activities.

Communication skills:

Starting points: Communication is a multifaceted competency that takes many forms. Some of the signs that a learner needs support at the basic level may be an expression of preferences for some forms of communication and overt resistance to others, perhaps even noting that knowing how to write or speak is “not important.” One interviewee described a situation where an IT technician refused to talk to any colleagues on the telephone, directing them all to an instant messaging service. Learners may simply excel in some forms of communication but not in others. For example, some learners may appear shy in group settings but write clear, succinct memos. Others may shine when making presentations but struggle to compose pithy written communication. Still others may resist reading but show excellent abilities to listen. These are signs that a learner needs support in developing a basic awareness of the complexity of communication skills to set personal goals to improve in the different facets of these skills.

Ideas for raising learner awareness:

- **Confront misconceptions and explain:** In school and work, underscore the importance of clarifying that success in any career, even technical careers, depends on being effective at communicating in various ways¬¬ (e.g., spoken, written, listening,

reading, face to face, online). Industry professionals and leaders should clearly convey how much time they typically have spent writing or speaking or listening on the job in various ways, from email to telephone calls to meetings. Employers of new hires need to provide models and examples of preferred forms of workplace communication. Share research-based evidence, such as surveys of graduates, about the surprising level of importance of communication skills.

- **Practice:** Encourage technical students to take humanities courses or ensure that technician programs include required courses or coursework on developing the writing and speaking skills unique to career technical fields. This idea may be challenging to implement without high-level changes. Some interviewees noted that in many technician programs, there are few approved courses or incentives to enroll in these types of elective courses.

- **Support:** Rather than acknowledge only those who show a particular talent for communication, encourage and recognize learners who demonstrate effort and growth in communication and provide learners with rubrics and examples of quality communication.

- **Play:** Provide samples of a range of communication types (e.g., workplace memos, emails, presentations) presented to different workplace audiences (e.g., another technician, manager, division vice-president). Discuss the different approaches used to present technical information to audiences that are technical and nontechnical.

- **Reflect and grow:** Provide feedback and reflection tools not only on formal communication products, but also on everyday communication within groups and in class.

Raising Awareness around Personal Qualities

Openness to lifelong learning:

Starting points: Signs of a lack of understanding about the importance of continuous learning come in both direct and covert forms. For instance, a new employee may demonstrate arrogance because of having a credential or degree, failing to appreciate that there are many new forms of knowledge and skills specific to the workplace still to be learned. Or an employee may struggle with a problem for a long time without asking for help. These are signs that learners may be resistant to reflecting on their level of skill and knowledge and developing strategies to expand their skills. Often those who lack an openness to lifelong learning are laboring with the misconception that their capabilities are a fixed trait rather than something that can be developed through effort. Or these may be signs that the learner is unsure of how to approach and organize a complex learning task. The K-12 years are an ideal time to demonstrate to students what can be achieved through thoughtful effort with the support of structures like curriculum and strong teachers, but employers also can provide encouragement and support for staying open to learning.

Ideas for raising learner awareness:

- **Confront misconceptions and explain:** Discuss the pace of change in technology and global production methods in business over the past 25 years and describe the kinds of changes in available jobs and individual job responsibilities that have occurred. Offer experiences or exercises drawn from programs that raise awareness that learning and improving are possible with effort. For example by assigning similar tasks before and after a learning activity and facilitating reflective conversation on comparing task performance before and after.

- **Practice:** In secondary and postsecondary classrooms, where so much of the activity is scripted by instructors, provide learners with opportunities to figure some things out for themselves. Providing less structured learning opportunities may not be the most efficient way to reach content learning goals, but it provides learners with practice assessing their learning needs and developing learning strategies. In the workplace, interviewees described gradually structuring such activity, usually beginning with onboarding activities, such as initial training followed by job shadowing and a phase of mentoring by a more experienced peer.

- **Support:** Provide consistent encouragement for effort that is focused and productive—even when it does not arrive at the final desired product or solution at first. Provide a library of resources to support self-directed learning and make them accessible at the learner's convenience. To support learning, include estimates of time to study each reference and self-assessment tools.

- **Play:** Foster self-directed learning by offering recognition or some form of credit or incentive for independent study or enrichment. A secondary instructor can incorporate greater opportunity for independent study through showcases and extra credit. In the workplace, tuition recovery programs signal that learning on the job is valued, for example.

- **Reflect and grow:** Provide coaching, particularly to build confidence in independent learning and to help the learner navigate decision points along the path of self-directed learning (e.g., how to rescope the learning task to adjust to time constraints or limits in prior knowledge of a topic).

Adapting to Workplace Expectations:

Starting points: Those needing some basic awareness of what is colloquially known as "work ethic" may come off as self-absorbed, inclined to complain rather than offer solutions, or prone to hand in work that misses the mark. While it is tempting to overly correct such behaviors or rush to judgment, it may be that the learner suffers from a lack experience or role models in developing the capacity to adapt to workplace expectations or that the teacher or manager has failed either to model or set clear standards about demonstrating the interpersonal/teamwork skills associated with a pleasant demeanor and willingness to help, the initiative to help out with problems, and the dependability to engage in the level of work that is needed to get a task done and to show up reliably to work.

Ideas for raising learner awareness:

- **Confront misconceptions and explain:** In school and work, it is important to clarify that success in any career depends on being perceived as adapting flexibly to workplace expectations. For students, discuss how developing such adaptability in school builds habits that can transfer to the workplace. Besides providing examples through testimonials from industry professionals and leaders, consider reviewing the three basics of what is involved from the Occupational Work Ethic Inventory (OWEI) (Petty, 1993): interpersonal/teamwork skills, initiative, and dependability.

- **Practice:** During individual and team tasks, provide positive learners with feedback when they have demonstrated grace under pressure, helpfulness, resourcefulness, and dependability. While it is tempting to note how these elements are more obvious with some people and not others—as if they are fixed personality traits (Noftle & Robins, 2007)—embrace a more developmental approach of cultivating and strengthening these attitudes and behaviors in everyone. Consider using reciprocal communication techniques (e.g., *Crucial Conversations* [Patterson, Grenny, McMillan, & Switzler, 2002]) to engage learners who are seen as not doing their share of the work. These communication techniques are based on direct discussions to reach a solution; they are free from accusations and overt expressions of negative judgment.

- **Support:** Consider posting signs in a work area promoting the values of adapting to workplace expectations or developing a rewards or recognition program for those who demonstrate a solid commitment to work. Promote the importance of respectful and candid communication when there are different perceptions of the level of effort required to complete a task. Consider providing references and resources on how to engage in difficult conversations about meeting workplace expectations. Some schools and states enforce promptness by marking students as "absent" after they are tardy to class several times.

- **Play:** Encourage learners to review articles in the popular media that clarify the level of effort and resilience involved for individuals to achieve impressive feats in the technician field and ask them to highlight the evidence of productive commitment to work in action.

- **Reflect and grow:** Incorporate elements of the OWEI and Crucial Conversations into all team and project assessment tools so that learners can give and receive feedback and reflect on their own progress in demonstrating adaptability to workplace expectations.

Raising Awareness About Business Fundamentals

Situational Awareness:

Starting points: Employers described the signs that a learner lacks basic situational awareness in various ways. It may be that a candidate for a technician position is stuck for an answer in an interview with a higher level executive. It may be that an employee focuses narrowly on job-specific tasks without considering how personal timeliness or quality of performance affects others who rely on that team member's actions to complete their own work (e.g., not responding to emails, declining to return telephone calls, overlooking critical details in one's work, or failing to provide sufficient guidance or support to team members). Finally, it also may be that the employee lacks a sense of the bigger picture of what the company's products do for society or its customers. These are all signs that the learner needs help to shift beyond an egocentric or introverted perspective to one that turns outward and considers the needs of others to a greater extent.

Ideas for raising learner awareness:

- **Confront misconceptions and explain:** In school and work, it is important to clarify that success in any career depends on being aware of the larger mission of one's organization and how one's organizational role serves this mission. To familiarize learners with the core concepts of a company mission, the ideas of Stephen Covey for developing a personal mission statement are useful. Stories about how companies organize around missions is another point that can be emphasized in classroom visits by industry professionals or through initial onboarding by employers.

- **Practice:** As one way to develop situational awareness, an interviewee suggested including entrepreneurial elements in classroom project activities (e.g., how to address a need in society, how to develop a service that customers will pay for). Learning skill sets within real contexts was perceived as a possible way to help early-career technicians develop a more intuitive sense of how different tasks fit together to meet larger goals. Consider collaboratively creating a classroom or department mission statement. Once the statement is developed, post it in accessible locations so learners can reflect on how their tasks support that mission.

- **Support:** Consider providing tools for developing a mission statement or using a mission statement to guide one's decisions. Provide examples of different personal or company mission statements. Alternatively, provide examples of an elevator pitch—the situation where you pitch an idea to a top-level manager in the time it takes to ride in an elevator. This exercise could focus on a way to improve technical processes to achieve goals important to company management, such as cost savings or time efficiency.

- **Play:** Encourage learners to research and review the mission statements of similar organizations or individuals whom they admire.

- **Reflect and grow:** Offer tools for assessing the quality of mission statements and encourage regular review and updating of the mission statement. Foster periodic reflection on how to improve each learner's individual contribution to achieving the mission.

Considerations for Groups Underrepresented in Technical Fields

Find pathways for exposing girls and students of color to technical fields: A key challenge in building employability skills in technicians is the lack of early exposure to such fields among girls and students of color. Entering these fields can be intimidating when no one at home or in one's life has provided encouragement or experience. It can lead to a particular employability skills challenge: lack of confidence. This type of mindset colors the learner's level of engagement in technician work and may be misunderstood by both instructors and hiring managers as a lack of "work ethic," for example. Selection processes for technician education opportunities often rely heavily on subjective perceptions, which can be hampered by problems of implicit bias—where the interviewer makes decisions based on unconscious attitudes or stereotypes.

Suggested approaches: Some interviewees suggested that building awareness of what technical careers exist and what the day-to-day work is like would go a long way toward improving diversity. They argued that low numbers of students in some underrepresented groups are not the result of barriers in the community college system or workplaces but are due to some young people (girls in particular) not seeing fields like information technology and advanced manufacturing as possible career tracks. One interviewee suggested that at the K-12 level, students could be encouraged to engage in self-testing

to better understand their job interests and strengths to discover a hidden potential for technical careers (IT17IND). Another employer interviewee (IT15IND) partners with nonprofit organizations such as the Girl Scouts to engage young people in STEM activities and raise girls' awareness of STEM careers.

Other interviewees discussed the societal problems of bias, stereotyping, and racial and ethnic segregation as barriers. According to research, the evidence of these barriers is that a higher proportion of African American, Hispanic, and Native American youth ages 16 to 24 are disconnected from school and employment, which poses a problem for developing the employability skills. To meet their needs, studies have identified common features of programs that have attained successful graduation and employment outcomes. For example, such programs provide internships supported by coaching and wraparound basic services for transportation, housing, and financial literacy. Often these programs also include focused presentations on the importance of the employability skills of communication, teamwork, and work ethic, as well as classroom-based activities to rehearse the skills. (See Chapter 4 for more on classroom-based approaches.)

Another approach to addressing societal barriers involves measuring the rates of different demographic subgroups in participating in and completing technician courses and work-based learning opportunities. For example, organizations may consider conducting an audit of participation among women and students of color in work-based learning opportunities in technician fields. Such audits are stipulated by the 2018 Carl D. Perkins Career and Technical Education Act (Perkins V) and focus on gathering quantitative data that track the numbers of "nontraditional" students (e.g., girls) who are enrolled in courses and work-based learning opportunities in technician fields.

Program Example

Who: Ernest Friend, Florida State College at Jacksonville

What: Dual enrollment IT outreach program for girls

Where: Coordinates with two Jacksonville high schools and two international business partners

Learning principles: Practice

URL: https://www.fscj.edu/academics/college-readiness-programs/dual-enrollment

Florida State College at Jacksonville has used secondary outreach to increase diversity in its IT programs and to give younger students practice in engaging in teamwork and communication skills with college-level peers. For the past 4 years, the dual enrollment IT program has specifically targeted 11th- and 12th-graders, with a special focus on recruiting girls. Those electing to enter the program may complete the 2-year certificate before they finish high school. The outreach involves parents, too. While some dual enrollment courses are taught at high school campuses, the IT team prefers to hold the security classes at the college each morning 4 days a week because it really "raised the bar for them when they get to be with adults." The students take a school bus to the college for the courses. The experience introduces the youth not only to the IT content and field, but also to the practices of communication and teamwork that are most useful when interacting with older college students. In addition, the college students also hone their skills of helping the younger students.

Chapter 4. The Foundational Stage: *Classroom Practice for Employability Skills*

This chapter discusses how educators and employers may offer classroom-based experiences that support practice, reflection, and feedback around employability skills. For this phase of development, we draw primarily from research discussing activities used in the first two years of college.

Once made aware of the importance of employability skills, learners can benefit from opportunities to rehearse, refine, and improve these skills. Such activities are helpful to "unlearn" unproductive beliefs about employability skills, such as "teamwork is bad," "learning is something done only in school," or "becoming a technician means not having to focus on writing, reading, or speaking." Many of the resources for this chapter draw from college classroom interventions intended to provide practical experience to develop interpersonal/teamwork and communication skills. For the other employability skills, the research team relied on research literature from industrial or organizational psychology.

Foundational Understanding of Relationship Skills

Interpersonal/teamwork skills

Starting points: Learners at the starting point of interpersonal/teamwork skills development may worry about getting personal credit for their individual contributions, frequently express concern about how to manage "free riders" who fail to do their share of the work for the team, or overreact to the predictable conflicts that come with team efforts. Learners at this level may fail to appreciate the unique contributions of each team

member to an effort and may even engage in egocentric comparisons, measuring other team members against their own unique talents. At this level of interpersonal/teamwork skill development, the challenge for the instructor or manager is to help these learners concentrate on team goals rather than individual ones, notice the diverse skills of other team members, and understand strategies for managing productivity problems. It also helps to set realistic expectations for teamwork, understanding that some team conflict is natural. Instructors and managers should expect to provide foundational learners direct guidance to resolve team conflicts, and they are likely to be asked to serve as referee for team conflicts; this ability may be particularly challenging to develop and require dedicated training for instructors and managers. Both research and interviews indicated that team friction may be particularly notable in IT courses, with students feeling uncomfortable with team members who are different from them (e.g., in gender or race or ethnic background) and needing support to navigate misunderstandings.

Ideas for supporting foundational learners:

- **Confront misconceptions and explain:** Gently challenge or question when a learner complains about failing to get individual credit or criticizes team members. Steer the learner toward finding positive ways to focus on the team accomplishment, giving each team member an opportunity to shine in a unique way, and cultivating a mindset that is open to learning from and relying on other team members for productive work.

- **Practice:** Engage learners in preproject teamwork exercises and set up team projects involving between three and four members who are different in skill, experience, and/or cultural background. Provide simulated work experiences in face-to-face and/or virtual forms to support practice in teamwork.

- **Support:** Help troubleshoot team tensions as needed, but focus on providing solutions that help learners manage challenges and conflicts independently. For example, provide tools and techniques for managing team members who routinely show up late, skip meetings, or fail to turn in work on time. Ensure project teams have a regular time to check in with the instructor/manager to discuss not only technical aspects of the work, but also aspects related to team dynamics and regulating their own emotions. Model and reward honest and respectful feedback.

- **Play:** Engage learners in using tools for noticing their own emotions and the emotions of others on a team and for developing strategies for managing emotions effectively.

- **Reflect and grow:** Provide teams with both self-rating and 360-degree peer rating rubrics to raise awareness about these skills and discuss the results relative to lessons learned. To reduce inaccurate peer assessments—such as inflated ratings to curry social favor or artificially low ratings to exclude or retaliate against team members—use multiple measurement strategies concurrently (e.g., both observational and self-reported).

Communication skills:

Starting points: Learners may avoid writing and speaking and seem to lack confidence in expressing themselves in group settings. The challenge in this case is to give the learners practice and coaching, being sure to provide some models and experiences to support foundational practice with work-relevant forms of communication.

Ideas for supporting foundational learners:

- **Confront misconceptions and explain:** Gently question when a learner expresses self-doubt about speaking or writing. Call on the learner who consistently avoids participating in a discussion or expressing a point of view. Emphasize the importance of having all perspectives expressed to arrive at the best result. Provide stories from workplaces where clear and candid communication saved the day.

- **Practice:** Foster the use of "work-relevant" forms of reporting and writing. Engage learners in reviewing and discussing guidelines for effective techniques for presenting information and participating in job interviews. Videotape team presentations and mock job interview sessions and then review them with the learners to identify more and less effective communication strategies. Offer opportunities to practice these skills by inviting future employers in to observe team presentations or by inviting managers from other workplace divisions to review department presentations.

- **Support:** Provide examples of work-related genres of communication (e.g., progress reports, memos). Offer praise for effective communication. Offer alternative approaches to improve less effective forms of communication.

- **Play:** Encourage learners to first consider what their audience wants and needs to know through games where team members take on different roles.

- **Reflect and grow:** Provide rating rubrics to help guide and improve basic forms of workplace-relevant communication. Provide timely feedback on all written and oral communication products to help to improve grammar and presentation skills.

Foundational Understanding of Personal Qualities

Openness to Lifelong learning:

Starting points: The learner may display a reluctance to ask questions and seek help. This may be a particular challenge with technicians since part of the attraction to technical work is pride in being the one who can solve the technical problems that few others can. However, interviewees consistently noted that technicians will be expected to engage in continual on-the-job learning to adapt to a specific company culture and to continual changes in the processes and technologies of their workplace and industry.

Ideas for supporting foundational learners:

- **Confront misconceptions and explain:** When a learner appears to be silently struggling, gently check in to see how things are going. Sometimes simply doing this permits the learner to ask for help. Making the learner aware of resources and the availability to consult with more experienced peers also may help.

- **Practice:** Design lessons and work tasks that stretch but don't overwhelm learners—creating assignments that have some similarity with those they've completed before but that require additional knowledge of skills or that require them to apply what they know in one situation to a new situation. Provide tips on how to attack the problem, such as assessing their relevant past knowledge and skills to address the problem and adapting what they have learned in previous situations to the new challenge.

- **Support:** Provide learners with resources to continue learning, such as introducing them to reference manuals and online professional community spaces.

- **Play:** Provide an exercise where teams pitch an idea to a group that is preseeded with "cards" that represent specific common failures or rejections (e.g., lack of budget, not aligned with company mission, unpredictability in company leadership, lack of sufficient team know-how, mechanical breakdown). Once presented with these "rejection cards," the teams each practice brainstorming pivots and shifts in direction, identifying what they need to learn to adapt to the new conditions.

- **Reflect and grow:** Provide opportunities to repeat the same tasks over time and encourage learners to compare their work products over time so that they learn to recognize signs of their own growth.

Adapting to Workplace Expectations:

Starting points: Signs that a learner needs some foundational experience in adapting to workplace expectations come through in uneven performance in the different aspects of this employability skill. For example, the learner may display positive interpersonal/teamwork skills but fail to deliver work products on time; the learner may be efficiently productive but appear stingy and unwilling to help others on the team; or the learner may eagerly volunteer to take on tasks but then become overwhelmed and underperforming. To build a person's adaptability to workplace expectations at the foundational level, the instructor or manager needs to focus on cultivating habits of planning before doing tasks and reflecting after the task is completed on what facets went well or which could be improved. Such activities help with time management, which is a critical observable behavioral element of adapting to workplace expectations.

Ideas for supporting foundational learners:

- **Confront misconceptions and explain:** Clearly set expectations for being positive, helpful, dependable, and reliably punctual at the outset of classroom-based projects. Offer guidelines on how to manage time, identify areas where you can help, and ensure that you take on a reasonable share of the load and can deliver results.

- **Practice:** In advance of projects, ask learners to list the common types of situations that can lead to challenges in time management, punctuality, and attendance. Encourage learners to plan strategies they will use should any of these challenges emerge during projects.

- **Support:** Provide time management tools during the project, including those learners are likely to find useful in the workplace (e.g., Gantt charts, to-do lists, apps for multitasking). To help learners understand expectations about effort and productivity, provide guidelines on how to estimate how long it typically takes to complete assigned tasks and check in frequently to ensure the effort is moving toward completion. Praise learners when they demonstrate punctuality, effort, and habits of advance notification. Incentivize timely attendance and preparedness in both course grading formulas and in setting baseline requirements for participation in internships and cooperative education. Foster transparent record-keeping of punctuality and absences.

- **Play:** Develop rituals for celebrating team members' efforts that reflect effective responses to unanticipated challenges.

- **Reflect and grow:** In project rubrics and after-action reviews, include individual and team ratings of punctuality, attendance, timely task completion, and resourcefulness. Particularly helpful is for individual team members to compare their self-ratings of their performance with how their team members rated them. Support reflection activities after learners complete tasks through discussion or written reflections, helping them review how long it took to do the work. These types of reflections support improved planning and time management in the future.

Foundational Understanding of Business Fundamentals

Situational Awareness:

Starting points: Signs that someone is struggling at the foundational level of situational awareness include procrastinating or ignoring requests from others on the team during the project. It may also include rushing into doing specific tasks before engaging in sufficient consultation with stakeholders or completing an overall project plan.

Ideas for supporting foundational learners:

- **Confront misconceptions and explain:** Set clear expectations about taking some time to identify key stakeholders to be served with your project and to consider their needs and how the project can meet them. Emphasize the need to balance planning with iterative input from stakeholders.

- **Practice:** To foster greater understanding of complex organizations, consider creating work simulations that involve planning changes in technology or team activities that blend learners from different classes, majors, or work divisions.

- **Support:** Provide learners with information about business trends in their technician field so they can anticipate the kinds of evolving situations they are likely to need to manage. Provide ways for learners engaged in actual work or work simulation activities to observe, note, and reflect on system-level changes taking place in their field.

- **Play:** Have learners engage in an exercise where they adopt different roles in a specific project, such as manager and technician, they individually reflect on what they

need to know and do to complete the task, and then they share those perspectives with each other in a discussion.

- **Reflect and grow:** Create assessments for projects and tasks that not only require technical proficiency, but also assess how business factors (e.g., equipment costs, competitive advantage, training costs, technology refinement and integration costs) affect strategic decisions about workplace technology.

Considerations for Groups Underrepresented in Technical Fields

Watch assumptions and judgments about a learner's "work ethic": Findings from the interviews indicated that both educators and employers rely heavily on "lay theories" to rationalize why some learners appear to have a strong capacity to adapt to workplace expectations and others do not. This rather commonplace perspective treads on some controversial ground. For example, social psychologists have documented relationships between how rigid someone's expectations are about "Protestant work ethic" and his or her level of implicit bias against African Americans and the elderly. Similar patterns emerged with bias against "millennials" in this study's interviews.

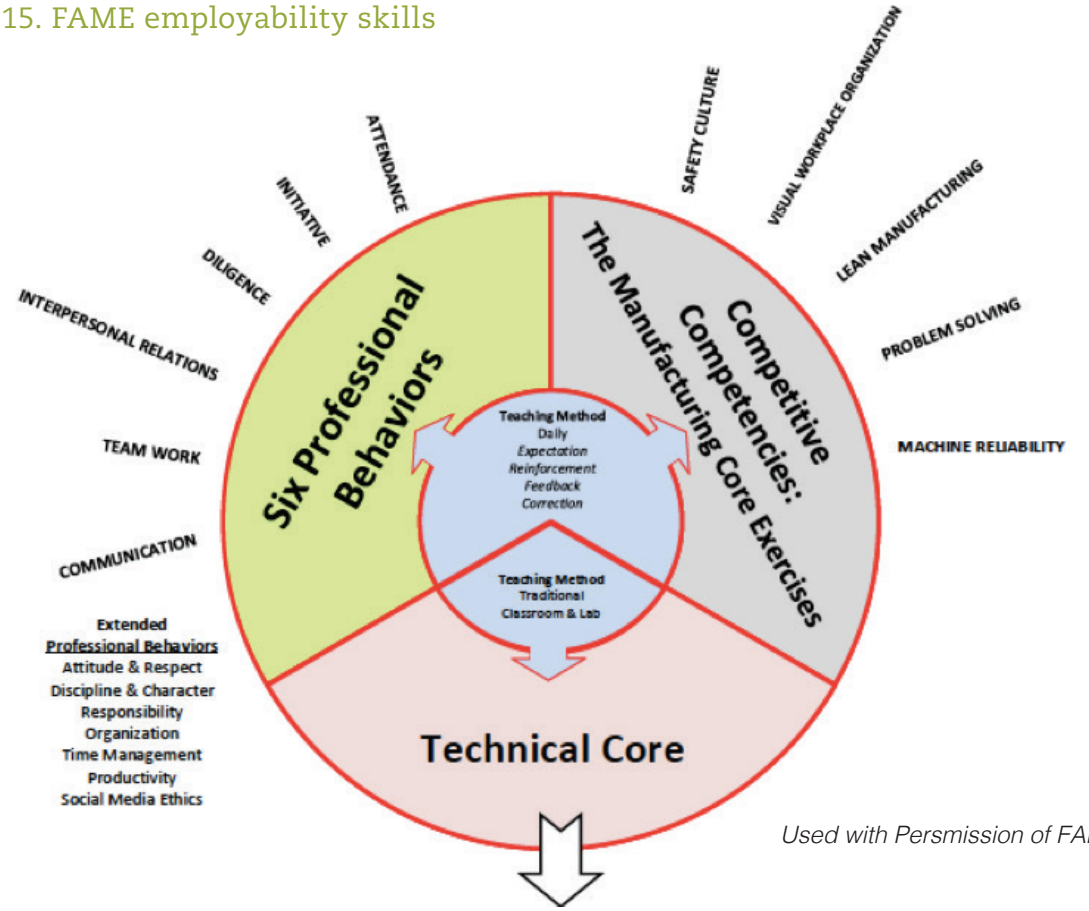
Suggested approach: Before rushing to judgment, take steps to inquire of the learner directly and respectfully, noting which behaviors contradict your own expectations. Once this inquiry is completed, decide on next steps for coaching and support. For example, advanced manufacturing educators who used this approach learned that students and adults from low-income backgrounds showing weak punctuality or attendance frequently lacked access to reliable transportation, child care (including backup care), or doctors who could document serious medical conditions. They found students sometimes felt shame and vulnerability in discussing these circumstances. The educators began to help connect students with services like discounted bus passes and resources to establish backup plans for transportation and child care. Advanced manufacturing employers described the importance developing strong communication skills in managers so companies can stay informed about employee needs and develop supplemental supports.

Program Example

Who: Dennis Parker, Toyota
What: Federation for Advanced Manufacturing Education (FAME) (KY)
Where: 31 locations in 13 states
Learning principles: Confronting misconceptions, explaining key concepts, practice, reflect & grow
URL: http://fame-usa.com/

FAME is a comprehensive foundational employability skills development program created by Toyota. It clearly defines desired employability skills and provides education methods (Exhibit 15). This program is used by nearly 300 partner employers in multiple industry sectors, from oil and utilities to cosmetics. Employers that use it as part of "earn-to-learn" degree partnerships with technical and community colleges. FAME also offers the Advanced Manufacturing Technician (AMT) Academy, a 2-week, 8-hour-a-day summer training session for employers and their partners at technical and community colleges. Learners engage in activities where they have to present information publicly, dress professionally, work on teams, and practice the other employability skills. Starting as of 2019, the National Association of Manufacturers' (NAM) Manufacturing Institute has adopted the FAME program as its national workforce program.

Exhibit 15. FAME employability skills



Used with Persmission of FAME USA.

Chapter 5. The Apprentice Stage: *Work-based Application and Reflection for Employability Skills*

This chapter discusses how educators and employers may coordinate experiences to bridge classrooms and workplaces to provide real-world opportunities to apply employability skills. For this phase of development, we draw primarily from research discussing activities used in the final two years of undergraduate programs and throughout graduate programs. In some cases, the research team needed to generate some techniques by drawing from the literature on industrial or organizational psychology and popular articles in business management and human resources.

After having the opportunity to participate in structured classroom exercises to apply employability skills, learners can benefit from applying the skills in an actual work setting. Structured forms of work-based learning—such as cooperative education and apprenticeships that combine authentic work experience with school instruction—have been increasingly recognized as a way to prepare youth for college and career. Particularly useful during transitions from formal education to the workplace, structured work-based learning also helps support better alignment of education and industry learning requirements. Work-based learning refers not only to cooperative education, apprenticeships, and internships, but also to any form of classroom instruction that brings real workplace cases or working professionals into the classroom or that helps students prepare for and reflect about learning from work experiences. Further, depending on the nature of the work-based learning experience, employers may count it in making hiring decisions.

While these applied practices assume that learners have had some basic exposure to past employability skills instruction, the educators and employers participating in this

research repeatedly noted that it would be incorrect to assume that every student or new employee comes with adequate readiness to apply employability skills effectively. The early experiences with work-based learning are a time for experimentation and learning from mistakes—within reason. Further, working for outside employers usually involves careful preparation and screening. Both educators and employers use various techniques to gauge someone's readiness for work-based learning activities: third-party referrals, direct observation, and gatekeeping assessments. They also use such data to personalize instruction for learners during internships, developing clear goals for the experience. The research indicated that most educators schedule work-based learning *later* in the academic learning cycle (e.g., capstone courses) and most employers schedule such activities *early* in the workplace onboarding process (e.g., coaching and mentoring).

Learning to Apply Relationship Skills

Interpersonal/teamwork skills

Starting points: Making the transition from a school team project to a workplace team presents some challenges as learners shift from working with a single teacher and a group of classroom peers to working with several managers and coworkers who are more mature, more experienced, and possibly located at multiple remote sites. Given these new variables, the odds increase that a learner can miss a signal or request from a team member and wind up letting down the team. To help learners manage the challenges of the applied workplace context, the instructor and manager should help learners (1) take a proactive approach to clarifying the tasks and deadlines for the team, (2) manage their emotions and behavior with minimal expectations for a teacher or manager to resolve conflicts, and (3) learn to identify which coworkers in the workplace can serve as role models or critical friends to help the learner grow and develop. The literature discussed techniques to develop applied team behaviors and attitudes.

Ideas for preparing to engage in applied experiences:

- **Confront misconceptions and explain:** While learners may think technical or academic skills are most important for a work-based learning experience, convey how closely they will be observed for their demeanor in all interpersonal interactions during work-based learning experiences. Explain methods for handling various types of potential workplace team conflicts, such as asking for assistance and negotiating when an assigned work task is larger than expected or likely to take longer than the supervisor expects.

- **Practice:** Require learners to describe the teams they're interacting with during work-based learning experiences. Have them note when managers and team members at the work site demonstrate effective methods of utilizing the diverse skills on a team and ensuring productivity. Have them develop a stretch goal to engage in one critical team-related task during their work-based learning experience, such as setting up and coordinating regular meetings for the team and providing support for a team task.

- **Support:** Ensure those involved in work-based learning have a way to check in regularly with a workplace and/or school mentor. Create the conditions for more experienced peers in the workplace to serve as mentors or to be observed during job shadowing activities. Keep in mind distinctions between learners with more and less work experience; more experienced students may rely less on instructors for conflict resolution but may benefit from guidance on identifying unique talents of team members.

- **Play:** During work-based learning, encourage learners to use tools to consider the different perspectives on work tasks they have observed on the job (e.g., Kolb's [1984] learning styles rubric). Such reflective activities help learners appreciate diverse points of view in the workplace.

- **Reflect and grow:** Use standard rubrics, team grading, and regular conversational check-ins that permit discussions about interpersonal/teamwork skills and team processes that work well or could use improvement.

Communication skills:

Starting points: Communicating in a work setting differs from the communication routines of school. While communication in school is largely to permit a teacher to assess whether a learner understands key concepts and can perform procedures adequately, work communication centers on discussing technical matters that support task completion and demonstrating affective skill in supporting one's team. To help learners develop such applied skills of communication, instructors and managers told us that they focus on practice and building confidence in both technical forms of communication (e.g., providing technical explanations and proficiency in writing memos and providing oral summaries of project status to fellow team members) and more affective forms of communication (e.g., picking up on nonverbal signals about coworkers' moods, making sure to convey interest and confidence in one's demeanor and expressions, scheduling times to talk about work processes and expectations, and using appropriate strategies to recruit support for specific tasks).

Ideas for preparing to engage in applied experiences:

- **Confront misconceptions and explain:** Set goals for work-based learning experience to gain new insights on how to communicate effectively and practice communication skills. Differentiate between technical forms of communication and affective forms of communication relevant to the workplace.

- **Practice:** Encourage learners to practice a range of communication types during work-based learning assignments, such as writing memos and making brief status reports to a work team. Provide opportunities to practice making presentations about lessons learned during the work-based learning experience.

- **Support:** Encourage learners to seek out company communication templates and materials, such as videos, written examples, templates, and rubrics

- **Play:** Before learners seek work-based learning opportunities, offer both practice job interview sessions and rapid job networking sessions so learners can develop a better understanding of what employers want and how to present themselves. Offer opportunities to practice virtual communication, including choosing online tools and scheduling meetings with team members who may be in different time zones.

- **Reflect and grow:** During the work-based learning experience, use standard rubrics or regular conversational check-ins on presentations and written products to support improvement over time. Praise learners when they communicate effectively and credibly using the specific terminology of a technical area.

Learning to Apply Personal Qualities

Orientation to Lifelong learning:

Starting points: While it is common to associate education settings with learning, many adults fail to associate the workplace with learning. Yet research indicates that adults devote between 200 to 650 hours a year in self-directed learning (Livingstone, 1999), and most of that pertains to work. Employers reported expecting interns, new hires, and experienced employees to continue to learn while on the job. They also reported investing in this process, offering extensive training programs to prepare new employees for the technical and cultural demands of their jobs. In some cases, lengthy classroom training programs were paired with mentorship programs to start recent community college

graduates on a path of continued learning on the job. To help learners apply lifelong learning to the work-based learning, instructors and managers should prepare learners to note opportunities to learn more using both short-term methods (e.g., self-directed learning through available print and online reference resources and informal guidance) and long-term methods (e.g., self-directed learning through online courses and simulations and structured mentoring).

Ideas for preparing to engage in applied experiences:

- **Confront misconceptions and explain:** Prepare learners to learn while in the work-based learning experience. Encourage them to ask questions, look up published company learning resources, and identify mentors at the work site. Encourage them to identify areas of interest for future learning.

- **Practice:** Provide opportunities for interns and early-career employees to learn from mistakes on the job. This is only possible when there are low-stakes activities with limited impact on the bottom line. Look for practice opportunities where a mistake would not be costly and let employees know they can ask questions as they work. Employers also reported success with training programs that included extensive up-front classroom training and closely supervised work with more senior employee mentors. These mentorships provide opportunities to reflect and learn from experience and mistakes.

- **Support:** Provide opportunities for technicians and interns to have their work checked by mentors in both school and the workplace. For example, a technician could attempt to resolve a client technical issue alone and then vet the solution with a more experienced employee or school mentor before putting it into practice. Provide access to well-organized information resources to support on-the-job learning.

- **Play:** Encourage learners to discuss with their mentors how they learn on the job. Share your own experiences of learning on the job. Have groups of learners share their on-the-job learning experiences when they return to a classroom setting.

- **Reflect and grow:** Provide regular specific feedback and work with early-career employees to draw generalizations from the specifics. For example, rather than repeatedly providing feedback about team miscommunication, discuss communication skills and ways to develop them with the employee or intern directly.

Adapting to Workplace Expectations:

Starting points: Research has confirmed that during work-based learning, supervisors of apprentices use observations to monitor their capacity to adapt to workplace expectations. Research also suggests that workplace novices involved in work-based learning are more likely to demonstrate constructive attitude, helpfulness, and basic dependability than taking the initiative to improve workplace processes (although some young learners may vary from this pattern, such as the story about a young Steve Jobs in his days working for Nolan Bushnell at Atari). Past studies on how learners transition from school to career emphasized that learners set learning goals in the workplace based on their sense of self-efficacy in specific work tasks and their expectations of how their performance will be rewarded or acknowledged.

Ideas for preparing to engage in applied experiences:

- **Confront misconceptions and explain:** Work ethic remains viewed as abstract and hard to discuss. Provide learners with examples of good work ethic and concrete descriptions of behaviors perceived as demonstrating good work ethic. Set specific expectations about workplace expectations in agreements with employers offering students work-based learning experiences. Help employers understand that their ideas of work ethic may differ from those of interns or apprentices: Research indicates that new workers are more likely to focus on positive attitudes than suggesting ways to improve work processes.

- **Practice:** Consider discussing principles of work ethic in a classroom setting first, and then ask learners to apply or observe these principles in their work-based learning experience. Then discuss the results or findings with the class. Have learners discuss with their workplace managers their personal commitment to punctuality, attendance, positive demeanor, and dependability at the beginning of the work-based learning experience.

- **Support:** Provide checklists and glossaries of the different facets of work ethic. Provide various ways for learners to discuss and describe expectations and experiences regarding work ethic on the job. Note that research indicates supervisors make assessments of work ethic based on observations.

- **Play:** Encourage learners to take colleagues, coworkers, and/or workplace managers to lunch to learn about the different perspectives toward work and work ethic. For example, discuss work-life balance and the kinds of situations that demand adjustments to those general guidelines.

- **Reflect and grow:** Have learners keep a journal of the work-based learning experience to support reflection on their own self-efficacy regarding different work tasks. Encourage them to stretch their reflections to consider ways they can assist effectively on works tasks. Celebrate success in maintaining a positive and helpful demeanor during challenging work-based learning situations and maintaining records of dependable attendance and punctuality.

Learning to Apply Understanding of Business Fundamentals

Situational Awareness:

Starting points: During work-based learning experiences, learners are likely to concentrate primarily on gauging their self-efficacy in assigned work tasks and deciding if they feel inclined to pursue a career in the field. While this personal exploration is critical, learners should be encouraged to step back and learn more about the business and its role in society during these experiences, too. Having this larger view offers another avenue for career exploration, particularly whether the work will align with personal goals and values. Job candidates can set themselves apart by displaying an understanding of the business. One of the useful theories to inform such explorations is self-determination theory. This theory guides learners to consider not only their self-efficacy (competence) in a field, but also the degree to which they feel a sense of belonging in it (relatedness) and a sense of agency (autonomy) within it.

Ideas for preparing to engage in applied experiences:

- **Confront misconceptions and explain:** Learners may see the work-based learning experience as a type of audition and have high anxiety about it. Reframe the experience as an opportunity to determine how much the actual technical work and the mission of the company align with their interests and provide them with a sense of satisfaction.

- **Practice:** Either during or before work-based learning experiences, encourage learners to do some research on the company's history. This may include reviewing biographies of the company's founders and reading news reports on its recent initiatives. Foster reflection and discussion about how much the company's mission aligns with the learners' personal values.

- **Support:** Establish a culture in the classroom where it is comfortable to discuss how much or how little congruence a learner feels with technician work and company culture, and to notice the differences between the culture of school and the workplace.

- **Play:** Consider bringing in a panel of technician professionals into class and having each share their personal connections to their work and their view of the societal importance of the field they are working in.

- **Reflect and grow:** Various questionnaires are available to foster reflection on competence, relatedness, and agency in the workplace. These offer a more formal method of gauging one's true feelings about a work-based learning experience. The results also may offer fodder for more discussion that could inform a range of decisions about whether to pursue work in a field. Such results may also help educators improve the relationship with employers offering their students work-based learning experiences.

Considerations for Groups Underrepresented in Technical Fields

Make Space for Late Discovery of Technical Talent and Passion: Given the limited exposure to IT and advanced manufacturing technician work that women, African Americans, and Hispanics have in their childhoods, work-based learning becomes a particularly critical component of programming designed to improve diversity in these fields. The interview data indicate that access to such opportunities remains inadequate, and several interviewees discussed the logistical challenges of assuring enough local employers were offering work-based learning experiences. Further, research indicates that the prevalence of learners studying technical subjects in a second language provides an opportunity for educators to build cross-cultural awareness and proficiencies highly relevant to the workplace through work-based learning experiences.

Suggested Approaches: The interviews conducted for this research indicated that the primary method for expanding work-based learning opportunities is to hire dedicated school personnel or contractors to conduct industry outreach and prepare learners to demonstrate basic employability skills during work-based learning experiences. Another approach emerging from industry is for many employers to pay a membership fee to an intermediary organization that either represents an industry sector or local businesses

in general in supporting various forms of education outreach. Resulting work-based learning experience may include competitions, field trips, provision of mentors and role models, and internships. A particularly original approach involved "technology mobiles" that travel out to places where youth congregate informally, such as football games, and invite them to try out technology in a hands-on way. Such efforts may be augmented with support from instructors, guidance counselors, and employers who can spotlight the achievements and experiences in these fields by nontraditional learners.

The interviewees—particularly the educators—thought there were significant barriers for groups underrepresented in technical fields wishing to enter the workforce. Several cited the discrimination and bias women face when entering these careers that can make early-career success difficult. The literature indicated that English-as-Second-Language (ESL) learners may face similar barriers. To provide support, educators work on raising awareness of bias and discrimination among all students. Some educators use scenario-based problem solving. One example an educator described was having a group of women students work out possible responses if they are the only woman on a job and male colleagues share tools with one another but not with them. To build cross-cultural sensitivity, the literature described leveraging the existing differences in technical classrooms with students who are first-language and second-language learners—creating groupings and guidelines around how to interact effectively across languages and cultures. Providing opportunities to think through these circumstances in advance allows the students to be prepared if they face these problems in their jobs.

Another frequently cited barrier to success is the constellation of challenges that low-income people face early in their careers. Commonplace expectations to arrive at work on time and to stay focused on work all day can be challenging if reliable childcare, healthcare, and transportation are out of reach. Several educators talked about helping students who regularly missed class because of these kinds of challenges to connect with services such as bus passes and look for services that the student will be able to continue to rely on into their first jobs.

Program Examples

Who: Maurice Capillaire, Industry Staffing Agency (CA); Wyn Wilson, Work Training Staff Specialist (MI)

What: Center for Applied Competitive Technologies, College of the Canyons (CA) & Lansing Community College (MI)

Learning principles: Confronting misconceptions, explaining key concepts, practice, reflect & grow

URL: For Lansing Community College: https://www.lcc.edu/academics/areas-of-study/computers-engineering-technology/apprenticeships/index.html and https://lcc.edu/services/ces/

Some colleges supplement classroom support for employability skills with classes and services provided either by a contractor or a dedicated staff member. These specialists often have useful connections with local employers, either providing staffing outreach for industry or outreach regarding part-time, full-time, or internship opportunities. College of the Canyons hires a contractor who teaches a weekly class for an academic term to adults entering a manufacturing industry. This contractor focuses on resume writing, practice interviews, coaching in emotional intelligence, and employer visits. In particular, he strives to help learners identify their own personal values and talents so that they are better equipped to assess whether a job (or work-based learning experience) resonates with them on deeper level. Lansing Community College has Career & Employment Services office for the college as a whole. In addition, there is a group in the Technical Careers Division who works exclusively with the technical career students. Trades Technology Services has four staff members, including two full-time staff members who identify internship opportunities and degree relevant part-time and full-time entry-level opportunities. One staff member provides workshops to support employability skills for IT students. The Lansing program also revolves around a staff member who serves as a single point of contact for local employers and who sends out weekly emails to students featuring job opportunities. The staff member also offers individual appointments and classes to review job postings, develop resumes and cover letters, and refine interview skills. The program features special events bringing employers to campus, including an IT speed networking event with a couple of dozen local employers, hallway tables with visiting employers, and information sessions with hiring managers.

Chapter 6. The Workforce-Ready Stage: *Deepening On-the-Job Learning of Employability Skills*

This chapter discusses how employers may provide ongoing opportunities to develop employability skills, coordinating with education partners as needed to provide focused seminars and courses. For this phase of development, we draw primarily from research into activities used by both managers of technicians and educators of incumbent workers in technician fields. In some cases, the research team needed to generate some techniques by drawing from the literature on industrial or organizational psychology and popular articles in business management and human resources.

While opinions remain divided about how malleable employability skills are once a learner reaches adulthood and enters the workforce, this chapter takes the perspective that employability skills may be developed throughout a lifetime. This chapter also provides some elaboration on how employability skills take slightly different developmental trajectories in the fields of information technology and advanced manufacturing as a result of their different work contexts.

On-the-Job Development of Relationship Skills

Interpersonal/teamwork skills

Starting points: Once a worker has secured a position in a technician field, future advancement and promotion depend almost as much on the employee's interpersonal/teamwork skills—particularly those associated with taking leadership—as on technical

acumen. Interpersonal/teamwork skills become especially important if a technician hopes to shift to a management role. The challenge for the manager is to note when a technician shows either strong potential or notable lapses in interpersonal/teamwork skills and then use a variety of coaching techniques and on-the-job tasks to guide the learner toward developing these skills further.

Ideas for supporting on-the-job development:

- **Confront misconceptions and explain:** Clarify the importance of interpersonal/teamwork skills for career advancement in technician fields. Explain how empathy plays a role in customer service and how timely and open communication supports effective teamwork. Give examples of career pathways in the company and explain the role of employability skills in pursuing those paths (e.g., expert technician vs. management).

- **Practice:** Consider setting up an extended onboarding experience during which a new hire is partnered with a mentor to provide classes and coaching. For IT technicians, this training may include practice fielding different types of calls to a help desk followed by debriefs with a mentor on recorded and transcribed interactions. For advanced manufacturing technicians, this might involve taking a Dale Carnegie course sponsored by the employer.

- **Support:** Convey that making mistakes in interpersonal interactions is expected and model appropriate forms of feedback. Several information technology and advanced manufacturing employers discussed the importance of noting when employees succeed.

- **Play:** Consider offering role-playing exercises to learn how to interact with customers and team-building games to learn how to develop trust and interdependence among work colleagues.

- **Reflect and grow:** Provide frequent feedback on interpersonal strategies that are successful in the company for smooth teamwork. Several employers discussed the importance of taking the time to talk to employees face to face over coffee or lunch to provide supportive input on how to manage challenging social interactions.

Communication skills:

- **Starting points:** Research underscores that many computer science and engineering graduates are surprised when they discover how much time they devote in the workplace to communication tasks. Top skills include listening, conversing, following instructions, and giving feedback. Graduates also have noted the need for making presentations and having strong reading and writing skills. As with interpersonal/teamwork skills, job applicants with past experience in customer service or sales might want to emphasize it to underscore their communication skills.

Ideas for supporting on-the-job development:

- **Confront misconceptions and explain:** Explain that the greater reliance on software-as-a-service in IT fields and lean management and flexible automated systems in advanced manufacturing mean that tasks change more rapidly, which requires more communication. Give clear examples of the pace and frequency of communication required to do the work.

- **Practice:** Help new technicians understand the finer points of effective communication in the company. In information technology, this might mean learning to explain technical matters in an accessible, confident, and patient tone. If working on a multinational IT team, it might include coaching on different cultural norms and expectations regarding communication and work, such as never emailing European partners on weekends. Employers can arrange for local community colleges to train their employees with focused courses on communication skills or have instructors teach courses at the company site over several months.

- **Support:** Model effective listening skills and efficient communication skills that convey technical information with "just enough" detail. Model effective communication in email and other electronic forms. Provide templates for longer-form writing, such as memos, contractual documents, or client reports.

- **Play:** Serving as a role model to youth interested in entering information technology or advanced manufacturing has been shown to have positive impacts on communication skills.

- **Reflect and grow:** Provide feedback on the appropriate length and clarity of communications, expected formality of dress for client presentations, and expectations about who to carbon copy (cc) or blind carbon copy (bcc) on emails.

On-the-Job Development of Personal Qualities

Orientation to Lifelong learning:

Starting points: Interviewees linked workplace success with asking questions, being open to trying new things, and learning through work experience. The challenge for the manager is to convey the value and importance of continuous learning while remaining open to the types of learning experiences that employees seek to pursue. Also, managers need to be aware that learning on the job does not necessarily mean supporting employees to take courses; it might mean supporting employees when they volunteer for a new kind of assignment or responsibility. For example, several interviewees from industry described volunteering to perform tasks outside their own job descriptions to learn on the job. In many ways, learning on the job has historically been the employee's responsibility, but there are some actions that employers can take to foster a learning-friendly culture.

Ideas for supporting on-the-job development:

- **Confront misconceptions and explain:** Provide opportunities for learning on the job, even for those more seasoned employees who may expect that they no longer need to learn at work. Offer opportunities to reach into new areas and make explicit the expectation that the employee will be learning on the job. Sometimes this is done by presenting employees with stretch opportunities or tasks that challenge them to move to the next level. For more on this approach, see the book, Multipliers: How the Best Leaders Make Everyone Smarter (Wiseman, 2010).

- **Practice:** Cultivate an environment where the employers and managers understand the need for lifelong learning and understand that learning sometimes involves making mistakes. Create a culture in which there is a tolerance for trying new things with the occasional mistakes that accompany learning. Build quality control checks into workflows so that employees can take risks without high costs.

- **Support:** Provide employees with structured opportunities for goal setting and the time for achieving their learning goals. For example, if an employee wants to learn a specific skill, provide the opportunity to work alongside someone who practices the skill regularly. Encourage employees to ask questions and to come forward when they need support. Provide clear materials for organizing the information that people

will need to do their jobs so they can learn it as needed. One employer (Advanced Manufacturing Employer 12) described the kind of learning that happens in a new job—things like learning where files are kept and how workflows are managed—as "tribal knowledge." For this kind of learning, employers must think of the most clear and efficient ways for organizing and supplying information.

- **Play:** Create opportunities for employees to take on the role of informal teacher or reporter at a team meeting, sharing highlights of what they have learned through company-sponsored coursework or taking on new job roles and responsibilities.

- **Reflect and grow:** Build a culture of learning from experience by building a habit of scheduling post-project debriefs either individually or in small groups to reflect on what situations could have been handled better.

Adapting to Workplace Expectations:

Starting points: The technician workplace runs on a common expectations for work performance, and it is critical for new employees to figure out the expectations quickly, whether such rules of the game are written or unwritten. The challenge for the manager is to keep an open mind and avoid rushing to judgment. Most employers participating in this research have found they need to provide more direct instruction on work expectations now than they did a generation ago. Research predicted this change as workplaces became diverse and multinational. For example, employers may be surprised when employees take breaks more frequently than expected or check their cellular telephones while working. Job applicants with past military experience might want to emphasize it as employers often associate such service as useful for developing the capacity to adapt to work expectations.

Ideas for supporting on-the-job development:

- **Confront misconceptions and explain:** As younger workers enter the workplace, employers need to check understandings periodically around workplace expectations. Explain company values and provide examples of employees who embody those values. Be clear about expectations regarding punctuality, length of meetings, and periods for lunch and breaks.

- **Practice:** Provide new employee onboarding experiences designed to familiarize them with basic expectations about dependability, positive demeanor, and initiative. In

information technology, this might involve mentoring in the first few months of work. In advanced manufacturing, it might involve a boot camp on clocking in and out on time, not using a personal cellular telephone during work hours, and following rules for using designated walkways and wearing safety equipment.

- **Support:** Provide resource libraries that employees can easily access to check on rules and procedures. Provide tools for employees to set personal goals and track progress toward them.

- **Play:** Consider providing a novel way to engage employees in using specialized reflection questions based on the OWEI (Petty, 1993) to recognize different ways to demonstrate work ethic: posters, card decks, cartoons. Note that some programs are emerging to award scholarships to those demonstrating work ethic in trade programs.

- **Reflect and grow:** Engage managers in coaching employees in setting and meeting the goals to improve in work ethic. Encourage stretch goals.

Lifelong Development of Business Fundamentals

Situational Awareness:

Starting points: One way to ensure success in the workplace is to understand the larger context of the business. Such information can help employees predict which divisions of a company will grow or shrink and what changes to technology or personnel are on the horizon. Immediate supervisors and managers might offer some insight, but if not employees can improve their own chances of success by monitoring the company website and making a habit of regularly consuming news about the company and its competition in the popular press or trade media. This might also involve staying informed about new forms of technology, new competitive or security threats to the business, or new methods of doing business in the field.

Ideas for supporting lifelong development:

- **Confront misconceptions and explain:** While it may be tempting to view a job in transactional terms—carefully monitoring the exchange of one's time for each paycheck received—this approach leaves the employee potentially vulnerable to changes that could affect his or her job. For this reason, it is important to explain to employees the importance of building habits to expand and deepen their knowledge about the company, its customers, and its competition.

- **Practice:** Include in onboarding programs a fundamental overview of the company, what services it provides, and the customers it serves. One IT company participating in the study devoted the first 3 months to instilling this understanding in its employees: 30 days on understanding the company, 30 days on its technologies and business divisions, and 30 days on understanding its customers.

- **Support:** Develop newsletters and other educational media to update employees across the company about activities in their own department and in other departments.

- **Play:** Encourage "watering holes" and lunch brown bag sessions where employees can learn about latest initiatives. Consider fostering participation through social media and social activities.

- **Reflect and grow:** Consider recognizing participation in activities on company history and future plans in discussions between managers and employees.

Considerations for Groups Underrepresented in Technical Fields

Companies are Still Learning to Embrace Diversity: Faced with persistent shortfalls in qualified workers, many U.S. information technology and advanced manufacturing companies are advertising their openness to diverse workers more than ever, but too often their efforts result in only modest results. As two advanced manufacturing educators put it, to embrace diversity companies need to commit more to recruitment and transformation of their cultures. Also, managers need to recognize that, once hired, workers who have not had extensive experience with skilled technician work or who have had negative work experiences can be successful in the future—and take appropriate action to ensure they are. In some cases, managers may want to help workers benefit from recognizing how their lack of opportunity for learning technician skills in the past might be related as much to structural barriers to success as their own choices.

Suggested Approach: This study identified several promising approaches to improving workplace diversity. These break down into two categories: external outreach and internal programming. The external outreach approaches maintain linkages between industry and the local education system and community. The internal programming approaches involve consulting with company employees from underrepresented groups to identify ways to make the company culture more inclusive.

External outreach

Role models. Companies may provide financial support for diverse employees to engage in community outreach, such as advising student clubs, judging school robotics competitions or class projects, or supporting tours of the company and field trips. Such role models can inspire and encourage people from more diverse groups to consider entering technician fields. Women in advanced manufacturing can confront common misconceptions that technician work is dirty and requires extensive heavy lifting, and women in information technology can confront the common misconception that the work is socially isolating. Using company role models in marketing materials can promote diverse recruitment.

Collaborative programming. Community colleges—the nation's open-access higher education institutions—are critical partners for employers, particularly for those that form a regional industry employment sector. Such partnerships can support diversity in various ways. They can connect company human resources personnel with college programmers to ensure broad dissemination of openings for internships and jobs. They can connect department hiring managers with college deans and faculty who can prepare, support, and recommend interns or candidates for earn-to-learn programs. Partnerships can connect employers with college programs that provide supports for high-need populations, such as transportation resources (e.g., loaner cars and carpool programs, free or reduced-price bus or train tokens). Partnerships can also help a company access community college contract training faculty to hold courses to improve the employability skills of company managers and teams.

Internal programming

Obtaining Feedback for Inclusive Practices. Interviews for this research indicated that technicians in both information technology and advanced manufacturing who are from historically underrepresented groups have developed skills to confront implicit bias and microaggression from managers, coworkers, and clients based on stereotypes about their gender, ethnicity, or race. For example, women interviewees described experiences of having IT clients wait until the "real" IT expert arrived and being discouraged by family, school personnel, and peers from engaging in technician activities that make them seem less feminine or "like a tomboy." As one IT professional said, "We have to learn that balance. When do we need to speak up? When do we need to create a bubble (from the outside stereotypical messages)? I had to set the tone for the environment of what I would tolerate and what I wouldn't" (IT Employer 17).

Program Examples

Who: Robert Matthews

What: Mott Community College, Flint (MI)

Learning principles: Explaining key concepts, practice, reflect & grow

URL: https://www.mcc.edu/workforce_dev/wfd_index.shtml

To coordinate student referrals with local manufacturers, the workforce development team at Mott Community College has created a "fast track" employability skills program. On the basis of a survey of 80 to 100 employers, Mott identified the perceived skills gaps of new hires. Many of these gaps are in employability skills, not technical skills. As a result, the college is developing the Workforce Promise program. Mott is planning to provide employers with a guarantee that any students hired from the Workforce Promise program will be ready; if they're not, employers would send them back to the college at no cost.

Who: Tiffany Davis, Director of Workforce and Talent Development

What: St. Louis Community College, St. Louis (MO)

Learning principles: Explaining key concepts, practice, play, reflect & grow

URL: https://www.stlcc.edu/programs-academics/accelerated-job-training/boeing-pre-employment-training.aspx

To support local manufacturers, including Boeing, the workforce team at St. Louis Community College provides preemployment accelerated training. After being hired by Boeing, students sign up for a 10-week program, and the employer pays the tuition. It runs 8:00 a.m. to 5:00 p.m., like being on the job site, and includes segments on core technical skills and regular feedback on workplace skills, such as showing up on time and proper etiquette (focusing on work and not chatting or being on the phone).

Who: Hilary Pickerel

What: Vigor Industrial (OR)

Learning principles: Explaining key concepts, practice, play, reflect & grow

URL: https://vigor.net

To help local manufacturers improve their internal culture, Vigor Industrial has a variety of structured curriculum that its contractors deliver in school or the company site. The curriculum trains supervisors, managers, and leaders in self-awareness, handling conflict, communicating effectively, and managing teams. Companies can customize the length and depth of the program, from concentrated retreats lasting 1-2 days to programs that unfold over several months. Vigor Industrial has found it takes time to develop these competencies, and that it helps to have a variety of employees in one group to broaden the conversation.

Conclusions

The rising interest in employability skills within technician fields reflects the need to manage the following three interacting large-scale changes that are currently occurring in these fields: A more diverse group of workers than ever, the continual introduction of new technologies, and a highly fluid set of conditions for getting the work done. These three interacting trends raise the need for technicians to become proficient in the five high-priority skills identified in this research: (1) Interpersonal/teamwork skills to support effective teamwork and collaboration; (2) communication skills to support both technical work and relationships; (3) orientation to lifelong learning to keep current with rapid changes in technical fields; (4) adapting to work expectations by showing dependability, positive professional behavior, and taking the initiative to resolve problems; and, (5) situational awareness that shows intellectual engagement in the larger business mission and consideration of how one's work impacts business productivity. Further, this research found that both technician educators and employers need to devote more effort to understanding the challenges of stereotyping and implicit bias that underrepresented groups experience when entering and working in technician fields, taking time to ensure that all the technicians they educate and train develop sensitivity and a deeper appreciation for how to support each other.

To develop the five essential employability skills and the focused employability skills to support diverse workplaces, the research showed that educators and employers can use a much wider range of learning principles and instructional methods than most currently use. In addition to explaining what these skills are and giving learners opportunities to practice them during team activities, educators and employers can

confront misconceptions that these skills are less important than technical skills. They can create supportive environments where technicians believe they can improve these skills and receive feedback and opportunities to reflect on lessons learned. They can use playful modes of learning, where technicians take on different team roles to develop greater empathy and business awareness.

To improve employability skills in the technician workforce, both educators and employers also need to expand their understanding of how people develop these skills. In the current research study, both groups expressed a preference for teaching technical skills rather than employability skills. Sometimes the narrow focus on technical skills was based on a perceived lack of time. This barrier can be addressed by building employability skills development into the regular flow of instruction and work using the recommended learning approaches in this report. Sometimes the narrow focus on technical skills was based on doubts that employability skills can be developed. Findings from neuroscience (Davidson & Begley, 2012) and psychology (Bjorklund, 2010; Dweck & Leggett, 1988) challenge the long-held perspective that employability skills are largely rooted in personality traits and demonstrate that such skills may be learned and developed throughout one's lifetime.

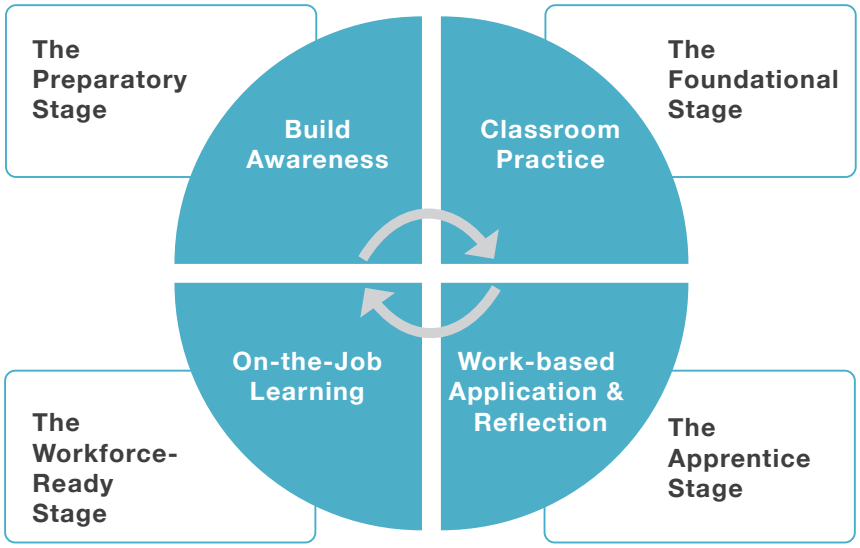
The importance of improving employability skills development is underscored by research that suggests that a narrow focus on technical skills may reinforce a lack of diversity in these fields. For example, social science studies demonstrate that employability skills are not consistently developed in all families and communities (Nagaoka, Farrington, Ehrlich, & Heath, 2015; Shechtman et al., 2016), and that many hiring decisions are based on employability skills, not technical skills (Hora, Benbow, & Smolarek, 2018). Studies also indicate that implicit bias continues to influence judgments and perceptions about diverse employees' "work ethic" (Hackett & Byars, 1996). Taking the perspective that anyone can develop employability skills at any time in their lives—and that educators and employers can play a critical role in that development—offers a productive path toward addressing this societal challenge.

In the future, research should focus on helping educators and employers deepen opportunities to develop employability skills at the point where their respective training efforts converge: work-based learning experiences (see Apprentice Stage in Exhibit 16).

Currently, work-based experiences include apprenticeships, earn-while-learning programs, internships, field trips, and job shadowing. In the future, work-based learning may include other learning modalities, such as virtual and augmented reality learning technologies. Our research indicates that these experiences offer educators and employers a potentially

powerful opportunity to change and improve the current system for developing employability skills. Using the developmental model advanced in this research, both technician educators and employers can better coordinate their distinct developmental responsibilities and better support the success of current and future technicians.

Exhibit 16. The four developmental stages of learning employability skills



Appendix A.
How We Conducted This Study

Literature Review

Original design decisions

The review focused on the fields of information technology and advanced manufacturing in 2-year colleges and the closely-related majors in 4-year colleges of computer science and engineering, respectively. It focused on studies of the following:

(1) Relationships between employability skills and employment outcomes in a technical field,

(2) Interventions that examined the effects on technicians or technicians-in-training of approaches to developing employability skills,

(3) Employer and/or educator perspectives on the relationships between employability skills and employment outcomes, and

(4) Measurement approaches for capturing employability skills.

Search procedures

From September through October 2017, the team conducted an initial search of the literature (Cooper, 2016). The search focused on the 14 most relevant journals (see Table A-1 for list). We used the following search terms: employability skills, SCANs, 21st century skills, soft skills, interpersonal/teamwork skills, communication skills, professional skills, team skills, teamwork skills, job readiness skills, nontechnical skills, career pathways, and noncognitive skills. The search terms were based on definitions of employability skills in the U.S. Department of Education's Employability Skills Framework (2019), which organizes about 40 separate applied competencies into three broad categories (Applied Knowledge, Effective Relationships, and Workplace Skills).

Screening procedures

A total of 1,398 articles were found, and the team screened 1,026 (73%). The screening was based on title and abstracts, and two researchers coded several factors. Since the screening was intended to familiarize the research team with the available extant literature only, the team did not focus on establishing inter-rater reliability in coding. The following elements were coded separately: What the study investigated (e.g., intervention), what

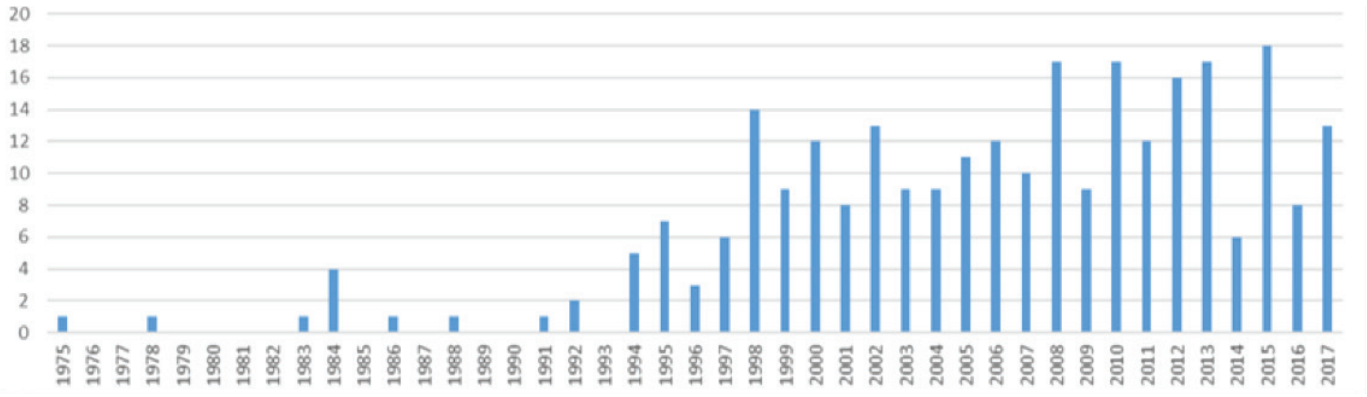
skill(s) were mentioned, what field(s), what types of interventions were used (if applicable), what research method was employed, the type of education setting (e.g., 2-year, 4-year), and whether historically underrepresented populations were addressed. Based on the screening, 273 were relevant to the goals of the study (27%) (see Exhibit A-1).

Exhibit A-1. Relevant articles identified through literature screening by journal

Journal	# Articles
IEEE Transactions on Education	72
Journal of Information Systems Education	67
Frontiers in Education Conference	34
Community College Journal of Research and Practice	25
Journal of Education and Work	24
International Journal of Training and Development	15
Journal of Career Development	10
Community College Review	9
Journal of Vocational Education Research	9
Engineering Education	4
Industrial and Organizational Psychology	4
Adult Education and Development	0
Applied Mechanics Review	0
CIRP Journal of Manufactural Science and Technology	0
Total	**273**

We examined trends in the publication of relevant articles and found an increase since the mid-1990s (see Exhibit A-2).

Exhibit A-2. Publication trends over time of articles on employability skills development in technical fields



Information Gathered from The Studies

Skills

Most studies emphasized interpersonal/teamwork skills, with more than 100 mentioning interpersonal skills or communication skills. Next most frequently mentioned was the overarching employability skill set; 66 articles mentioned this collection of skills. Third most mentioned were personal qualities (e.g., capacity for lifelong learning, work ethic, confidence, persistence, emotional regulation, independence, motivation, and time management). Other skills, such as cognitive skills (e.g., critical thinking, problem-solving, and creativity), career management skills, applied knowledge, understanding business, and entrepreneurship were mentioned at much lower frequencies.

Study types

Most of the literature was descriptive. The initial review counted: 91 case studies, 37 surveys, 31 theoretical articles or reviews, 30 not stated in the abstract, and 20 focused on developing measures. Only 5 studies described quasi-experimental designs and 4, random-controlled trials of interventions. Other study types included interview studies, correlational of skills and outcomes, multiple-methods studies, job listing analyses, and student reflection essays.

Fields, Settings, and Historically Underrepresented Populations

The initial review yielded 89 articles focused on the fields of information technology, 45 articles focused on advanced manufacturing, 50 focused on engineering, and 53 on general technical fields. The remaining articles either did not define their field (11), addressed multiple fields (10), or discussed information systems, business, or computer science. Most of the research was conducted in 4-year university settings (122), general higher education (50), workplaces (30), or community colleges (26).

Expert Review

An expert panel supported the work with six periodic reviews conducted by teleconference. The 7-member expert panel included a three current or former community college technician instructors, three experts in supporting underrepresented populations in technician education, and an evaluation scholar. The experts reviewed the findings from the literature scan and noted the dearth of available literature from the community college context. They provided, and the research team reviewed, references to scholarly literature focused on self-managing teams and a collection of practical resources to set standards and provide guidance around supporting diversity and employability skills development. Also, the expert panel recommended pausing the literature analysis pending the conclusion of the interview study (see below) to ensure key themes and priorities reflected the needs of community college technician educators and their industry partners.

Data Organization and Analysis for Literature Review

The final analysis of the literature took place from March through May 2019. The literature corpus included the original collection gathered and scanned by the research team, a set of materials provided by the expert panel, and additional materials shared by interviewees. Most of the materials provided by the expert panel and interviewees were practical in nature and did not yield insight into how such skills developed or what learning theories and principles were being applied. They were incorporated into a collection of practical resources for dissemination. To understand developmental and theoretical issues, one researcher conducted a rigorous review of the qualitative research studies in four of the employability skills and one researcher conducted a review of the lifelong learning skill.

The process involved organizing the literature for each of the five high-priority employability skills, and then documenting characteristics of most of the articles in a spreadsheet (Sandelowski & Barroso, 2006). These characteristics included basic identifying information, theories, methods, sample sizes, characteristics of the populations studied, instruction and assessment products, and key findings. During the review, the researchers discarded a couple dozen of the originally scanned articles, for example, if they were dated before 1980 or if they lacked information about learning theory, development, instructional methods, or assessment methods. In addition, the researchers added several new articles to the corpus by chasing citations in the original scanned articles and seeking out articles on critical learning theories. Ultimately, the final review focused on 47 articles on interpersonal/teamwork skills, 40 articles on communication, 6 articles on willingness to learn, 10 articles on work ethic, and 10 articles on situational awareness in a business context.

To analyze and synthesize the findings across the studies, the researchers followed procedures to check for data saturation (Fusch & Ness, 2015). These procedures included listing, tabulating, and descriptively summarizing common themes in the research findings regarding learning needs and instructional and assessment approaches used to develop each of the five high-priority employability skills identified in the interview study. During the analysis, the researchers gathered additional literature to obtain more information on the learning needs and instructional and assessment methods of the employability skills of lifelong learning, work ethic, and situational awareness. To examine developmental trajectory of instruction and learning needs, one researcher focused on the two largest literature collections, which addressed teamwork and communication skills, and then compared and contrasted the learning needs and instructional methods employed to develop these skills at different grade levels. The grade-level categories were: secondary, first two years of undergraduate programs, final two years of undergraduate programs, graduate programs, and workplace programs. Iterative analysis of themes took place until data saturation was achieved.

Interview study

Recruitment of Educators and Employers

From October 2017 through November 2018, the research team worked with two experts in the fields of information technology and advanced manufacturing to identify potential study participants. Consistent with a theoretical sampling model of grounded theory (Charmaz, 2014), interviewees were recruited based on their experience related to the research questions about employability skills instruction. We recruited those with both experience and a reputation as technician educators and employers who had participated in, created, or led programs to develop employability skills. When feasible, we attempted to identify educators and employers who had directly collaborated around employability skills development, but only about half of the sample met those criteria. Of the 47 initially recruited, 35 completed an informed consent to participate (74% response rate).

Sample of Educators and Employers

Characteristics of the final sample of educators and employers are presented in Exhibits A-3 and Exhibit A-4.

Exhibit A-3. Interviewee sample by technical domain and job role

Role	Information technology	Advanced manufacturing	Total
Educator	10	10	20
Industry partner	8	7	15
Total	**18**	**17**	**35**

Exhibit A-4. Interviewee sample by state, gender, and experience level

Characteristic	IT interviewees	AM interviewees
States	GA, FL, MI, IL, TX, CA	AL, WV, KY, MI, MN, IL, MO, TX, OR, CA, AZ
Gender	12 male, 6 female	14 male, 3 female
Experience	20+ years	20+ years

Over time, as the research team reviewed themes emerging in the interview data, they noted the middle-aged cohort of participants expressed repeated concern about "millennial" workers and discussed problems around the American culture changing in ways that resulted in less awareness of some basic elements of work ethic. Consistent with grounded theory, the research team checked with its expert panel to see if further interviewee sampling was needed to support theory construction (Tie, Birks, & Francis, 2019). The panel and research team decided to sample a small younger cohort of interviewees who may have had direct experience with some of the identified challenges that the educators and employers said they had observed. Specifically, we decided to recruit a sample that could bring the perspectives of being a millennial, or from an underrepresented group in a technician field (e.g., women, African-Americans, Hispanics, immigrants), or from a high-stress background, as these were the various conditions were believed by our initial group of interviewees to have negative impacts on the development of various types of employability skills in technician fields.

Recruitment of Recent Technician Graduates

To assist in outreach to the younger sample, the research team coordinated with workforce education administrators at Cabrillo College (Aptos, CA) and the Bay Area Community College Consortium (BACCC), a group that coordinates regional and workforce initiatives among 28 Bay Area colleges. Ultimately, educators in IT and biotechnology programs agreed to forward emails to eight current or former students. In addition, we received a referral from our project's senior advisor to one former student from Texas, who consented to participate. All interviewees were recruited based on instructors' knowledge of their characteristics as aligned with some or all of the criteria, including being from an underrepresented group or experiencing challenges from a high-stress background. Of those nine recruits, 5 students consented to participate (50% response rate).

Screening of Recent Technician Graduates

After providing online consent to participate in the study, the participants were linked to an online screening form with queries to determine which of the specific characteristics of interest they met. The research team based the online screening from the Adverse Childhood Experience (ACE) Questionnaire (Felitti et al., 1998). The queries asked participants to check whether or not they had identified with, and/or experienced, any of the following: being a millennial born between 1981 and 1996; being female, Hispanic, African-American, or an immigrant; and/or being raised in a low-income environment or one that could be characterized as high-stress (as indicated by having family members who experienced

addiction, mental illness, incarceration, and/or abuse, or who lacked the capacity to provide basic economic support). The resulting sample of interviewees included:

- 2 males, 3 women
- 4 millennials (born between 1981-1996)
- 2 minorities (Hispanic or African-American)
- 1 immigrant
- 2 from high-stress backgrounds

Interview Protocols

Protocol for Educators and Employers

The research team developed interview protocols with input from the senior project advisor, an experienced technician educator actively involved in promoting the development of employability skills in these fields. Consistent with grounded theory, we designed the interview protocols to include open-ended queries around issues relating to employability skills development and instruction. These interview protocols followed a common structure: An initial question about past experience supporting technician education, an orientation to the two employability skills frameworks most frequently used in technician fields (e.g., U.S. Department of Education, and U.S. Department of Labor field competency models), open-ended queries into their beliefs and theories about how these skills develop, open-ended queries into the instructional techniques and methods they use to teach them, and queries into their recommendations for improving the process of developing employability skills. The query into beliefs section asked participants for their theories about how such skills developed, which skills were most important and foundational, and their view of what should be considered regarding these skills and engaging historically underrepresented populations in technician fields. The queries into instructional techniques section asked participants what approaches they used to develop employability skills, what approaches they believed were most effective, and what methods they used to discern someone's proficiency in these skills. Finally, we asked participants about their recommendations to improve employability skills development and their ideas about current challenges and possible solutions. We conducted telephone interviews with all participants from December 2017 through December 2018.

Protocol for Recent Technician Graduates

The research team developed interview protocols with input from an expert panelist with experience working with younger technicians from underrepresented groups and high-stress backgrounds. The interview protocols of the recent technician graduates followed a common structure: A work ethic attitude check, an orientation to employability skills, a query into the employability skills presenting a struggle or challenge, and a query into ways they addressed any challenges. The work ethic attitude check featured three questions from the OWEI (Petty, 1993). The orientation section followed the same structure as that used with the educators and employers, specifically, it introduced participants to the Department of Education and Department of Labor employability skill frameworks. The queries into employability skills challenges and solutions followed a similar three-part structure: an open-ended question about either challenges or solutions to developing employability skills, a list of possible skill challenges or solutions from which they could choose all that applied to their life experience, and an open-ended question asking participants to discuss the applicable experiences in more detail, providing any relevant information about particular coping strategies and social supports that were helpful. The protocol closed with a general query for further comment. We conducted telephone interviews with all participants from November through December 2018.

Interview Data Organization and Quality Assurance

Researchers digitally recorded the interviews, discussed them, and then one researcher created a de-identified memo. Consistent with grounded theory, researchers composed the memos to include an initial high-level summary of themes (e.g., initial codes) that the participants raised in their interviews, and a detailed summary of their responses to all the questions. The research team sent the memos to all interviewees for verification and accuracy. Twenty-two (22) confirmed memo accuracy (63% response rate), and the remaining participants did not respond after three emailed reminders.

Researchers uploaded all educator and employer interview data into Dedoose (v. 8.2.14), an online qualitative and quasi-quantitative analysis tool. Consistent with grounded theory, the research team aggregated the initial codes from the memos. They used a constant comparative analysis across all the interviews, primarily checking for similarities and differences in how educators and employers discussed employability skills development. From these comparisons, the team developed the core category of “How employability skills develop.” In some cases, the initial codes became the higher-level intermediate codes; in other cases, the initial codes were so numerous that it was necessary to develop a set of intermediate codes that aggregated the initial codes into a higher level category (see Exhibit A-5 for summary).

Exhibit A-5. High level summary of interview codes (alphabetical order)

Parent codes	Intermediate codes	Initial codes
Big Themes	Approaches to assessment	1
	Approaches to instruction	28
	Big questions	0
	Challenges	1
	How employability skills develop, malleability	6
	Importance of employability skills framework	0
	Program design and structures	18
	Stigma for 2-year students	0
	Suggested other employability skills	2
	Supports needs for teaching/developing employability skills	8
	Underrepresented groups, social justice	6
	Who knows these skills best	0
	Why employability skills are important now	0
Field	IT	0
	Advanced Manufacturing	0
Interviewee type	Educator	0
	Employer	0
Interviewee characteristics	Female	0
Materials referenced		0
Department of Education Framework	Applied Knowledge	2
	Effective Relationships	2
	Workplace Skills	5
	Most important, foundational employability skills	0

Using this codebook, the research team jointly finalized the coding for the 35 interviews of employers and educators. At the beginning of this coding process, each researcher individually coded excerpts from a set of interviews, and then they met as a team for a few hours each month to check and reach agreement on these coded excerpts. During this process, they frequently recoded excerpts, refined code definitions, and developed a sense of how different themes related to each other. Over time, their understanding of the codes became more refined and the codes became "saturated," meaning no further codes emerged.

In advanced coding, the team refined the model of how the various conceptual categories explained the stories that interviewees had described. The researchers interpreted the data from the younger cohort of interviewees mainly as a way to check various elements of the emerging model of how employability skills develop and where gaps in the current social system were apparent.

Data Synthesis across Literature and Interviews

Finally, the research team verified the alignment of findings from the literature review and the interviews. In particular, this analysis focused on identifying the highest-priority employability skills and the primary learning principles.

Identifying the High-Priority Employability Skills

Step 1. Identifying a large starting range of potentially relevant employability skills for technicians

Before the research began, the team determined which of the many employability skill frameworks, lists, and definitions resonated with technician educators and trainers. Based on input from its team of workforce education and industry advisors, we chose two: the U.S. Department of Education's framework (see Exhibit A-6), and the closely aligned sections of the U.S. Department of Labor's Career Competency Models for information technology and advanced manufacturing (See Exhibit A-7 for competency model markups reflecting the selected skill categories). This initially guided our focus on 9 categories of employability skills comprising 46 subskills. We incorporated these skill categories and subskills into both the queries of research literature databases and the interview questions. Through the literature review and interviews, we identified an additional relevant employability skill categories and subskills, resulting in lists totaling 59 different subskills in the literature review and 61 different subskills from the interviews.

Step 2. Focusing on the most important employability skills

We employed quasi-quantitative methods to track frequency of skills mentioned in the interviews and the literature. We found the trends presented in Exhibit A-8 (interviews) and Exhibit A-9 (literature, numbers reflect coding from the original literature scan). Both analyses underscored the importance of the Effective Relationship and Workplace Skills categories and three subskills: **personal qualities, interpersonal/teamwork skills,** and **communication skills**. Closer examination of the highest-mentioned category—personal qualities—revealed that two qualities were particularly emphasized: openness to learning and the various elements that comprise **work ethic**, specifically, positive

Exhibit A-6: Employability Skills Framework (U.S. Department of Education, n.d.)

Applied Knowledge	Applied Academic Skills: Uses reading skills, writing skills, mathematical strategies and procedures, scientific principles and procedures
	Critical Thinking Skills: Thinks critically and creatively, makes sound decisions, solves problems, reasons, plans, and organizes
Effective Relationships	Interpersonal Skills: Understands teamwork and works with others, responds to customer needs, exercises leadership, negotiates to resolve conflicts, respects individual differences
	Personal Qualities: Demonstrates responsibility and self-discipline; adapts and shows flexibility; works independently; demonstrates a willingness to learn, integrity, and professionalism; takes initiative; displays a positive attitude and sense of self-worth; takes responsibility for professional growth
Workplace Skills	Resource Management: Manages time, money, materials, and personnel Information Use: Locates, organizes, uses, analyzes, and, communicates information Communication Skills: Communicates verbally, listens actively, comprehends written material, conveys information in writing, observes carefully Systems Thinking: Understands and uses, monitors, and improves systems Technology Use: Understands and uses technology

Exhibit A-7. Skills in the Career Competency Models for Information Technology and Advanced Manufacturing (U.S. Dept. of Labor, 2019) that Match Skills in the U.S. Department of Education Employability Skills Framework

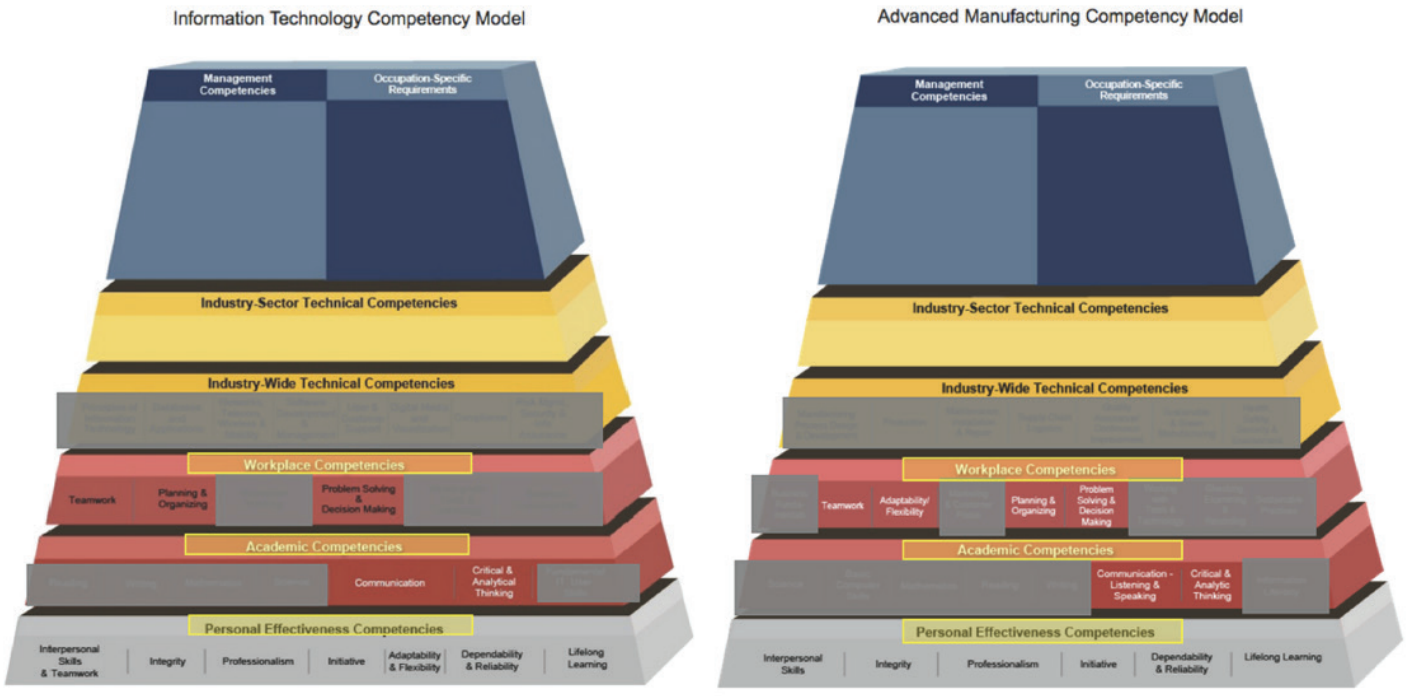
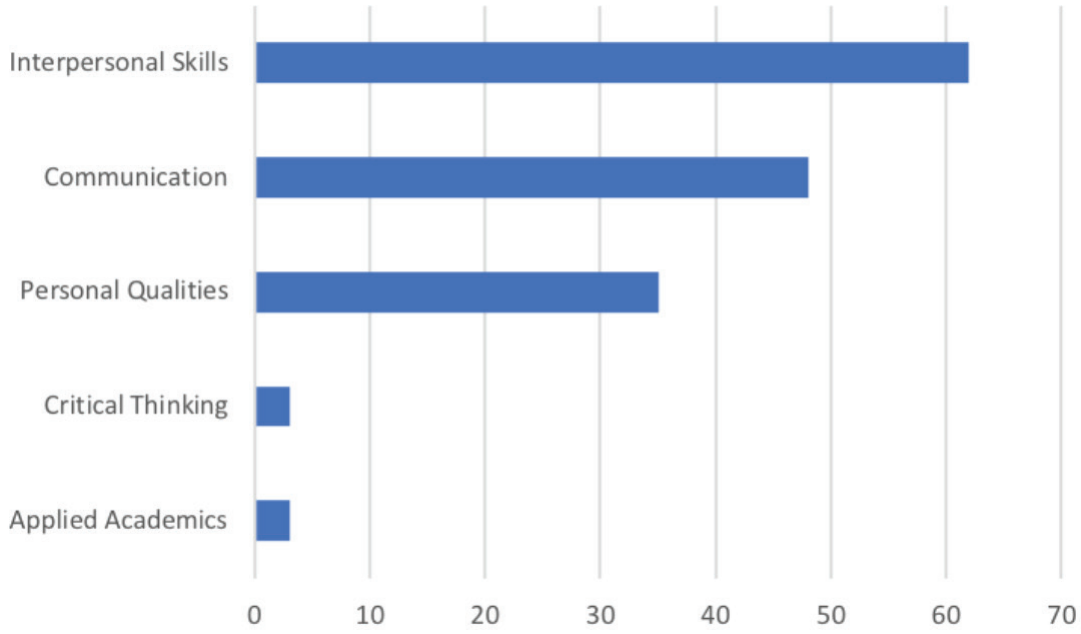


Exhibit A-8. U.S. Dept. of Education employability skill subskills mentioned most by educators and employers

Skills & Subskills	% mentioning		% mentioning		% mentioning
Effective Relationships	91%	Applied Knowledge	59%	Workplace Skills	76%
Personal Qualities	91%	Critical Thinking	47%	Communication	74%
Interpersonal Skills	85%	Applied Academic Skills	32%	Business Fundamentals*	25%

Personal Qualities: *Demonstrates responsibility and self-discipline; adapts and shows flexibility; works independently; demonstrates a willingness to learn, integrity, and professionalism; takes initiative; displays a positive attitude and sense of self-worth; takes responsibility for professional growth;* ***Interpersonal Skills:*** *Understands teamwork and works with others, responds to customer needs, exercises leadership, negotiates to resolve conflicts, respects individual differences;* ***Communication:*** *Communicates verbally, listens actively, comprehends written material, conveys information in writing, observes carefully;* ***Critical Thinking Skills:*** *Thinks critically and creatively, makes sound decisions, solves problems, reasons, plans, and organizes;* ***Applied Academic Skills:*** *Uses reading skills, writing skills, mathematical strategies and procedures, scientific principles and procedures.* ****Business Fundamentals:*** *Three types of business knowledge: "situational awareness" of a business mission's impacts on society and the relations of one's job to other company departments, "business ethics" that comprise respecting team members, following rules, and acting in the best interest of the company, and "market knowledge" that includes awareness of market trends, competition, maintaining customer relations, and recognizing major industry challenges . (Department of Labor, 2019).*

Exhibit A-9. Number of research articles related to specific employability skills in original literature scan



interpersonal/teamwork skills (or professionalism), dependability, and initiative (Petty, 1993). In addition, a new subskill emerged as important among 25% of the interviewees: **business fundamentals**. Based on these findings, these became the five subskills. The Applied Knowledge category was mentioned less frequently than the other two categories and its relevant subskills of critical thinking and applied academic skills were studied only modestly in the literature. Based on this finding, we removed the Applied Knowledge skill category from further consideration.

Identifying the Learning Principles

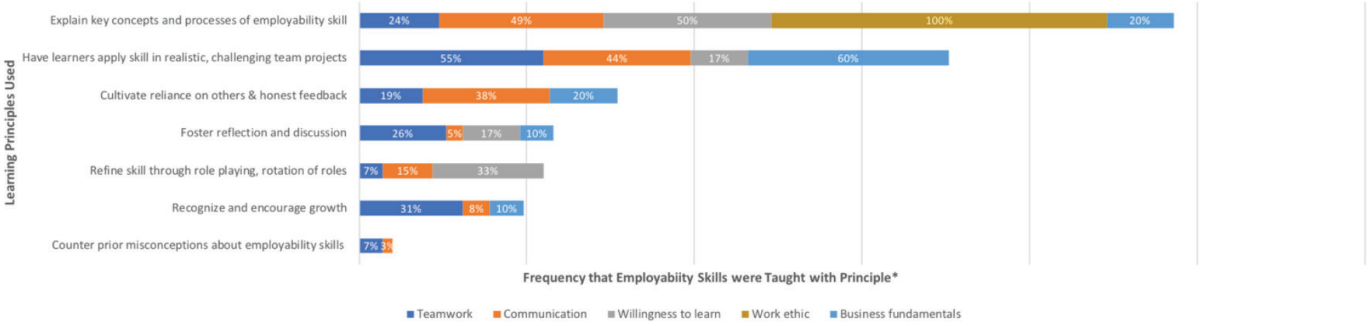
Step 1. Focusing on learning principles backed by research

Learning scientists have described seven core principles of learning that work in multiple domains (National Research Council, 2012). A review of the technician interview data and literature suggested that all these principles were relevant to the development of high-priority technician employability skills, but a closer analysis was needed to identify which principles educators and employers used most frequently and which might be promising for adaptation and application to a technician environment.

Step 2. Identifying the learning principles most frequently used by 4-year educators in computer science and engineering

The research team identified which of the seven learning principles were most frequently mentioned in the research literature as useful for teaching each of the five high-priority skills to computer science, information technology, and engineering students. This was done by coding each article for its learning principles and the employability skills discussed, and then tallying the number of times specific principles were used to teach specific employability skills. Exhibit A-10 shows the results of the frequency analysis.

Exhibit A-10. Primary learning principles employed by 4-year computer science and engineering educators to teach 5 high-priority technician employability skills

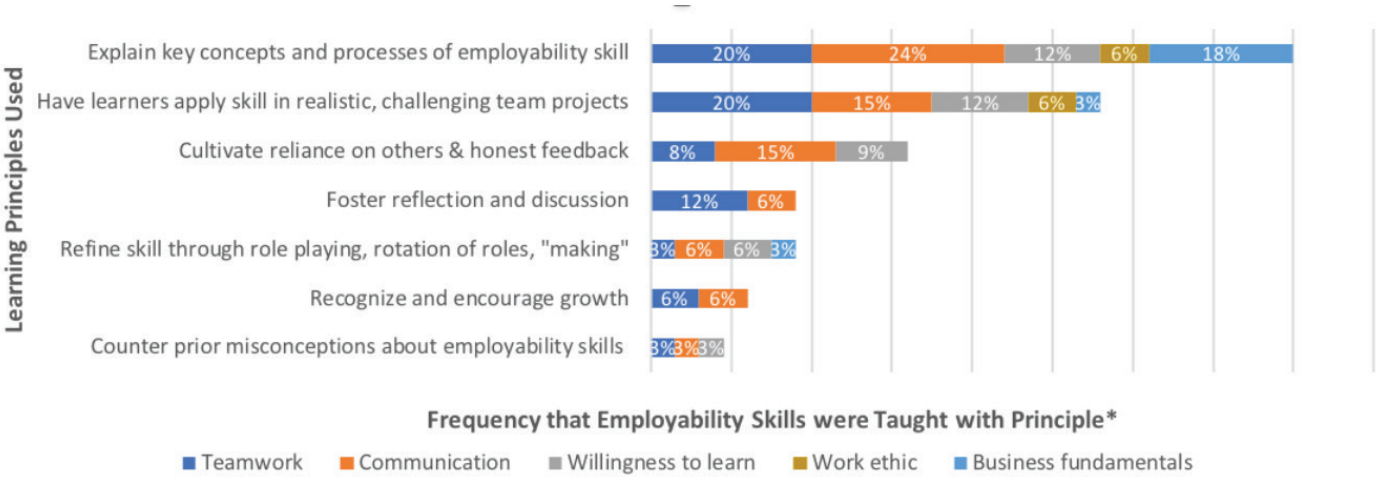


** Chart percentages reflect how often, within each corpus of research articles focused on specific employability skills, researchers used a particular learning principle to teach that employability skill. For reference, the total articles per each employability skill were, as follows: Teamwork, 47 articles; Communication, 40 articles; Business fundamentals, 10 articles; Willingness to learn, 6 articles; and, Work ethic, 8 articles.*

Step 3. Identifying the seven learning principles most frequently used by 2-year educators and employers in information technology and advanced manufacturing

Using the instructional practices identified in the literature as a guide, a researcher reviewed the number of times that instructional methods associated with each of the seven specific learning principles were mentioned by employers and 2-year technician educators to teach each of the five high-priority technician employability skills. Exhibit A-11 shows the results of this analysis.

Exhibit A-11. Primary learning principles employed by information technology and advanced manufacturing employers and 2-year educators to teach 5 high-priority technician employability skills



** Chart percentages reflect percentage of the 35 interviewees reported or recommended using a particular learning principle to teach a particular employability skill.*

Appendix B.
Research Resources

Chapter 3. Becoming Aware of Employability Skills

Finding	Associated articles
Interpersonal skills	
Provide rubrics to assess team quality and reflect on team processes; use over time to note improvement and growth	Aller et al., 2005; de Ramirez, Vélez-Arocho, Zayas-Castro, & Torres, 1998; dos Santos, 2017; Figl, 2010 ; Mantri, Dutt, Gupta, & Chitkara, 2008; Oakley, Hanna, Kuzmyn, & Felder, 2007; Schlimmer, Fletcher, & Hermens, 1994; Van Slyke, Trimmer, & Kittner, 1999; Williams, He, Elger, & Schumacher, 2007
Create teams intentionally with diversity of background, gender, and language to refine skills	Buche, 2013; Cheville, McGovern, & Bull, 2005; Dunaway, 2013
Communication skills	
Confront misconceptions by providing realistic information on how much time is spent writing or speaking or listening on the job; Surveys indicate high degree of communication required in technical fields	Crews & McCannon, 2000; Cross et al., 2013; Koong, Liu, & Liu, 2002; Sageev & Romanowski, 2001; Selfe, 1983
Provide models and examples of preferred forms of workplace communication	Fries et al., 2017; Norback, Llewellyn, Donnell, & Govindaraj, 2001; Vest, Palmquist, & Zimmerman, 1995; Polack-Wahl, 2000
Provide rubrics and self-assessments to assess communication quality; use over time to note improvement and growth	Decker & Egert, 2015; Fries, Cross, Zhou, & Verbais, 2017; Polack-Wahl, 2000; Pomykalski, 2006; Ume & Timmerman, 1995
Assign writing tasks for different audiences (e.g., technical, nontechnical)	Cook, Fluke, Chang, & Mann, 2012; Cross, Paretti, & Matusovich, 2013; Vest et al., 1995; Waitz & Barrett, 1997
Orientation to lifelong learning	Carbonell, Stalmeijer, Könings, Segers, & van Merriënboer, 2014; Schwartz, Bransford, & Sears, 2005; Pulakos, Arad, Donnan, & Plamondon, 2000; Carbonell, Könings, Segers, & van Merriënboer, 2016
Provide consistent encouragement for focused and productive effort when learners apply what they've learned in new settings and situations	
Adapting to workplace expectations	
Clarify importance of adapting to workplace expectations and review the basic elements of "work ethic" as defined in the Occupational Work Ethic Inventory (OWEI)	Hill & Petty, 1995; Hill & Rojewski, 1999
Provide positive feedback when learners demonstrate basic proficiency in work ethic	Patterson, Grenny, McMillan, & Switzler, 2002
Incorporate elements of OWEI and Crucial Conversations into all team and project assessment tools	Hill & Rojewski, 1999; Patterson et al., 2002

Finding	Associated articles
Situational awareness	
Have learners develop a personal mission statement as a first step toward understanding larger organizational mission statements	Covey, 1989
Underrepresented groups	
Provide wrap-around supportive services geared toward learners in career pathways who lack access to basic transportation and other resources	Lewis & Burd-Sharps, 2015; Showalter & Spiker, 2016

Chapter 4. Classroom Practice for Employability Skills

Finding	Associated articles
Employability skills	
Provide a program that gives learners a pathway to learning these skills as part of their technical program	Cranmer et al., 2004; Lekhakul & Higgins, 1994; Gay, Weiss, Hendel, Dawis, & Lofquist, 1971
Interpersonal skills	
Confront misconceptions about teamwork, provide strategies	Perry & Herren, 1998; Pimmel, 2003; Smith & Smarkusky, 2005
Use explicit pre-lesson exercises and lessons to demonstrate the value and importance of teamwork	Buche, 2013; Figl, 2010; Smith, Smarkusky, & Corrigall, 2008
Provide simulated work experiences in face-to-face and/or virtual forms to support practice in teamwork.	Chen, Sager, Corbitt, & Gardiner, 2008
Provide tips on how to manage team conflicts	de Ramirez et al., 1998; Dunaway, 2013; Figl, 2010; Napier & Johnson, 2007; Smith, 1995
Engage learners in using tools for noticing their own emotions and the emotions of others on a team and for managing their own emotions	Dunaway, 2013; Jordan, Ashkanasy, Härtel, & Hopper, 2002; Jordan & Lawrence, 2009
Implement 360-degree evaluation; use multiple assessments at multiple points in course to ensure accuracy and check improvement	de Ramirez et al., 1998; Finelli, 2001; Van Duzer & McMartin, 2000
Communication skills	
Gently question when a learner expresses self-doubt about speaking or writing; provide strategies	Bakos, 1986; Crews & McCannon, 2000; Chalifoux, Vinet, Chassé, & Prégent, 1988;
Foster the use of work-related genres of communication; Provide examples, videos of effective presentations, rubrics to guide and improve their communication, and timely feedback on grammar and presentation style	Bakos, 1986; Chalifoux et al., 1988; Eberle, Karro, Lerner, & Stallmann, 2013; Feldmann & Feldmann, 2000; Georgopoulos & Georgopoulos, 1984; Sageev, & Romanowski, 2001; Selfe, 1983; Sharp, 1998; Vest et al., 1995
Set up simulations requiring practice of these skills	Jeyaraj, 2010; Qurban & Austria, 2009

Finding	Associated articles
Communication skills (Continued)	
Seek out opportunities for students to mentor younger learners both in and out of school	Tucker, McCarthy, Hoxmeier, & Lenk, 1998
Encourage learners to consider what different audiences want and need to know through games where they take on different roles	Dunphy & Whisenand, 2006; Gider, Likar, Kern, & Miklavcic, 2012; Lingard, 2010; Michaelson, 1984
Provide ratings rubrics to help guide and improve basic forms of workplace-relevant communication; engage in continuous self-assessment of skills, and faculty feedback and coaching	Felder & Brent, 2010; Fries et al., 2017; Polack-Wahl, 2000; Pomykalski, 2006; Roppel, Hung, Wentworth, & Hodel, 2000; Savander-Ranne, Lundén, & Kolari, 2008; Ume et al., 1995
Orientation to lifelong learning	
Design lessons and work tasks that stretch but don't overwhelm learning, creating assignments that have some similarity with those learners have completed before but that require additional knowledge and skills	Bell & Kozlowski, 2008; Paletz, Kim, Schunn, Tollinger, & Vera, 2013
Adapting to workplace expectations	
Support planning around employability skills goals before projects and reflection after projects	Pintrich, 1991; Zimmerman, 1998, 2000
In project rubrics and after-action reviews, include individual and team ratings of punctuality, attendance, timely task completion, and resourcefulness	FAME, 2019
Situational awareness	
Consider creating work simulations and interdisciplinary teams to foster greater understanding of complex organizations	Kruck & Teer, 2009; McKell, Hansen, & Albrecht, 2008; Ngai, Lok, Ng, Lo, & Wong, 2005; Pellerin & Hadaya, 2008; Rosso, McClelland, Jansen, & Fleming, 2009; Seethamraju, 2011
Underrepresented groups	
Watch assumptions about work ethic, particularly when assessing the performance of those from different social groups and cultures	Cunningham, Nezlek, & Banaji, 2004; Katz & Hass, 1988

Chapter 5. Work-based Application and Reflection for Employability Skills

Finding	Associated articles
Employability skills	
Ensure those involved in work-based learning have a structured way to check in regularly with both workplace and school mentors	Cranmer et al., 2004; Lent, Brown, & Hackett, 2002; Reilly, 2013; Sommo, Mayer, Rudd, & Cullinan, 2012
Work-based learning refers to cooperative education, apprenticeships, internships, instruction bringing real workplace cases or working professionals into the classroom or helping students prepare for and reflect about learning from work experiences	Career and Technical Education Professional Development, n.d.
Develop clear employability skills goals for the learner's work-based learning experience; focus on specific social activities that involve fluent use of technical terminologies and procedures	Haasler, 2013; Lave & Wenger, 1991; Raelin, 1998; Rauner, 2004; Sung, Loke, & Ramos, 2013; Wenger, 1998
Support reflection on work-based learning experiences	Helyer, 2015
Interpersonal skills	
When providing guidance, keep in mind distinctions between students with more and less experience. More experienced students may rely less on instructors for conflict resolution but benefit from guidance on building on team member talents; providing team leaders with authority to "fire" low performers helps	Gilbuena, Sherrett, Gummer, Champagne, & Koretsky, 2015; Kruck et al., 2009; Van Slyke et al., 1999
Communication skills	
During work-based learning, set goals for learners to practice a range of communication assignments, both spoken and written	Reilly, 2013
Encourage learners to request access at work-sites to videos, writing samples, templates that model effective workplace communication	Cross et al., 2013; Georgopoulos & Georgopoulos, 1984; Gerhard, 1999
Use ratings rubrics, self-assessments and coaching feedback to help guide and improve basic forms of workplace-relevant communication on the job	Decker et al., 2015; Fries et al., 2017; Gilbuena et al., 2015; Isaias, Issa, & Pena, 2014; Pierson, 1997; Polack-Wahl, 2000; Pomykalski, 2006; Ume et al., 1995

Finding	Associated articles
Orientation to lifelong learning	
In today's workplaces, being able to efficiently draw from existing expertise continues to be important but being able to adapt to changes (e.g. new technology, new procedures) is increasingly important.	Mylopoulos & Woods, 2009
Adapting to workplace expectations	
Help employer-partners and learners agree on the concrete ways that meeting workplace expectations will be monitored, understanding the most new workers do not focus on process improvement but on positive attitudes	Petty & Hill, 2005
Make sure learners understand that employers use observations to monitor work ethic in the workplace	Evanciew & Rojewski, 1999
Situational awareness	
Remind learners to use work-based learning as an opportunity to learn about the company mission and to evaluate how much that mission aligns with one's values, talents, and interests	Holland, 1958, 1985; Ryan & Deci, 2000; Strong, 1935
Prepare learners to notice the differences between the cultures of school and work	Gallagher, 2015; Jackson, 2016
Underrepresented groups	
Be prepared to raise awareness of all learners about the impacts of stereotyping and bias	Hackett & Byars, 1996
Leverage diverse language cultures in a classroom to help build cross-cultural competence relevant to the workplace	Gilleard & Gilleard, 2002; Zaugg & Davies, 2013

Chapter 6. Deepening On-the-Job Learning of Employability Skills Table of Findings

Finding	Associated articles
Communication skills	
Serving as a role model to youth interested in entering a field builds communication skills	Cook et al., 2012
Orientation to lifelong learning	
Workplaces can be excellent contexts for developing expertise that can be readily applied to new situations if there is some tolerance for on the job learning (and the occasional mistake that accompany it) and opportunity for reflection and feedback	Pulakos et al., 2000

References and Bibliography

Aller, B. M., Kline, A. A., Tsang, E., Aravamuthan, R., Rasmusson, A. C., & Phillips, C. (2005). WeBAL: A web-based assessment library to enhance teaching and learning in engineering. *IEEE Transactions on Education, 48*(4), 764–771.

Amadeo, K. (2018). How information technology outsourcing impacts the economy. *The Balance.* Retrieved from https://www.thebalance.com/reducing-it-outsourcing-3306192.

Association for Career and Technical Education. (2010). *What is "career ready"?* Alexandria VA: Author. Retrieved from https://www.acteonline.org/wpcontent/uploads/2018/03/ Career_Readiness_Paper_COLOR.pdf

Bakos, J. D., Jr. (1986). A departmental policy for developing communication skills of undergraduate engineers. *Engineering Education, 77*(2), 101-4.

Baruch, Y., & Bozionelos, N. (2011). Career issues. In S. Zedeck (Ed.), *American Psychological Association handbook of industrial and organizational psychology* (pp. 67–114). Washington, DC: American Psychological Association.

Bell, B. S., & Kozlowski, S. W. (2008). Active learning: effects of core training design elements on self-regulatory processes, learning, and adaptability. *Journal of Applied Psychology, 93*(2), 296-316.

Bird, K., Foster, M., & Ganzglass, E. (2014). New opportunities to improve economic and career success for low-income youth and adults: Key provisions of the workforce innovation and opportunity act (WIOA). *Washington, DC: Center for Law and Social Policy.*

Bjorklund, B. R. (2010). *The journey of adulthood,* 7th Edition. Boston, MA: Prentice Hall.

Boaler, J., Dieckmann, J. A., Perez Núñez, G., Liu Sun, K., & Williams, C. (2018). Changing students' minds & achievement in mathematics: The impact of a free online student course. *Frontiers in Education, 3,* 1–7.

Bohle Carbonell, K., Stalmeijer, R. E., Könings, K. D., Segers, M., & van Merriënboer, J. J. G. (2014). How experts deal with novel situations: A review of adaptive expertise. *Educational Research Review, 12*, 14–29. https://doi.org/10.1016/j.edurev.2014.03.001

Buche, M. W. (2013). Teaching tip: A memory game to demonstrate the power of collaborative efforts to improve team performance. *Journal of Information Systems Education, 24,* 167–175.

Carbonell, K. B., Könings, K. D., Segers, M., & Merriënboer, J. J. G. van. (2016). Measuring adaptive expertise: development and validation of an instrument. European *Journal of Work and Organizational Psychology, 25*(2), 167–180. https://doi.org/10.1080/1359432X.2015.1036858

Carbonell, K., Stalmeijer, R. E., Könings, K. D., Segers, M., & van Merriënboer, J. J. G. (2014). How experts deal with novel situations: A review of adaptive expertise. *Educational Research Review, 12,* 14–29. https://doi.org/10.1016/j.edurev.2014.03.001

Career and Technical Education Professional Development. (n.d.). *Work-based learning.* Corpus Christi: Texas A&M University. Retrieved from http://cte.tamucc.edu/work-based-learning/

Chalifoux, J.-P., Vinet, R., Chassé, D., & Prégent, R. (1988). Engineering project design and communication Skills. *Engineering Education, 78*(5), 308–310.

Charmaz, K. (2014). *Constructing grounded theory.* Thousand Oaks, CA: Sage.

Chen, F., Sager, J., Corbitt, G., & Gardiner, S. C. (2008). Incorporating virtual teamwork training into MIS curricula. *Journal of Information Systems Education, 19*(1), 29–41.

Cheville, R. A., McGovern, A., & Bull, K. S. (2005). The light applications in science and engineering research collaborative undergraduate laboratory for teaching (LASER CULT)—Relevant experiential learning in photonics. *IEEE Transactions on Education, 48*(2), 254–263.

Cook, E., Fluke, C., Chang, R., & Mann, L. (2012). Volunteering in school science lessons: Expectations and experiences of university students. In proceedings of the *23rd Annual Conference of the Australasian Association for Engineering Education*, 556–564.

Cooper, H. (2015). *Research synthesis and meta-analysis: A step-by-step approach* (Vol. 2). Los Angeles: Sage Publications.

Covey, S. R. (1989). *The 7 habits of highly effective people.* New York NY: Free Press.

Cranmer, S., Kersh, N., Evans, K., Jupp, T., Casey, H., & Sagan, O. (2004). *Putting good practice into practice: Literacy, numeracy and key skills within apprenticeships: An evaluation of the LSDA development project.* London, England: National Research and Development Centre for Adult Literacy and Numeracy, Institute of Education, University of London.

Crews, T. B., & McCannon, M. (2000). Comparison of communication skills needed by information systems undergraduates and graduates as perceived by information systems professionals. *Journal of Information Systems Education, 11*(3/4), 151–156.

Cross, K., Paretti, M., & Matusovich, H. (2013). Student beliefs about learning communication skills. In proceedings of the *43rd Annual Frontiers in Education Conference* (pp. 251–256). Piscataway, NJ: Institute of Electrical and Electronic Engineers.

Cunningham, W. A., Nezlek, J. B., & Banaji, M. R. (2004). Implicit and explicit ethnocentrism: Revisiting the ideologies of prejudice. *Personality and Social Psychology Bulletin, 30*(10), 1332–1346.

Davidson R. J., & Begley, S. (2012). *The emotional life of your brain: How its unique patterns affect the way you think, feel, and live—and how you can change them.* New York, NY: Hudson Street Press.

Decker, A., & Egert, C. A. (2015, October). Is this thing on? Determining comfort level with communication skills in a technical discipline. In proceedings of the *45th Annual Frontiers in Education Conference* (pp. 1-8). Piscataway, NJ: Institute of Electrical and Electronic Engineers.

De Fruyt, F., Wille, B., & John, O. P. (2015). Employability in the 21st century: Complex (interactive) problem solving and other essential skills. *Industrial and Organizational Psychology, 8*(2), 276-281.

de Ramirez, L. M., Vélez-Arocho, J. I., Zayas-Castro, J. L., & Torres, M. A. (1998). Developing and assessing teamwork skills in a multi-disciplinary course. In proceedings of the *28th Annual Frontiers in Education Conference* (pp. 432–446). Piscataway, NJ: Institute of Electrical and Electronic Engineers.

dos Santos, S. C. (2017). PBL-SEE: An authentic assessment model for PBL-based software engineering education. *IEEE Transactions on Education, 60*(2), 120–126.

Dunaway, M. M. (2013). IS learning: The impact of gender and team emotional intelligence. *Journal of Information Systems Education, 24*(3), 189–202.

Dunphy, S. M., & Whisenand, T. G. (2006). Building camaraderie through information processing: The wuzzle picture-puzzle exercise. *Journal of Information Systems Education, 17*(1), 11–16.

Dweck, C. (2012). *Mindset: Changing the way you think to fulfil your potential.* Hachette UK.

Dweck, C. (2015). Carol Dweck revisits the growth mindset. *Education Week, 35*(5), 20-24.

Dweck, C. S., & Leggett, E. L. (1988). A social-cognitive approach to motivation and personality. Psychological Review, 95, 256–273.

Eberle, W., Karro, J., Lerner, N., & Stallmann, M. (2013). Integrating communication skills in data structures and algorithms courses. In proceedings of the *43rd Annual Frontiers in Education Conference* (pp. 1503–1509). Piscataway, NJ: Institute of Electrical and Electronic Engineers.

Evanciew, C. E., & Rojewski, J. W. (1999). Skill and knowledge acquisition in the workplace: A case study of mentor-apprentice relationships in youth apprenticeship programs. *Journal of Industrial Teacher Education,36*(2), 24–54.

Felder, R. M., & Brent, R. M. (2010). Hard assessment of soft skills. *Chemical Journal of Engineering Education, 44*(1), 63–64.

Feldmann, L., & Feldmann, J. (2000). Developing information literacy skills in freshmen engineering technology students. In proceedings of the *30th Annual Frontiers in Education Conference* (pp. S2E–1). Piscataway, NJ: Institute of Electrical and Electronic Engineers.

Feldman, J. M., & Hirshorn, S. I. (1978). A course in energy and public policy: A liberal art course for power engineers and public administrators. *IEEE Transactions on Education, 21*(3), 127–132.

Feller, R., & Kreutzer, J. (1985). Student advocacy demands promotion of private vocational schools as part of a total delivery system. *Journal of Career Development, 11*(3), 210–216.

Figl, K. (2010). A systematic review of developing team competencies in information systems education. *Journal of Information Systems Education, 21*(3), 323–337.

Finelli, C. J. (2001). Assessing improvement in students' team skills and using a learning style inventory to increase it. In the proceedings of the *31st Annual Frontiers in Education Conference* (pp. S2C–14). Piscataway, NJ: Institute of Electrical and Electronic Engineers.

Fries, R., Cross, B., Zhou, J., & Verbais, C. (2017). How student written communication skills benefit during participation in an industry-sponsored civil engineering capstone course. *Advances in Engineering Education, 6*(1), 1–22. Retrieved from http://advances.asee.org/wp-content/uploads/vol06/issue01/Papers/AEE-20-Fries.pdf

Fusch, P. I., & Ness, L. R. (2015). Are we there yet? Data saturation in qualitative research. *The Qualitative Report, 20*(9), 1408-1416. Retrieved from http://www.nova.edu/ssss/QR/QR20/9/fusch1.pdf

Gallagher, P. (2015). Graduate transition into work: The bridging role of graduate placement programmes in the small- and medium-sized enterprise workplace. *Journal of Education and Work, 28*(5), 461–480.

Gay, E. G., Weiss, D. J., Hendel, D. D., Dawis, R. V., & Lofquist, L. H. (1971). Manual for the Minnesota Importance Questionnaire. *Minnesota Studies in Vocational Rehabilitation, 28,* 1-83.

Gerhard, G. C. (1999). Techniques in a pseudocorporate environment [engineering education]. *IEEE Transactions on Education, 42*(4), 255–260.

Georgopoulos, C. J., & Georgopoulos, V. C. (1984). From university term papers to industry technical reports: An attempt to bridge the existing gap. *IEEE Transactions on Education, 27*(3), 143–147.

Gilbuena, D. M., Sherrett, B. U., Gummer, E. S., Champagne, A. B., & Koretsky, M. D. (2015). Feedback on professional skills as enculturation into communities of practice. *Journal of Engineering Education, 104*(1), 7–34.

Gilleard, J., & Gilleard, J. D. (2002). Developing cross-cultural communication skills. *Journal of Professional Issues in Engineering Education and Practice, 128*(4), 187–200.

Haasler, S. R. (2013). Employability skills and the notion of 'self.' *International Journal of Training and Development, 17*(3), 233–243.

Hackett, G., & Byars, A. M. (1996). Social cognitive theory and the career development of African American women. *The Career Development Quarterly, 44*(4), 322–340.

Helyer, R. (2015). Learning through reflection: The critical role of reflection in work-based learning (WBL). *Journal of Work-Applied Management,7*(1), 15–27.

Hill, R. B., & Petty, G. C. (1995). A new look at selected employability skills: A factor analysis of the occupational work ethic. *Journal of Vocational Education Research, 20*(4), 59–73.

Hill, R. B., & Rojewski, J. W. (1999). Double jeopardy: Work ethic differences in youth at risk of school failure. *The Career Development Quarterly, 47*(3), 267–279.

Hogan, R., Chamorro-Premuzic, T., & Kaiser, R. B. (2013). Employability and career success: Bridging the gap between theory and reality. *Industrial and Organizational Psychology, 6*(1), 3-16.

Holland, J. L. (1958). A personality inventory employing occupational titles. *Journal of Applied Psychology, 42*(5), 336-342.

Holland, J. L. (1985). *The Self-Directed Search: Professional manual.* Odessa, FL: Psychological Assessment Resources.

Hora, M. T., Benbow, R. J., & Smolarek, B. B. (2018). Re-thinking soft skills and student employability: A new paradigm for undergraduate education. *Change: The Magazine of Higher Learning, 50*(6), 30–37. doi:10.1080/00091383.2018.1540819

Isaias, P., Issa, T., & Pena, N. (2014). Promoting higher order thinking skills via IPTEACES e-learning framework in the learning of information systems units. *Journal of Information Systems Education, 25*(1), 45–60.

Jackson, D. (2016). Modelling graduate skill transfer from university to the workplace. *Journal of Education and Work, 29*(2), 199–231.

Jackson, D., & Hancock, P. (2010). Non-technical skills in undergraduate degrees in business: Development and transfer. *Education Research and Perspectives, 37*(1), 52–84.

Jeyaraj, A. (2010). Business process elicitation, modeling, and reengineering: Teaching and learning with simulated environments. *Journal of Information Systems Education, 21*(2), 253–264.

Jiang, J. J., Klein, G., & Means, T. L. (2000). Project risk impact on software development team performance. *Project Management Journal, 31*(4), 19–26.

Jordan, P. J., Ashkanasy, N. M., Härtel, C. E. J., & Hooper, G. S. (2002). Workgroup emotional intelligence: Scale development and relationship to team process effectiveness and goal focus. *Human Resource Management Review, 12*(2), 195–214.

Jordan, P. J., & Lawrence, S. A. (2009). Emotional intelligence in teams: Development and initial validation of the short version of the workgroup emotional intelligence profile (WEIP-S). *Journal of Management and Organization, 15*(4), 452–469.

Katz, I., & Hass, R. G. (1988). Racial ambivalence and American value conflict: Correlational and priming studies of dual cognitive structures. *Journal of Personality and Social Psychology, 55*(6), 893–905.

Kolb, D. A. (1984). *Experiential learning: Experience as the source of learning and development.* Englewood Cliffs, NJ: Prentice Hall.

Koong, K. S., Liu, L. C., & Liu, X. (2002). A study of the demand for information technology professionals in selected Internet job portals. *Journal of Information Systems Education, 13*(1), 21–28.

Kruck, S. E., & Teer, F. P. (2009). Interdisciplinary student teams projects: A case study. *Journal of Information Systems Education, 20*(3), 325–330.

Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation.* London, England: Cambridge University Press.

Lekhakul, S., & Higgins, R. A. (1994). Senior design project: Undergraduate thesis. *IEEE Transactions on Education, 37*(2), 203–206.

Lent, R. W., Brown, S. D., & Hackett, G. (2002). Social cognitive career theory. *Career Choice and Development, 4,* 255–311.

Leveson, L. (2000). Disparities in perceptions of generic skills: Academics and employers. *Industry and Higher Education, 14*(3), 157–164.

Levy, F., & Murnane, R. J. (2004). *The new division of labor: How computers are creating the next job market.* Princeton, NJ: Princeton University Press.

Lewin, K. (1951). Problems of research in social psychology. In D. Cartwright (Ed.), *Field theory in social science: Selected theoretical papers* (pp. 155–169). New York, NY: Harper & Row.

Lewis, K., & Burd-Sharps, S. (2015). *Zeroing in on place and race.* Brooklyn, NY: Measure of America.

Levy, F., & Murnane, R. J. (2004). *The new division of labor: How computers are creating the next job market*. Princeton, NJ: Princeton University Press.

Lingard, R. W. (2010). Teaching and assessing teamwork skills in engineering and computer science. *Journal of Systemics, Cybernetics and Informatics, 18*(1), 34-37.

Livingstone, D. W. (1999). Exploring the icebergs of adult learning: Findings of the first Canadian survey of informal learning practices. *Canadian Journal for the Study of Adult Education. 13*(2), 49–72.

Mantri, A., Dutt, S., Gupta, J. P., & Chitkara, M. (2008). Design and evaluation of a PBL-based course in analog electronics. *IEEE Transactions on Education, 51*(4), 432–438.

McKell, L. J., Hansen, G., & Albrecht, C. (2008). Direct assessment of IS student learning using an integrative exercise. *Journal of Information Systems Education, 19*(2), 223–228.

MHA Labs. (2019). *Skill building blocks.* Retrieved from http://mhalabs.org/skill-building-blocks/

Merriam, S. B., Caffarella, R. S., & Baumgartner, L. M. (2007). *Learning in adulthood: A comprehensive guide.* San Francisco, CA: John Wiley & Sons.

Michaelson, H. B. (1984). Teaching engineering students to communicate. *IEEE Transactions on Education, 27*(3), 151–154.

Moreau, M. P., & Leathwood, C. (2006). Graduates' employment and the discourse of employability: A critical analysis. *Journal of Education and Work, 19*(4), 305–324.

Mozilla Foundation. (2015). *Mozilla 21C skills and competency metagrid.* Mountain View, CA: Author. Retrieved from https://drive.google.com/file/d/0B9qOTaXg3UmRdXBDOEttSllpNFU/view

Mylopoulos, M., & Woods, N. N. (2009). Having our cake and eating it too: seeking the best of both worlds in expertise research. *Medical Education, 43*(5), 406–413. https://doi.org/10.1111/j.1365-2923.2009.03307.x

Nagaoka, J., Farrington, C. A., Ehrlich, S. B., & Heath, R. D. (2015). *Foundations for young adult success: A developmental framework.* IL: University of Chicago Consortium on Chicago School Research.

Napier, N. P., & Johnson, R. D. (2007). Technical projects: Understanding teamwork satisfaction in an introductory IS course. *Journal of Information Systems Education, 18*(1), 39–48.

National Association of State Directors of Career Technical Education Consortium. (2012). *Common career technical core.* Silver Spring, MD: Author. Retrieved from https://cte.careertech.org/sites/default/files/CCTC_Standards_Formatted_2014.pdf

National Network of Business and Industry Associations. (2014). *Common employability skills: A foundation for success in the workplace; The skills all employees need, no matter where they work.* Retrieved from http://businessroundtable.org/sites/default/files/ Common%20Employability_asingle_fm.pdf

National Research Council. (2012). *Education for life and work: Developing transferable knowledge and skills in the 21st century.* Washington, DC: The National Academies Press.

New World of Work. (2019). *Professional competencies list.* Redding, CA: NWoW. Retrieved from https://www.newworldofwork.org/wp-content/uploads/2016/10/21st-Century-Skills-Competencies-Attributes-Traits-Final-2017.pdf

Ngai, E. W., Lok, C. K., Ng, E. M., Lo, C. N., & Wong, Y. K. (2005). Collaborative project across three Hong Kong universities: A case study in e-commerce education. *Journal of Information Systems Education, 16*(1), 109–116.

Noftle, E. E., & Robins, R. W. (2007). Personality predictors of academic outcomes: Big five correlates of GPA and SAT scores. *Journal of Personality and Social Psychology, 93*, 116 –130.

Norback, J. S., Llewellyn, D. C., Donnell, J., & Govindaraj, T. (2001). Using a web-based system to integrate workplace communication skills into engineering curriculum. In proceedings of the *31st Annual Frontiers in Education Conference* (p. 11). Piscataway, NJ: Institute of Electrical and Electronic Engineers.

Oakley, B. A., Hanna, D. M., Kuzmyn, Z., & Felder, R. M. (2007). Best practices involving teamwork in the classroom: Results from a survey of 6435 engineering student respondents. *IEEE Transactions on Education, 50*(3), 266–272.

Occupational Information Network. (2019). *Skills search page.* Retrieved from https://www.onetonline.org/skills/

Organization for Economic Cooperation and Development. (2005). *The definition and selection of key competencies.* Paris, France: Author. Retrieved from https://www.oecd.org/pisa/35070367.pdf

Organization for Economic Cooperation and Development. (2013). *The survey of adult skills: Reader's companion.* Paris, France: Author. Retrieved from http://www.oecd-ilibrary.org/education/the-survey-of-adult-skills_9789264204027-en

Paletz, S. B. F., Kim, K. H., Schunn, C. D., Tollinger, I., & Vera, A. (2013). Reuse and Recycle: The Development of Adaptive Expertise, Routine Expertise, and Novelty in a Large Research Team. *Applied Cognitive Psychology, 27*(4), 415–428. https://doi.org/10.1002/acp.2928

Partnership for 21st-Century learning. *Framework for 21st century learning.* Retrieved from http://www.battelleforkids.org/networks/p21/frameworks-resources

Patterson, K., Grenny, J., McMillan, R., & Switzler, A. (2002). *Crucial conversations: Tools for talking when stakes are high.* New York, NY: McGraw-Hill.

Pellerin, R., & Hadaya, P. (2008). Proposing a new framework and an innovative approach to teaching reengineering and ERP implementation concepts. *Journal of Information Systems Education, 19*(1), 65–70.

Perry, M., & Herren, R. V. (1998). Barriers to integrating technical and basic communication skills in Georgia's postsecondary technical institutes. *Journal of Vocational Education Research, 23*(3), 253–263.

Petty, G. C. (1993, December). *Development of the occupational work ethic inventory.* Paper presented at the annual American Vocational Association meeting. Nashville, Tennessee.

Petty, G. C., & Hill, R. B. (2005). Work ethic characteristics: Perceived work ethics of supervisors and workers. *Journal of Industrial Teacher Education, 42*(2), 5–20.

Pierson, M. M. (1997). Annual progress reports: An effective way to improve graduate student communication skills. *Journal of Engineering Education, 86*(4), 363–367.

Pimmel, R. L. (2003). A practical approach for converting group assignments into team projects. *IEEE Transactions on Education, 46*(2), 273–282.

Pintrich, P. R. (1991). *A manual for the use of the Motivated Strategies for Learning Questionnaire (MSLQ)*. Ann Arbor, MI: National Center for Research to Improve Postsecondary Teaching and Learning.

Polack-Wahl, J. A. (2000). It is time to stand up and communicate [computer science courses]. In proceedings in the *30th Annual Frontiers in Education Conference* (pp. F1G–16). Piscataway, NJ: Institute of Electrical and Electronic Engineers.

Pomykalski, J. J. (2006). Constructing integrated writing assignments for the IS curriculum. *Journal of Information Systems Education, 17*(2), 171–183.

Pulakos, E. D., Arad, S., Donovan, M. A., & Plamondon, K. E. (2000). Adaptability in the workplace: Development of a taxonomy of adaptive performance. *Journal of Applied Psychology, 85*(4), 612–624. https://doi.org/10.1037/0021-9010.85.4.612

Qurban, M. H., & Austria, R. D. (2009). Improving the communication skills of IS developers during requirements elicitation using experiential learning. *Journal of Information Systems Education, 20*(3), 301–311.

Raelin, J. A. (1998). Work-based learning in practice. *Journal of Workplace Learning, 10*(6/7), 280–283.

Rauner, F. (2004). *Practical knowledge and occupational competence to act.* (ITB-Forschungsberichte, 14). Bremen, Germany: Universität Bremen, Institut Technik und Bildung (ITB). Retrieved from https://nbn-resolving.org/urn:nbn:de:0168-ssoar-366049

Reilly, M. C. (2013). *Inequality and opportunity in work-based learning.* Unpublished doctoral dissertation.

Roppel, T. A., Hung, J. Y., Wentworth, S. W., & Hodel, A. S. (2000). An interdisciplinary laboratory sequence in electrical and computer engineering: Curriculum design and assessment results. *IEEE Transactions on Education, 43*(2), 143–152.

Rosso, M. A., McClelland, M. K., Jansen, B. J. J., & Fleming, S. W. (2009). Using Google AdWords in the MBA MIS course. *Journal of Information Systems Education, 20*(1), 41–49.

Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being*. American Psychologist, 55*(1), 68–462.

Sageev, P., & Romanowski, C. J. (2001). A message from recent engineering graduates in the workplace: Results of a survey on technical communication skills. *Journal of Engineering Education, 90*(4), 685–693.

Sandelowski, M., & Barroso, J. (2006). *Handbook for synthesizing qualitative research.* New York, NY: Springer.

Savander-Ranne, C., Lundén, O.-P., & Kolari, S. (2008). An alternative teaching method for electrical engineering courses. *IEEE Transactions on Education, 51*(4), 423–431.

Schlimmer, J. C., Fletcher, J. B., & Hermens, L. A. (1994). Team-oriented software practicum. IEEE Transactions on Education, 37(2), 212–220.

Schwartz, D. L., Bransford, J. D., & Sears, D. (2005). Efficiency and innovation in transfer. *Transfer of Learning from a Modern Multidisciplinary Perspective, 3,* 1–51.

Seethamraju, R. (2011). Enhancing student learning of enterprise integration and business process orientation through an ERP business simulation game. *Journal of Information Systems Education, 22*(1), 19–29.

Selfe, C. L. (1983). Decoding and encoding: A balanced approach to communication skills. *Engineering Education, 74*(3), 163–64.

Sharp, J. E. (1998). Learning styles and technical communication: Improving communication and teamwork skills. In proceedings of the *28th Annual Frontiers in Education Conference* (pp. 512–517). Piscataway, NJ: Institute of Electrical and Electronic Engineers.

Shechtman, N., Yarnall, L., Stites, R., & Cheng, B. (2016). *Empowering adults to thrive at work: Personal success skills for 21st century jobs. A report on promising research and practice.* Chicago, IL: Joyce Foundation.

Showalter, T., & Spiker, K. (2016). *Promising practices in work-based learning for youth.* Washington, DC: National Skills Coalition.

Smith, H. H., III, & Smarkusky, D. L. (2005). Competency matrices for peer assessment of individuals in team projects. In proceedings of the *6th Conference on Information Technology Education* (pp. 155-162). New York, NY: Association for Computing Machinery.

Smith, H., III, Smarkusky, D., & Corrigall, E. (2008). Defining projects to integrate evolving team fundamentals and project management skills. *Journal of Information Systems Education, 19*(1), 99–110.

Smith, K. A. (1995). Cooperative learning: Effective teamwork for engineering classrooms. In proceedings of the *25th Annual Frontiers in Education Conference* (pp. 2b5–13). Piscataway, NJ: Institute of Electrical and Electronic Engineers.

Sommo, C., Mayer, A. K., Rudd, T., & Cullinan, D. (2012). *Commencement day: Six-year effects of a freshman learning community program at Kingsborough Community College.* New York, NY: MDRC.

Strauss, W., Howe, N., & Markiewicz, P. (2006). *Millennials and the pop culture: Strategies for a new generation of consumers in music, movies, television, the Internet, and video games.* Great Falls, VA: Lifecourse Associates.

Strong, E. K., Jr. (1935). Predictive value of the Vocational Interest Test. *Journal of Educational Psychology, 26*, 331-349.

Sung, J., Ng, M. C. M., Loke, F., & Ramos, C. (2013). The nature of employability skills: Empirical evidence from Singapore. *International Journal of Training and Development, 17*(3), 176–193.

Tie, Y. C., Birks, M., & Francis, K. (2019). *Grounded theory research : A design framework for novice researchers.* SAGE Open Medicine. DOI: 10.1177/2050312118822927

Tucker, M. L., McCarthy, A. M., Hoxmeier, J. A., & Lenk, M. M. (1998). Community service learning increases communication skills across the business curriculum. *Business Communication Quarterly, 61*(2), 88-99.

Ume, C., & Timmerman, M. (1995). Innovative communications oriented design projects in mechatronics courses. *IEEE Transactions on Education, 38*(3), 223–229.

U.S. Department of Education. (2019). *Employability skills.* Washington, DC: Office of Career, Technical, & Adult Education. Retrieved from https://cte.ed.gov/initiatives/employability-skills-framework

U.S. Department of Labor. (2019a). *Competency model clearinghouse.* Washington, DC: Author. Information technology model retrieved from https://www.careeronestop.org/CompetencyModel/competency-models/information-technology.aspx; Advanced manufacturing model retrieved from https://www.careeronestop.org/CompetencyModel/competency-models/advanced-manufacturing.aspx

U.S. Department of Labor. (2019b). *Your transferable skills are a major selling point; make sure you know yours.* Retrieved from https://www.careeronestop.org/JobSearch/Resumes/ ResumeGuide/TopResumeStrategies/identify-transferable-skills.aspx

U.S. Department of Labor. (1991). *What work requires of schools: A secretary's commission on achieving necessary skills (SCANS) report for America 2000.* Washington, DC: Author.

Van Duzer, E., & McMartin, F. (2000). Methods to improve the validity and sensitivity of a self/peer assessment instrument. *IEEE Transactions on Education, 43*(2), 153–158.

Van Slyke, C., Trimmer, K., & Kittner, M. (1999). Teaching teamwork in information systems courses. *Journal of Information Systems Education, 10*(3/4), 36–46.

Vest, D., Palmquist, M., & Zimmerman, D. (1995). Enhancing engineering students' communication skills through multimedia instruction. *Journal of Engineering Education, 84*(4), 383–387.

Waitz, I. A., & Barrett, E. C. (1997). Integrated teaching of experimental and communication skills to undergraduate aerospace engineering students. *Journal of Engineering Education, 86*(3), 255–262.

Wenger, E. (1998). Communities of practice: Learning as a social system. *Systems Thinker, 9*(5), 2–3.

Williams, B. C., He, B. B., Elger, D. F., & Schumacher, B. E. (2007). Peer evaluation as a motivator for improved team performance in bio/ag engineering design classes. *International Journal of Engineering Education, 23*(4), 698–704.

Wiseman, L. (2010). *Multipliers: How the best leaders make everyone smarter.* New York, NY: HarperCollins.

Zaugg, H., & Davies, R. S. (2013). Communication skills to develop trusting relationships on global virtual engineering capstone teams. *European Journal of Engineering Education, 38*(2), 228–233.

Zimmerman, B. J. (1998). Developing self-fulfilling cycles of academic regulation: An analysis of exemplary instructional models. In D. H. Schunk & B. J. Zimmerman (Eds.), *Self-regulated learning: From teaching to self-reflective practice.* New York, NY: Guilford Press.

Zimmerman, B. J. (2000). Attaining self-regulation: A social-cognitive perspective. In M. Boekaerts & P. R. Pintrich (Eds.), *Handbook of Self-Regulation* (pp. 13–39). New York, NY: Academic Press. doi:10.1016/B978-012109890-2/50031-7

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