



A COMMUNITY COLLEGE GUIDE TO

Excellence and Equity in STEM Programs

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The Aspen Institute College Excellence Program

**The Aspen Institute’s College Excellence Program
supports colleges and universities in their quest to
achieve a higher standard of excellence, delivering
credentials that unlock life-changing careers and
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them with the knowledge, skills, and research-backed
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student outcomes**.

Since our founding in 2010, we have used data to
elevate excellence in practice; conducted extensive
research to deeply understand what improves student
success and equity; equipped the field with tools and
guidance to replicate what works; and developed diverse,
transformational leaders advancing student success.

For many years, community colleges across the country have been working hard to improve student success—reflected in a 5.4-percentage-point jump in three-year completion rates.¹ While such improvement deserves recognition, more needs to be done.

Today, just over 42 percent of community college students graduate from any institution in six years.² Among those graduates, too many earn credentials that are not aligned to good jobs. According to the Community College Research Center (CCRC), only about a quarter of associate degree graduates and a little more than a third of occupational certificate holders completed programs associated with earnings of at least \$35,000 two years after completion.³

Those limitations affect some community college students more than others.⁴ Black and low-income students complete degrees at lower rates.⁵ And while the graduation rate for Hispanic students is comparable to the national average—and has been improving—Hispanic community college graduates are much more likely than other students to complete programs associated with wages below \$35,000 (and

less likely to complete programs associated with earning higher wages).⁶

Colleges aiming to graduate students into good jobs in their regional labor markets often come to the same conclusion: They need to focus on programs aligned to jobs in science, technology, engineering, and math (STEM). Conclusions about the value of STEM programs are rooted in data: Across the country, median earnings for full-time workers ages 25 and older in STEM fields are \$77,400—a full \$30,000 more than the median wages for workers in non-STEM occupations.⁷ Some STEM jobs require a community college credential in a career and technical field, others a bachelor's that can begin with a pre-major associate degree program.

It is with these realities in mind that over the past few years the Aspen Institute College Excellence Program (Aspen) has been investigating what it takes to deliver excellent and equitable STEM programs—those that effectively prepare low-income, Black, Hispanic, and female students for in-demand STEM careers.

We partnered with the Siemens Foundation to recognize these programs with the Excellence and Equity in Community College STEM Award: An Aspen-Siemens

¹ Reflects an increase in completion among first-time, full-time credential-seeking students between cohort that started in 2011 and cohort that started in 2017: <https://nces.ed.gov/ipeds/TrendGenerator/app/answer/7/21>.

² "Completing College: National and State Reports With New Longitudinal Data." National Student Clearinghouse Research Center, February 2022. https://nscresearchcenter.org/wp-content/uploads/Completions_Report_2021.pdf.

³ Fink, John, and Davis Jenkins. "How Much Are Community College Graduates Earning Two Years Later?" *The Mixed Methods Blog*, January 13, 2022. <https://ccrc.tc.columbia.edu/easyblog/how-much-are-community-college-graduates-earning.html>.; Carnevale, Anthony P., Strohl, Jeff, Cheah, Ban, and Neil Ridley. "Good Jobs that Pay without a BA." Center on Education and the Workforce. *Georgetown University*, 2017. <https://goodjobsdata.org/wp-content/uploads/Good-Jobs-wo-BA-final.pdf>.; "Three Educational Pathways to Good Jobs." Center on Education and the Workforce. *Georgetown University*, 2017. Last modified August 13, 2021. <https://cew.georgetown.edu/cew-reports/3pathways/>.

⁴ Butrymowicz, Sarah, Amy, Jeff, and Larry Fenn. "How career and technical education shuts out Black and Latino students from high-paying professions." *The Hechinger Report*, October 22, 2020. <https://hechingerreport.org/how-career-and-technical-education-shuts-out-black-and-latino-students-from-high-paying-professions/>.

⁵ "Completing College: National and State Reports With New Longitudinal Data." National Student Clearinghouse Research Center, February 2022. https://nscresearchcenter.org/wp-content/uploads/Completions_Report_2021.pdf.

⁶ Hispanic students earn 25 percent of community college credentials nationally. Yet, they complete 27 percent of all credentials leading to wages below \$35,000 per year but only 18 percent of awards leading to wages above \$35,000 per year. Black students earn 11 percent of credentials in each category, matching their proportion of all earned awards. See: Fink, John. "What community college programs are associated with higher economic opportunity for Black and Latino students?" Community College Research Center, 2022.

⁷ "Employment in STEM occupations." U.S. Bureau of Labor Statistics. Last modified September 8, 2022. <https://www.bls.gov/emp/tables/stem-employment.htm>.

Partnership (“Aspen-Siemens awards”). Award-winning programs align to four sectors that offer jobs with strong wages for graduates: advanced manufacturing, energy, healthcare, and information technology (IT).⁸

We have conducted research on why and how these programs consistently deliver excellent and equitable outcomes. In addition to insights from Aspen-Siemens award winners, this guide draws examples from other

Aspen research. Several examples are drawn from finalists and winners of the Aspen Prize for Community College Excellence, which assesses both equity and workforce outcomes; others come from colleges featured in Aspen’s *The Workforce Playbook*. In each case, research for this guide started by identifying colleges with high, improving, and equitable student outcomes, and then moved to site visits and research interviews at those colleges. ■



WHAT’S IN THIS GUIDE?

Observations on and insights about colleges’:

1

Outreach and
Recruitment

2

Onboarding,
Advising and
Student Support

3

High-Quality Programs
and Employer
Partnerships

We hope the strategies, principles, and examples in this guide will help more community colleges deliver programs that promote social mobility and develop talent equitably in their communities.

⁸ Aspen and Siemens partnered to recognize colleges across multiple years using several different criteria. This report borrows examples from all years of the Aspen-Siemens Awards but primarily focuses on those given in 2020. For more information on the Excellence and Equity in Community College STEM Award, see Aspen’s website: <https://highered.aspeninstitute.org/siemens-aspen-stem/>.

OUTREACH AND RECRUITMENT



To achieve equity in STEM program enrollments—and ultimately in the numbers of program graduates—the colleges we studied (1) assess gaps in participation, and then (2) devise scaled strategies to reach and recruit the populations underrepresented in their STEM programs.

Assessments typically began with an analysis of existing and prospective students' demographics in a college's service area (and how they've changed over time), seeking to answer two questions:

- Which student demographic groups in the community are not enrolling in the college's high-value STEM programs?
- Where do prospective students of color and those from low-income backgrounds (or other underrepresented groups) in the college's service area live, learn, and work?⁹

Such analyses almost always reveal racial and gender disparities.¹⁰

49% of white workers have "good jobs" compared to 36% of Black workers. (CEW)

Scaled strategies to close those gaps begin with a recognition that prospective students from lower-income families may not be aware of the range of opportunities in STEM fields, or the outcomes STEM programs can deliver.¹¹ So effective colleges design strategies to build aspirations and a sense of belonging among underrepresented students, through recruitment that reaches into places where students of color are most likely to be found, using messages likely to resonate. Sometimes equity strategies are woven into general recruitment efforts; other times they're more targeted, with materials and outreach plans created for specific groups and/or specific STEM programs. We found this work was often done through partnerships with K–12 schools and other community partners.¹²

⁹ Questions, indicators, and sources to guide this analysis can be found in Table 2 of Aspen's *The Workforce Playbook*: https://highered.aspeninstitute.org/wp-content/uploads/2019/06/The-Workforce-Playbook_Final.pdf.

¹⁰ "Community Colleges in the Evolving STEM Education Landscape." National Research Council and National Academies of Engineering, 2012. <https://doi.org/10.17226/13399>; Bahr, Peter Riley, Jackson, Grant, McNaughtan, Jon, Oster, Meghan, and Jillian Gross. "Unrealized Potential: Community College Pathways to STEM Baccalaureate Degrees." *Journal of Higher Education*, 88, no. 4 (2007): 430–478. Accessed November 22, 2022. <https://doi.org/10.1080/00221546.2016.1257313>; Chen, Xianglei, and Matthew Soldner. "STEM Attrition: College Students' Paths Into and Out of STEM Fields." National Center for Education Statistics. U.S. Department of Education, November 2013, 8. <https://nces.ed.gov/pubs2014/2014001rev.pdf>; Zhang, Jizhi, Bohrnstedt, George, Zheng, Xiaying James, Bai, Yifan, Yee, Darrick, and Markus Broer. "Choosing a College STEM Major: The Roles of Motivation, High School STEM Course-taking, NAEP Mathematics Achievement, and Social Networks." American Institutes for Research, June 16, 2021. <https://www.air.org/sites/default/files/2021-07/Choosing-a-College-STEM-Major-June-2021.pdf>.

¹¹ "Community College STEM Pathways: Policy Fact Sheet." Community College Research Center, *Teachers College, Columbia University*, July 2022. <https://ccrc.tc.columbia.edu/media/k2/attachments/community-college-stem-pathways.pdf>.

¹² This finding is echoed in research from other organizations that shows early outreach to middle and high school students can expose underrepresented students to the possibilities of community college and positively influence college-going decisions. See, e.g., https://cdn.ymaws.com/www.ncan.org/resource/resmgr/publications/eapolicystrategies_2016.pdf and https://ies.ed.gov/ncee/wcc/Docs/PracticeGuide/higher_ed_pg_091509.pdf.

Partnerships for Access in Rural Areas and Smaller Cities

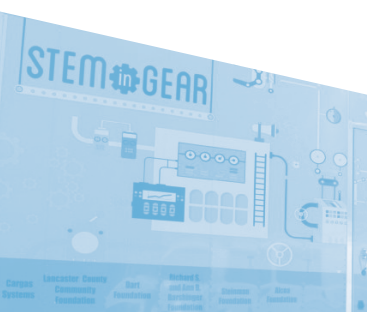
Thaddeus Stevens College of Technology in Lancaster, Pennsylvania, primarily serves rural areas and small towns. Consistent with its founding mission, the college developed an outreach and recruitment approach with a single goal in mind: fully serving low-income individuals, people of color, and others underserved in their region.¹³ The college intentionally recruits each of these groups into all its STEM programs, including electrical technology, an Aspen-Siemens award-winning program.

Program leaders started by updating recruitment materials to include voices and images of students from each group. Then the college partnered with several regional organizations—including Philadelphia Youthbuild, which serves students of color in urban areas—to ensure the messages reached target audiences. Thaddeus Stevens also reaches K–12 students through its “STEM in Gear” program, which trains college faculty to deliver courses and programs in regional high schools in subjects from engineering and robotics to manufacturing and aviation. By delivering programs at multiple locations, the college extends opportunities broadly to get diverse students excited about STEM and engaged in a rigorous classroom experience. Sustained for over five years, those and

other strategies contributed to the college increasing enrollment of low-income students by 34 percent, and expanding access for students of color by 47 percent.

 Though women make up at least half the total workforce today, only 1 in 4 STEM jobs are currently held by a woman. (*Community College Times*)

Mississippi Gulf Coast Community College has worked to increase equitable access to STEM programs across three campuses and six centers in southern Mississippi, including many rural communities. Known for its strong workforce programs, the college created a process operations technology program to meet statewide demand for workers at power generation facilities, waste treatment plants, petroleum refineries, and other large processing operations. An analysis of STEM program enrollments revealed that women were dramatically underrepresented (while Black and Hispanic students were proportionate to those in the college’s service area).¹⁴ To respond, program leaders developed a multi-pronged approach to recruit female students. One of the most effective tactics: hosting summits, attended by more than 100 high school girls annually, that include panels and hands-on demonstrations, and introduce participants to women at different stages of their careers who are working in the field. Today, the process operations technology program—one of the college’s largest—maintains an annual enrollment of nearly 300 students, including a steadily growing number of women who are being prepared to enter these well-paying, traditionally male-dominated professions.



Thaddeus Stevens College of Technology—“STEM in Gear” student



¹³ Thaddeus Stevens College of Technology, Mission & Core Values: <https://stevenscollege.edu/about/mission-core-values/>.

¹⁴ For fall 2022, the racial makeup of enrollment in STEM fields was 64 percent white, 19 percent Black, and 17 percent all other minorities—according to census data, the racial makeup of the college’s district is 71 percent white, 23 percent African-American, and 6 percent other.

Partnerships for Equitable Enrollment in Urban Areas

At **Seminole State College of Florida**, faculty members from the network systems technology program visit middle and high schools to speak with students in minority- and women-specific technology clubs, with the goal of expanding access to IT careers. Students in these clubs visit the college and meet with IT faculty and staff, familiarizing themselves with the program early in their college search. Seminole State also partners with a local youth-serving nonprofit, CodeOrlando, to highlight IT careers and engage high schoolers in a five-week summer program that puts them on the path to dual enrollment in the college's networking program. In its work with partners, the college researches and designs marketing materials to appeal to women and students of color, using images that show students they belong and data that conveys the value of IT credentials, including earnings information and employment outcomes. This work has paid off: More than half of students in a recent IT cohort at Seminole were Black, Hispanic, or Native American.

At **Cuyahoga Community College** (Tri-C) in Cleveland, the nursing program partners with local organizations to recruit students and provide them mentorship and support. Understanding the data on who was historically underrepresented in nursing programs, Tri-C turned to local organizations for help, including the Cleveland Council of Black Nurses and the local chapter of the National Association of Hispanic Nurses. Those partners share information about the nursing program with prospective students, and then connect students with mentors of color once they enroll. The strategy pays off: The percentage of students of color in nursing matches that of the overall student body at Tri-C.

“All of our students are going to do things like pay their rent, so it was just making sure information about our programs was easily accessible [in locations they would regularly visit].”

— Jose DeJesus Gil
Dean of Enrollment Management
San Jacinto College

San Jacinto College—
Nursing students



San Jacinto College in Houston recruits prospective students for its programs—including the Aspen-Siemens award-winning programs in process technology and nursing—in unusual places, including libraries, low-income housing communities, and apartment leasing offices. “Thinking outside of traditional partners that any community college would seek required getting down into the trenches,” said Jose DeJesus Gil, dean of enrollment management. “All of our students are going to do things like pay their rent, so it was just making sure information about our programs was easily accessible.”

Partnerships in Historically Underserved Areas

Green River College is located outside Seattle, in an area with plenty of tech jobs. To help diversify the talent pipeline and provide underserved and place-bound students access to the tech industry, Green River launched Expanding Career and Educational Learning in Information Technology (EXCEL-IT), which included two primary strategies.

First, the college looked to expand concurrent enrollment at local high schools in diverse and economically challenged areas.¹⁵ Teachers at those high schools were certified to teach college-level courses, and the college helped establish needed computer infrastructure so high school students could access computing facilities similar to those on the college campus. More recently, Green River built on the success of the effort to explore building a 2+2+2 STEM degree pathway with support from the Washington State Board for Community and Technical Colleges and the National Science Foundation.

Second, EXCEL-IT leaders launched an exploratory initiative to reach another underserved population: local Native American tribes. The program established a partnership with Muckleshoot Tribal College, where two instructors were trained to offer IT courses. Of the first cohort of 26 students who started in 2018, half have earned their associate degree from Green River and are now working in a technical job. Half of those students (about 25 percent of the original cohort) have continued their studies in an applied baccalaureate program, and are on track to graduate. One reason for the success of this effort: College faculty truly understand tribal students. “We let them know we care and are interested in their success,” says IT instructor Tim Mason, a tribal liaison.

Broward College has worked hard to put STEM programs in diverse communities. Shortly after becoming president at Broward College in South Florida, Gregory Haile asked for an analysis of where Broward’s students lived. The data were troubling: The college enrolled very few students from the county’s six ZIP codes with the lowest postsecondary attainment and highest unemployment rates. Part of the problem, Haile concluded, was the location of Broward’s campuses: Of its 11 sites, only two were close to those six ZIP codes, and public transportation between those locations and Broward was inadequate.

So President Haile’s team created a strategy, called Broward UP, to put valuable programs into those six areas. The college partners with municipalities and local nonprofits (such as the United Way) to site educational centers in public spaces—libraries and community centers—where it offers free courses, educational programs, and wrap-around support. The college relies on partners to help publicize these offerings, sharing stories from the community paired with data on outcomes. Leaders believe Broward UP’s effectiveness flows in part from the trust community partners have helped the college build, which enables prospective students to hear messages that dispel misconceptions about college costs and whether students will be welcomed.

Broward UP is not just an enrollment strategy: It’s rooted in providing students with clear paths to jobs that pay a family-sustaining wage, many in STEM fields. For example, the college’s new centers offer healthcare certifications (such as a 90-hour EKG tech certificate) and tech certifications (such as a seven-week, 16-hour JAVA programming course). Broward is also working to ensure that many programs delivered in their community-based centers allow students to transfer credits into longer-term STEM programs.

¹⁵ “Expanding Career and Educational Learning in Information Technology (EXCEL-IT): Award Abstract #1400688.” National Science Foundation, November 16, 2019. https://www.nsf.gov/awardsearch/showAward?AWD_ID=1400688.

The results: More than 30 partner organizations, over 3,500 new students enrolled, more than 2,200 industry certifications and certificates of completion awarded, and 144 students moved from continuing education

to a Broward degree program.¹⁶ Florida TaxWatch, an independent group, calculated that the students who complete the program will earn (on average) an additional \$204,000 in their lifetimes. ■

TRANSFORMATIONAL RECRUITMENT AND ONBOARDING PRACTICES:

TRADITIONAL	TRANSFORMATIONAL
<p>Enrollment strategies rely on outreach and recruitment primarily (or even exclusively) in communities from which students have traditionally come, without consideration of the diversity of those communities.</p>	<p>Enrollment strategies are routinely built on an analysis of which current students and which populations in the service area are under-enrolled in STEM programs, with the goal of identifying equity gaps and employing strategies to close them.</p>
<p>Recruitment communications are one-size-fits-all, often aimed primarily at what might appeal to students from high schools that have historically sent students into STEM programs.</p>	<p>Recruitment materials include differentiated messaging for specific groups of prospective students, including adult learners, people of color, English-language learners, and other historically underserved groups.</p>
<p>The college recruits prospective students into the institution by making general statements about opportunity and the value of college, without regard to which programs students might enter.</p>	<p>The college has developed a scaled strategy to recruit diverse students into STEM programs by sharing information about program value in partnership with K-12 schools, community organizations, and municipalities.</p>
<p>College leaders are unaware of how students experience their programs and communications/marketing material.</p>	<p>The college partners with K-12 schools, community-based organizations, and others to hear from students how they perceive the college and its programs—and then uses that information to improve programs and communications.</p>
<p>The college develops work-based learning opportunities only with partners that have historic relationships with faculty and program leaders.</p>	<p>The college partners with organizations where diverse populations are located, to ensure broad access to work-based learning and provide nonacademic support.</p>

¹⁶ For more information about Broward UP, visit <https://www.broward.edu/browardup/>.



REFLECTION QUESTIONS:

Does your college have explicit goals and strategies for workforce development that include attracting, training, and graduating students from targeted populations, such as underemployed adults or racial and ethnic groups underrepresented in high-value CTE programs?

Does your college or any individual program tailor outreach messages to the populations you aim to recruit?

Does your college use K-12, nonprofit, and other regional partnerships to recruit diverse students?

What could you do to strengthen these partnerships or develop new ones?

ONBOARDING, ADVISING, AND STUDENT SUPPORT



Few students arrive at college with a clear idea of where they're headed, and too few receive the information they need to thoughtfully choose or effectively complete a program of study.

Moreover, most students who enter with an interest in STEM majors never finish those programs. According to a 2014 National Center for Education Statistics report on attrition from STEM programs, over two-thirds of the associate-degree students who entered STEM fields between 2003 and 2009 left those fields by spring 2009, half for other majors and half by exiting college altogether.¹⁷ This attrition is especially troubling given the small number of community college students who choose STEM programs: The same study found that just 20 percent of associate-degree students chose a STEM major at some point within six years of entering postsecondary education in 2003–2004.

At every community college visited during our research, we heard about roadblocks—both academic and nonacademic—faced by students of color, female, and/or lower-income students in selecting and completing a STEM program. These barriers range from uncertainties about financial aid to inaccessibility of math tutoring to inadequate healthcare.¹⁸ Colleges achieving excellent and equitable levels of student success in STEM

Median earnings for full-time workers ages 25 and older in STEM fields are

\$77,400

—a full \$30,000 more than the median wages for workers in non-STEM occupations.



Seminole State College—Network support student

programs understand that overcoming those barriers is often difficult for students, so the colleges take responsibility for removing them. College leaders create effective caseload advising systems with mandatory touchpoints; ensure broad, distributed responsibility for flagging and responding to student challenges; provide program-specific career support; and disaggregate data to ensure student supports are equitably accessed and result in equitable outcomes.

Excellent colleges implement advising systems that guide students onto pathways that make sense for their aspirations and needs. These advising systems are designed to connect students to economic opportunity—and ensure opportunity extends equitably to students who have historically been left out.

¹⁷ Chen, Xianglei, and Matthew Soldner. "STEM Attrition: College Students' Paths Into and Out of STEM Fields." National Center for Education Statistics. U.S. Department of Education, November 2013. <https://nces.ed.gov/pubsub/2014/2014001rev.pdf>.

¹⁸ These challenges have become even more noticeable amid the COVID-19 pandemic, with many underserved students facing outsized financial, health, and family challenges and citing advising, affordability, and labor market information as their most pressing needs from institutions. "Reconnecting Recent High School Graduates With Their Education Aspirations," Center for Education Consumer Insights, *Strada Education*, June 23, 2021. <https://cci.stradaeducation.org/pv-release-june-23-2021-reconnecting-recent-high-school-graduates-with-their-education-aspirations/>.

Early Career Advising and Program Connections

Most students come to community college with a primary aim: to get a good job.¹⁹ Yet many don't get on a clear pathway toward a credential with labor market value early enough, delaying and often preventing their attainment of their primary goal. As noted in this report's introduction, students of color and those from low-income backgrounds are less likely than others to complete programs that lead to strong labor market outcomes. For this reason, colleges aiming to advance equity in STEM program enrollments and completions focus substantial efforts on helping students (both when they enter and through their first semester) clarify an area of interest, understand associated job prospects, and start on an efficient path toward completion of a high-value credential, meaning one that reliably leads to either a good job or bachelor's attainment.

Counselors and advisors at **Lorain County Community College** (Lorain) in Northern Ohio expressed concern that most students came to their offices without a basic understanding of the jobs available in the region, much less what to study to access those. They knew from regular data reports that the large majority of Lorain students received need-based aid, so they concluded that connecting those students to a degree that offered a good wage was essential.²⁰ Data also showed leaders that over 80 percent of Lorain students stay in the county after graduation, meaning employers would benefit if the college could graduate more well-trained students.



Broward College—Nursing students

The college decided that meeting its goals required that students make earlier and better-informed program decisions. So with an eye toward equitable talent development, the college decided to redesign career guidance, making it mandatory and front-loading it in the student journey. In 2021, Lorain partnered with Team NEO, an economic development organization in Northeast Ohio, to develop *Careers by Design*, a curriculum focused on career pathways that align with regional job opportunities. Through a five-week training series, the college's outreach, career development, and academic advising staff were taught how to understand workforce trends in the region, and how to explain to students how Lorain's pathways would help them access good jobs.

Beginning with three large industry sectors in Northeast Ohio—manufacturing, IT, and healthcare—staff learned about regional talent gaps, high-growth sectors, and the strongest opportunities for graduates to earn a family-sustaining wage in the area. Facilitators helped staff explore the barriers and motivations students might face, including lack of knowledge about certain jobs and negative perceptions about whether students from backgrounds underrepresented in those industries would be welcomed. Staff engaged in activities and exercises applying concepts to their work. Information about family-sustaining wage thresholds and equity gaps in certain industries were coupled with practice on how to frame good workforce opportunities and how to guide students toward an earlier decision.

¹⁹ "Who Are We Missing?: Understanding and Reaching Underrepresented Prospective Community College Students." College Excellence Program. *The Aspen Institute*, 2019. https://highered.aspeninstitute.org/wp-content/uploads/2019/11/ASP-CEP-Messaging-Toolkit_ResearchInsightsBrief.pdf; Bara Stolzenberg, Ellen Bara, Aragon, Melissa C., Romo, Edgar, Couch, Victoria, McLennan, Destiny, Eagan, M. Kevin, and Nathaniel Kang. "The American Freshman: National Norms Fall 2019." Cooperative Institutional Research Program. *Higher Education Research Institute, University of California Los Angeles*. <https://www.heri.ucla.edu/monographs/TheAmericanFreshman2019.pdf>.

²⁰ "College Navigator." Integrated Postsecondary Education Data System (IPEDS). National Center for Education Statistics, U.S. Department of Education, 2022.

At colleges that achieve equitable outcomes in STEM programs, strong advising doesn't stop once students make a program decision—it extends through to completion and job entry. **Seminole State** embeds career program advisors (CPAs) in each of the nine pathways connected with associate of science degrees. CPAs are subject matter experts in their pathway, able to provide insights about and connections to related industries. Each CPA is responsible for meeting with all students in their assigned pathway in their early days on campus (students can schedule additional appointments with CPAs online).

Leon Portelli, head of Seminole's information technology program, said “[The CPA] is a constant presence at everything from program and student life activities to employer site visits.” For the IT program, the consistent presence of the CPA has helped forge stronger connections with employers. CPAs help facilitate relationships with local employers and industry leaders, often leading trips to visit those employers and expose students to potential careers. Student outcomes have benefited from these connections: 88 percent of students from the program are employed within one year of graduation, higher than the regional average.

FIVE KEYS TO STUDENT ONBOARDING

If diverse students are to select and complete a STEM program, it's important that colleges help them enroll in and complete coursework aligned to their likely field of interest as early as possible. As the Community College Research Center (CCRC) found, “Students who entered a program of study [defined as taking at least nine credit hours in the same program area] in the first year were more likely to complete a credential or transfer to a four-year institution within five years than were students who did not enter a program until the second year or later.”²¹ But the CCRC also notes that it typically takes “a term or more before [students] can take a course in their chosen field of interest.”²² Colleges with strong onboarding processes, CCRC notes, help students do five key things in their first semester:

1

Explore career and college options and interests

2

Engage with faculty, students, and others in relevant fields

3

Choose an academic and career direction through meta-majors

4

Select a program of study

5

Develop a full-program plan to guide their progress

²¹ Jenkins, Davis, and Sung-Woo Cho. “Get with the Program: Accelerating Community College Students' Entry into and Completion of Programs of Study.” Community College Research Center. *Teachers College, Columbia University*, January 2012, 9. <https://ccrc.tc.columbia.edu/media/k2/attachments/accelerating-student-entry-completion.pdf>.

²² Jenkins, Davis, Lahr, Hana, Pellegrino, Lauren, Kopko, Elizabeth M., and Sarah Griffin. “Redesigning Community College Student Onboarding Through Guided Pathways.” Community College Research Center. *Teachers College, Columbia University*, May 2020. <https://ccrc.tc.columbia.edu/publications/redesigning-community-college-onboarding-guided-pathways.html>.

Unavoidable, Individualized Advising and Comprehensive Supports

Many community colleges we researched shifted advising from optional to mandatory, which research shows can improve outcomes.²³ Many successful colleges in our research ensure students interact with staff or faculty with subject area expertise, who help them create and stay on a clear academic path. At some institutions faculty provide most advising, while at others (often larger institutions) faculty advise on academic planning and work with professional advisors to provide other support. Regardless, excellence and equity in student outcomes are achieved in part through unavoidable, individualized advising.²⁴

Cuyahoga Community College (Tri-C) has had substantial success increasing enrollment and graduation of diverse students in STEM programs, including its Aspen-Siemens award-winning nursing program (see page 31). The nursing program offers tuition assistance, monthly stipends that allow students to work fewer hours off campus, mandatory tutoring, stress-reduction activities, and events to familiarize their families with their academic demands.

Undergirding Tri-C's nursing program success is a broader effort to help more students graduate. As part of a comprehensive approach, the college employs a team of student success specialists who supplement the work of faculty counselors, adding an additional layer of support for the college's 34,000 students. Each specialist is assigned a caseload of students and helps them understand the goals of a first-year student success

Building in a dedicated touchpoint for students as they make key decisions such as choosing a program is critical to getting and keeping them on the right pathway.

course, navigate financial aid, access the career center, and commit to attending academic tutoring whenever faculty determine students are struggling. Lindsay English, Vice President of Learning Engagement, explained that student success specialists often refer students to their faculty counselor when academic plans might need to change or when a student believes a program is not a good fit.

Dr. English cites student success specialists as a central reason Tri-C's three-year graduation rate has increased from 3 percent to 26 percent since 2009, with similar improvements for Black and Hispanic students. When describing why these specialists are so important, she explains, "They're not waiting around for students to connect with them. They're proactive. They attend the first-year experience course. They're connecting by email, text, phone appointments."

Broward College combines strategic advising and additional support to deliver excellent and equitable outcomes in STEM programs—including its Aspen-Siemens-award-winning nursing program. Three data points led Broward College to revamp its nursing program: First, administrators realized the college's large nursing program was not enrolling students from communities with high unemployment and low education rates, contributing to inequitable student access and success. Second, local hospitals and healthcare providers were unable to find enough trained nurses, frustrating area employers. Finally,

²³ "Advising and Student Supports at Community Colleges: Policy Fact Sheet." Community College Research Center. *Teachers College, Columbia University*, July 2021. <https://ccrc.tc.columbia.edu/media/k2/attachments/advising-student-supports-community-colleges.pdf>.

²⁴ Dadgar, Mina, Nodine, Thad, Reeves Bracco, Kathy, and Andrea Venezia. "Integrating Student Supports and Academics." WestEd, 2013. https://www2.wested.org/www-static/online_pubs/resource1296.pdf.

demographic trends showed the problem was going to get worse. Broward County’s elderly population—already nearly one-fifth of the county—was growing and would need even more nurses in the future. Meanwhile, the Hispanic population was growing more rapidly than any other demographic, but not enough were becoming nurses to meet workforce needs.

To ensure equitable access to this valuable program, Broward connects with prospective students of color via K–12 schools and partnerships with Urban League chapters, CareerSource, and local nonprofits. Broward established robust onboarding programs for those students, including free tutoring and early pathways planning to get new students solidly on track. Broward worked with local hospitals to expand nurse extern positions, giving diverse students opportunities to practice and improve their clinical skills working alongside registered nurses. Career fairs, recruiting events, resume writing workshops, and an “employment concierge” help students navigate the hiring process and translate their credentials and experiences into jobs.

The results are compelling: A recent nursing cohort was 78 percent students of color, 65 percent low-income students, and 80 percent single mothers. Graduation rates have remained strong, and program graduates have a 97 percent job-placement rate. The pass rate for the Registered Nurse National Council Licensure Examination is nearly 86 percent, and hospital employees interviewed for this report noted that Broward graduates are “ready to work.”

As Broward proves, comprehensive student advising and support structures—when designed at scale—can lead to excellent and equitable student outcomes. Likewise, a culture of care and ownership of student outcomes by faculty and staff, especially when combined with student support structures, can lead to excellence and equity.

Leaders at **Lake Area Technical College** (Lake Area) in rural South Dakota emphasize that every employee has a role to play in advancing student success. Everyone from nutrition services workers to faculty to administrators are members of student support teams. They are all intentionally onboarded into a culture that understands that concerns about a student should quickly result in a connection with faculty advisors and the student services center.

Lake Area had already established such an approach when refugees from Myanmar arrived in South Dakota and enrolled in Lake Area’s welding program. College staff soon realized the students needed help with college-level English and alerted faculty, who quickly developed an English as a second language (ESL) course that fit around the welding program schedule. “The ESL instructor discovered challenges happening beyond the classroom and expanded the curriculum to not only navigate college, but also navigate living in a new community,” noted Lake Area vice president Diane Stiles. The instructor arranged tours of the community and ensured students were connected to available community resources, from transportation to basic goods. According to Stiles, the support these students received not only helped them succeed at high levels, but encouraged more students from Myanmar to enroll in other programs, including law enforcement and automotive technology.

Overall, success rates at Lake Area are strong—73 percent of students graduate or transfer within three years, and nearly everyone is placed in a job after graduation.²⁵ Thanks to the thoughtful approach to advising and support, recent refugees experience similar levels of success.

²⁵ “Outcomes.” Lake Area Technical College. Accessed November 22, 2022. <https://www.lakeareatech.edu/about-us/outcomes/>.

Nonacademic Supports Tied to STEM Program Completion

Much has been written in recent years about the many nonacademic obstacles students face that can make it hard to remain in college.²⁶ Colleges researched for this guide provide a range of thoughtfully designed supports, from food pantries to clothes closets to transportation and childcare vouchers. Information about such supports can be found in several guides, including the Lumina Foundation’s *Beyond Financial Aid*.²⁷

The question investigated for this guide is specifically how these supports enable diverse students to complete STEM credentials. In South Dakota, an innovative scholarship program called Build Dakota combined two goals—access and workforce success—in a single approach that advances completion of STEM programs for low-income students and ensures employment after graduation. The scholarship program provides nearly 400 need-based full-ride scholarships each year to support students in high-demand occupations such as welding and computer information systems.²⁸ Most Build Dakota scholars participate in the “Stretch the Million” program that increases the aid provided by the state through an industry match. Industry partners interview scholarship applicants, and accepted students commit to working with a sponsor employer for three years after graduation. In return, students get a full ride along with opportunities for part-time work and summer internships.



Lake Area Technical College—Welding student (top),
Odessa College—Moble Fab Lab (bottom)

Leaders at Lake Area believe this scholarship program leads directly to high graduation rates for Pell students, including in STEM fields. Data support this conclusion. The advent of the Build Dakota scholarships coincides with the college’s successful efforts to reduce the graduation gap between Pell and non-Pell students, from 15 percent a decade ago to less than 2 percent today.

²⁶ “#RealCollege 2021: Basic Needs Insecurity During the Ongoing Pandemic.” The Hope Center for College, Community, and Justice. *Temple University*, 2021. <https://hope4college.com/rc2021-bni-during-the-ongoing-pandemic/>.

²⁷ “Beyond Financial Aid: How colleges can strengthen students’ financial stability, leading to higher completion rates.” Lumina Foundation. Accessed November 22, 2022. <https://www.luminafoundation.org/campaign/beyond-financial-aid/>.

²⁸ The Build Dakota Scholarship program covers tuition, books, and other required program expenses for students in high-need industry programs at Lake Area Technical College. Please see Lake Area’s website for more information, including a list of the college’s high-need industry programs: <https://www.lakeareatech.edu/connections/foundation/scholarships/build-dakota-scholarships/>.

Math Preparation for STEM Program Skills

A consistent barrier to advancing equity in STEM programs is postsecondary math.²⁹ Using standardized assessments of college readiness, many community colleges determine that large numbers of students are not prepared for credit-bearing math courses, which are required in most STEM programs. So they place students in developmental math, a reality faced by up to two-thirds of incoming community college students each year—and a disproportionately large number of students of color and low-income students.³⁰ One study found that only 20 percent of students in developmental math courses went on to pass college-level mathematics, which of course means the remaining 80 percent had virtually no chance of completing a STEM program.³¹

Part of the solution: stop placing so many students in free-standing developmental math courses. Many community colleges have moved to co-requisite models that place students who previously would have started in developmental math into program-level courses right away, providing just-in-time support to improve their math skills during the course. Research strongly suggests that—for most students—co-requisite models lead to better outcomes than free-standing

developmental education models.³² Another strategy is to redefine which math courses are required in each program, more closely tailoring requirements to the math skills students actually needed for their programs of study (and ultimately their careers) and avoiding unneeded and often lengthy math sequences. The Dana Center at the University of Texas at Austin and Community College Research Center, among others, have researched and confirmed the promise of such reform approaches.³³

While important, those reforms alone are unlikely to achieve equity in STEM program completion. Among students who enroll in college algebra—the first level of college math offered at many community colleges and some four-year institutions—only half pass, and only 10 percent of those who pass go on to enroll in college calculus.³⁴ Understanding these realities, many community colleges aiming to achieve equity in STEM work with K–12 schools to increase math readiness of community college entrants, with a focus on students of color and those from low-income backgrounds.

Harper College, located outside Chicago, took this approach. Between 2010 and 2014, the college partnered with K–12 schools to dramatically increase math readiness for entering Harper students. This work was spurred by negative publicity: In 2008 a regional newspaper highlighted the high number of recent high school graduates who placed into developmental programs at Harper. While some community college leaders might have blamed K–12s and hoped things got better, Harper College leaders chose a different approach: partner with K–12s to solve the problem.

²⁹ Listorn, Cynthia and Amy Getz. “The Case for Mathematics Pathways.” Charles A. Dana Center. *The University of Texas at Austin*, 2019. https://dcmathpathways.org/sites/default/files/resources/2019-03/CaseforMathPathways_20190313.pdf; “Launch Years: A New Vision for the Transition from High School to Postsecondary Mathematics.” Charles A. Dana Center. *The University of Texas at Austin*, 2020. <https://www.utdanacenter.org/sites/default/files/2020-03/Launch-Years-A-New-Vision-report-March-2020.pdf>.

³⁰ “Developmental Education: Policy Fact Sheet.” Community College Research Center. *Teachers College, Columbia University*, July 2021. <https://ccrc.tc.columbia.edu/media/k2/attachments/developmental-education-fact-sheet.pdf>; Bryant, Rhonda Tosi-A-Fatt. “College Preparation for African American Students: Gaps in the High School Education Experience.” *The Center for Law and Social Policy (CLASP)*, February 2015. <https://www.clasp.org/sites/default/files/public/resources-and-publications/publication-1/College-readiness2-2.pdf>; Patrick, Kayla, Socol, Allison, and Ivy Morgan. “Inequities in Advanced Coursework: What’s Driving Them and What Leaders Can Do.” *The Education Trust*, January 2020. <https://edtrust.org/wp-content/uploads/2014/09/Inequities-in-Advanced-Coursework-Whats-Driving-Them-and-What-Leaders-Can-Do-January-2019.pdf>; “Community College STEM Pathways: Policy Fact Sheet.” Community College Research Center, *Teachers College, Columbia University*, July 2022. <https://ccrc.tc.columbia.edu/media/k2/attachments/community-college-stem-pathways.pdf>.

³¹ “Developmental Education: Policy Fact Sheet.” Community College Research Center. *Teachers College, Columbia University*, July 2021. <https://ccrc.tc.columbia.edu/media/k2/attachments/developmental-education-fact-sheet.pdf>.

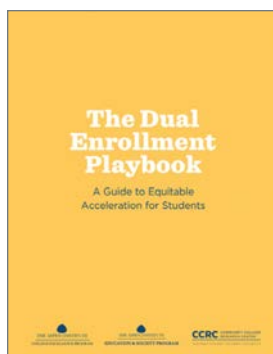
³² “Developmental Education.” Community College Research Center. Accessed November 22, 2022. <https://ccrc.tc.columbia.edu/publications/developmental-education.html>.

³³ See footnotes 35 and 36.

³⁴ Listorn, Cynthia, and Amy Getz. “The Case for Mathematics Pathways.” Charles A. Dana Center. *The University of Texas at Austin*, 2019. https://dcmathpathways.org/sites/default/files/resources/2019-03/CaseforMathPathways_20190313.pdf.

After creating a consortium that enabled sharing student data between the college and its three largest area K–12 districts, Harper conducted a study on the course-taking patterns of high school juniors and seniors. It found that high school seniors who did not take math in their final year were more likely than those who did to test into developmental math at the college. So the school districts revamped student advising and parental communications to encourage more students to take math through all four high school years. Harper and its partners also uncovered a significant misalignment between the math sequence in high schools and the college's expectations of math readiness. So the high schools introduced a new Algebra 3 course, equivalent to Harper's highest level of developmental math, which more than 1,200 juniors and seniors registered for in just the first year it was offered. Students who receive a B or higher on the final, which was co-created by high school and college faculty, are accepted at Harper as college-ready without a placement test. The results of these efforts: a 27-percentage-point increase in students entering Harper placing into college-level math, from 46 percent to 73 percent.

Another approach to increasing math readiness: enroll more diverse students in college-level math courses before they leave high school. As documented in *The*



Dual Enrollment Playbook: A Guide to Equitable Acceleration for Students, **Valencia College** partnered with the Osceola School District to increase the college-going rate in the Orlando area, which at 40 percent was one of the lowest in Florida. To achieve

this, the partners aimed to increase high-quality dual enrollment at the high schools in the district with the most diverse student populations. The idea was not just

to get more Black, Hispanic, and lower-income students into college courses, but to set them up for success in college, including in STEM and other programs offered at Valencia and through its 2+2 dual enrollment partnership with the University of Central Florida (called DirectConnect).³⁵

As the partnership progressed, a major challenge emerged: the Osceola School District did not have enough instructors qualified to teach college-level math. So Valencia paid for eight math instructors to teach in local high schools, an investment Valencia leaders deemed necessary to ensure their region's diverse students were ready for college, including STEM pathways. Their conclusion is supported by research: A recent study found that historically underrepresented students who took dual enrollment algebra in Florida were more likely to later enroll in STEM programs in community college.³⁶ And yet, nationally, under-represented students of color are least likely to be enrolled in rigorous math courses.³⁷

Community colleges effective at ensuring equity in STEM programs don't stop focusing on math until students are prepared to achieve what they came for, which for many is a bachelor's degree. A leading example comes from **San Jacinto College** in Texas, which participates in the Louis Stokes Alliance for Minority Participation program, designed to increase the number of students of color completing associate degree programs that lead to STEM bachelor's degrees. A few years after the program started at San Jacinto,

³⁵ Valencia College, DirectConnect to UCF: <https://valenciacollege.edu/future-students/directconnect-to-ucf.php>

³⁶ Minaya, Veronica. "Can Dual Enrollment Algebra Reduce Racial/Ethnic Gaps in Early STEM Outcomes? Evidence from Florida." Community College Research Center. *Teachers College, Columbia University*, February 2021. <https://ccrc.tc.columbia.edu/media/k2/attachments/dual-enrollment-algebra-stem-outcomes.pdf>.

³⁷ Banilower, Eric R., Smith, P. Sean, Weiss, Iris R., Malzahn, Kristen A., Campbell, Kiira M., and Aaron M. Weis. "Report of the 2012 National Survey of Science and Mathematics Education." Horizon Research, Inc., February 2013. <http://horizon-research.com/NSSME/2018-nssme/research-products/reports/technical-report>.

data analysis revealed that students often struggled after transferring to a four-year university. Further investigation led program leaders to conclude that both San Jacinto and its four-year university partner were partly responsible. Advisors from both institutions had encouraged students to complete all their general education requirements before transferring—as a result, after transferring engineering students struggled with the high number of upper-division math and science courses. So program leaders and faculty

in the engineering program at San Jacinto worked with their four-year partners to offer a new introduction to engineering course at San Jacinto, and increase math preparation support by adding pre-term boot camps for calculus 1 and 2. As a result of these efforts and additional advising and financial aid, between 2018 and 2021 San Jacinto increased both the number (from 385 to 774) and percentage (from 53 to 59 percent) of STEM transfer students who are underrepresented students of color.³⁸ ■

TRANSFORMATIONAL RECRUITMENT AND ONBOARDING PRACTICES:

TRADITIONAL	TRANSFORMATIONAL
Advisors are trained on how to help new students build a first-term schedule, but not how to help students choose a program and plan for completion in specific fields.	Advisors are trained and responsible for helping all students—including students of color and those from low-income backgrounds—enter and complete programs of study with strong post-graduation success, including STEM programs.
The college offers students optional career guidance.	Career guidance and career exploration are designed as an integral part of what students experience, from entry through the first year and to graduation.
Student supports, such as tutoring and emergency aid, are available but optional, and passively advertised to students.	Robust academic and nonacademic student supports are built into the student journey through active promotion, awareness of student needs (e.g., early alerts), and mandatory advising.
Entering students enroll in math courses, including non-credit-bearing developmental education, based on placement test scores.	The college works to increase math readiness and success rates through a variety of means, including high school and university partnerships. Students' math skills are evaluated based on multiple measures, and those who need additional preparation are placed into co-requisite courses with additional supports.

³⁸ See more about the Houston Community Colleges Louis Stokes Alliance for Minority Participation program here: https://www.nsf.gov/awardsearch/showAward?AWD_ID=0903948.



REFLECTION QUESTIONS:

During the onboarding process:

- How does the onboarding process help students choose a program of study likely to lead to post-graduation success that also fits their interests, financial goals, current financial situation, and desired job characteristics?
- How does the college ensure program leaders, advisors, and faculty monitor and advance equity in who enters high-value STEM programs?

Professional development:

- How are advisors, faculty, and staff trained to connect diverse students with academic and nonacademic resources aligned to program completion?
- How are advisors and staff provided professional development to ensure more students, including students of color and low-income students, make choices aligned with strong post-graduation success, especially in STEM fields?

During the first year:

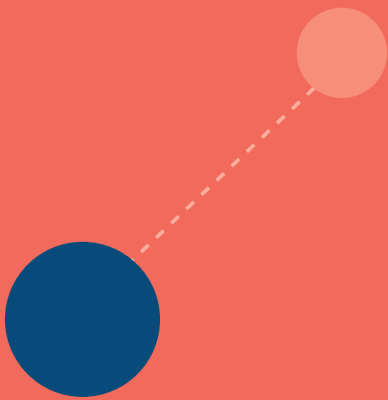
- Does the college require career exploration for students multiple times during their first semester and first year, especially for students who are undecided?
- Does the college monitor and ensure students, including students of color and low-income students, continue to make progress in programs with strong post-graduation success, including STEM programs?

Preparation and math skills:

- How does the college help students improve their math skills so they can enter and make progress toward a STEM credential?
- How does the college assess readiness for STEM programs, and has it considered changes to increase equitable access and success (e.g., corequisite courses, aligning program math requirements to job skills)?



HIGH-QUALITY PROGRAMS AND EMPLOYER PARTNERSHIPS



While strategic outreach and structured advising can increase equitable access to STEM programs, the long-term success of students depends on the quality of programs and instruction.

Strong programs provide excellent teaching from expert faculty who have practical knowledge and experience with industry skills and standards—and who know how to teach what they know to diverse students. Beyond the classroom, trusting and productive partnerships between colleges and employers ensure all programs include the kind of applied learning students need to be prepared for in-demand, family sustaining-wage jobs, and that those opportunities are equitably delivered to students who have historically been left out of such opportunities. This combination of quality teaching, programs, and partnerships is the key to the impressive and equitable workforce outcomes at the colleges included in this guide.

Scaled Applied and Work-Based Learning Opportunities

Providing hands-on experience relevant to students' future careers is essential for job readiness. Research has shown a correlation between students who have an applied job or internship during college and higher levels of employee engagement and well-being after college.³⁹ Yet, nationally, many students don't participate in high-quality work-based learning. And participation is inequitably distributed: Those in bachelor's programs



Mississippi Gulf Coast Community College—Process technology student

participate more than community college students—and students of color and low-income students are more likely to enroll in community colleges than other students.⁴⁰

Many colleges have found ways to ensure equitable participation in work-based learning, not just through internships but also by embedding those experiences in the classroom. **Mississippi Gulf Coast Community College** has an award-winning process technology program, from which graduates earn an average of \$53,000 per year, \$10,000 more than the average for

³⁹ Seymour, Sean, and Shane Lopez. "'Big Six' College Experiences Linked to Life Preparedness," *Gallup News* (blog), April 8, 2015. <https://news.gallup.com/poll/182306/big-six-college-experiences-linked-life-preparedness.aspx>.

⁴⁰ "A Guide to Upskilling America's Frontline Workers: A Handbook for Employers." UpSkill America. *The Aspen Institute*, July 24, 2015. https://www.aspeninstitute.org/wp-content/uploads/2018/03/Upskilling_Employer_Handbook_042015.pdf.; Cahill, Charlotte. "Making Work-Based Learning Work." *Jobs for the Future*, 5. https://jfforg-prod-new.s3.amazonaws.com/media/documents/WBL_Principles_Paper_062416.pdf; Carnevale, Anthony P., Smith, Nicole, Melton, Michelle, and Eric W. Price. "Learning While Earning: The New Normal." Center on Education and the Workforce. *Georgetown University*, 2015, 15. <https://cew.georgetown.edu/wp-content/uploads/Working-Learners-Report.pdf>.

other workers in the region. The program has long embedded hands-on learning opportunities in all courses, ensuring students of color and low-income students do not need to rely on off-site internships and other hard-to-access options to learn work-ready skills. Through these and other high-quality learning experiences, the program has achieved impressive and equitable results: completion rates among STEM majors improved from 52 percent in 2015 to 54 percent in 2018, with a jump from 44 percent to 50 percent for Black students.

Those outcomes were in jeopardy when the COVID pandemic began, and the college moved process technology (and other programs) to virtual formats. Students no longer had access to on-campus welding kits and programmable logic controller trainers they used before the pandemic to apply what they learned. While some students could afford the equipment, the college knew most low-income students could not. So faculty sent needed equipment to every student, then lectured online and guided students through activities to build up industry-specific skills. In this way, the college ensured those with limited financial means could continue hands-on learning in the wake of a disruption that threatened student learning.

Few colleges can guarantee work-based learning for every student, but that's what happens at **Lake Area Technical College** (Lake Area). The college has scaled work-based learning in every program of study, through a plan rooted in universal accountability and ubiquitous availability. Perhaps most important: Lake Area has moved responsibility for engaging in work-based learning from students—who at many other colleges are expected to fit optional internships into their busy lives—to faculty, who are responsible for ensuring every student engages in substantial work-based learning aligned to their program of study.

To meet that goal, every program has developed and maintained a robust set of both employer-based and on-campus work-based learning opportunities. So while some agriculture students are working afternoons at the John Deere tractor facility to develop job-critical skills, others are meeting on campus with employers to build custom-made cattle guards. Students interact with industry partners in a variety of other ways as well: employer-led specialized trainings, field demonstrations, and presentations at career events.

This combined system of accountability and availability ensures every Lake Area student—37 percent of whom are Pell-eligible—benefits from the kind of work-based learning that imparts skills employers expect to see in recent graduates. That in turn has contributed to a 99 percent employment rate for Lake Area graduates, and to a 72 percent three-year graduation rate for Pell-eligible students in Lake Area's programs, only two percentage points lower than for non-Pell-eligible students.

Faculty with Industry Experience and Instructional Training

Community colleges often hire industry experts as CTE instructors. They enter the classroom with deep subject matter expertise and industry connections, but often are not formally trained to teach. Many programs in our research—those that deliver strong and more equitable outcomes—require substantial professional development for first-time instructors. Training focuses on strong instructional methods, such as making the implicit explicit in their lessons, translating industry jargon into plain language, identifying and sharing unspoken professional norms with students, and demystifying STEM career trajectories.

Thaddeus Stevens College of Technology advances specific learning goals for instructors by pairing newly hired teachers with exceptional senior instructors, called “success coaches.” Coaches help faculty prepare and present lessons, and learn to engage students. “We know that we have to get students to remember, understand, and apply what they learn in the classroom,” says Tim Bianchi, Thaddeus Stevens’ vice president for academic affairs. “How do you get students to analyze and become independent learners? Our coaches drill down on each of these pieces so that when a faculty member is petitioning the college for tenure, they can demonstrate progress and student learning.”

Strategic faculty professional development is another approach. **Northeast Wisconsin Technical College** requires every faculty member to spend 40 hours annually on professional development, half focused on maintaining technical knowledge and half on becoming a better instructor. **Gateway Technical College**, also in Wisconsin, engages with the National Coalition of Certification Centers to have its expert instructors train Gateway faculty on the latest industry equipment standards, so they can pass those skills along to students. These expert industry instructors help Gateway faculty learn about skills for their students while also answering basic questions about pedagogy and teaching techniques. According to Matthew Jenisin, Gateway’s president, the college’s instructors trust the advice from their peers, perhaps even more so than they would from faculty with long academic careers.

THE IMPORTANCE OF FACULTY DIVERSITY

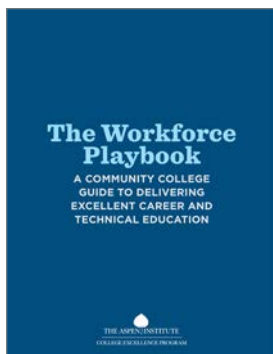
Many community colleges recognize that advancing diversity in STEM programs requires doing more to helping students see themselves in the faculty who connect them to their fields of study. The challenge: Black, Hispanic, and Indigenous people have long been underrepresented in STEM fields, shrinking the pool of available expert faculty. The goal of faculty diversity is rooted in evidence about its positive effects. For example, a recent study showed a significant correlation between the graduation, transfer, and drop out rates for underrepresented students among colleges with more racially diverse faculty.⁴¹ But, as several community college leaders interviewed for this report noted, diversifying STEM faculty can be challenging for several reasons. As noted, fewer Black, Hispanic, Indigenous, and lower-income people have the STEM degrees often required to teach. And those with such degrees can usually make more money in industry or teaching at a four-year university. Our research revealed a few isolated successes in diversifying STEM faculty somewhat, but not at a scale that offers lessons to other colleges. However, others in recent years have made recommendations that can be used to build a more diverse STEM faculty.

⁴¹ Cross, James David, and Carol A. Carman. “The Relationship between Faculty Diversity and Student Success in Public Community Colleges.” *Community College Journal of Research and Practice* 46, no. 12 (2021). Accessed November 22, 2022. <https://doi.org/10.1080/10668926.2021.1910595>. <https://www.aplu.org/wp-content/uploads/strengthening-pathways-to-faculty-careers-in-stem-recommendations-for-systemic-change-to-support-underrepresented-groups.pdf>.

Employer Partnerships that Boost Diverse Employee Hiring

As markets shift and populations change, employers often experience talent shortages. Those who understand enrollment patterns often turn to community colleges for talented, diverse workers.

For good reasons, many employers are interested in increasing workplace diversity. A McKinsey report on hundreds of public companies found that “Those in the top quartile for ethnic and racial diversity in management were 35 percent more likely to have financial returns above their industry mean. And those in the top quartile for gender diversity were 15 percent more likely to have returns above the industry mean.”⁴² These positive outcomes hold true in healthcare as well: analyzing more than a dozen studies, the *Journal of the National Medical Association* concluded that diverse teams of health care providers improve patient care, communication, and financial performance of the clinic or hospital.⁴³



As Aspen highlighted in its *The Workforce Playbook* research, maintaining program quality and employer partnerships requires honest, regular feedback between colleges and employers. Our research for this guide revealed that

those same partnership qualities can advance equity in STEM programs.

A strong example comes from **Miami Dade College**, located in a community where growth in the number of startup and global companies has resulted in a regional hub for tech, gaming, and e-sports. Employers came to understand they could not meet their demands for talented workers unless they diversified who they hired—and Miami Dade saw an opportunity to prepare students for high-paying jobs.

So in 2015 the college launched the Miami Animation & Gaming International Complex (MAGIC), an intensive, hands-on program to develop skills in game design, production, graphics programming, modeling, lighting, motion, and sound. The college offers associate degrees in game development and design, animation, and game art, as well as certificates in the emerging field of virtual reality and augmented reality technologies. Miami Dade enables low-income students to benefit from these programs by working with the Bosch Community Fund to offer 59 scholarships each year for full-time students in the MAGIC programs, as well as summer camp scholarships for high school students. The program draws on diverse industry professionals from Univision, Nickelodeon, and others that reflect the student population to serve as mentors. Those same companies also provide funding and equipment, and contribute to curriculum development.

According to employers, MAGIC graduates take only one month to efficiently contribute, rather than the typical six to nine months for animation and gaming hires. And during the 2021–2022 academic year, of the 439 students in the associate degree MAGIC program, 78 percent were Hispanic and 11 percent Black. “They’re not here ... out of the goodness of their hearts,” program head Mauricio Ferrazza said, speaking of employer partners. “They’re here because it makes good sense to work with us.”

⁴² Buris, Michelle, Kumar, Tanu, and Andrew Stenner. “Community Colleges Collaborate to Advance Racial Equity in Manufacturing.” The Century Foundation, May 17, 2022. <https://tcf.org/content/report/community-colleges-collaborate-to-advance-racial-equity-in-manufacturing/?session=1&session=1>.

⁴³ Gomez, L. E., & P. Bernet. “Diversity improves performance and outcomes.” *Journal of the National Medical Association* 111, no. 4 (2019): 383–392. Accessed November 22, 2022. <https://doi.org/10.1016/j.jnma.2019.01.006>.

Similarly, **San Jacinto College** works closely with many leading petrochemical employers in the area in and around Houston to build a talented, diverse employee pipeline. The college's partnership with LyondellBasell, a global plastics and chemical company, deepened substantially when the company donated \$5 million to the college to help build a new Center for Petrochemical, Energy, and Technology (CPET). LyondellBasell experts also helped develop the facility's curriculum, with the ultimate goal of building a reliable pipeline of much-needed skilled workers for their plants and refineries.

David Gosnay, a LyondellBasell operations manager for training and logistics, spends 60 percent of his workweek at the facility, serving as a liaison between industry and education. He does so because the company gains so much value from the partnership. "Partnering with San Jac gets us in on a ground level to train students to a high industry standard," explains Gosnay. "Students come to me for career advice, and I also observe course content and curriculum to make sure what's being taught aligns with industry practices. We want that personal connection, and presence is important."⁴⁴

San Jacinto College—Process technology students



The partnership helps LyondellBasell reach its diversity, equity, and inclusion goals. In 2021, students of color made up 76 percent of students enrolled in process operations and 72 percent of students in instrumentation technology. Every year, San Jacinto graduates about 220 process operators and about 90 instrumentation technicians. Since the opening of the CPET facility in 2019, 90 operators have been hired by LyondellBasell, a sought-after employer among graduates due to its wages, benefits, culture, and reputation. While program graduates are employed by many companies—the college reports a 90 percent employment rate—LyondellBasell has been hiring a growing percentage of each graduating class, from 3 percent when the program started to 17 percent of the most recent graduating class.

LyondellBasell has a track record of developing its own workforce and promoting from within, demonstrated by current executive leaders who have followed that path. By hiring diverse talent for entry-level roles, the company is building a talent pool that can advance to leadership, helping it meet one of its DEI goals. The partnership with San Jacinto, where 60 percent of

LyondellBasell, a global plastics and chemical company, donated \$5 million to San Jacinto College to help build a new Center for Petrochemical, Energy, and Technology (CPET).



⁴⁴ Trevizo, Melissa. "CPET offers unique connections for students and industry," San Jacinto College Newsroom (blog). July 25, 2022. <https://www.sanjac.edu/news/cpet-offers-unique-connections-students-and-industry>.

students are Hispanic and another 10 percent Black, helps grow and diversify the leadership pool.

It's this kind of relationship—in which the employer can count on the college to supply diverse talent, and diverse students know they can rely on the college to gain skills for good jobs—that leads to more equitable access to STEM fields.

Among the benefits of such partnerships:

- **Human resources:** When a new or growing program needs additional instructors or training on new equipment, employers can be part of the solution by arranging for faculty to visit worksites to stay on top of industry trends, agreeing to job-sharing agreements so faculty can work part-time, and supplementing salaries for faculty and program leaders.
- **Modern equipment and facilities:** Employers can help fund the materials, equipment, and space required for high-quality learning environments that simulate work experiences.
- **Student resources:** Employers can help students by providing scholarships, sponsorships, work-based learning opportunities, internships, and interview or job placement guarantees.
- **Advocacy:** External support from employers and economic development groups can help colleges meet their financial needs. For example, CEOs can accompany presidents to help advocate that policymakers provide funding for their colleges or modify laws or regulations that increase costs or reduce flexibility. Employers can also represent the college at area recruiting events, or advocate for a bond issue needed to build and improve facilities.

Accelerated Skills Training as Stepping Stones to Economic Mobility

Not all students can forgo income for two years or more to earn an associate degree that leads to a STEM job. They need short-term programs that more quickly lead to good jobs. Community colleges can help, developing opportunities for accelerated skills development in STEM fields that lead to in-demand jobs that offer good wages and (often) career paths.

A leading example is **Valencia College's** accelerated skills training programs, which provide 4- to 28-week programs in five industries: advanced manufacturing, construction, transportation and logistics, healthcare, and IT—marketed with the tagline “Weeks, not years.” The process of creating these programs began in 2012, when a US Department of Labor (US DOL) grant was awarded to a coalition of Florida schools to research industry needs and begin to plan new programs. Valencia leaders connected with Lockheed Martin and learned they were struggling to find staff for production and entry-level manufacturing jobs. Valencia and Lockheed Martin collaborated on a whitepaper that led to another US DOL grant in 2014, which allowed the college to build an Advanced Manufacturing Training Center and establish their first accelerated skills program.

As Valencia's accelerated skills programs have expanded and grown to graduate nearly 1,000 students per year, Lockheed Martin has remained a close partner. The company helped Valencia create and review the curriculum for a 10-week electronic board assembly (EBA) technician program—and HR staff from Lockheed Martin connect with students during the first week of class and then work with the college to sync class schedules to hiring dates and plan for on-site interviews

and student referrals. In 2018 Lockheed Martin gave \$300,000 to Valencia to establish a scholarship fund for EBA and computer numeric control (CNC) programs, and \$30,000 to market these programs to women and veterans. During the grant period (2018–2021), 29 percent of EBA and CNC were women, 11 percent veterans, 27 percent Black, and 36 percent Hispanic. Since the creation of both the EBA and CNC programs in 2015, Valencia has trained 467 students, 126 of whom have subsequently been employed at Lockheed Martin.

In 2020–2021 students in Valencia’s accelerated skills training programs had a 95 percent completion rate and an 82 percent job placement rate (early data for 2021–2022 indicate that placement has moved above 90 percent). To ensure low-income workers and unemployed residents can participate, almost all students (94 percent) have no out-of-pocket costs (thanks to scholarships and federal funds). The programs continue to grow in five STEM industries, providing pathways to predictable, reliable employment for many un- and underemployed community members. ■

TRANSFORMATIONAL PRACTICES FOR BUILDING HIGH-QUALITY STEM PROGRAMS AND EMPLOYER PARTNERSHIPS:

TRADITIONAL	TRANSFORMATIONAL
Applied learning opportunities are optional for students, resulting in lower participation rates among students of color and those from low-income backgrounds.	Applied learning opportunities are inevitable, embedded in the curriculum, and provided through multiple modalities to meet the needs and schedules of diverse students.
STEM instructors in workforce programs are recruited from industry and expected to learn how to effectively teach diverse students through trial and error.	STEM instructors, including adjuncts, are onboarded with training on evidence-based instructional techniques and oriented to the college’s student success and equity goals.
Colleges and employers engage in advisory board and other regional workforce meetings, sharing general updates about programs and workforce needs.	Employers are active partners in developing and maintaining strong workforce programs, setting targets for the number of workers, developing program content, contributing scholarships for low-income students, and partnering with the college to ensure work-based learning meets the needs of all students.
Employers look to colleges for immediate solutions when they need talented workers.	Employers and the college collaborate on long-term strategies to educate and employ a well-trained pipeline of diverse talent that reflects the local community and strengthens the employer’s bottom line.



REFLECTION QUESTIONS:

Do your programs make high-quality work-based learning (including paid internships, co-ops, clinicals, and apprenticeships) inevitable for all students, including students of color and low-income students? Are these opportunities delivered collaboratively with employers?

- How could you strengthen these opportunities? Do employers have the capacity to provide hands-on supervision and mentorship? What resources and equipment does your college need to provide high-quality, work-based learning experiences?
- How do you ensure programs are offered in locations and at times that enable all students—including lower-income students who work full- and part-time—to fully participate in work-based learning?
- How can you provide the resources and develop accountability systems to check that faculty and program heads ensure every student participates in high-quality work-based learning?

Are program heads and program designers trained to engage employers effectively in the curriculum design process? Does this include consideration of strategies for diverse learners?

How does your college equip program leaders to approach employers, ask the right questions about talent gaps, discuss demographic changes, and respond to employer requests? Do program leaders and others who interact with employers know how to approach employers to advance the college's equity goals in mutually beneficial ways?

Does the college have structures in place (e.g., effective advisory board meetings, annual program reviews) to ensure program heads and faculty proactively solicit feedback from employers, including frontline managers, about what is working well and what needs improvement?

CONCLUSION

Much more equitable levels of student enrollment and success in STEM programs are essential if community colleges are to reach their promise as engines of regional talent and economic mobility. Overcoming racial, socioeconomic, and gender disparities in STEM programs will not happen overnight. It will require sustained reform, the kind that Aspen-Siemens Award winners and others in this guide show is possible. They make clear to historically underrepresented students that they belong in rewarding STEM fields. Not a few students at a time, but many students across multiple programs. They reform outreach and on-ramps, as well as internal education and advising systems. They sustain strong employer partnerships that set targets for diverse workers and support the development of needed talent.

We are grateful for the colleges featured in this playbook for helping Aspen and the field understand what it takes to achieve excellence and equity in STEM programs. As community colleges across the nation work to achieve greater equity in completion and post-graduation success, we look forward to learning from more colleges as they apply lessons from the field.

College Overview

Siemens STEM Award Winners, 2020



CUYAHOGA COMMUNITY COLLEGE

NURSING
CLEVELAND, OHIO—URBAN

34,407 students
30% of students receiving Pell Grants
31% Black, Hispanic, and Indigenous students



MISSISSIPPI GULF COAST COMMUNITY COLLEGE

PROCESS OPERATIONS TECHNOLOGY
PERKINSTON, MISSISSIPPI—RURAL

12,001 students
42% of students receiving Pell Grants
29% Black, Hispanic, and Indigenous students



LAKE AREA TECHNICAL COLLEGE

WELDING TECHNOLOGY
WATERTOWN, SOUTH DAKOTA—RURAL

2,615 students
33% of students receiving Pell Grants
5% Black, Hispanic, and Indigenous students



SEMINOLE STATE COLLEGE OF FLORIDA

NETWORKING
SANFORD, FLORIDA—URBAN

25,235 students
29% of students receiving Pell Grants
43% Black, Hispanic, and Indigenous students



SAN JACINTO COLLEGE

NURSING AND PROCESS TECHNOLOGY
PASADENA, TEXAS—SUBURBAN

42,923 students
23% of students receiving Pell Grants
73% Black, Hispanic, and Indigenous students



THADDEUS STEVENS COLLEGE OF TECHNOLOGY

ELECTRICAL TECHNOLOGY
LANCASTER, PENNSYLVANIA—URBAN

1,642 students
42% of students receiving Pell Grants
23% Black, Hispanic, and Indigenous students



GREEN RIVER COLLEGE

INFORMATION TECHNOLOGY
AUBURN, WASHINGTON—URBAN

11,847 students
20% of students receiving Pell Grants
21% Black, Hispanic, and Indigenous students

College Overview

Featured Winners and Finalists of the Aspen Prize for Community College Excellence



BROWARD COLLEGE

FORT LAUDERDALE, FLORIDA—URBAN

57,071 students

37% of students receiving Pell Grants

67% Black, Hispanic, and Indigenous students



MIAMI DADE COLLEGE

MIAMI, FLORIDA—URBAN

83,464 students

45% of students receiving Pell Grants

86% Black, Hispanic, and Indigenous students



VALENCIA COLLEGE

ORLANDO, FLORIDA—URBAN

64,593 students

36% of students receiving Pell Grants

57% Black, Hispanic, and Indigenous students

Featured Colleges from *The Workforce Playbook* and the Frontier Set



LORAIN COUNTY COMMUNITY COLLEGE

ELYRIA, OHIO—URBAN

13,395 students

28% of students receiving Pell Grants

19% Black, Hispanic, and Indigenous students



HARPER COLLEGE

PALATINE, ILLINOIS—URBAN

22,623 students

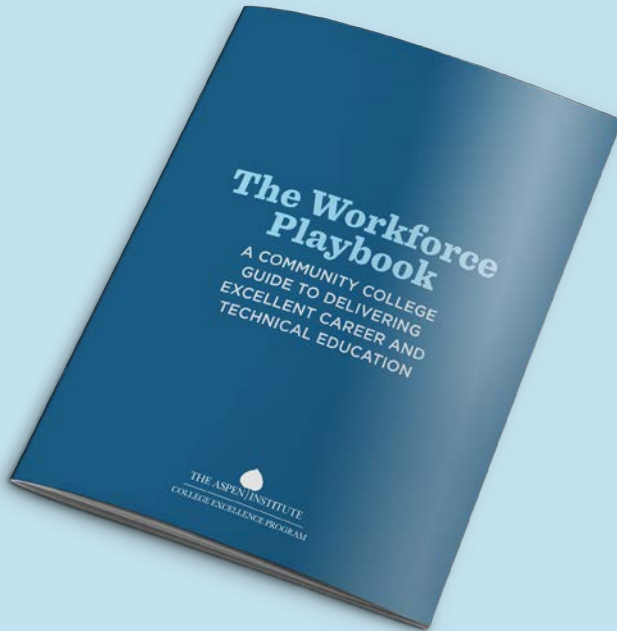
21% of students receiving Pell Grants

34% Black, Hispanic, and Indigenous students

More Resources

The Workforce Playbook

[as.pn/WorkforcePlaybook](https://www.aspeninstitute.org/WorkforcePlaybook)



The Dual Enrollment Playbook

[as.pn/DualEnrollmentPlaybook](https://www.aspeninstitute.org/DualEnrollmentPlaybook)



STEM Award and Case Studies

[as.pn/STEM Award](https://www.aspeninstitute.org/STEMAward)



Messaging Toolkit

[as.pn/messaging](https://www.aspeninstitute.org/messaging)



We hope the strategies, principles, and examples in this guide will help more community colleges deliver programs that promote social mobility and develop talent equitably in their communities.



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