

REPORT | APRIL 2022

Preparing for Tomorrow's Middle-Skill Jobs

How Community Colleges Are Responding to Technology Innovation in the Workplace

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The Community College Research Center (CCRC), Teachers College, Columbia University, has been a leader in the field of community college research and reform for over 25 years. Our work provides a foundation for innovations in policy and practice that help give every community college student the best chance of success.

Acknowledgments

Funding for this research was provided by Lumina Foundation and the Ralph C. Wilson, Jr. Foundation. The views expressed in this publication are those of the authors and do not necessarily represent those of the funders. The authors wish to thank the colleges and college representatives who participated in this project. The authors also wish to thank Allison Forbes, Sarah Griffin, Lauren Pellegrino, and Adnan Moussa, who contributed to the research, and Elizabeth Ganga, Mary Laphen, Paul Osterman, Wendy Sedlak, and Doug Slater, who provided valuable feedback on earlier report drafts. The report was designed by Stacie Long.

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Inside This Report

Community colleges throughout the nation have long been instrumental in providing workforce education to both adult and traditional-age students seeking good jobs. By imparting students with general and technical skills in a variety of occupational areas, community colleges play a key role in regional economies and in preparing workers for jobs that require some college but less than a bachelor's degree. Yet, across sectors, these "middle-skill" jobs are changing. The increased use of technologies such as robotics and artificial intelligence are altering the kinds of skills and the level of skills that these jobs require, and the pace of change is only accelerating. Community colleges need to adjust to this change in order to offer compelling workforce programs that attract prospective students and meet the needs of employers. Generally speaking, community colleges also want to do more than simply match students and employers in entry-level middle-skill jobs: They want to create opportunities to help students advance educationally and in the labor market over the long term, and to do so in ways that narrow rather than exacerbate inequities between racial or ethnic groups.

In this report, we describe a study conducted by the Community College Research Center (CCRC) and the Massachusetts Institute of Technology's Task Force on the Work of the Future to understand how community colleges are adapting their workforce programs to changing skill demands, diversifying pathways to certificates and degrees, and grappling with equity concerns. We spoke with over 200 administrators, faculty, and staff at eight community colleges to learn about each college's recent experiences with employers and students in the context of workforce programming in three occupational fields: allied health, information technology, and advanced manufacturing. These fields are growing in importance in many areas of the country, and they are undergoing rapid technological innovation. Focusing on these fields, we asked representatives from our study colleges (1) how skill demands are changing for good-quality entry-level jobs, (2) how colleges are modifying their instruction and support services to help students acquire essential skills, (3) how colleges are helping students who are in short-term programs get into more advanced programs that lead to better jobs, and (4) what steps the colleges are taking to promote access to high-opportunity programs for Black and Latinx students and low-income students.

Adapting to Evolving Employer Skill Demands

Our interviewees acknowledged rapid change in workplace technology in the three fields we examined, and they underscored that many jobs now require the performance of a wider range of tasks and responsibilities than in the past. They emphasized four categories of skills that employers are increasingly seeking: (1) foundational skills in math, reading, and writing; (2) technical skills for specific positions; (3) digital literacy skills to interpret, analyze, and communicate using digital platforms; and (4) a broad mix of interpersonal and cognitive skills central to collaboration, critical thinking, and customer service. Our interviewees also noted

that—because workplace technologies change quickly—employers tend to seek data-literate, adaptable generalists rather than narrowly trained specialists.

In response, workforce programs are modifying curricula and instruction to include the greater use of data and digital technologies. It is challenging and expensive, however, for college programs to stay current with evolving technologies across occupations and fields. That is one major reason why our interviewees stressed the importance of work-based learning opportunities—which have a strong tradition in fields like healthcare and IT—in the rapidly changing labor market. As digital and automation technologies diffuse across industries, efforts to locate more work-related learning in actual workplace settings—through co-op programs, internships, clinical placements, or apprenticeships—are increasing. But it is not easy to find and manage placements for such opportunities. Colleges are responding in two ways: They are creating new roles or positions to build relationships with employers to expand work-based learning programs, and they are simulating work situations at the colleges to bring greater attention to a variety of workplace skills, including those related to customer service.

Connecting Short-Term and Long-Term Programs

Community colleges have historically offered a broad range of career-focused programs, including two-year transfer-oriented and technical degree programs, shorter-term for-credit certificate programs, and noncredit workforce training programs that often last less than one semester. Increasingly, this programming is being pulled in two different directions: toward both longer-term and shorter-term programs. A concern with this development is that short-term programs that may help a student land an entry-level job are largely disconnected from longer-term programs that impart greater skills, so students who gain some modest advantage in the labor market are not supported to pursue stronger career goals. To deal with this concern, colleges are exploring ways to rethink how short-term and longer-term programs can be integrated into a set of coherent pathways that lead—over time, through periods of employment and education—to high-wage, in-demand jobs. Among the colleges we studied, half are reconsidering their organizational divisions and other institutional structures that can serve as barriers between occupational and academic, credit and noncredit, and short-term and long-term programs.

In some cases, colleges have introduced work-focused intermediate credentials into longer degree programs; in others, they have aligned the learning requirements and courses of shorter-term credentials so that they can count as the first part of longer programs without loss of credits or momentum. Despite some progress, across the study colleges, the growth of “stackable credential” pathways remains limited. The process of building stackable credentials and getting students to pursue multiple credentials is slow and difficult. Having clear entry and exit points in pathways becomes critical, as does guidance to both students and employers on the competency milestones embedded in each credential.

Several colleges are also working to integrate credit and noncredit offerings, traditionally offered in separate divisions, by bringing some related programs under a single administrative umbrella. Housing credit and noncredit programs together may help colleges react more nimbly to changes in labor market demand, and doing so may also make it easier for noncredit students to be awarded credits that they can later apply to a degree program. Yet our interviewees emphasized that noncredit students—who are disproportionately low-income students, English language learners, and older adults—often need a range of supports to persist and complete courses and programs. These are not easy to provide given ongoing resource constraints. A related concern is the need to better understand the characteristics, experiences, and outcomes of noncredit students. Unlike students in credit programs, students in noncredit programs are not typically tracked before, during, or after they leave a program.

Addressing Equity Concerns

As community colleges modify their workforce programs to meet changing skill demands for entry-level and higher-level occupations, they run the risk that their adjustments could have a negative effect on equitable access to and success in high-value programs. While the colleges express a commitment to racial equity within their workforce programs, they struggle to operationalize that commitment in policy and practice. One key issue is selective admissions criteria in high-value workforce programs with limited enrollments, such as nursing. The rejection of large numbers of students applying for these programs typically affects underrepresented Black and Latinx students disproportionately.

Another (related) problem is that advising and support for students in workforce programs is often inadequate, which hinders success among underserved students. Advising and academic support systems in community colleges tend to be designed with transfer students in mind. Indeed, we learned from interviewees at several colleges that advisors are often unfamiliar with specific workforce programs. Since low-income and minoritized populations are overrepresented in workforce rather than transfer programs, the lack of advising and support for workforce students has substantial equity implications.

Several colleges in the present study are using student data and tailored approaches to formulate and advance equity goals. One college is illuminating equity gaps by disaggregating student enrollment and achievement data in both transfer and workforce programs by gender, race/ethnicity, and first-generation status. Sharing this data across the college has driven efforts to improve retention and completion of underserved students in high-value programs. Another college is using state funding to provide scholarships to eligible students for short-term certificate programs with strong labor market value in allied health and cybersecurity. The college has focused its outreach for the programs on local Zip codes where many Black residents live.

Considerations for Colleges and Policymakers

Interviewees at the eight colleges we visited emphasized several considerations for modifying the design of workforce programs in the face of changing skill demands. It is important to recognize that several of these considerations are in tension with funding constraints that affect under-resourced community colleges throughout the nation. Indeed, many colleges will require resources as well as further guidance to reform and strengthen workforce programming. The federal government, state policymakers, philanthropies, businesses, and intermediaries all have a role to play in supporting research, development, and technical assistance to help colleges make changes that benefit students enrolled in workforce programs.

Modifying Program Curricula

- **Reassess how math needs of workforce students are met.** The completion of both developmental and college-level math coursework is a substantial barrier for many workforce students, particularly those who have been out of school for some time. Colleges should help students address math readiness needs more quickly, and they should reconsider what math competencies are most important in light of changing skill demands. There are proven models for how to help students acquire the math skills they need. For example, Washington State's Integrated Basic Education Skills Training program (I-BEST) uses a team-teaching approach that pairs a basic skills instructor and an occupational instructor in the delivery of training in fields such as nursing and precision machining. A recent randomized controlled trial found that I-BEST produced a large impact on attainment of workforce certificates, though it did not increase receipt of higher-level credentials such as associate degrees (Martinson et al., 2021). Another approach developed by the Charles A. Dana Center at the University of Texas at Austin, called Dana Center Math Pathways (DCMP), focuses on quantitative reasoning and statistical concepts that align with students' programs of study. A randomized controlled trial found that DCMP increased students' completion of the developmental math sequence and their likelihood of taking and passing college-level math (Zachry Rutschow et al., 2019). What these programs have in common is an emphasis on the practical applications of math to students' lives and occupations.
- **Do more to help workforce students develop digital literacy skills.** In almost every field of employment, workers need to be comfortable using computers and digital technology. They need to know how to input, access, and interpret computer-generated information to perform their jobs and solve problems. This includes knowing how to read graphs, charts, and other visual displays of data. Increasingly, digital literacy is a foundational skill, no less than English and math skills. It is also a relatively new subject for most community college instructors to teach. Community college and industry leaders may need to work together to develop standards and curricula for teaching the digital literacy skills needed for particular fields. Industry groups and intermediaries may also have a role to play in setting standards and developing teaching tools for instructors to use in their courses.

- **Focus greater efforts on providing work-based learning opportunities.**

Work-based learning may be one of the only ways students can network with employers and get hands-on experience with the latest technological equipment in their field. Colleges need to facilitate increased student access to employers who might hire them, preferably by making work-based learning experiences a more routine component of workforce programming. As valuable as it is for students, work-based learning is difficult for colleges to offer at scale, mainly because of the labor involved in establishing agreements with employers to accept students and provide adequate supervision. Additional investments are needed from both the public and private sectors to substantially increase the number of students who participate in work-based learning and to allocate opportunities equitably. Advances in virtual simulations and scenario-based learning hold promise for giving more students workplace-like experiences even when they cannot be placed with employers due to resource constraints.

Reorganizing College Structures and Supports

- **Rethink the relationship between credit and noncredit workforce offerings.**

Finding ways to connect credit and noncredit programming may build a more coordinated approach to labor market entry and advancement for students. A critical step in this work is improving the collection and use of data on noncredit student enrollments, program completions, and post-program outcomes. Federal and state education and workforce agencies can lend support by helping colleges improve their data collection and tracking systems for noncredit students.

Many colleges also need help linking to state employment data systems to gain timely information on the employment and earnings of their former students—information that they can use to strengthen the advising they offer to incoming students about the wages associated with different fields of study. Colleges can also use this information to refine programs or discontinue training programs that do not lead to living wages.

- **Better align short-term certificate programs with longer-duration degree programs.** Colleges should redesign workforce programming around stackable credentials, sequential postsecondary certificates and degrees along a career pathway that individuals can pursue over time. Stackable credentials is not a new idea, but most programs are small in scale. Our research suggests that colleges offering stackable credentials can do a better job of explaining to students how they work and helping them see the value of further education. Students may need to receive this information at different points in time and be shown what supports are available to help them combine work and school. One college in our study has made it standard practice to ensure that every short-term certificate course it offers also counts toward an associate degree so that students in certificate programs will benefit if they return to the college for a degree at a later date.

- **Reorganize advising and support services for workforce students, many of whom are from underserved populations.** To facilitate greater completion and success, colleges should offer workforce students a stronger set of cohesive

supports that match their needs throughout the college experience. Students earning certificates and degrees in fields like advanced manufacturing, healthcare, and IT should be assigned to dedicated advisers who understand the course requirements and career opportunities in these fields. While this level of advising costs more than what most colleges provide now, research by CCRC suggests that colleges can cover the added expense with grant funding and/or modest tuition and fee increases. It also suggests that the added investment pays off in terms of increased retention and graduation of students and, in some states, increases in performance funding to institutions (Jenkins et al., 2020). Colleges can make strong advising a selling point to potential students who may be weighing the benefits of community college versus other training options.

Addressing Equity Concerns

- **Enhance efforts to recruit underserved students and provide a culturally responsive campus environment.** When colleges express a clear commitment to improve outcomes of underserved students, they need to think explicitly about their recruitment practices and program selection criteria for high-value workforce programs. Colleges can enhance their recruitment strategies for Black and Latinx students through more tailored messaging and by using dedicated, high-touch recruiters. Attending explicitly to the identity of minoritized students may also be crucial. Developing a campus climate that actively welcomes diverse students, is responsive to their experiences, and strives to build community can help to foster a greater sense of belonging and self-efficacy that may be essential for the retention of underserved students (Brathwaite et al., 2021).
- **Disaggregate student data across programs to examine equity gaps and identify reforms.** Colleges should use their own institutional research departments to disaggregate student enrollment and achievement data in each program to reveal equity gaps in high-value programs of study. Using data from one state system, CCRC produced a guide to show how this type of analysis can be done (Fink & Jenkins, 2020). Colleges that make an effort to examine program enrollments by race/ethnicity, gender, and other student characteristics can begin to ask questions about the patterns they observe. For example, are Black and Latinx students underrepresented in occupational fields that lead to the highest wages? If so, do these patterns simply reflect student preferences, or are college policies and practices influencing students' choices, either intentionally or unintentionally? Colleges may find it helpful to form working groups or committees involving institutional research, faculty, and student services staff to explore these and related issues and to develop institutional responses.
- **Eliminate the “digital divide” in student access to technology.** During the pandemic, most community colleges were forced to move instruction and student services online. For some students, the ability to take courses remotely was a positive development, especially if they lived far from campus or if they had other obligations such as parenting young children. For others, the shift to online

learning was a negative factor, especially if they did not have dependable access to a computer or the internet or a quiet place where they could work (Brock, 2021; Cooper et al., 2020). Colleges should seek ways both to fund technology upgrades to equipment used in workforce programming—which is essential for teaching digital literacy skills—and to ensure that all students have adequate access to personal computers and the internet. Similar to advising, the additional costs associated with enhanced technology support may pay off for colleges in terms of increased student enrollment, retention, and completion.

We conducted this study as the pandemic was just beginning. If anything, the trends we identified in terms of the need for greater skills development for employment have become more salient over the past year. As the nation comes out of the pandemic, community colleges will need to adapt to new realities: the growth of online coursetaking, even more accelerated technology innovation in the workplace, uneven recovery among low-income workers, and declining community college enrollments. From our interviews, we saw institutions that know some of the ways they need to change to adjust to these new realities. We did not, however, see a comprehensive approach at any one college. Greater funding for community college workforce programming and innovation, philanthropic and industry involvement, and networking among leading institutions will be needed as the skill demand trends for middle-skill jobs identified in this report continue.

Introduction

Workforce education is integral to the community college mission. Almost three out of five associate degrees (57%) and nearly all certificates (94%) earned at public two-year colleges are in career-oriented fields in which direct employment is the student goal (Carnevale et al., 2020). A recent nationally representative survey of more than 3,600 civilian employees between the ages of 24 and 64 reveals just how important community college education is to the U.S. economy. Nearly half of all respondents (48%) indicated that they had attended a community college at some point in their lives, and a quarter (26%) said they had done so as an adult (Osterman, 2021a, 2021b). A majority of those who went to community college said that they sought training for a specific occupation or industry, and that the training was useful for developing skills and improving their employment situation (Osterman, 2020). Community colleges clearly play a substantial role in workforce education, yet there is growing concern that the increase in workplace automation and efficiency that has begun to occur through technologies such as robotics and artificial intelligence will significantly reduce the demand for middle-skill jobs for which this education is so important. Likewise, there is concern that the growth of new workplace technologies will dramatically change the level and mix of skills that students in community college workforce programs need to acquire (Hodgson, 2016; Spencer, 2018).

While robots and artificial intelligence have already eliminated jobs in a range of industries, including manufacturing, retail, and healthcare, the greater challenge for community college workforce programs may lie in adapting to new and rapidly evolving skill demands from regional employers. Automated machines need to be serviced, complex organizational problems need to be solved, and even the most sophisticated technologies do not replace the need for human intelligence and empathy, particularly in customer-facing job roles. Moreover, during the next decade, a combination of retirements and slow population growth are expected to produce worker shortages across sectors, even in fields that have lost jobs to automation and outsourcing. Indeed, worker shortages in skilled jobs may be exacerbated in the short term by the effects of the pandemic.

Community colleges will continue to play a large role in educating the nation's workforce, but they will need to adjust to ongoing changes in local labor markets and occupational skill requirements in order to offer compelling workforce programs that attract prospective students and meet the changing needs of regional employers. As this report will demonstrate, college leaders generally recognize this, but they are less certain about how to make programmatic changes that accommodate evolving employer skill demands. What is more, college leaders want to do more than match students and employers in entry-level middle-skill jobs. They want to structure programs and supports in ways that help students advance educationally and in

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the labor market, and to do so in ways that narrow rather than exacerbate gaps between racial and ethnic groups (and in some fields, between women and men) in employment, earnings, and other life outcomes.

To understand how community colleges are dealing with these issues, researchers from the Community College Research Center (CCRC) and from MIT's Task Force on the Work of the Future visited eight community colleges across the country and interviewed over 200 administrators, faculty, and staff (for more on the study design and persons interviewed, see Appendix A). Our goal was to hear about each college's recent experiences with employers and students and to learn about the adjustments they are making to workforce programs in three occupational fields: allied health, information technology (IT), and advanced manufacturing. We chose these fields for three reasons: they are growing in importance across the nation, they typically provide good career opportunities for community college graduates, and they are undergoing rapid technological innovation. In our interviews at each college, we used their workforce programs in these fields to discuss four themes:

- 1. Changing skill demand:** What combination of skills do students need to succeed in middle-skill jobs that are changing due to the introduction of innovative technologies?
- 2. Instruction and support services:** How do colleges design and deliver programs and student supports to help students acquire essential skills?
- 3. Pathways to credentials:** How are colleges helping students in noncredit and short-term certificate workforce programs advance into more valuable degree pathways in their chosen field?
- 4. Opportunity and equity:** What steps are colleges taking to promote participation in high-value workforce programs by students from underserved populations?

This report describes how the colleges we studied are adjusting to changing skill demands, expanding pathways to credentials and degrees, and grappling with how to promote equity within high-value workforce programs as skill demands for good jobs rise.

Under Focus: Three Occupational Fields

Healthcare

Healthcare and social assistance occupations continue to expand and now account for about 20 million jobs, or 13% of all jobs in the U.S. (U.S. Bureau of Labor Statistics, 2021) Allied health community college workforce programs focus on many different direct care and ancillary specialties, including nursing, nursing assistance, physical therapy, respiratory therapy, pre-hospital emergency services, medical records, among others. The continued development of computer-controlled medical devices and electronic record-keeping are affecting what technical competencies workers in healthcare occupations need to have and how they are trained. Workers need to know how to operate, maintain, and troubleshoot new equipment and how to interpret and communicate data related to patient care.

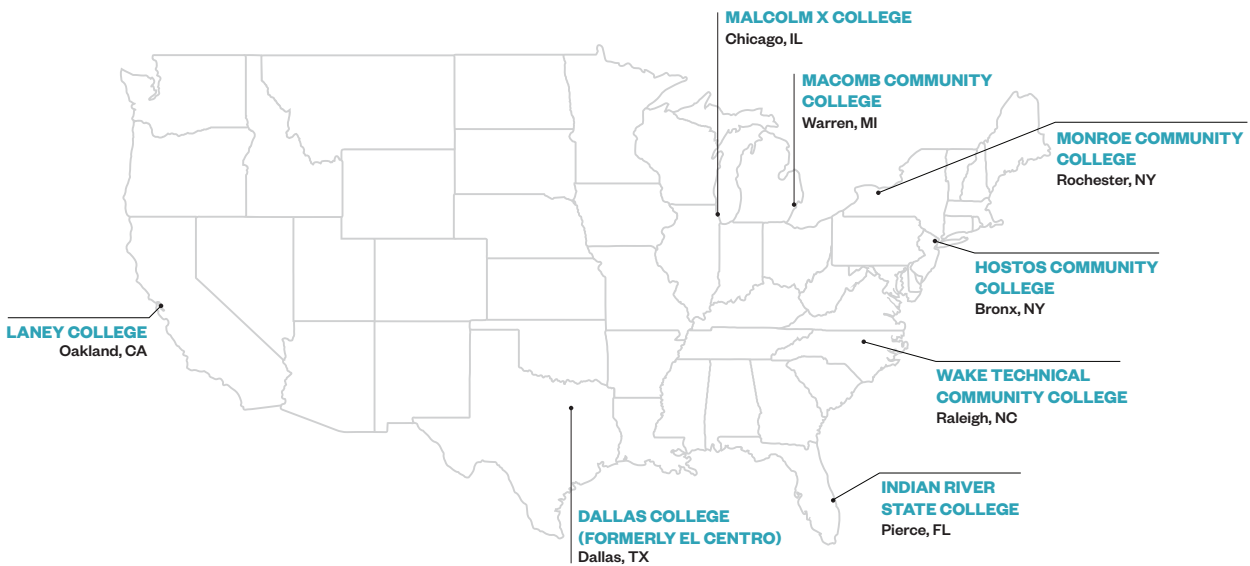
Information Technology

Information technology occupations account for roughly 5 million jobs, or about 3% of jobs in the U.S. They are difficult to count because technologies and job categories change and because the jobs are spread throughout industries in the economy (Beckhusen, 2016; Wolf & Terrell, 2016, U.S. Bureau of Labor Statistics, 2021). IT jobs focus on developing, installing, and maintaining new computer and communication hardware and software, and many other jobs require IT competencies. Community college IT workforce programs focus on specific occupational skill areas, including networking, maintenance and repair, and cybersecurity. Some colleges have highly specific programs, such as robotics programming.

Advanced Manufacturing

Manufacturing accounts for about 12 million jobs, or 8% of all occupations in the United States (U.S. Bureau of Labor Statistics, 2021). While this number is not expected to increase substantially, new technology is creating upskilling opportunities in manufacturing jobs. Automated production emphasizes both careful monitoring to avoid operational stoppages and well-considered and well-executed maintenance and repair. Community college advanced manufacturing workforce programs focus on traditional manufacturing processes—design, machining, and quality control—as well as specific technologies that are used in these processes, such as computer numerical control in machining and using a programmable logic controller to automate production within a plant.

Colleges in the Study



We recruited colleges for the study that have reputations for strong workforce training programs and that are located in different parts of the country. Colleges that participated include:

- Dallas (formerly El Centro) College in Dallas, Texas;
- Hostos Community College in The Bronx, New York;
- Indian River State College in Fort Pierce, Florida;
- Laney College in Oakland, California;
- Macomb Community College in Warren (suburban Detroit), Michigan;
- Malcolm X College in Chicago, Illinois;
- Monroe Community College in Rochester, New York; and
- Wake Technical Community College in Raleigh, North Carolina.

Each of these colleges offers training in allied health, information technology, or advanced manufacturing (though not all colleges offer training in all three fields). Each is also known for its efforts to work with employers to advance equity and increase regional economic opportunity. The regions served by the colleges reflect very different labor markets and populations (see Appendix B for more detailed descriptions of the colleges and their regions). As Table 1 shows, some of the colleges (e.g., Indian River, Laney, and Wake Tech) are located in fast-growing areas with relatively low levels of poverty. Others (e.g., Hostos, Malcolm X, and Monroe) are located in cities that have had little or no population growth over the past decade and that have relatively high rates of poverty. The communities served by Hostos and Monroe have experienced particularly high rates of unemployment in the first year of the pandemic.

Table 1.

Demographic and Labor Market Characteristics in Areas Surrounding Study Colleges

	POPULATION CHANGE (2010-2019)	MEDIAN ANNUAL HOUSEHOLD INCOME (Average, 2015-2019)	UNEMPLOYMENT RATE in May 2019	UNEMPLOYMENT RATE in May 2021	PERSONS IN POVERTY (2019)
Dallas (Dallas County)	11.3%	\$59,607	3.2%	5.8%	14.0%
Hostosn (Bronx County)	2.4%	\$40,088	5.0%	13.6%	26.2%
Indian River (St. Lucie County)	18.4%	\$52,322	3.9%	5.3%	10.5%
Laney (Oakland)	10.8%	\$73,692	3.0%	7.0%	16.7%
Macomb (Macomb County)	3.9%	\$62,855	3.9%	4.4%	8.6%
Malcolm X (Chicago)	-0.1%	\$58,247	3.9%	9.4%	18.4%
Monroe (Rochester)	-2.4%	\$35,590	5.1%	7.9%	31.3%
Wake Tech (Wake County)	23.4%	\$80,591	3.4%	3.7%	8.0%

Source. U.S. Census Bureau. (n.d.).

Findings

How do colleges describe changing employer skill demands? And what adjustments are they making in response?

A large body of academic, business, and policy literature describes how the adoption of new technologies (in the context of international trade in a global economy) drives changes in skills needed by workers across industries and occupations throughout the United States and what effects these changes have on regional labor markets (Bughin et al., 2018; Merisotis, 2021). The literature holds that the nation is undergoing a clear shift in employer skill demand characterized by a declining need for manual skills, an increasing need for cognitive skills that add value to automated systems and intelligent machines, and an increasing need for a range of social and professional skills required for increasingly complex and customer-facing tasks. A recent national survey documents the extent to which different skills are used in the workplace by workers with different levels of education. The results of the survey are consistent with the general view that cognitive and digital skill demands are on the rise, particularly for middle-skill jobs that are likely held by survey respondents with “some college,” many of whom attended community colleges (Osterman, 2020).

Table 2.
Percentage of U.S. Workers Required to Use a Given Skill at Least Once per Week

	EVERYONE	ONLY HIGH SCHOOL DEGREE OR LESS	SOME COLLEGE*	FOUR-YEAR COLLEGE DEGREE OR MORE
Facing a complex problem that takes at least 30 minutes to find a good solution.	47%	31%	46%	61%
Being required to read a document of more than five pages.	35%	18%	32%	51%
Being required to perform physical labor for a 30 minute or more stretch.	40%	59%	46%	22%
Being required to use addition, subtraction, multiplication.	75%	68%	78%	80%
Being required to use math <i>beyond</i> addition, subtraction, multiplication.	38%	31%	36%	45%
Being required to use a computer for tasks such as word processing, email, or web-search (but <i>not</i> including using a device such as a cash register that is connected to a computer which need not use any programs on your own).	78%	60%	79%	92%
Being required to use a computer and work with specialized software <i>beyond</i> word-processing, web-browser, or email.	66%	49%	66%	82%

*Some College refers to community college attendance with or without earning a credential or four-year college attendance without earning a degree.

Source: Osterman (2020) and additional results from the original survey. Sample is working adults, age 24-64. The survey was conducted January 2020.

In accord with this research, college and workforce development leaders at the colleges we studied emphasized four broad categories of skills that employers want to see in new hires: academic skills, technical skills, digital literacy skills, and professional skills.

Table 3.
Skill Categories for Middle-Skill Job Entrants Emphasized by Workforce Program Interviewees

SKILL TYPE	DESCRIPTION
Academic skills	Foundational skills in math, reading, and writing
Technical skills	Job-specific skills for specialized positions in local industries
Digital literacy skills	Skills needed to read, manage, analyze, and communicate data using various digital platforms
Professional skills	A broad mix of interpersonal and cognitive skills that are central to workplace readiness, collaboration, critical thinking, problem-solving, and communication

While the teaching of academic and technical skills has long been at the core of community college workforce programs, our interviewees made it clear that in the fields we targeted—allied health, information technology, and advanced manufacturing—program standards for these skill categories are shifting. We also learned that employer expectations related to the other two skill categories—digital literacy and professional skills—are becoming increasingly important. The rise of all these skills poses distinctive challenges in the design and delivery of community college workforce

programs. Colleges find that they need to update traditional curricula, rethink the boundaries of some historically separate occupational disciplines, and experiment with new ways to promote student mastery of the bundles of skills employers seek in both entry-level and higher-level middle-skill workers.

Because workplace technologies change quickly, employers are seeking data-literate, adaptable generalists rather than narrowly trained specialists. Colleges are adjusting their programs in response.

Traditionally, community college workforce training programs taught students the technical skills they needed to get a job in local industry, alongside a modest amount of instruction in math and English. This model is now proving insufficient. In today's workplace, equipment is frequently modified or replaced, and job tasks change as new or improved technology is introduced. Community college workforce staff we interviewed spoke less about teaching specific technical skills required for a given industry and more about preparing students to be adaptable generalists who can apply a range of skills to novel workplace situations. They emphasized that employers now expect new workers to have stronger foundational skills in math and English; to have some technical facility in their field; and, increasingly, to be adaptable—to be able to learn quickly on the job, in large measure by possessing skills in critical thinking and problem-solving, in conjunction with or independent of new technology.

Increasingly, employers also expect new middle-skill workers to have digital literacy skills, which are also central to adaptability. To illustrate this, a college workforce leader explained that, in many workplace settings, facilities operations have begun to incorporate IT tools; the result is that maintenance workers now interpret charts and figures to complete job tasks. For example, operating and maintaining furnaces now involves more advanced technology, requiring repair workers to gather and report data using performance diagnostics communicated remotely by smartphone applications. Similarly, in manufacturing, machine operators are required to make decisions by interpreting data they receive from automated equipment. In allied health, nurses and nursing assistants routinely collect and enter patient information into computers and provide feedback to patients on blood pressure, glucose levels, and other indicators that they are monitoring.

In response to these demands for adaptability, leaders in a growing number of workforce programs recognize the need to provide curricula and instruction that include the use of data, computers, and digital technologies. Hostos Community College, for example, added a digital literacy module to its entry-level allied health program curricula in reaction to employers who wanted home health aides to be able to input patient information digitally. And Laney College revamped a traditional skilled-trades heating, ventilation, and air conditioning (HVAC) program to respond to the growth in “smart buildings” in commercial and residential construction, which requires technicians to understand and apply data analytics.

Leaders in a growing number of workforce programs recognize the need to provide curricula and instruction that include the use of data, computers, and digital technologies.

We heard from workforce leaders and faculty that the demand for data-literate generalists can also lead colleges to make programs more interdisciplinary, which helps prepare students to handle more diverse responsibilities on the job. Faculty at one college, for example, described how automation has encouraged skilled trades programs, such as welding, to add computer science applications to the curriculum. At another college, manufacturing programs have been revised in response to the changing expectations of floor technicians, some of whom now use Google Glass to work remotely with engineers in programming equipment to execute specific tasks. Macomb Community College (see box) changed its automotive program curriculum to focus on more technology-assisted analytical tasks. Even some liberal arts programs are considering ways to become more work-relevant by increasing students' digital competencies. For example, Dallas College has explored a partnership with Adobe to meet the IT industry's need for more creative, well-rounded thinkers by linking an industry-recognized certificate in IT within the existing liberal arts program.

Modifying the Automotive Program at Macomb Community College

As automakers increasingly see themselves as technology companies that build vehicles, they want their workers to have some of the electronics and programming skills typically taught in IT programs. As a result, many technician jobs have been augmented, with skilled technicians now expected to do the work once done by engineers. For instance, we learned from stakeholders at Macomb that Nissan planned to retrain 75 of their mechanical technicians to do higher-level work. These employees, who are knowledgeable about vehicles and assembly systems, were previously responsible for replacing parts and keeping machines running on the factory floor. Due to technology advances, the need for these tasks has declined. The technicians now need to know how to run tests and evaluate problems to inform production and the quality assurance process.

Reflecting on the advancing technology in the workplace, Macomb's automotive faculty realized that some of their existing courses did not adequately meet employer needs. As a result, Macomb took on the challenging work of restructuring automotive course content to include IT and electronics curricula. It also developed new courses, including one called Experimental Testing, which teaches students to gather data using in-depth diagnostic tools.

In response to the demand for greater professional skills, some colleges are opting to add curricula and instruction dedicated to workplace readiness and career planning. Hostos Community College, for example, offers a one-credit course called Introduction to Career Practices, which includes mock interviews and training in workplace conflict resolution. Based on employer input, Monroe Community College revamped a capstone course for students earning an HVAC certificate to include a focus on workplace readiness skills and on helping students plan their careers.

Increased emphasis on digital literacy may require colleges to reconsider math content and math program requirements so that they better align with student and employer needs.

Community college math coursework in workforce programs includes basic math elements, with some program requirements building toward the learning of higher-order math skills in algebra and trigonometry. But, as we have described, with technology tools increasingly embedded in daily work life, employers are expecting middle-skill employees to demonstrate higher levels of digital literacy—they want new workers who are comfortable using data and who have some prior exposure to data analytics. This trend has implications for what kind of math content should be emphasized in workforce programs.

While the colleges we visited are beginning to embed data skills into some technical training courses, workforce leaders told us they are still grappling with how to change math course content and requirements in their programs to better meet this employer expectation for greater digital literacy. Many math courses have not evolved and remain algebra-centric. Organizations such as the Carnegie Foundation for the Advancement of Teaching and the Dana Center at the University of Texas at Austin have developed curricula for colleges to use that offer alternative math pathways emphasizing quantitative literacy and statistics for students who do not plan to enter STEM fields (Carnegie Math Pathways, n.d.; Charles A. Dana Center, n.d.). Our field visits suggest that while most colleges are aware of these efforts, they have not fully embraced or implemented such pathways, even though they see the barriers that traditional math prerequisites create for some students. At one college, for instance, we learned that while students who had earned a short-term noncredit credential in HVAC were heavily recruited into the HVAC credit-bearing program, they struggled to transition because they had difficulty meeting the math requirements.

Changes in skill demands are driving colleges to broaden student access to work-based learning opportunities, but coordination and scale are significant challenges.

Work-based learning has long been a signature feature of occupational training programs, particularly in healthcare but also in IT, engineering technology, and other fields. As new digital and automation technologies diffuse across industries, efforts to locate more work-related learning in actual workplace settings—through co-op programs, internships, clinical placements, or apprenticeships—are increasing, according to many workforce leaders and faculty members we spoke with. They noted how learning at the work site can address the challenge of becoming familiar and experienced with the latest equipment and software. They further explained that changes to workplace technology often outpace a college's ability to update its equipment and facilities, making work-based learning all the more important for providing students access to up-to-date technology. Given how quickly new programming languages and software become available in IT professions, for example, work-based learning helps students in IT programs graduate with marketable skills. Nearly 25% of biotechnology students at Indian River State College,

for instance, now participate in a paid internship in the field while they are students. Through this program, the college screens potential employers and organizations to ensure that internships include relevant job-based learning, that they are aligned with the students' college coursework and program of study, and that they can lead to viable employment opportunities.

Work-based experiences can also be an effective way to introduce students to the social and professional skills they need. Communication, teamwork, and problem-solving skills are often best developed in real-world settings in which students work in actual teams and for actual clients. Some student services personnel we interviewed advocated for more access to internships and work-based learning opportunities as a means to help students develop a professional network and build their resumes. Workforce program staff spoke frequently about how workplace experiences can help many students, particularly those with limited employment histories, develop a basic understanding of jobs and the workplace. They argued that it was essential for some students in gaining readiness for employment.

Communication, teamwork, and problem-solving skills are often best developed in real-world settings in which students work in actual teams and for actual clients.

Despite the perceived benefits of work-based learning, the colleges we spoke with described practical limitations to their efforts to place students in work sites. Some constraints are on the student side. Many students lack the time or resources to undertake an internship or apprenticeship while also managing their other responsibilities, including outside employment and childcare duties. There are also serious limits to college capacity to find and manage placements. Traditional requirements for clinical placements in healthcare have enabled these programs to develop the capacity and relationships to secure and manage student placements. But this is not the case in most fields, and even in healthcare identifying viable placements is one of the primary limits to expanded program enrollment. Locating internships is resource-intensive for college personnel, and most programs are not staffed to build out a robust work-based learning initiative at scale.

Finally, employers are often reluctant to engage in work-based learning and hiring. Some colleges we studied reported hesitancy on the part of employers to recognize the talent and skill of community college students and to commit to hiring students for permanent positions. Hostos Community College, for example, identified employers willing to participate in an IT apprenticeship program—only to have the companies back out when the college stipulated that students be considered for employment opportunities upon completion.

To help engage employers more effectively, Malcolm X College works closely with a City Colleges of Chicago district-level department charged with expanding apprenticeships in Chicago. Malcolm X meets with the department each month to discuss available opportunities. Malcolm X has worked with the department to try to transition some healthcare industry relationships into apprenticeships, but progress has been limited.

In a rapidly growing economy, employers may be more receptive to work-based learning. Wake Technical Community College is launching and planning to scale

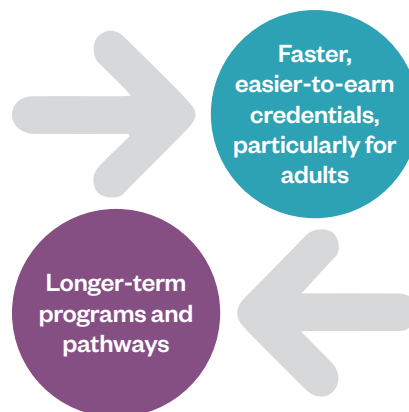
apprenticeship programs in 11 state and federally registered occupations within construction and automotive fields, including building maintenance workers, cellular tower technicians, and automotive technicians. To channel employer interest into sustainable programs, Wake Tech established an executive director of apprenticeships and other work-based learning roles to ensure that the college is implementing and sustaining scalable work-based learning programs. Other colleges having some success expanding work-based opportunities, including Indian River State College and Monroe Community College, similarly created new positions at the college to strengthen relationships with employers.

In lieu of learning at a work site, some occupational programs are simulating work situations and experimenting with other ways to add instruction and experience focused on professional skills, such as customer service skills. At Wake Tech, for example, students in its simulation and game development program can demonstrate their projects for employer representatives on campus. This provides them with valuable networking time with potential future colleagues as well as the experience of presenting their work in a formal setting. Several programs offer students who cannot participate in an apprenticeship or internship the option of completing a capstone project. An employer participates in the development of the project and reviews it upon completion (often fulfilling the formal requirements of an in-person internship).

How are colleges adjusting to meet the simultaneous demand for short-term credentials and longer-term pathways?

Community colleges have long offered a range of career-focused programs, including two-year technical and occupational degree programs, shorter-term for-credit certificate programs, and noncredit workforce training programs that typically last less than one semester. Increasingly, this programming is being pulled in two different directions: toward both longer-term and shorter-term programs. On the one hand, colleges want to address growing employer demand for higher-level skills that are served by more intensive, often longer-duration programs, such as applied baccalaureate programs (available at an increasing number of community colleges in 24 states) and associate degree programs that lead seamlessly to transfer into four-year programs (in nursing, for example). On the other hand, colleges want to address the demand for lower-level skills served by short-term programs (such as IT certification programs) that lead directly and quickly to entry-level employment in high-value fields. The pandemic-related labor market disruptions have increased interest in short-term, accelerated credentials among employers, colleges, and adults seeking to get back into the workforce. This interest has been fueled, in part, by the investment of federal and state recovery funds in the expansion of short-term programs.

Workforce Programming Is Moving in Two Directions



The colleges we studied are aware of the pros and cons of offering more short-term training and credentials, as we discuss below. Workforce leaders articulated a vision of more varied options for students, particularly adults, through an expansion of short-term credential programs that have clear labor market demand and value and that enable students to enter the workforce quickly. As part of this vision, they are exploring ways to rethink how short-term and longer-term degree programs can be integrated into a set of coherent pathways that lead to high-wage, in-demand jobs. Among the colleges we studied, half were reconsidering their organizational divisions and other institutional structures that can serve as barriers between occupational and academic, credit and noncredit, and short-term and long-term programs.

Colleges are expanding short-term training programs sought by local residents and employers.

Shorter-duration credentials have been a steadily growing component of postsecondary skill training for years. Between 2000 and 2010, the number of short-term certificates awarded by community colleges increased by more than 150% (Ositelu et al., 2021). By 2018-19, more than 40% of awards made by public two-year colleges were certificates of less than two years (Jenkins & Fink, 2021). For adults trying to get back into the workforce or to improve their careers, shorter, lower-cost programs with fewer academic requirements can be particularly attractive. The pandemic has added urgency for both job seekers and employers. However, evidence on the returns to shorter-term occupational training is mixed, as earnings vary widely across fields. Workers with certificates in engineering, for example, may have median earnings equivalent to those of many bachelor's degree holders. But certificates in education and cosmetology—though widely offered and popular with many students—generally fail to provide a route to family-sustaining wages (Carnevale et al., 2020). Despite their appeal, many short-term programs produce limited returns for students—unless students continue on to earn additional certificates or a degree (Ositelu, 2021).

In our site visits, we observed several factors underlying colleges' efforts to expand short-term credential programs. Most important, colleges are focused on growing credentials that could lead to well-paying jobs for which there is significant hiring in their local economy. This requires college and workforce leaders to build on and learn from close relationships they have with local employers. They must learn about specific hiring needs so that programs emphasize skills that employers want in new employees and so that curricula can be modified as needs change. Clarity in understanding what training and support employers are able to offer new hires is critical. Funding is also critical: Students enrolling in these programs, often adults with limited resources and substantial family responsibilities, often require basic needs support in addition to tuition assistance. In response, colleges are seeking funding sources to help these students persist and complete programs.

One way colleges have created shorter-term certificate programs is by breaking them off from existing degree programs and offering new for-credit certificates through these departments. For example, after learning from local employers that they wanted

students with more extensive mechatronics skills and experience, Monroe Community College created a 30-credit mechatronics certificate leading to an entry-level position in industrial equipment maintenance. The revised, accelerated program, which was developed out of a traditional manufacturing associate degree program, weaves classroom learning with hands-on experience in the operation and maintenance of electro-mechanical computer-controlled systems found in up-to-date automated manufacturing environments. Certificate earners can move directly to employment or use the program as the first half of Monroe's associate degree program in applied integrated technology.

Some colleges have prioritized programs that do not confer college credit but that do open the door to high-demand jobs with employers in key regional industries. Working with industry advisory councils, Macomb Community College, with deep roots in the regional automotive and aerospace/defense industries, responded to skill changes and augmentation in the automotive industry by developing a series of six- to eight-week intensive (40 hours a week) micro-credential programs that provide students with skills that employers recognize when making hiring and advancement decisions. One of these micro-credentials is designed to help technicians learn in-demand skills traditionally expected of engineers. Close ties to auto industry employers have enabled Macomb to adapt program content to keep up with industry changes. The curriculum for a robot technician certificate, for example, has been adjusted several times to incorporate cloud-based computing and cybersecurity basics, which employers now want potential hires to be proficient in.

Some colleges have prioritized programs that do not confer college credit but that do open the door to high-demand jobs with employers in key regional industries.

Other colleges we studied are working closely with national and local employers to launch short-term noncredit credentials in high-demand fields. At Malcolm X College, which is located in close proximity to some of Chicago's largest healthcare facilities, one third of students are enrolled in health occupation programs, and another third would like to enroll in allied health programs but must first complete developmental education requirements. To increase employment opportunities for students outside of allied health, Malcolm X leaders recently launched a cybersecurity program that can lead to an accelerated, industry-recognized badge. The program aims to help students master skills that are expected by industry leaders, such as Google, so that program completers can cast a wide net for employment.

Colleges recognize that short-term programs can be more valuable when they are aligned with longer-term credentials.

Well-targeted and well-designed short-term credential programs can be a valuable workforce training option—particularly for those with limited time and resources to pursue a degree program. By signaling the attainment of entry-level skills that employers seek, a short-term credential can function as a substantial advantage in the job market. However, individuals who earn standalone short-term credentials run the risk that an initial labor market advantage may stand in their way of advancement over time, as individuals with more advanced credentials get picked for higher-level jobs.

To overcome this potential problem, many within the community college workforce field embrace the idea of “stackable credentials” that combine short- and longer-term credential programs into a coherent pathway to advancement. A stackable credential is part of a sequence of occupation-specific educational credentials that may be of short duration, have labor market value by themselves, can be earned over time, and provide a clear pathway for advancing in a career. By design, stackable credentials are a way for colleges to encourage students to get on a pathway to a range of jobs within a particular field, no matter where they start within a college and how much time they can devote to a learning program in the near term.

We found several examples of colleges implementing stackable credentials in particular occupational fields, and colleges generally were enthusiastic about the concept. A college administrator overseeing workforce programming explained,

We have a visual model that shows how you can get from a 15-credit sequence in a pathway to a 30-credit milestone, then to 60 and to 120 credits when you get a bachelor’s degree. Then you add to that a look at the demand, the kind of wage increases you can expect. . . . You can see a path, and you can start to get a feel for what can be in your future if you choose to invest in this path.

Some of the colleges we studied are further along than others in restructuring course sequences and skill progressions so that credentials in a particular field can stack more easily. This is essential in having students (and employers) understand the pathway from a first credential to one or more with greater value in the labor market. In some cases, colleges have introduced work-focused intermediate credentials into longer degree programs; in others, they have aligned the learning requirements and courses of shorter-term credentials so that they can count as the first part of longer programs without loss of credits or momentum.

At Wake Technical Community College, for example, some business degree programs have embedded certificates in their curricula so students can still receive a credential with labor market value even if they leave before completing an associate degree. Monroe Community College has broken down a robotics degree program into a series of incremental, credential-granting bundles of courses. Monroe is also restructuring its nursing programs into a pathway with clear entry and exit points: The licensed practical nurse (LPN) program now functions as a next step for students who have completed the less-intensive certified nursing assistant (CNA) program. As an incentive to encourage more students to come back, the college reserves slots in the LPN program for CNA completers who want to continue on to the next credential.

Indian River State College is integrating its short-duration credential programs into its college-wide framework of “guided pathways”—a comprehensive reform approach whereby community colleges fundamentally redesign their programs and support services in ways that create clearer, more educationally coherent pathways to credentials with strong labor-market value (CCRC, 2020). Indian River mapped most courses across programs of study to specific certificates or degrees, ensuring that all credits count toward a degree. The college deploys student advisors in specialized areas of

study (e.g., allied health, computer science, digital and media studies) to help students recognize and understand different education and career pathways upon entry. As a result, even students who stay only a semester or two realize they can return and apply earned credits to a degree. Dallas College is another institution that has developed a systemic approach to encouraging and granting more stackable credentials. The college identifies students who qualify or are close to qualifying for an intermediate credential; it automatically grants the credential or alerts students that they could complete the credential if they take one more course.

Despite some progress, the process of building stackable credentials and getting students to pursue multiple credentials is slow and difficult. College administrators identified several institutional-level challenges. Faculty involvement is essential given that stacking requires alignment of learning expectations, curricula, and pedagogy across credentials in a pathway. Degree program faculty can be hard to engage, in part because they may be isolated from direct technical training found in initial short-term credential programs. Successful stacking efforts also require stronger advising and supports to help students make sense of available career and education choices, particularly since the introduction of more varied program options in a given occupational area may make student decision-making more difficult. Having clear entry and exit points in pathways becomes critical, as does guidance to both students and employers on the competency milestones embedded in each short-term credential, whether earned on the credit or noncredit side of the institution. Without this clarity, students may be less likely to return to an educational institution and reap the benefits of additional credentials. It is also the case that specification of entry and exit points can have an unintended effect, making it easier for students to stop out after earning a first credential before completing a next-level credential that could open up better paying career opportunities.

Successful stacking efforts require strong advising and supports to help students make sense of available career and education choices, particularly since the introduction of more varied program options in a given occupational area may make student decision-making more difficult.

Colleges are rethinking the organizational divide between credit and noncredit workforce divisions, but lack of information about noncredit students remains a problem.

Most community colleges offer both for-credit and noncredit workforce training programs, which are traditionally delivered through distinct divisions. For-credit certificate and degree programs are held to higher standards in terms of faculty qualifications, curricular content, and reporting requirements, partly because these programs, unlike noncredit programs, are eligible for federal financial aid. Noncredit programs can be more flexible in setting program length and completion requirements and in how they meet employer needs, but they do not typically transfer easily, if at all, to credit programs, even within the same occupational field (Buckwater & Maag, 2019).

The colleges we studied are interested in aligning and integrating occupational skills training offerings in their credit and noncredit divisions in order to build a more coherent and effective institution-wide approach to labor market advancement. This

requires a rethinking of institutional structures, practices, and policies that serve to perpetuate the siloed nature of credit and noncredit education (see box on Hostos Community College). Some colleges are trying to improve alignment by providing more supports to students enrolled in noncredit training courses. Others are contemplating or engaged in institution-wide changes. Limited data on noncredit students is a key challenge in undertaking broad reforms.

Several colleges are nonetheless moving toward a whole-institution approach to integrating credit and noncredit by restructuring leadership and bringing some related programs under a single umbrella. Macomb Community College has been a leader in merging credit and noncredit divisions, with specific workforce-related departments incorporating associated noncredit programs under a single management structure. Its long-standing integration of credit and noncredit programs allows the college to adapt more nimbly to changes in labor market demand and evolving workplace technology. Housing credit and noncredit programs together also makes it easier for noncredit students to be awarded credits that they can later apply to a degree program that further advances their career.

Aligning Credit and Noncredit Programs at Hostos Community College

Hostos Community College in New York City is prioritizing credit/noncredit alignment in five occupational fields that are important in its regional labor market: medical billing and coding, culinary arts and food protection, construction management, health information technology, and community health work. It has created stronger Prior Learning Assessment (PLA) articulation agreements between the noncredit workforce division and for-credit programs in these fields, which stipulate credit equivalencies of noncredit coursework that can be used toward degree programs. As part of their effort to ensure that noncredit students have access to greater support, Hostos used a grant to hire a transition advisor for students who start in noncredit programs in these fields. Hostos also made student services events available to both credit and noncredit students.

In addition, workforce development staff are tracking the number of students who enter noncredit certificate programs, complete programs, pass certificate exams, and obtain jobs. Hostos workforce leaders are also working with the admissions and financial aid offices to code noncredit courses so that they are recognized in the student information system. And they created a code for continuing education students themselves. As workforce leaders at Hostos indicated, better student data could help the college make improvements to existing programs and inform the development and promotion of new or enhanced programs.

Wake Technical Community College has announced a commitment to creating a “one college” organizational structure where all students can access credit and noncredit programs in their discipline seamlessly. As part of this effort, most noncredit hours will transfer to credit courses, and students will have full access to college supports such as advising and learning supports. Starting with the IT department, the college has created a new provost position to oversee all IT programs offered at the institution, including

credit and noncredit programs. Going forward, Wake Tech leadership views the college as a “ladder institution” for the community, meaning that regardless of where or how individuals enter the college, they are supported in achieving their short-term and long-term goals.

Colleges that have begun integrating credit and noncredit divisions understand the need to extend academic and other supports to students enrolled in noncredit courses, particularly for those who aspire to enroll in credit programs. Several colleges emphasized that their noncredit students—who are disproportionately low-income students, English language learners, and older adults—often need a range of supports to persist and complete. At one college, advising staff were enthusiastic about the changes and believed it was in the best interest of all students to bring these traditionally siloed areas under unified leadership. However, they also expressed concern about how to provide advising and support to noncredit students, given existing capacity issues and high student-to-advisor ratios on the credit side.

While these examples are encouraging, workforce leaders across the colleges emphasized the need to better understand the characteristics, in-program experiences, and outcomes of noncredit students. To this end, many institutions are working to improve the collection and use of data on student enrollments, advancement, and completion. Unlike students in credit programs, students in noncredit programs are not typically tracked before, during, or after they leave a program. Few if any mechanisms exist to measure their educational progress and post-program employment outcomes or to keep them engaged with the college after completion of an initial course or program. Almost all colleges reported that student information systems for credit and noncredit divisions are not integrated, in part because the more robust credit-side systems are not easily adapted for noncredit offerings. This disconnect and the lack of long-term tracking of noncredit student enrollment and progress hinder efforts to integrate credit and noncredit offerings. Colleges generally know little about their noncredit students.

In a few cases, we heard about federally funded noncredit programs in which colleges are required to report on the number and characteristics of students served and their outcomes. These data, however, are mainly used for compliance and seem to have little use to the colleges. At some institutions, noncredit students do not receive a college identification number and do not have access to college resources such as the library or advising. This further cements the “second class” status of noncredit students.

There is much work to be done in this area. Colleges have limited incentives to collect data on noncredit students, as noncredit students do not typically count in per-student funding allocations by states. There is no national record of noncredit students, nor is there a national (or accreditation-based) standard for collecting data on noncredit students. IPEDS, the federal reporting system for postsecondary institutions, does not ask colleges to report on noncredit students. To further complicate matters, states and institutions differ in how they designate a student as noncredit, making any attempts at standardization even more daunting.

Few mechanisms exist to measure the educational progress and post-program employment outcomes of noncredit students.

How are colleges addressing equity concerns within their workforce programs?

As community colleges modify their workforce programs to meet changing skill demands for entry-level and higher-level occupations, they run the risk that their adjustments could have a negative effect on equitable access to and success in high-value programs. In trying to meet employer needs, colleges might inadvertently create or exacerbate barriers for low-income and minoritized students, which could lower the numbers of underserved students who enroll in and complete programs associated with high-wage employment.

Some colleges in this study are in the early stages of establishing a shared understanding of what equity-minded practice means at their institutions. And many interviewees we spoke with identified critical factors that get in the way of diversifying workforce programs and narrowing gaps in student access and success. Some of the colleges have established working groups or task forces to address equity concerns. And a couple of the colleges are focused on practical ways to increase participation in programs that lead to strong employment outcomes among Black, Latinx, and other underserved students, as well as on ways to support the basic needs of their students who are under economic hardship.

Colleges express a commitment to equity within their workforce programs, but they struggle to operationalize that commitment in policy and practice.

Leaders from the colleges we studied described why equity needs to be front and center as workforce programs adapt to changing skill demands. Many interviewees discussed the need to support underserved residents and local economic development, which is a core community college mission. Hostos Community College, for instance, serves large numbers of students who are underrepresented in postsecondary education. It is located in the South Bronx, one of the poorest areas in New York City. The population is about 30% Black and 65% Latinx, with large numbers from Puerto Rico, the Dominican Republic, and Mexico—half of its residents are foreign-born (Cappello, 2020). Hostos has a long history of providing healthcare training programs to South Bronx residents, driven in large part by the acute healthcare needs of the community. Hostos sees economic and community development as its foundational purpose.

Representatives from other colleges in our study voiced similar sentiments. At Dallas College, workforce leaders explained that the city's rapidly changing and growing economy must include the participation of populations that have been historically underrepresented in the higher-wage workforce. They hold that the college should play a role in expanding the pipeline to good jobs for local, largely Latinx residents, slowing gentrification in the process. The circumstances in and around Raleigh, North Carolina, are similar. The Raleigh and Research Triangle region has experienced both rapid growth and increased inequality in recent years. In response, Wake Technical Community College sees a need and opportunity to support greater economic mobility for Wake County residents. The college is paying particular attention to the lowest income quintile of the population, according to several college leaders, a focus that shapes Wake Tech's

decisions about what programs to offer, how to conduct outreach to local high schools and neighborhoods, and even where to locate future branch campuses.

College workforce leaders we interviewed have a strong desire to improve outcomes for underserved students. However, they tended to point to three issues that hinder their efforts to increase access to programs, improve success in programs, and facilitate strong labor market outcomes for underserved students, which we outline below. The issues are complex and, in some respects, they extend beyond the control of college workforce programs. Yet many interviewees argued that their colleges must do much more to promote equitable student outcomes.

Selective admissions criteria in high-value workforce programs may place underserved students at a disadvantage.

While community colleges are open-enrollment institutions, workforce programs that lead to high-wage jobs, career growth, and nearly guaranteed employment—such as nursing and dental hygiene—tend to be so popular that they rely on selective admissions. Despite strong interest from prospective students, state regulations, higher program costs, and staffing challenges limit the number of seats in such programs. Dental hygiene programs, for instance, are limited to 25 students per year at some institutions. Colleges may use exams, grades, prerequisite course completions, and other criteria to rank students for acceptance into high-value allied health programs. As noted earlier, prerequisite developmental math requirements and lengthy math course sequences impede access to good programs and success for many students. At one college, for example, efforts to diversify selective occupational programs have been difficult because many students do not advance beyond developmental math courses or do not complete the math course requirements for the programs.

These requirements highlight what many consider to be a central difficulty in using academic proficiency criteria in selective admissions: achieving the right balance between program integrity and rigor and the desire to help more students who could benefit from these programs. The rejection of large numbers of students applying for these programs typically affects Black and Latinx students disproportionately (Anderson et al., 2021). What is more, the traditional social networks of faculty, staff, and employers may reinforce biases in recruitment and program advising for prospective students.

Limited advising and support in workforce programs may hinder success among underserved students. Advising and academic support systems in community colleges tend to be designed with transfer students in mind. Most colleges encourage students to use some form of academic tutoring for transfer-oriented math and English courses, for example, but do offer or emphasize tutoring for workforce-specific courses such as Math for the Trades. College advisors are typically generalists who focus on supporting degree-seeking and transfer students on matters related



There's implicit bias [and] institutionalized racism. Colleges need to ask, 'How far are we willing to go to support students entering the workforce?' Just creating jobs and bringing employers in is not enough to solve the systemic issues.

– Community college workforce leader



to scheduling and completing the right courses for their academic and career plans. We learned from interviewees at several colleges that advisors are often unfamiliar with specific workforce programs. Colleges frequently rely on individual workforce division instructors, many of whom have worked in industry, to provide ad hoc advising and counseling to students interested in workforce programs. While some colleges offer more formal advising support for students enrolled in workforce programs, staffing is often inadequate, and support is limited in scope. At one college, for example, two retention specialists were charged with overseeing close to 700 students across two programs, certified nursing assistant and precision machining.

Support for students enrolled in for-credit workforce programs is often provided through career centers, where students receive help connecting with potential employers and developing their resumes. While career centers offer students valuable information about employment opportunities and how to seek out jobs, they do not typically address the academic and personal needs of students enrolled in workforce programs. Since low-income and minoritized populations are overrepresented in workforce rather than transfer-oriented programs of study, the lack of advising and support for workforce students has substantial equity implications.

Colleges are using student data and tailored approaches to formulate and advance their equity goals.

Like many community colleges across the country, the colleges in this study are still early in the work of aligning workforce reform efforts with their efforts to address equity concerns. We identified several examples in which colleges are taking steps to promote education pathways to good jobs for underserved students.

Indian River State College is using data to identify and address equity gaps.

To measure and reduce gender and racial/ethnic gaps in access to high-demand, high-wage programs, Indian River faculty, staff, and administrators have institutionalized data sharing down to the course level, so that everyone at the college is accountable to support student success. College leaders meet regularly with the institutional research office to disaggregate student enrollment and achievement data in programs by gender, race/ethnicity, part-time/full-time, first-time-in-college, and first-generation status. Doing so can illuminate equity gaps in both transfer and workforce programs. They share this data across the college, making presentations on student success and equity to academic departments and student services staff. The analysis of student data has driven efforts to improve retention and completion of underserved students within workforce programs. The college created a task force to identify strategies to close achievement gaps between Black and White students and increase participation in high-value programs.

Malcolm X College and Laney College are beginning to identify specific student populations for particular interventions. Many of the colleges in this study struggle to define what equity means within their institutions and how it relates to workforce programs. To address this problem and define what “equity-minded practice” means for the college community, Laney College administrators established a student success

and equity committee. The committee grew out of an awareness that economic hardship within their service area contributes to achievement inequities at the college and within the district. Among the three colleges in its district, Laney serves the largest population of low-income students, with high levels of homelessness and food insecurity. As a first step, the committee examined student data to identify which groups are disproportionately impacted according to these and other hardship measures defined by the state. They found that Black, Southeast Asian, and veteran students are some of the most affected. Based on that information, the committee began to identify practices to help impacted students meet basic needs and achieve their academic and career goals. For instance, through its Umoja program, Laney embeds tutoring and curriculum that is culturally relevant to the African American experience in some of its classes.

Malcolm X has an explicit focus on increasing Black enrollment within workforce programs, in part aided by funding from the Workforce Equity Initiative created by the Illinois legislature. This state initiative aims to expand Black enrollment and success in short-term occupational certificate programs. With its grant, Malcolm X expanded five existing for-credit allied health programs and created a new for-credit cybersecurity program. Grant funds were used to provide “last-dollar” tuition scholarships for eligible students, which provide money to pay for tuition expenses not covered by Pell grants and other financial aid.

The college focused its outreach for the programs on local Black residents who could benefit from and succeed in for-credit short-term programs. This is an important goal for the college, which is located in a neighborhood on Chicago’s West Side where the proportion of Black residents has been shrinking. To meet the state’s benchmark of 60% Black enrollment in the programs, Malcolm X worked closely with community partners to aim marketing and outreach to particular Zip codes. After one year, the college met its goal to enroll 190 Black students in the six programs and to place 90 completers in jobs.

Considerations for Practice

This report has presented findings from a study of how eight community colleges are responding to changes in skill demands sought by employers for middle-skill jobs, changes that are rooted in the increased use of automation and digital technologies in the workplace. The research we conducted focused on the colleges' workforce programs in three high-value fields that are undergoing rapid workplace technological change—allied health, IT, and advanced manufacturing. The colleges themselves represent a diverse cross section of U.S. community college contexts in terms of local economic vitality, trends shaping regional industries and employers, the funding and infrastructure of their workforce programs, and the characteristics of their enrolled students. Variations in these factors may affect how each college responds to new skill expectations, including, for example, how each one engages and collaborates with local employers, revises the structure and curricula of workforce programming in ways that help students and promote equity, and introduces other sustainable innovations at a meaningful scale. Yet, despite differences in their particular circumstances, we were struck by the extent to which these colleges share a common understanding of the challenges they face, the kinds of modifications they believe are important for them to make, and the most difficult barriers they feel must be overcome.

Here we summarize key considerations for community colleges that want to respond effectively to evolving skill demands of local employers, as voiced by interviewees in our study. It is important to recognize that several of these considerations are in tension with funding constraints that affect under-resourced community colleges throughout the nation. Community colleges that want to provide better workforce education programming will benefit from additional funding aimed directly at this goal.

Modifying Program Curricula

The colleges in our study reported that skill demands for middle-skill jobs are increasing along several dimensions. Foundational math and English skill expectations have been rising for some time, posing instructional and curricular challenges, particularly in the area of math preparation. What is more recent is the growing demand for digital literacy and professional skills (including teamwork, customer service, and problem-solving skills), which previously were associated with higher-skill jobs requiring a bachelor's degree. College leaders emphasized several considerations for modifying the design of workforce programs in the face of rising skill demands.

Reassess how the math needs of workforce students are met.

The completion of both developmental and college-level math coursework constitutes a substantial barrier for many students, particularly those who have been out of school for some time, keeping them from enrolling in and succeeding in

high-value workforce programs. There are proven models for how to help students acquire the math skills they need. For example, Washington State's Integrated Basic Education Skills Training program (I-BEST) uses a team-teaching approach that pairs a basic skills instructor and an occupational instructor in the delivery of training in fields such as nursing and precision machining. A recent randomized controlled trial found that I-BEST produced a large impact on the attainment of shorter-term workforce certificates, though it did not increase receipt of higher-level credentials such as associate degrees (Martinson et al., 2021; see also Anderson et al., 2017).

Colleges may also want to consider how the use of corequisite developmental math courses, which allow students to enter college-level courses sooner, and the use of multiple math pathway courses, whose content better matches students' career goals, can better address students' math needs (Logue et al, 2016, Charles A. Dana Center, n.d.). A randomized controlled trial of Dana Center Math Pathways, which focuses on quantitative reasoning and statistical concepts that align with students' programs of study, found that it increased students' completion of the developmental math sequence and their likelihood of taking and passing college-level math (Zachry Rutschow et al., 2019).

Do more to help workforce students develop digital literacy skills.

Colleges should address what kind of preparation and activities best support the acquisition of digital literacy skills in workforce programs. Several of the community colleges in this study have adjusted curricula and instruction to embed the greater use of computers, digital technologies, and data analytics into the technical courses of particular programs. In some cases, new curricula and courses have been developed in consultation with industry leaders. Nevertheless, digital literacy is a relatively new subject of instruction, and some of the workforce program directors and faculty we interviewed expressed a need for industry-defined standards and teaching materials that could be used in the classroom. This may be an area where federal funding or philanthropic support is needed to support curriculum development, either through grants to community colleges or intermediary organizations with expertise in digital learning.

Focus greater efforts on providing work-based learning opportunities.

Work-based learning is understood as an increasingly valuable experience for workforce students. It is a useful way for students to learn about norms of employment and the workplace, network with prospective employers, and acquire general and specific job skills, including professional skills that revolve around collaboration, problem-solving, and customer service. Given the difficulty workforce programs have in keeping up with technology upgrades, work-based learning is often useful in imparting digital literacy skills. Indeed, work-based learning may be one of the only ways students can get hands-on experience with the latest technological equipment and tools in their field.

All the colleges in this study acknowledge the need to facilitate increased student access to employers who might hire them, preferably by making work-based learning experiences a more routine component of workforce programming. Yet these opportunities are difficult to arrange with employers at a substantial scale. How to grow a range of work-based experiences—including capstone projects, internships, clinical placements, and apprenticeships—is a focus of significant effort across the colleges we studied. Some are hiring new staff to reach out to employers and bolster employer engagement. Additional resources from state, federal, and private sources will be needed both to substantially increase the number of students who benefit from work-based learning and to allocate opportunities equitably. Where resources are limited, virtual simulations and scenario-based learning may offer another way to provide workplace-like experiences to a greater number of students.

Reorganizing College Structures and Supports

Long-standing divisions between community college credit and noncredit workforce programs, between shorter-term and longer-term for-credit workforce programs, and between direct-entry workforce and transfer-oriented degree programs are coming under greater scrutiny. As skill demands rise and as community college workforce program enrollments decline, at least in some fields, many colleges are seeking ways to provide their students with clearer education pathways to good jobs and careers (or to transfer destinations for bachelor's degree programs). Some are experimenting with ways to reorganize college structures in ways that might enable more workforce students to succeed in their programs and in the labor market. Our interviewees emphasized two related restructuring strategies, and they noted the importance of reconsidering advising and supports for workforce students in conjunction with these strategies.

Rethink the relationship between credit and noncredit workforce offerings.

Several of the colleges in our study are making efforts to align credit and noncredit workforce offerings in ways that build a more coordinated approach to labor market entry and advancement for their students. Some are providing noncredit students with more intensive support and better information about related for-credit programs in the same field. Others are moving toward a whole-college framework by reorganizing credit and noncredit divisions under a single management structure. A critical step in this work is improving the collection and use of data on student enrollments, program completions, and post-program outcomes. Most colleges have separate systems for credit and noncredit students, and noncredit systems are not usually set up to follow the trajectories of noncredit students. Integrating these two data systems is difficult. (Yet, as we describe below in our discussion of equity in program participation, the collection and use of good data are instrumental for understanding what is occurring in colleges.) Different program standards and funding streams in credit and noncredit programs make this work of aligning these offerings all the more challenging.

Federal and state education and workforce agencies can lend support by providing grants and technical assistance to colleges to improve their data collection and tracking of noncredit students. Many colleges also need help linking student records to state employment data systems to gain timely information on the employment and earnings of students who have enrolled in credit and noncredit programs. Colleges can use this information to strengthen the advising they offer to incoming students about the wages associated with different fields of study. They also need this information to make improvements in programs or discontinue training that does not lead to living wages.

Better align short-term certificate programs with longer-duration degree programs.

Earning a short-term credential can help someone get an entry-level job. But as skill demands rise, a short-term credential may provide little help in the way of career advancement. In response to this conundrum, the colleges we studied are increasingly interested in redesigning their workforce programming around stackable credentials, sequential postsecondary certificates and degrees along a career pathway that individuals can pursue over time. Examples include CNA, LPN, and RN programs in nursing, and certificate and degree programs in IT). Some colleges we studied have introduced intermediate credentials into longer-term degree programs; others have aligned courses in shorter-term credential programs so that they serve as the first part of longer-term programs. Yet the creation of stackable credential pathways has not been systematic across workforce programs at these colleges, and the use of stackable credentials by students remains modest. Our research suggests that colleges offering stackable credentials can do a better job of explaining to students how to make short-term certificates add up to a degree and how this may lead to higher earnings. Students may need to receive this information at different points in time and be shown what supports are available to help them combine work and school. Employers also have a role to play in promoting and facilitating the return to college for additional credentials.

Reorganize advising and support services for workforce students, many of whom are from underserved populations.

As colleges we studied are working to bring program offerings in the same field into better alignment, they are finding that they need to rethink what advising and support services are directed toward workforce students. Previous work by CCRC and others suggests that offering students a set of cohesive supports that match their needs throughout the college experience can facilitate greater completion and success (Karp et al, 2021; Brock & Slater, 2021). Strong advising is particularly important for students in career pathways with stackable credentials (Cotner et al., 2021).

Yet, there is a substantial resource challenge in providing improved advising and support for workforce students; student-to-advisor ratios, for example, among transfer-oriented students are already high. CCRC's research on guided pathways reforms suggests that colleges can cover the expense for additional advisors with grant funding and/or modest tuition and fee increases. It also suggests that the added

investment pays off for colleges and students in terms of increased retention and graduation. In some states, performance-based funding may also help colleges recoup their investments (Jenkins et al., 2020). Finally, in a time when many colleges are faced with declines in enrollment, strong advising services may be used as a selling point to potential students who are weighing the benefits of community college versus other training options.

Addressing Equity Concerns

In principle, modifying workforce program curricula, increasing student supports, and reorganizing college structures to better align traditional workforce and academic offerings are all steps that contribute to or are at least consistent with an equity agenda. Representatives from the colleges in our study also emphasized the importance of improving recruitment strategies and using student data to build consensus around reforms and interventions that promote success among underserved students. They also focused attention on inequitable access to technology.

Enhance efforts to recruit underserved students and provide a culturally responsive campus environment.

When colleges express a clear commitment to improve outcomes of underserved students, they need to think explicitly about their recruitment practices and program selection criteria for high-value workforce programs, especially those programs with competitive admissions or limited availability. Colleges can enhance their recruitment strategies for Black and Latinx students through more tailored messaging and by using dedicated, high-touch recruiters. In addition, leveraging connections with community-based organizations and other organizations may be helpful in recruiting diverse learners.

Colleges also need to examine the cultural climate of workforce programs as well as specific supports that could be important for underserved students, including supports that address basic needs such as food insecurity. Attending explicitly to the identity of Black, Latinx, and other minoritized students may also be crucial. Developing an instructional and support services climate that actively welcomes diverse students, is responsive to their experiences, and strives to build an on-campus community can help to foster a greater sense of belonging and self-efficacy that may be essential for the retention of underserved students (Brathwaite et al., 2021).

Disaggregate student data across programs to examine equity gaps and identify reforms.

Colleges can use their own institutional research departments to disaggregate student enrollment and achievement data in each program to reveal equity gaps in high-value workforce programs (Fink & Jenkins, 2020). Data on labor market outcomes of program completers is also instrumental. Sharing this data across the college, with both faculty and student services staff, can be useful in persuading stakeholders about stark inequities in access and outcomes by race/ethnicity, family income, and

other student characteristics. It can also inform efforts to improve the recruitment, retention, and completion of underserved students in particular programs.

Our study suggests that not all colleges take full advantage of this institutional-level data. What is more, as noted above, institutions are often lacking data on students in noncredit programs, including information on student characteristics, in-program experiences, and transitions into next-level programs or employment—information that is critical for a college trying to smooth the transition between short-term and long-term workforce programs and improve labor market outcomes. Lack of data on noncredit students and the poor use of student data generally limits the ability of a college to determine whether students are well-served, what equity gaps exist in enrollment and completion of high-value programs, and whether equity gaps are narrowing or widening as a result of innovations and reform. It also makes it hard to combine data on equity across colleges and states.

Though the lack of noncredit data has captured the attention of national organizations such as the National Student Clearinghouse, buy-in from federal, state, and college leaders is needed. A starting point would be establishing a set of unified metrics and definitions for states, systems, and institutions to count students enrolled in credit and noncredit programs disaggregated by student characteristics, and then collect information on different noncredit education metrics (e.g., enrollment by program, hours of training, credential attainment, and post-program outcomes).

Eliminate the “digital divide” in student access to technology.

Colleges must balance their assessment of industry expectations for digital literacy among prospective employees with what they are capable of offering students, which is different across colleges. Interviewees from several colleges we studied, particularly those serving low-income urban populations, said that they lack the resources to upgrade the technology used in workforce programming as much or as often as they would like. The lack of up-to-date technology in workforce programs limits instruction in digital literacy skills. Another concern is that students themselves may lack easy internet access. They may not own a personal computer, or they may have to share it with several family members. This dynamic became even more evident during COVID, as most colleges shifted to online learning and began lending students laptops and providing them with Wi-Fi access. Underserved students are more likely to encounter these problems.

Colleges should seek ways both to fund technology upgrades to equipment used in workforce programming and to ensure that all students have adequate access to personal computers and the internet. This may include partnering with local businesses, government agencies, or nonprofits to distribute laptops to students who do not have them and increase the availability of Wi-Fi hotspots on campus and in neighborhoods where students live. Similar to advising, the additional costs associated with enhanced technology support may pay off in terms of increased student enrollment, retention, and completion.

Conclusion

We conducted most of the interviews for this study before the COVID-19 pandemic. If anything, the trends we identified in terms of the need for greater skills development for employment—and the associated strategic questions confronting community colleges—have become more salient during the pandemic (Parker et al., 2020). Adults without a college degree and Black and Latinx Americans have been laid off or have experienced reductions in hours and income at a higher rate than others. The pandemic has forced businesses and consumers to adjust their behavior in ways that are likely to have long-term consequences for the labor market, including increased reliance on remote work and demand shifts within industries and occupations (Lund et al., 2021).

As the nation emerges from the pandemic, community colleges will need to adapt to new realities: the growth of online course-taking, even more accelerated technology innovation in the workplace, uneven recovery among low-income workers, and declining community college enrollments. From our interviews, we saw institutions that know they need to change, and know some of the ways they need to change to adjust to these new realities. We did not, however, see a coherent, comprehensive approach at any one college. Nor do we feel that there is a national as opposed to many local responses among community colleges. In response to the Great Recession, the Department of Labor instituted the \$1.9 billion Trade Adjustment Assistance Community College and Career Training (TAACCCT) grant program as a means to help community colleges better serve dislocated workers by expanding and improving workforce programming in high-value fields. A comparable federal grants program may be needed to help community college workforce training programs meet today's workforce challenges. State and local governments, industries, and philanthropies also have a role to play in supporting research, development, and technical assistance that will help community colleges deliver the high-quality training and supports students need to achieve their goals and eliminate disparities by race and ethnicity in program access and student outcomes.

Community colleges will need to adapt to new realities: the growth of online coursetaking, even more accelerated technology innovation in the workplace, uneven recovery among low-income workers, and declining community college enrollments.

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Appendix A: Study Method and Data Sources

To examine how community college workforce training content and curricula, organizational design, and delivery methods are adjusting to accommodate new technologies and shifting skill demands, we conducted field visits to the participating colleges between October 2019 and March 2020. Each site visit lasted two to three days. Data collection activities included (1) semi-structured interviews with college administrators and workforce leaders and staff, (2) semi-structured focus groups with faculty (both credit and noncredit) and student services staff, and (3) observations of workforce training programs. At a few sites, we also interviewed some employers who work closely with the college. All interviews were audio recorded with participants' permission. Interview protocols were designed to learn about credit and noncredit workforce training across three occupational fields: allied health, information technology, and advanced manufacturing. We also gave room for the colleges to tell us about other programs, strategies, or initiatives that they felt were relevant to the study, in particular, those focused on equity issues. In total, we interviewed 215 people, including college presidents and other administrators, workforce leaders and staff, faculty, student support professionals, and employers. Table A1 lists number of participants by stakeholder type.

Table A1.
Total Number of Study Participants by Stakeholder Type

STAKEHOLDER TYPE	TOTAL NUMBER OF PARTICIPANTS
College presidents and administrators	54
Workforce development and noncredit administrators and staff	41
Credit faculty	44
Noncredit faculty*	22
Student services staff	48

*Some colleges have limited noncredit programming.

After each field visit, we prepared feedback memos to colleges that highlighted emergent findings. The feedback memos also provided an opportunity to follow up with the colleges on any unanswered questions or points of clarification after our field visits.

Data analysis was inductive, allowing for the emergence of conceptual categories and descriptive themes. The analysis process consisted of three phases: (1) coding scheme development, (2) data coding and organization, and (3) analysis of coded data. During the third phase, we identified common patterns and relationships in responses and generated cross-cutting themes. In particular, we looked for common challenges across institutions and sought to highlight innovative examples.

Appendix B: College and Area Descriptions

Dallas College

Dallas College, formerly El Centro College, is situated in downtown Dallas, just blocks from City Hall and the Reunion Tower landmark. It is in a fast-growing area whose population increased by 11.3% since 2010. Many companies call Dallas home, including American Airlines, AT&T, and Texas Instruments, each of which employs more than 10,000 people in the area. The healthcare and manufacturing industries are also quite robust in the city.

About 85% of the college's nearly 13,000 students were enrolled in part-time programs in 2019, which is the largest share of part-time students among study colleges. Most of Dallas's students identify as Hispanic (51%), with another 22% identifying as Black and 15% identifying as White. Two thirds (66%) of Dallas students are female, and 26% of full-time students receive Pell Grants. The largest study-relevant for-credit workforce programs in fall 2019 included computer and information sciences (1,728 students), health professions (1,592 students), and nursing (571 students).

Hostos Community College

Hostos Community College is located in the South Bronx neighborhood of New York City, an area with a large immigrant population. It is the least educated area in our study, with a bachelor's attainment rate of 20.4% in 2019. Bronx County grew by 2.4% over the last decade and is home to businesses including FreshDirect, the online supermarket company, and the New York City grocery chain Morton Williams.

Hostos is one of the smallest colleges we visited, enrolling 7,120 students in 2019. Non-White students make up the large majority of students at Hostos, with 91% of enrollees identifying as either Hispanic (62%) or Black (29%). Hostos has the largest share of Pell Grant recipients (66%) of the colleges in our sample. The largest study-relevant for-credit workforce programs in fall 2019 included health professions (1,742) and nursing (787).

Indian River State College

Indian River State College in St. Lucie County, Florida sits at the heart of a rapidly growing region along the Atlantic Ocean known as the Treasure Coast. St. Lucie grew by 18% between 2010 and 2018, and—relative to other sites in the study—has a low poverty rate (10.5%) and a low unemployment rate (3.9% during the time of our data collection). The two largest employers in the county are the public schools and Indian River State College. Other major industries include healthcare services, call centers, and boat manufacturing. St. Lucie County offers many recreational opportunities, and many people choose it as a place to retire.

Indian River State College enrolled close to 17,000 students in 2019. Half its students identify as White, 25% as Hispanic, and 15% as Black. About one out of three students receive Pell Grants. The three largest for-credit workforce programs relevant to this study's three occupational areas in fall 2019 were in health professions (1,657 students), computer information and science (953), and engineering-related technology (434).

Laney College

Oakland, California—home to Laney College—saw its population grow by 10.8% in the last 10 years. Among the areas in our study, Oakland, with an average income of roughly \$73,700 and a 44% bachelor's attainment rate, is relatively wealthy and well educated. Although the technology industry looms large in neighboring San Francisco, companies in a variety of sectors—including health, transportation, and consumer goods—call Oakland home. The medical group Kaiser Permanente is the city's largest employer, with Oakland Unified School District, the state and local governments, and Southwest Airlines among the major employers.

Laney is among the most racially diverse colleges in our study, with 27% of students identifying as Asian, 25% as Hispanic, 19% as Black, and 14% as White. Just 22% of Laney's nearly 10,500 students receive Pell Grants, the lowest share of colleges in our study. The three largest study-relevant for-credit workforce programs in fall 2019 included computer and information services (698), engineering-related technology (102), and engineering (74).

Macomb Community College

Located just 20 miles from Detroit, Macomb Community College's story cannot be extricated from the region's historic automotive and manufacturing industries. Macomb County experienced modest growth (3.9%) over the last decade and, with a poverty rate of 8.6% and median household income of nearly \$65,000, is home to a wealthier population than most colleges in this study. The engineering, transportation, and business sectors in Detroit employ a substantial number of Macomb residents.

Macomb enrolled 20,000 students in 2019. Its students are largely White (70%); Black students comprise the second-largest racial group (11%). The largest for-credit workforce programs relevant to this study in fall 2019 included health professions (888), engineering-related technology (872), and computer and information sciences (628).

Malcolm X Community College

Malcolm X Community College is one of seven colleges in the City Colleges of Chicago and is located about three miles west of the city's central business district. In addition to sitting in the shadow of the United Center, which the Chicago Bulls and Blackhawks call home, Malcolm X is just steps from several prominent hospitals and

healthcare facilities, including Rush University Medical Center and the University of Illinois at Chicago College of Medicine. Malcolm X is one of just two colleges in our study that is in an area that is not growing; in fact, Chicago saw its population decline by 0.1% from 2010–2019. Chicago has both a larger share of impoverished residents (18.4%) and college-educated residents (39.5%) than most other regions in our study.

Malcolm X is the smallest college in our sample, enrolling just shy of 7,000 students in fall 2019. The student population is mostly Hispanic and Black (50% and 35%, respectively) and mostly female (75%). The largest study-relevant for-credit workforce programs in fall 2019 were in health professions (1,183) and nursing (343).

Monroe Community College

Rochester, New York, home to Monroe Community College, is the birthplace of storied companies like Xerox, Kodak, and Western Union. It saw its population decline by 2.4% over the last decade, as those same corporations declined. Rochester has a 31.3% poverty rate and an average household income is \$35,590. Today, the largest employers include the University of Rochester, Rochester Regional Health, and Wegmans, the grocery chain headquartered in the city.

Monroe enrolled just over 11,500 students in fall 2019, and it is the only college in our study at which full-time enrollment (6,927) meaningfully exceeded part-time (4,645). Fifty-five percent of students at Monroe identify as White, 21% as Black, and 11% as Hispanic. Just over half (51%) of Monroe students received a Pell Grant in 2019. The three largest study-relevant for-credit workforce programs in fall 2019 included health professions (1,370), engineering-related technology (394), and computer and information sciences (355).

Wake Technical Community College

Wake County, North Carolina—which includes the city of Raleigh—grew by 23.4% over the last decade, the fastest rate of any area in our study. Wake Tech’s hometown is also the wealthiest and most educated community across the study colleges, with an average household income of \$84,215 and a bachelor’s attainment rate of 54.1%. Further, Wake County is a hub of higher education: North Carolina State, Meredith College, and several other postsecondary institutions have roots there. The area is also home to many businesses, including several with ties to the technology industry. Along with Verizon and Lenovo Group, the software company SAS Institute is based in Wake County. In April 2021, Apple announced it would invest \$1 billion to build a campus in the county.

Wake Tech is the largest college in our study, with just over 22,000 students in 2019. Two thirds of for-credit students enroll in part-time programs, and nearly 20,000 additional students participate in noncredit programs. Half (50%) of Wake Tech students in credit-bearing programs identify as White, with another 22% identifying as Black and 13% as Hispanic. The three largest study-relevant for-credit training programs in fall 2019 included health professions (2,830), computer and information services (1,517), and engineering (841).

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