



Evaluation of the Michigan Coalition for Advanced Manufacturing (M-CAM)

Final Report

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Cover Photo: Brittany Schroeder, a CNC machining student at Lake Michigan, is using the lathe to face a piece of stock to length



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Executive Summary

Background

The Michigan Coalition for Advanced Manufacturing (M-CAM) initiative was designed to help unemployed adults (including TAA-certified workers and veterans) gain the skills required to fill available jobs in Michigan's advanced manufacturing sector. The M-CAM initiative was developed by a consortium of eight community colleges in Michigan and funded by the U.S. Department of Labor's (DOL) Employment and Training Administration (ETA) under Round 3 of the Trade Adjustment Assistance Community College and Career Training (TAACCCT) grant program.

The M-CAM leadership team selected Social Policy Research Associates (SPR) as the initiative's third-party evaluator in March 2014. SPR's evaluation culminates in this Final Report, which describes key features of the initiative, factors influencing implementation, participant outcomes, program impacts, and systems outcomes. The report draws on four rounds of site visits to each college, case study interviews with students, a student survey, Efforts To Outcomes (ETO) data on student participation, and wage data from the state of Michigan. The report also draws on comparison data on over 4,000 students enrolled in Automotive and HVAC programs.

Structure of Consortium and Management of Grant

The key entities in the M-CAM initiative included the Board of Advisors (made up of the Presidents of each college), Macomb as the lead college for the consortium, and the M-CAM operational staffs within the industrial trade, workforce and student services divisions at each of the eight colleges.

As the lead college, Macomb oversaw work plan implementation, convened meetings of colleges and key partners, reported on outcomes to DOL, and coordinated with contractors (including the third-party evaluator, technical assistance provider, and communications firm).

Each college in the consortium, with the exception of Bay, led at least one M-CAM activity. As an Activity Lead, a college was responsible for (1) developing a work plan for task execution, (2) convening colleges to discuss approaches related to the activity, and (3) developing a common M-CAM implementation approach.

- The M-CAM Consortium included eight Michigan Community Colleges: Bay de Noc, Grand Rapids, Kellogg, Lansing, Lake Michigan, Macomb, Mott, and Schoolcraft.
- The colleges used the \$24.9 million grant to update equipment and on-campus technology, enhance coordination and build capacity across the eight colleges, improve student access to career advising, and better align training to meet future labor needs of employers.
- The colleges focused on enhancing curriculum and hands-on learning opportunities with new equipment in four M-CAM pathways: Production, Welding, CNC Machining, and Multi-Skilled Technician/Mechatronics.
- A key focus of the grant was on aligning training curricula across each of the eight colleges to industry standards and industry-recognized certifications.
- To develop a comprehensive career pathways system, colleges focused on developing intensive upfront assessment and career counseling, foundational skills training, and job placement services.

Student Enrollment and Training Completion

The M-CAM consortium and each individual college exceeded the TAACCCT-grant enrollment goals: the colleges enrolled 3,925 students in M-CAM, representing 143 percent of the cumulative enrollment goal. Macomb was the most successful at recruitment, in that it enrolled 1,348 participants (255 percent of its target).

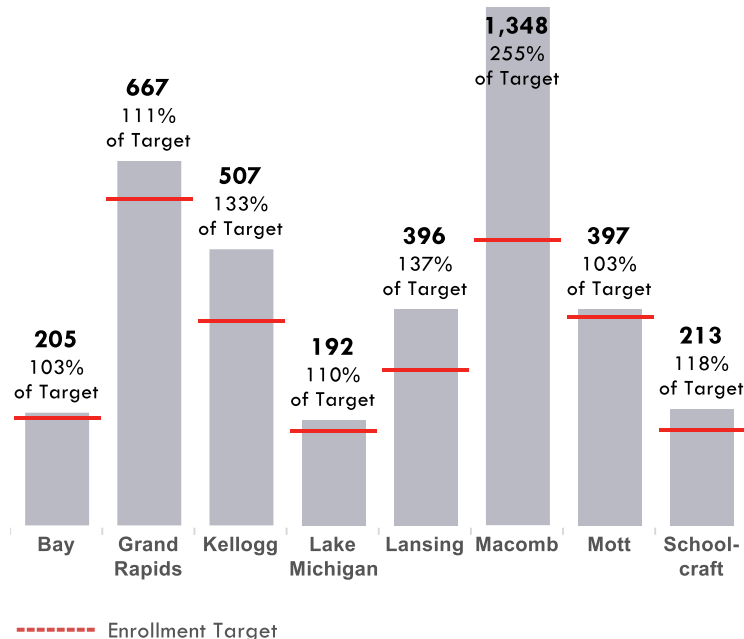
As of July 31, 2017, 25 percent of all M-CAM participants were still enrolled in advanced manufacturing programs. Fifty-six percent of all participants had completed and exited, while 19 percent had withdrawn from M-CAM programs without completing. The student survey results show that students who withdrew did so primarily because of life conflicts, rather than because of dissatisfaction with their training.

There was broad variation in the age and life-experience “profile” of students. Six in 10 M-CAM students were either over 40 or under 25 years of age. Students in these two groups typically varied greatly in their work experience, understanding of manufacturing trades, and life responsibilities. Furthermore, students who faced significant life challenges—housing instability, criminal history, transportation challenges—often viewed M-CAM as a vital “second chance.”

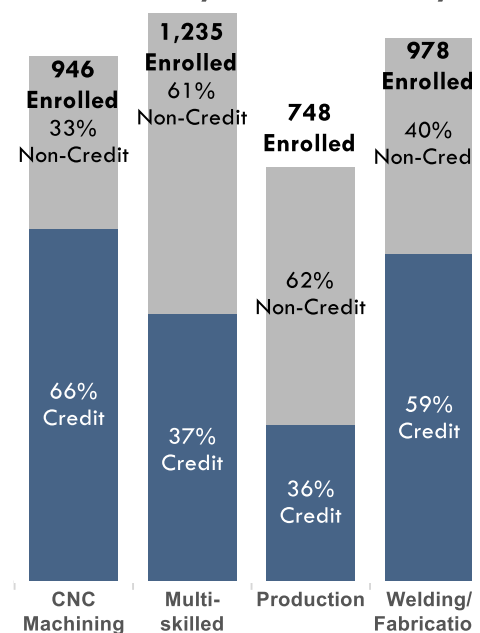
- Sixty-one percent of M-CAM participants were white males. Twenty percent of students were African American and 13 percent were female.
- The 31 percent of participants who were over the age of 40 often viewed M-CAM as a chance to upgrade their manufacturing skills to improve employment prospects. In contrast, the 28 percent of participants under the age of 25 were often still exploring career path options.
- Fifty-four percent of M-CAM participants were employed at the time of enrollment and looking to upskill so that they could move into higher paying manufacturing jobs.

Enrollment by College

Number of Participants and Percent of Enrollment Target Reached



Enrollment by Career Pathway



Recruitment Practices

The success of M-CAM colleges in surpassing their enrollment goals for the grant was particularly impressive given the broader context for enrollment at each of the colleges. Overall, enrollments across the M-CAM colleges declined over the course of grant implementation, mainly because of the thriving economy and the demand for labor among local employers. M-CAM staff members, therefore, had to be particularly aggressive in their recruitment efforts to ensure that programs were full and that they were reaching their target enrollment goals.

With the support of grant funds, colleges distributed pamphlets, conducted presentations at partner organizations, and advertised in local newspapers. These recruitment efforts influenced more than enrollment numbers: college staff members reported that the grant greatly increased the ability of colleges to market their programs and to increase awareness of manufacturing-sector training and employment opportunities. A staff member at Kellogg said, “M-CAM has helped to increase marketing... in industrial trade programs and occupations. The grant has put us on the map.”

Foundations for M-CAM Training

M-CAM’s training programs were administered at the college level and, thus, the training curricula were developed independently at each college. Nevertheless, for the initiative to function as intended and realize its goals, the colleges in the consortium had to coordinate their work in identifying skills gaps, developing their training programs, and aligning them to industry standards.

To facilitate this process, M-CAM created a workgroup for each industry pathway made up of key faculty members, instructors, and staff members. These groups worked to make the curricula within each pathway more employer-focused across colleges in the consortium, identify appropriate industry-recognized professional certifications, enhance alignment with national industry-recognized professional credentials, develop technology-enabled learning strategies (e.g., hands-on learning, online coursework, online communities), and incorporate updated technology into the course content.

As key elements of their revamping of training programs, colleges selected and purchased new equipment and actively engaged employers to ensure that programs aligned with industry standards.

- Promising recruitment practices: (1) Presentations by employers and faculty at recruitment orientations helped prospective students understand the value and importance of training. (2) Close collaboration with key partner agencies facilitated recruitment, particularly of vulnerable populations.
- Recruitment challenges included negative perceptions of manufacturing among students and their families, low entry-level pay in production, and limited college staff time dedicated to recruitment.
- The majority of the colleges spent between 20 and 40 percent of their grant funds on new equipment. These purchases increased the availability of hands-on, experiential learning for students on the types of equipment used by industry partners. Nearly half of the equipment purchased was used to strengthen the Multi-Skilled/Mechatronics pathway.
- M-CAM supported a tremendous infusion of new equipment for colleges, a number of which had had limited opportunities to invest in equipment prior to the TAACCCT grant.

Employer Engagement

The colleges all had employer relationships prior to M-CAM, but the M-CAM grant required that they reconnect with their employer base and strengthen those relationships. M-CAM staff and faculty members worked with employers to inform all aspects of the implementation of the pathways model, particularly alignment of curricula with industry practices, standards, and credentials, and development of employment and work-based learning opportunities. In this process, the career coaches and job development staff members were instrumental in helping colleges reach out to employers and engage them in job placement and other activities.

Growth in employer partnerships over the life of the grant speaks to the consortium's deliberate efforts to actively engage employers in strengthening their career pathways. Consortium colleges engaged at least 188 employers they had previously not worked with and leveraged those connections in meaningful ways. Furthermore, over 60 percent of employers supported colleges in five or more ways, reflecting a deep level of engagement.

Core Training Programs

M-CAM promoted improvements in noncredit and credit programs in the four advanced manufacturing pathways. Colleges made the following changes to training programs:

- The Multi-skilled/Mechatronics pathway experienced the most change. Ten new programs were developed, while 17 were enhanced. Programs were aligned with Siemens and Packaging Machinery Manufacturers Institute (PMMI) certifications.
- In welding, the colleges developed seven new programs and enhanced 15. Key changes included the addition of robotic welders and virtual welders and the opportunity for students to earn American Welding Society (AWS) certifications.
- Colleges developed two new programs in CNC machining and enhanced 14, primarily through the incorporation of new equipment and National Institute for Metal Working Skills (NIMS) certifications.
- Colleges developed at least six new production programs and enhanced four others with the addition of Manufacturing Skill Standards Council (MSSC) Certified Production Technician certifications.

- Across the consortium, the number of reported employer partnerships nearly doubled, from 204 in Fall 2014 to 392 in Spring 2016.
- 356 employers across the consortium (91 percent of total employer partners) assisted with job placement for students. These employers interviewed participants at colleges, participated in job fairs, and actively coordinated with M-CAM staff members to hire students. Two of the most common employer roles were posting job listings and coordinating with M-CAM job developers to hire students.
- Ninety percent of students surveyed were satisfied or very satisfied with the training they had received.
- There were no significant differences in student satisfaction by college or by career pathway.
- Students who were interviewed appreciated:
 - The high quality of instructors, who they viewed as having deep-levels of industry experience, and
 - The hands-on and applied approach to learning.

Pathway Enhancements

M-CAM aimed to promote individuals' access to career pathways in manufacturing by strengthening students' academic and "soft" skills, allowing them to earn credit for what they already knew, and providing mechanisms for them to transfer credit from one institution to another. The colleges made the following changes to enhance career pathway supports for students:

- Colleges worked to strengthen students' foundational skills by harnessing and supplementing existing college resources, enhancing contextualized learning in core training programs, incorporating online basic skills testing and remediation, creating bootcamp-style pre-enrollment cohort programs, and providing supplemental workshops.
- Colleges used technology to enhance pathways. For instance, colleges incorporated Tooling U, MSSC online courses, Amatrol, and AMTEC into curricula to create hybrid course options and provide additional support.
- Colleges established agreements so that students could receive credit for coursework completed at one college (or high school) when transferring to another institution or, in the case of noncredit-to-credit articulation, when transferring from one division to another in the same college.
- The colleges identified industry certifications within each pathway, engaged their registrars in establishing equivalency values for each certification, and signed articulation agreements with other M-CAM colleges, as well as with two four-year colleges—Eastern Michigan University and Ferris State University.
- Although all M-CAM colleges had strategies for assessing prior learning and awarding credit for it, advancing the use of prior learning assessment (PLA) among advanced manufacturing students was not a strong focus of grant implementation. Rather, the focus was on articulating credit from noncredit to credit programs and across institutions using third-party industry certifications as a basis for determining what students had learned. The consortium presidents signed a written agreement allowing the use of third-party industry certifications for articulation across their colleges, which was a significant advancement given Michigan's decentralized community college system.

- Employer partners strongly emphasized the need for colleges to focus on strengthening students' "soft skills," such as punctuality and communication skills.
- M-CAM students who were interviewed generally wanted to focus on technical training and did not feel as though they needed support for "soft skills."
- Promising practices in promoting foundational skill development included:
 - Strengthening coordination between existing programs on campus
 - Offering more remediation in technical math
 - Having employers talk to students about the importance of "soft skills."
- Challenges to incorporating the teaching of foundational skills into manufacturing courses included resistance from faculty and low attendance at optional workshops
- Most colleges included online courses as an "optional" rather than a required component of the courses.
- M-CAM students were generally unaware that they could earn credit for prior learning.

Counseling and Student Support

A key goal of the M-CAM initiative was to create an intrusive case management and career coaching system through which students would receive a wide variety of counseling and support services, including academic advising, help with educational planning, career coaching, job search and job placement assistance, and referrals for supportive services. With TAACCCT grant funding the colleges hired additional staff members with a variety of titles (e.g. career coaches, success coaches, intake and enrollment staff, and job developers) to provide these services. Colleges also bolstered student supports by strengthening on- and off-campus partnerships—with college admissions, advising and job placement offices, Michigan Works!, the Public Welfare Department, employer associations, and community- and faith-based organizations.

M-CAM career coaches interacted with students at a frequency that ranged from three times a week to once a month. During meetings with students, career coaches provided four core types of support.

- Academic support: Helping students select a career pathway and training program, choose courses and set up class schedules, navigate the college enrollment process, apply for financial aid, improve study skills, and access college tutoring services.
- Career information and counseling: Assisting students with developing or improving their resumes and developing cover letters; providing information on how to look for jobs and succeed in employment interviews.
- Assistance with job search and placement: Providing job announcements; assisting with job search; coordinating hiring events like job fairs; matching students to job or work-based learning opportunities.
- Help dealing with life issues: Providing counseling; referring students to supportive services such as financial aid, childcare, and transportation assistance.

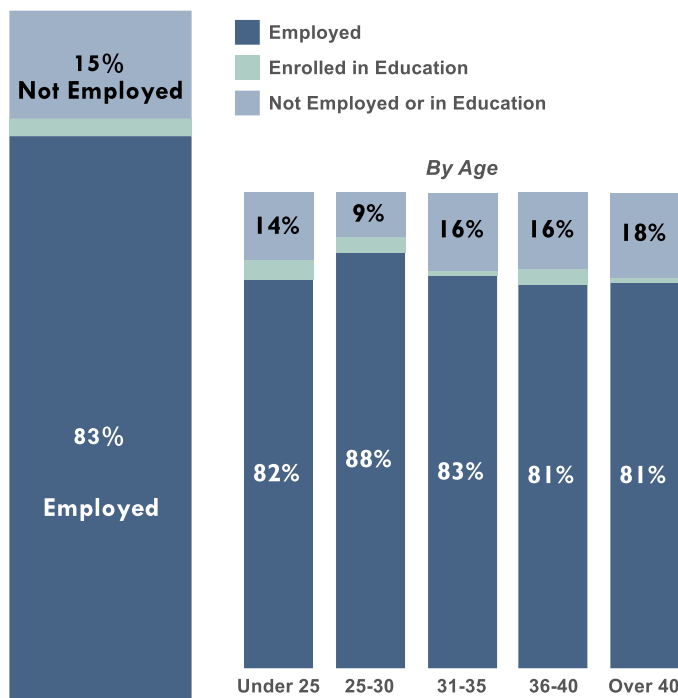
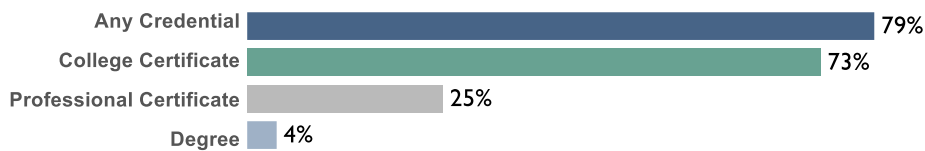
Participant Outcomes

The M-CAM consortium strove to provide clear career pathways to well-paying advanced manufacturing jobs for participants. Measures of success in this area include the rate of program completion, certifications earned, employment placement, retention in employment, and average post-training wages.

- College leads reported that the largest “added value” of M-CAM was the enhanced counseling and student support services.
- The number of staff members providing counseling and supportive services at each college ranged from one to five.
- While M-CAM coaches were the main providers of student support, instructors at the M-CAM consortium colleges also advised students about academic planning and scheduling, provided them with instructional assistance and career advice, and, in some cases, helped connect them to jobs, internships, and apprenticeships.
- Among student survey respondents:
 - 91 percent were satisfied with the academic support services.
 - 90 percent were satisfied with help they received with life issues.
 - 85 percent were satisfied with career information and counseling.
 - 83 percent were satisfied with job search and job placement.

- Fifty-six percent of M-CAM students completed their studies and exited from M-CAM services (subsequent statistics are for these participants alone).
- M-CAM participants across the eight colleges earned 2,829 college certificates, 2,094 professional credentials, and 155 degrees. Seventy-eight percent of participants exited M-CAM services with at least one of these certifications.
- Eight-three percent of participants who successfully completed their programs were employed by the first quarter after exit. One percent of participants were enrolled in further education and not employed, and fifteen percent were neither employed nor enrolled in further education.

Percent of Exiters Completing Credentials, Overall



- Older participants and African American participants were less likely than others to receive a college degree, regardless of their career pathway.
- Colleges awarded the following professional certifications: 941 AWS, 326 NIMS, 241 MSSC, 75 Siemens, and 73 PMMI. They also awarded OSHA 10 and Fanuc certifications.
- The percent of students completing any credential varied significantly by college.
- Sixty-eight percent of exited participants who completed our survey felt that their training helped them obtain their most recent job.
- 80 percent of those employed after exit were employed in manufacturing-related industries, compared to 65 percent prior to the program.
- Participants from all four career pathways and among all age groups attained high employment rates. There were no significant differences between groups, although participants between 25-30 were employed at the highest rate.

- The average wage exited participants received for new positions was \$13.66, well above the minimum wage in Michigan (\$8.90 as of January 2017) and above the living wage estimate of \$10.24 (the estimated hourly wage that an individual must earn to support himself or herself in Michigan).
- Seventy percent of incumbent worker participants who successfully completed their programs earned a wage increase after enrollment. On average, incumbent workers received an 11-percent wage increase as a result of M-CAM training.
- Of those that were employed at the time of program completion, 81 percent were still employed three quarters (approximately nine months) later.

Impact Study Findings

The evaluation compared the employment outcomes for M-CAM students to a comparison group of students from the same colleges that enrolled in automotive technician or Heating, Ventilation, and Air Conditioning (HVAC) programs. The evaluation also conducted a historical analysis, comparing outcomes for M-CAM students to those that participated in advanced manufacturing programs at the colleges prior to M-CAM.

- M-CAM students had significantly higher employment rates and higher earnings than those in comparison groups of study, even after adjusting for differences between groups in baseline characteristics.
- After controlling for differences in characteristics, M-CAM students who were employed earned on average about \$500 to \$1000 more per quarter than students enrolled in the comparison group programs.
- The historical analysis showed that the enhancements brought about by M-CAM improved the probability that a student would find employment by at least 10 percentage points. The effect of M-CAM enhancements on earnings were less clear. (This analysis only included programs that had existed prior to grant implementation and that were “enhanced” with grant funds).

- Participants 36–40 years of age made the highest average hourly wage (\$14.90 per hour). Those 18–24 made \$12.55 per hour, and those over 40 \$14.35 per hour.
- Before enrolling in M-CAM, incumbent workers had an average wage of \$15.91; after completing their programs they made, on average, \$17.25 per hour.
- Among incumbent workers, the value of participating in M-CAM programs seemed to be highest for workers between the ages of 25 and 40.
- African American participants earned lower wages on average than their white counterparts and were less likely to receive a wage increase if they were employed at enrollment.
- Women received lower wages than did men, but if they were incumbent workers then they were just as likely as men to get a wage increase.
- Employment rates for M-CAM students were 10-22 percentage points higher than for students enrolled in automotive or HVAC programs at the same colleges, during the same time period.

Systems Outcomes

The M-CAM initiative played an important role in strengthening partnerships and making structures and processes at the system level more conducive to supporting career pathways in advanced manufacturing.

- Consortium colleges deepened their engagement and collaboration with industry associations and employers, the public workforce system, nonprofit and community-based organizations, and four-year educational institutions.
- M-CAM funding helped bridge the divide between noncredit and credit programs and helped bring greater awareness of advanced manufacturing programs to college administrators, employers, and prospective students.
- By aligning programs to industry-recognized standards and using third-party industry certifications as a basis for awarding academic credit, the colleges built cross-consortium consistency into their training programs.
- The colleges leveraged the M-CAM grant to obtain additional resources that allowed them to purchase and upgrade equipment, expand facilities, and integrate intrusive case management services for advanced manufacturing students into their service delivery systems.
- Efforts to adequately and reliably track M-CAM student outcomes led to improved, even transformative, changes in how the colleges gathered and reported program-level data and used it to document employment-related outcomes and growth in partnerships and to inform decision-making.

Further Research

The positive educational and employment outcomes that emerged from M-CAM are a sign of what can be accomplished when colleges provide additional support to students and partner closely with employers. The impacts achieved by the program are in keeping with a growing body of research showing the effectiveness of regional sector-driven workforce initiatives. Moving forward, it would be valuable to explore what it is about sector-based initiatives like M-CAM that lead to impacts. It would also be valuable to better understand how students intersperse learning and work in a career pathway model over time and to examine in more detail the differences in outcomes seen in older vs. younger workers, women vs. men, and African Americans vs. whites so that the colleges could more effectively serve specific populations. Finally, given stagnating wages at the national level, it would be useful to better understand how various factors—particularly those related to automation—influence wage growth in advanced manufacturing.

- M-CAM increased coordination between colleges in Michigan, which is notable given that the colleges operate in a decentralized system.
- The colleges designed clear, coherent career pathway models for M-CAM’s four career pathways—Welding/Fabrication, CNC Machining, Multi-Skilled Technician/Mechatronics, and Production.
- The colleges used the grant as an opportunity to “move the needle” on data access and availability. Several college presidents met with the Director of Michigan’s Talent Investment Agency (TIA) to discuss the importance of data sharing and data access. At the time of our report, the Michigan Legislature was considering an expansion of the state’s Social Security Act expanding access to wage data for community colleges and their evaluators.

CHAPTER 1:

Introduction



The Michigan Coalition for Advanced Manufacturing (M-CAM) initiative was designed to help unemployed adults (including TAA-certified workers) gain the skills required to fill available jobs in Michigan’s advanced manufacturing sector. The M-CAM initiative was developed by a consortium of eight community colleges in Michigan and funded by the U.S. Department of Labor’s (DOL) Employment and Training Administration (ETA) under Round 3 of the Trade Adjustment Assistance Community College and Career Training (TAACCCT) grant program. The four-year grant was funded in October 2013.

The M-CAM leadership team selected Social Policy Research Associates (SPR) as the third-party evaluator of the initiative in March 2014. SPR’s evaluation design called for a comprehensive implementation study, an outcomes study, and a rigorous quasi-experimental impact evaluation. This Final Report includes findings from each facet of the study. This initial chapter of the final report describes the economic context in Michigan, the key aspects of the M-CAM initiative itself, and the evaluation’s methods.

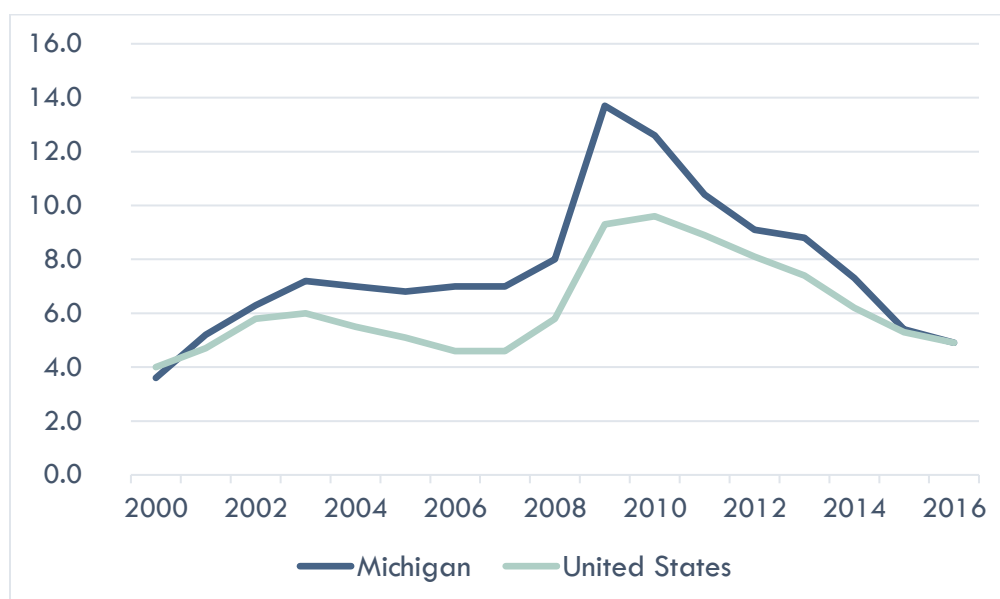
THE CONSORTIUM

- **Bay de Noc Community College**
(Bay)
Escanaba, MI
- **Grand Rapids Community College**
(Grand Rapids)
Grand Rapids, MI
- **Kellogg Community College**
(Kellogg)
Battle Creek, MI
- **Lake Michigan College**
(Lake Michigan)
Benton Harbor, MI
- **Lansing Community College**
(Lansing)
Lansing, MI
- **Macomb Community College**
(Macomb)
Warren, MI
- **Mott Community College**
(Mott)
Flint, MI
- **Schoolcraft College**
(Schoolcraft)
Livonia, MI

Economic Context

In the planning stages of the M-CAM initiative, Michigan was still recovering from the global economic recession of 2007–2009. The recession affected Michigan more harshly than the United States as a whole, and the state had not quite reached its pre-recession (2007) unemployment levels by 2013, when the DOL awarded the TAACCCT Round 3 grants (Exhibit 1). However, throughout the course of the TAACCCT grant, the unemployment rate in Michigan improved, returning to pre-recession levels in 2014 and catching up with the average level in the U.S. shortly thereafter. By 2016, the unemployment rate in the United States and in Michigan were both at 4.9 percent, which is below the 5.0 percent mark that the Federal Reserve considers “full employment.”

Exhibit 1: Unemployment in Michigan and the United States



Source: Bureau of Labor Statistics, Local Area Unemployment Statistics, annual average unemployment rate (not seasonally adjusted).

The context of an improving economy shaped the M-CAM initiative in both positive and negative ways. Increased employer demand for skilled workers benefitted M-CAM, because colleges had an easier time placing participants into jobs. Furthermore, because employers needed workers, they were motivated to engage actively with M-CAM training programs by participating in advisory committees, offering work-based learning opportunities and incumbent worker training programs, and taking part in job placement activities, such as career fairs.

On the other hand, the improving economy made it more difficult for the colleges to recruit students into the M-CAM programs; when jobs are available, individuals would generally rather work than participate in training programs. Similarly, students who found jobs in the early stages of their training were at higher risk for exiting programs prior to completion. Also, as is explained further in Chapters 4 and 10, the colleges served many more incumbent workers and individuals with significant employment barriers than they anticipated when they applied for the grant.

The changing economy also complicated the efforts of the colleges to reach trade-affected workers in Michigan. The number of trade-affected workers in Michigan decreased from 80,551 in the 2008–2013 period to 14,730 in the 2011–2016 period, a decline of 81.7%.¹ This made it more difficult for the colleges to recruit trade-affected workers, a target group for TAACCCT-funded programs.

Manufacturing in Michigan

Largely due to the automobile industry, Michigan is ranked fifth among the states with the highest employment in manufacturing (576,576 jobs in 2014). The “big three” automobile companies – Ford, General Motors (GM), and Chrysler – were all founded in Michigan and still make the state their headquarters. Although manufacturing employment in Michigan has decreased considerably since the 1980s and 1990s, manufacturing still accounts for more than 14 percent of all jobs in Michigan, giving the state a higher concentration of jobs in manufacturing than all but nine other states.

The loss of many manufacturing jobs in the automobile industry that occurred prior to and during the great recession has left its mark on the labor supply in Michigan. Employers reported difficulty in recruiting young people into the trades because high schools do not have enough trade programs and because there is a stigma attached to entering the manufacturing field. Due to the recent history of industrial decline, manufacturing is sometimes seen by parents, teachers, counselors and students as a technologically outdated field that is unstable and not promising. M-CAM was seen by employers we interviewed as an opportunity to change this perception and showcase the cutting-edge nature of advanced manufacturing in Michigan.

Exacerbating the labor shortage is the fact that many of the current industry workers were close to retirement age. M-CAM faculty members identified particular niches of advanced manufacturing that have a high concentration of skilled and semi-skilled workers who are on the verge of retiring. For example, one faculty member noted that, based on his industry experience, skilled tool and die makers and machine maintenance technicians are going to be in very high demand as older workers retire.

“In the manufacturing space, [most local companies] supply to the auto industry... and when the economy went bust, and Michigan’s economy was bleak long before other parts of the county, it hit us hard. Some of the smaller manufacturers shut their doors... and when the recovery started, the companies discovered that they didn’t have a workforce to fill their positions.”

Dr. Steve Elder, President of Grand Rapids

“[What] we have is not only a shortage of qualified people for entry-level jobs, but also the qualified people are on the verge of retirement. So it’s not just finding the people today... the jobs you’re talking about, the average age of that workforce is probably 55 years old; they’re not going to be working for the next 40 years. We have some major serious problems here in Michigan with skilled labor.”

Employer Partner, Macomb

¹ Source: U.S. Department of Labor Trade Adjustment Assistance program. <https://www.doleta.gov/tradeact/> (accessed June 7, 2016). Search was from January 1 of the starting year to June 7 of the ending year (the date the data were collected for the report).

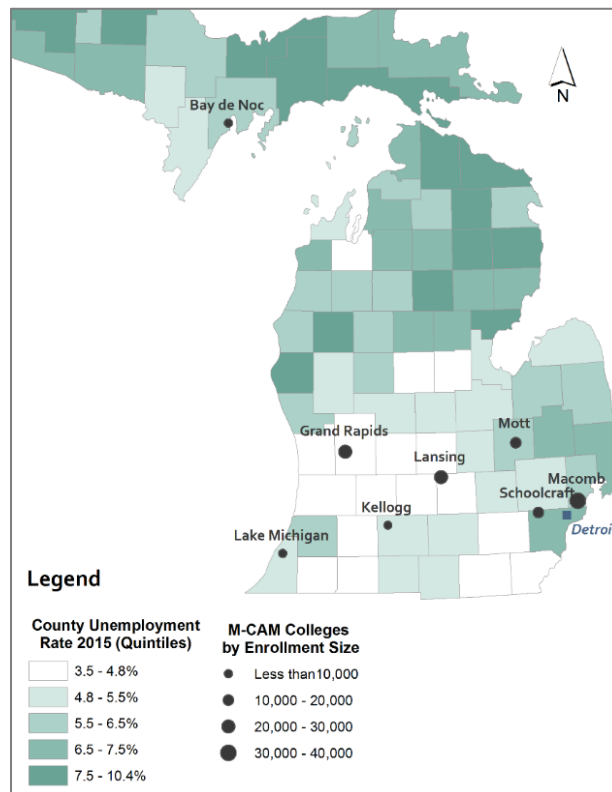
Overview of M-CAM

As described above, the M-CAM consortium was formed in the aftermath of the global economic recession of 2007–2009, when the economy in Michigan was just starting to recover. To train workers for the jobs expected to be in demand in the future and to meet the projected labor-force needs of industry, the eight community colleges that were part of the M-CAM consortium used TAACCCT funding to update manufacturing equipment and technology, expand advanced manufacturing course offerings, and strengthen career pathways.

M-CAM Service Area and Target Populations

The M-CAM service area included the Detroit metropolitan area as well as the cities of Flint, Grand Rapids, Lansing, Southwest Michigan, and Michigan’s rural Upper Peninsula. The target population for the M-CAM initiative included TAA-eligible workers, veterans, and other unemployed or underemployed adults. As illustrated in Exhibit 2 below, the participating colleges are in local areas with very different labor markets; in 2015, unemployment rates across the sites ranged from a low of 3.5 percent to a high of over 7.5 percent. Thus, variations in participant outcomes across the colleges need to be viewed within the context of their individual labor market conditions.

Exhibit 2: Map of M-CAM Colleges and 2015 Unemployment Rates in Michigan



Source: Bureau of Labor Statistics, Local Area Unemployment Statistics, 2015. Enrollment data from the Integrated Postsecondary Education Data System, National Center for Education Statistics

Goals

The overall goals of the M-CAM initiative, informed by an analysis of the gap between the skills of unemployed workers and the needs of employers in the advanced manufacturing sector, were as follows:

- Update and align on-campus technology with industry standards
- Develop a real-time, web-based longitudinal database to track student characteristics and outcomes for reporting and evaluation purposes
- Enhance coordination and build capacity across the eight colleges by pooling expertise and developing standard core learning objectives
- Improve student access to career advising so that students can make informed career choices and obtain employment after training completion
- Cooperate more closely with employers to align training to meet current and future job needs.

“This \$24.9 million DOL grant is an important step forward for Michigan community colleges and employers in leveraging our historical strength in “making things” while harnessing the promise of advanced manufacturing for the economic benefit of our residents, businesses and communities.”

Dr. Jim Jacobs, President of Macomb

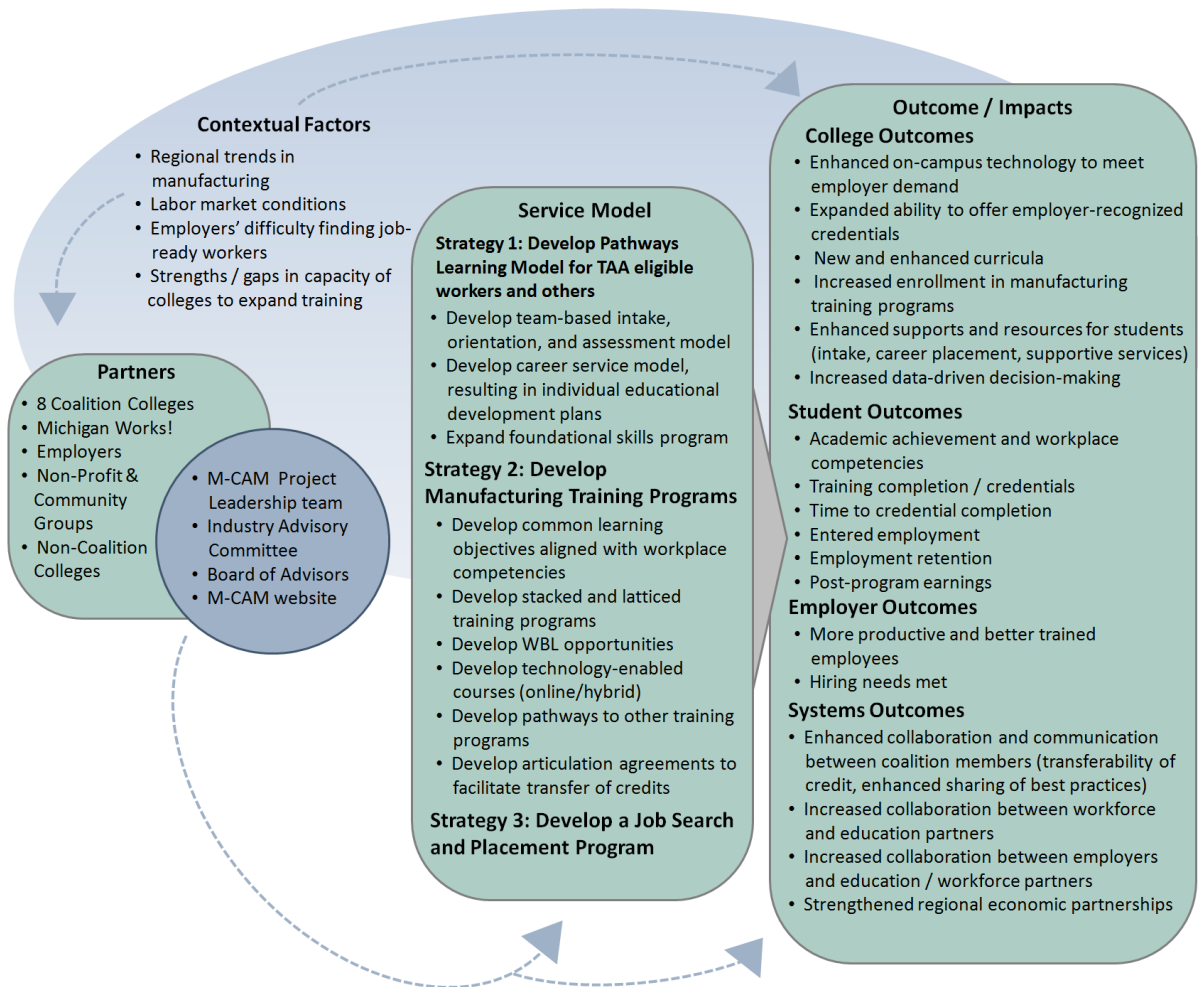
Drawing on the results of an employer survey, the M-CAM consortium created a service model that aimed to promote job readiness skills, foundational skills, articulated career pathways, employer engagement, career planning, and prior learning assessments. The consortium also used the survey to identify training gaps, such as a lack of local access to courses for specific certificates.

M-CAM Initiative Theory of Change

The M-CAM logic model provides an overview of the theory of change that informed the initiative’s approach to implementation (Exhibit 3). It shows key partners, strategies, and anticipated outcomes and impacts. The logic model assumes that contextual factors play a role in shaping the outcomes. The state of the economy, labor market conditions, employer needs, and regional trends in manufacturing influence the likelihood that students will elect to enroll in training and their prospects for finding employment after training. The logic model also depicts M-CAM’s organizational leadership structure, which included the leadership team, industry advisory committees, and a Board of Advisors, as important features of the initiative.

The M-CAM consortium approached the realization of the initiative’s goals by implementing three strategies:

Exhibit 3: M-CAM Logic Model



1. **A pathways learning model** – intensive upfront assessment and career counseling, foundational skills training, prior learning assessments, and articulated career pathways with many entry and exit points.
2. **Manufacturing training programs** – new and enhanced curricula in the four M-CAM pathways (production, welding, CNC machining, and mechatronics); new industry-recognized professional certifications, college certificates, and degrees; online learning and hybrid course options; employer advisory boards; and new equipment.
3. **A job search and placement program** – job placement services, work-based learning opportunities, and building relationships with employer partners.

Taken together, these strategies were meant to ensure that students would have the supportive services, career guidance, and updated training curricula and facilities that they needed to complete training, obtain quality employment, and enjoy future wage increases. In addition to promoting these student outcomes, these strategies were intended to have college-level and system-wide impacts. Their

implementation would, for example, enhance bridges between credit and non-credit programs at the colleges and articulation agreements with other colleges and universities, which would make it easier for a student to start in a non-credit course and then transfer to a credit or degree program. On a consortium-wide level, the strategies aimed to increase collaboration between colleges, enhance relationships with employers, and promote economic resilience in the region.

Fidelity to TAACCCT Model

M-CAM was funded under round 3 of DOL's TAACCCT grant program. DOL requested that all third-party evaluators analyze how faithful grantees were to the core elements outlined in Solicitation for Grant Application (SGA) guidelines for TAACCCT implementation. Following are core elements highlighted in the SGA.

- **Use evidence-based design principles.** The SGA defines this as (1) the sharing of evidence on the effectiveness of new approaches being developed and (2) the use of data for continuous improvement.
- **Creation of stacked and latticed credentials.** This is defined as (1) demonstration of skills or competencies through observable methods, (2) the use of prior learning assessments, and (3) the use of best practices related to stacked credentials (flexible training schedules, use of supportive services to promote retention).
- **Creation of articulation and transferability of credit between colleges.** This is defined as (1) increased linkages with four-year and two-year colleges and other programs, (2) development of articulation agreements for all TAACCCT-funded classes at other M-CAM colleges, (3) presence of articulation agreements with two-year and four-year colleges for some TAACCCT-funded programs, and (4) the existence of bridges between credit and noncredit courses.
- **Integration of advanced technology and online learning.** This is defined as (1) integration of online or technology-based learning into program design, (2) creative commons licensing of all TAACCCT-funded curricula and materials, (3) the use of formative assessments for online courses, and (4) integration of best practices related to online learning (learners have control over their interaction with the media, learners can reflect on and assess their learning).
- **Strategic alignment.** This is defined as (1) directing partnerships and outreach efforts at TAA-eligible participants, (2) making an effort not to duplicate other services in the community, (3) collaboration with public and private philanthropic efforts, (4) employer involvement in developing curriculum for each career pathway, (5) active involvement of employers on advisory boards and employer commitment to provide resources and hire graduates, (6) collaboration with the workforce system, and (7) collaboration with nonprofit partners or labor organizations on the provision of wrap-around services.

Appendix B shows how faithful colleges were to the different aspects of the TAACCCT model, both at the beginning and the end of their grant implementation. Overall, the fidelity of M-CAM colleges to the

TAACCCT model was high, particularly in their use evidenced-based design and in the area of strategic alignment.

Overview of this Report

This final report describes and analyzes implementation of the M-CAM TAACCCT grant and seeks to answer the following four research questions:

- How and to what extent has each college implemented the key features of the M-CAM initiative?
- What factors have influenced grant implementation?
- What are the enrollment, educational and employment outcomes of M-CAM at the participant, college, and systems level?
- What is the impact of the M-CAM program on wages and employment?

SPR's evaluation includes multiple sources of qualitative and quantitative data, all of which will be highlighted in this report. In particular, SPR is drawing on four two-day site visits to each college (conducted in the fall of 2014, spring 2015, spring 2016, and spring 2017). These visits included semi-structured interviews with college presidents, faculty, students, employers, key partners and grant-funded staff. In addition to site visits, SPR is drawing on over 45 phone interviews with students and systems partners, a survey of student completers and non-completers, and observations of consortium meetings (either by telephone or in person). Quantitative sources include administrative data on student characteristics, participation and outcomes from the Efforts To Outcomes (ETO) participant database, administrative data from colleges on students from comparison programs, as well as wage and employment data on M-CAM participants and students in comparison groups from the Michigan's Talent Investment Agency. A full list of SPR's evaluation research questions and a detailed list of data sources is in Appendix A.

The next two chapters provide more detail on the structure and maintenance of the M-CAM initiative at the consortium level (Chapter 2) and the college level (Chapter 3). Chapter 4 describes recruitment and intake activities, enrollment, and participant characteristics. Chapters 5, 6 and 7 describe how the consortium developed manufacturing training programs by enhancing specialized training programs (Chapter 5 & 6) and shifting to a pathways model of training (Chapter 7). Chapter 8 is an overview of coaching and student services that were provided to M-CAM participants. Chapter 9 describes the colleges efforts to provide students credit for prior learning and to articulate credit across colleges. Chapter 10, 11, and 12 highlight program outcomes and impacts and the participant and systems level outcomes achieved under M-CAM. Chapter 13 concludes the report with a summary of outcomes and recommendations for local partners as they seek to strengthen regional partnerships moving forward.

CHAPTER 2:

Structure of the Initiative



Each of the eight community colleges making up the Michigan Coalition for Advanced Manufacturing is completely independent, governed by a locally-elected community college board that administers its activities and not accountable to a state-level agency.² This autonomy provides each community college with a great deal of flexibility to adapt its programs to the needs of its surrounding community, but it also presents considerable challenges for the implementation of a project like M-CAM, which seeks to align efforts across colleges. As a multi-program initiative that involved many entities, M-CAM required a robust management structure at the consortium level that was responsible for oversight, management, and coordination. This chapter provides an overview of this structure and describes how the initiative's management and coordination functions were staffed and carried out.

Consortium-level Leadership

The key entities involved in high-level decision making, oversight, and policy guidance for the M-CAM initiative were the Board of Advisors (made up of the presidents of the consortium colleges) the Corporation for a Skilled Workforce (CSW) (a third-party technical assistance provider) Macomb College, (the lead college for the consortium) and the industrial trade and workforce divisions at each of the eight colleges. The relationships among these entities are diagrammed in Exhibit 4.

As members of the Board of Advisors, the college presidents provided high-level guidance to and oversight of grant implementation in its early phases. The presidents met quarterly in the first year of the grant and then as needed after that point. Although they were not involved in the day-to-day administration of the grant or the initiative, the college presidents removed roadblocks and raised the profile of M-CAM at their respective institutions.

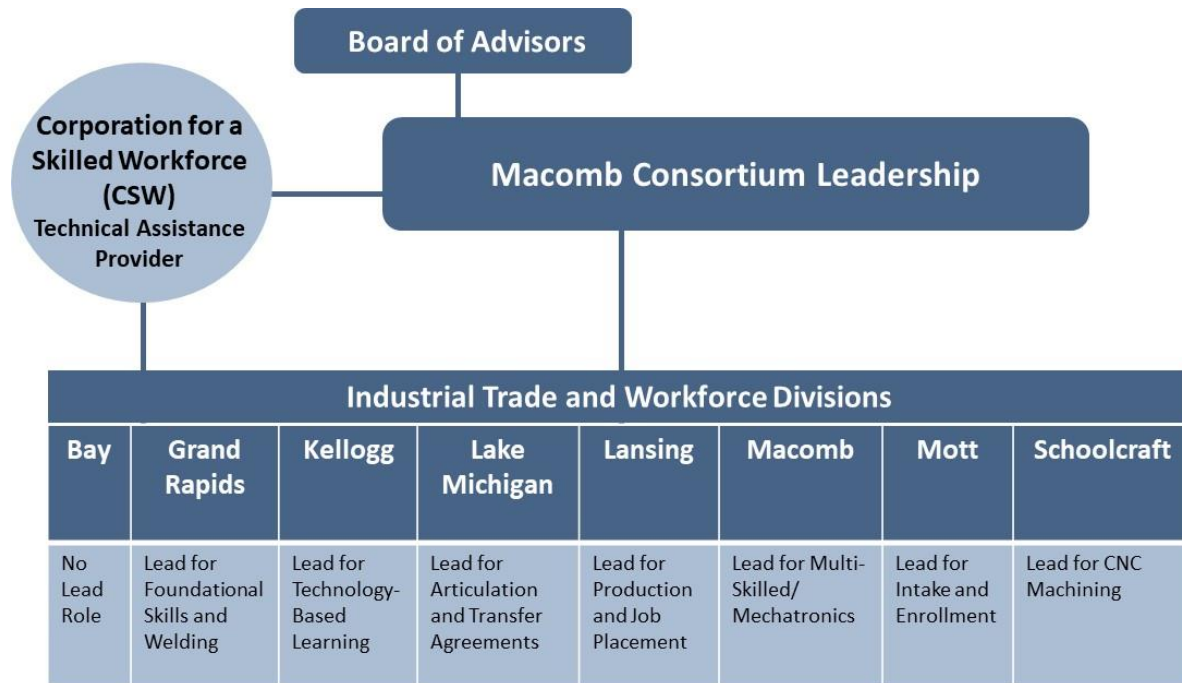
As the consortium lead, Macomb was responsible for the fiscal management and oversight of the grant. Macomb oversaw work plan implementation, convened meetings of colleges and key partners, reported on outcomes, coordinated with contractors (including the third-party evaluator, technical assistance provider, and communications firm), and monitored the grant. Macomb was also responsible for interacting with and reporting to the DOL. For most of the grant period, Macomb had three staff members responsible for coordinating grant activities, including a consortium lead. Other staff members

² Autonomy and Innovation: Systemic Change in a Decentralized State (2012).

[http://www.mcca.org/uploads/fckeditor/file/JFF%20-%20ATD%20in%20Michigan%20-%202012\(1\).pdf](http://www.mcca.org/uploads/fckeditor/file/JFF%20-%20ATD%20in%20Michigan%20-%202012(1).pdf) Accessed June 23, 2016.

at the college, such as staff members from the finance department, also helped to support grant administration.

Exhibit 4: Organizational Structure of the M-CAM Initiative



Each college in the consortium, except for Bay, was responsible for “leading” at least one M-CAM activity. As an Activity Lead, a college was responsible for (1) developing a work plan for task execution, (2) convening colleges to discuss approaches and share best practices related to the activity, (3) summarizing baseline approaches or capacities at each of the colleges, and (4) developing a common M-CAM implementation approach for the activity. As Activity Lead for Intake and Enrollment, for instance, Mott developed sample intake forms and enrollment procedures. Similarly, as Activity Lead for Technology-based Learning, Kellogg developed an online learning community for M-CAM staff, students, and faculty. The colleges serving as leads for the four career pathways held quarterly (and, in some cases, monthly) meetings in the first two years of the grant during which they discussed which industry certifications best met their local employers’ needs and how to build industry certifications into their noncredit and credit training programs.

In Spring 2015, Macomb contracted with Corporation for a Skilled Workforce (CSW) to provide technical assistance to consortium colleges. The role of CSW was to (1) facilitate meetings and cross-college exchange, (2) provide individual coaching to each college on grant implementation, and (3) support Activity Leads in the development of required grant deliverables.

Consortium-level Coordinating Activities

As illustrated in Exhibit 5, several mechanisms were used to coordinate grant activities and facilitate peer exchange among consortium members. Key among these mechanisms were monthly in-person “Strategy and Operations” meetings, periodic faculty meetings for each of the four career pathways (welding, CNC machining, Multi-skilled/mechatronics, and production), meetings with key partners like Michigan Works! (the state’s publicly funded workforce system) and multi-day semi-annual meetings. These in-person meetings were supplemented with periodic webinars and conference calls on key topics. Consortium stakeholders also used a Dropbox site to share documents and resources across colleges.

Exhibit 5: Consortium Coordinating Activities

ACTIVITY	PARTICIPANTS	DESCRIPTION	FREQUENCY
Strategy and Operations Meetings	M-CAM leads and managers from each college, M-CAM Consortium Lead, CSW staff members, and other partners as needed.	These in-person meetings were held the third Thursday of every month, 10am-2pm. The last of these meetings was February 2017.	Monthly
Bi-Annual Meetings	M-CAM leads and managers from each college, M-CAM Consortium Lead, M-CAM Consortium Manager, other M-CAM staff members (career coaches, job developers, registrar staff), and CSW staff members	Attendees of these two-day in-person meetings varied depending on the focus of the meeting. One important focus was intake and enrollment processes and M-CAM deliverables.	Twice a Year
Board of Advisors Meetings	College presidents and M-CAM Consortium Lead	During these meetings, the college presidents received updates on the status of M-CAM.	As Needed
Industry Pathway-Specific Meetings	M-CAM college leads, M-CAM college faculty, and CSW staff members	These meetings occurred either in-person or as conference calls. During these meetings faculty made decisions about alignment of courses and professional certifications.	As Needed

ACTIVITY	PARTICIPANTS	DESCRIPTION	FREQUENCY
Partner Engagement Meetings	M-CAM leads, M-CAM managers, CSW staff members, and M-CAM partners such as Michigan Works! and Michigan Manufacturing Technology Centers	M-CAM partners held at least two consortium-wide meetings with Michigan Works! staff members and two consortium-wide meetings with Michigan Manufacturing Technology Centers.	As Needed
Consortium Calls/Webinars	M-CAM leads, M-CAM managers, and CSW staff members	These meetings were for sharing information between the in-person meetings.	As Needed
Weekly Update	M-CAM leads, M-CAM managers, and CSW staff members	All “need to know” consortium information was summarized in one email.	Weekly until last six months; then monthly
Dropbox Document Sharing	M-CAM leads and managers and CSW staff	Dropbox was used for sharing of internal information across the colleges.	Ongoing
Website	External stakeholders	The website was used for external communication and sharing of information.	Ongoing

M-CAM leads identified the monthly in-person “strategy and operations” meetings as particularly useful means for coordinating consortium activities. Macomb launched these meetings in the Spring of 2015, after it became clear that existing communication strategies, such as regular conference calls, were insufficient for achieving the objectives of the grant. The in-person strategy and operations meetings proved essential for cementing cross-college relationships and for getting the traction needed to complete grant deliverables. Their success depended in large part on the attendance of the college leads, who had the authority to make decisions and act on key decision-points. During these meetings, attendees discussed, and made considerable progress on, matters related to some of the consortium’s most important accomplishments:

- **Implementation of work plan components.** Each of the initiative’s work plan components (such as developing a common intake system, integrating foundational skills, and developing a job placement system) was assigned a college lead. The lead colleges worked closely with the consortium leadership team at Macomb and CSW to support M-CAM implementation consortium-wide.
- **Pathway development and identification of industry-recognized professional certifications.** A cross-college group, consisting of college leads and faculty members, was formed for each of the

four major training areas (machining, welding, multi-skilled/mechatronics, and production). The first step that consortium members took was to develop a list of competencies, skills, and abilities that would be taught across their courses; as part of this process, they surveyed a sample of industry representatives within their core geographic areas to ensure that these competencies, skills, and abilities were valued by employers. They then identified existing industry-recognized professional certifications for each career pathway area and mapped the curriculum competencies to that shared industry standard.

- **Partner engagement.** Consortium stakeholders met with Michigan Works! and Michigan Manufacturing Technology Centers (MMTC) to discuss how to strengthen career pathways at a regional level. The consortium also worked with Michigan's Trade Adjustment Assistance (TAA) lead in identifying opportunities to engage trade-affected workers and local rapid response staff members who conduct outreach to populations that had been displaced from their jobs.
- **Data availability and access.** Access to wage data was key to the ability of consortium member colleges to track the employment and retention outcomes of M-CAM students. Towards this end, the college presidents met with the lead for the state Talent Investment Agency and wrote a joint letter advocating for broader access to wage data. Several college staff members also distributed existing agreements they had with their local workforce investment boards (WIBs) to share data on participants.
- **Communications and dissemination.** The colleges worked on the development of an M-CAM website and shared information on M-CAM at conferences and other industry events. In 2016, the consortium contracted with a communications firm to help "tell the story" of M-CAM to key stakeholders, particularly industry.

As will be discussed in more detail in subsequent chapters, faculty across the different colleges appreciated the in-person meetings that focused on pathway development and identification of professional certifications. Initially, many faculty members expressed reticence in incorporating industry certifications into their noncredit and credit training programs. But, after attending training and becoming certified themselves, faculty members began to see the utility of industry certifications and the possible ways noncredit students could use the certifications to transition into credit programs. Faculty members also greatly appreciated the opportunity to interact and network with faculty from other colleges. Several faculty representatives from across the M-CAM consortium reported that the career pathway discussions helped them identify new learning opportunities for their students and ways to save money on educational materials.

In general, the colleges used their in-person meetings to create a sense of community and get ideas for how to tackle common challenges. They shared information on such topics as recruitment, credit articulation, engagement of faculty, and lynchpin partnerships.

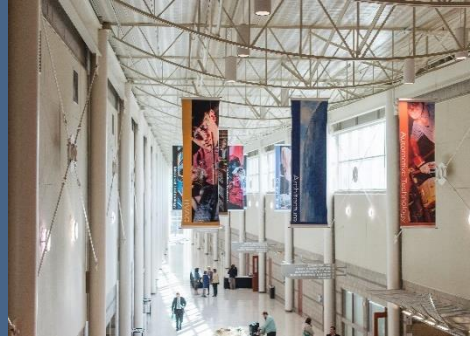
Challenges to Consortium Management

M-CAM's consortium experience was similar to that of other large complex initiatives, in that key partners spent the early part of the initiative struggling to generate a collective vision, define roles, and create transparent accountability mechanisms. For the most part, these challenges were successfully overcome by mid-way through grant implementation.

- **Creating and nurturing a shared vision.** In the early stages of the initiative, there was an uneven level of understanding among college leads about what the colleges had committed to as part of their participation in the grant. Once the leads understood grant deliverables and requirements, there were multiple stakeholders within each college, including grant-funded staff and faculty members, who didn't automatically buy-in to the vision of the initiative and had to be persuaded of its value in order for the initiative to move forward. College presidents and leads were key to communicating a value for the goals of the grant.
- **Establishing lines of authority and group accountability mechanisms.** In a collaborative such as M-CAM, leadership is dispersed and control is shared and mutual. Collaborators share accountability and risk. Since Macomb, the lead college, had limited authority over the other colleges, it took time for M-CAM to develop group strategies under which stakeholders could be held accountable for doing their parts. Accountability developed over time, and once developed, it was based in strong relationships, a sense of mutual goodwill, and the development of consistent mechanisms for documenting the commitments and progress that collaborators had made.
- **Supporting peer exchange and learning.** College leads and grant-funded staff members were eager to learn from one another. It was not always easy, however, to figure out how to effectively support peer learning and exchange, particularly among front-line staff members such as the career coaches or job developers. As will be described in the chapters that follow, the consortium developed mechanisms (such as online learning communities and exchanges at in-person meetings) to enable college staff members at all levels to share effective practices. For the most part, however, these mechanisms did not provide front line staff members with the quality of exchange and learning that they were looking for.

CHAPTER 3:

College-Level Grant Implementation



An understanding of the unique qualities and capacities of each of the eight M-CAM colleges is essential to understanding why individual programs, levels of enrollment, and outcomes vary from college to college. Each college is unique in terms of its local economic context, the robustness and characteristics of its advanced manufacturing credit and workforce development noncredit programs, and its relationships with faculty members, local workforce providers, and local employers. In addition to these factors, M-CAM grant implementation at each college has been shaped by the size of the M-CAM grant the college received, the programs selected for development at the college, and the level of grant-funded staffing. This chapter highlights some of these variations, thus setting the stage for subsequent report chapters, which go into greater depth about how the grant influenced the credit and noncredit advanced manufacturing programs and services available to students at each college.

M-CAM Training Programs

M-CAM colleges differed in their training program offerings along two dimensions: the balance of credit and noncredit programs and the specific pathways for which they had programs. This section comprises an overview of these variations and some of their causes. (See chapters 6 and 7 for detailed information on the training programs themselves as they existed at each college.)

Credit-bearing advanced manufacturing courses at the M-CAM colleges were generally for students interested in earning a two-year associate degree or one-year college certificate. Each course was usually a full quarter or semester long, and students who took these courses received academic credit and a letter grade. (Kellogg was an exception to this pattern; it offered open-entry training programs, which were modularized to allow students the opportunity to earn fractional credit based on the module or modules completed.)

Noncredit programs were designed for students who wanted to learn or upgrade skills quickly so that they could enter the workplace with as little delay as possible; students often earned a certificate of completion, and often earned a third-party industry certificate as well. Most noncredit programs were open-entry (available to anyone who signed up), though students were assessed for basic skills and

“Noncredit classes are designed for students who want to learn or upgrade skills quickly. With the noncredit, we can consolidate an entire year’s worth of training in maybe as little as 12 weeks, so for people who are on a fast track or need employees very rapidly, it works exceptionally well. For people who have a day job and can put in three hours a day or at night, the credit works well, but being able to [offer] both of them...is a real plus for the community, that’s for sure.”

Faculty member, Macomb

sometimes had to meet other minimum qualifications required by an employer. In the case of industry-specific and customized noncredit training, the training was usually offered to incumbent workers or individuals who met the specific enrollment requirements of a local employer. Noncredit M-CAM programs generally consisted of short-term classes (often full-time for 4–8 weeks, but sometimes lasting as long as 28 weeks) offered through the workforce division or continuing education division of the college.

CREDIT VERSUS NONCREDIT STUDENT CASE STUDY

Student: *Carlos (pseudonym)*

Pathway: *Multi Skilled (noncredit)*

Carlos is a 54-year-old white male with a family to support. His wife and two older children were also attending college, so he had the extra burden of paying for college as well as other life necessities (e.g., food, clothing, etc.). He had worked several jobs throughout his career, and even owned his own retail business until the economic downturn forced him to close it. He decided to make a career change and entered a noncredit multi-skilled M-CAM training program. While he wanted to take additional classes, even credit courses, he had to provide for his family so attending a short-term training program that could provide him the skills and training to find employment quickly was his main reason for selecting the noncredit multi-skilled program.

“I would like to [take more classes] but how much education can you get [when] you've got to get a job. I'm completely...switching fields. I went back and they offered me to go back to another class so I took that class.... They have classes that are continuing all the time that I can go to apparently...”

Student: *Aiden (pseudonym)*

Pathway: *Welding (credit)*

Aiden, by contrast, is a 19-year-old single white male who was looking to use his past work experience to pursue a long-term apprenticeship-supported welding training program to gain entry into a local union. He received scholarships for attending college and, as of the time of his interview, had not had to take out any student loans for his education. He was not sure if he wanted to transfer to a four-year university or try to get a job once he completed his welding program. He has time to pursue a fulltime training program because he only has himself to support.

“I really got in at a good time. Brand new equipment. Brand new lab equipment. Brand new textbooks. I got in at a really good time. So, everything was a great experience. Meeting all the people...these might be people I work with in the future. And the teachers are great...it's been an excellent course.”

As illustrated in Exhibit 6, the M-CAM colleges offered a diverse mix of programs. All eight colleges offered M-CAM credit programs in at least two of the four advanced manufacturing pathways. Bay and Kellogg offered credit programs exclusively; Lake Michigan and Schoolcraft offered mostly credit programs. Five colleges enrolled M-CAM students in noncredit advanced manufacturing programs. Most students enrolled in M-CAM training programs at Grand Rapids, Lansing, Macomb, and Mott were noncredit students. These three colleges offered a mixture of open entry, cohort training programs as opposed to employer-sponsored training programs.

The decision to develop new or enhanced credit programs versus noncredit training programs within the four M-CAM pathways was rooted mostly in the way that advanced manufacturing and workforce development programs at each of the colleges were structured prior to M-CAM (see Chapter 6). Colleges that had well-developed noncredit workforce divisions tended to focus on the development or enhancement of noncredit programs first, because of the ability of these divisions to be flexible, adaptable, and to set up courses quickly in response to employer demands. Because the development or enhancement of credit programs is, by contrast, a lengthy and involved process at most colleges, requiring layers of administrative and faculty review, these colleges focused first on getting noncredit courses in place. Another factor affecting the choice of which kind of training program to focus on was the locus of grant administration. The M-CAM colleges that housed grant administration in their academic departments (and did not have well-developed noncredit programs) tended to emphasize the development or enhancement of credit programs.

The decision to focus on credit programs vs. noncredit programs had a variety of consequences. The colleges that concentrated on developing new credit programs took longer to get their programs up and running than colleges creating noncredit programs, and they tended to be slower to enroll students (once again, the exception was Kellogg, which had a unique competency-based credit training curricula). While new credit programs had a slower start because it took the first year and half of grant implementation to develop the programs and obtain approval, they were more likely to be sustained after the grant period because they had gone through such lengthy review and were more integrated into the permanent fabric of the college. Also, students attending credit programs were usually eligible for financial aid, whereas noncredit students were primarily self-paying, employer-sponsored, or funded with public workforce training funds.

As is described in much more detail in Chapter 6 and Chapter 7, the colleges also differed in which of the four advanced manufacturing training programs they offered. Due to the economic contexts of local areas, not all eight colleges could provide programs in each was not possible given the economic contexts of the local areas in which the colleges operated, the existing array of programs at the colleges, the capacity of faculty members, and the work required to develop new programs. Thus, colleges decided to build upon and strengthen their existing programs while developing new training programs in only one or two pathways (mainly in mechatronics and/or production).

**Exhibit 6: M-CAM Programs Offered by Each College
(Based on ETO Enrollments)**

		BAY	GRAND RAPIDS	KELLOGG	LANSING	LAKE MICHIGAN	MACOMB	MOTT	SCHOOLCRAFT
Welding/ Fabrication	Credit	✓	✓	✓	✓	✓*		✓	✓
	Non-Credit		✓		✓	✓*	✓	✓	✓*
CNC Machining	Credit		✓	✓		✓	✓	✓	✓
	Non-Credit		✓				✓	✓	✓
Multi-Skilled/ Mechatronics	Credit	✓*	✓	✓	✓*	✓	✓	✓	✓*
	Non-Credit		✓		✓		✓	✓*	
Production Operations	Credit			✓	✓*				
	Non-Credit		✓		✓		✓*	✓	

* Low enrollment due to a new, limited, or discontinued program

- Welding** was offered by all eight M-CAM colleges and was the largest M-CAM training area in terms of overall enrollment. Welding programs prepared students to work as welding assistants, welders, production assistants, fabricators, and pipe fitters. Seven of the colleges enrolled M-CAM students in credit welding programs, with the potential to complete a college degree, associate degree, or a college certificate in welding. Five colleges enrolled students in noncredit programs in welding, where students could learn the fundamentals of welding for entry-level positions as well as American Welding Society (AWS) industry certifications.
- Computer Numerical Control (CNC) Machining** prepared students for careers as operators, machinists, programmers, tool and die makers, and engineering technicians. Five colleges³ enrolled M-CAM students in credit CNC machining programs leading to associate degrees, and four also enrolled students in noncredit CNC machining programs.
- Multi-skilled/Mechatronics programs** were an area of development for several colleges over the course of the grant. These programs trained students for careers in industrial maintenance, including electrical and mechanical machine repair and assembly line maintenance, as well as robotics. All colleges attempted to provide some type of multi-skilled or mechatronics training. Seven offered credit programs, four noncredit.
- Production** programs were entry-level manufacturing programs offered by four of the colleges (a fifth college—Macomb—had such a program but discontinued it during the early phases of grant implementation because the college determined that the entry-level wages were too low for their

³ This number includes only colleges that enrolled M-CAM students in CNC machining. Lansing offered CNC machining at the college but did not enroll M-CAM students into this program.

students). Students in these programs were prepared to enter careers on assembly lines and in quality control or to transition into more intensive advanced manufacturing programs like those described above. For the most part production programs were noncredit; an exception was the program at Kellogg, where production students received 8.74 credit hours for successful completion of course content.

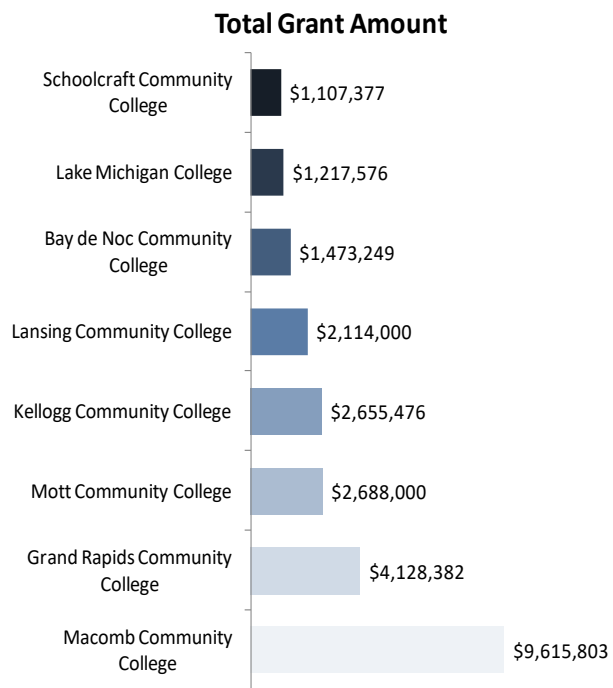
Grant Size and Grant-funded Staffing

Grants ranged from a low of 1.1 million dollars at Schoolcraft to 9.6 million dollars at Macomb.⁴ Variations in funding reflected the different roles that the colleges had in the initiative as well as expectations for how many programs would be developed or enhanced and how many students would be enrolled at each college. Funding differences led to very different staffing levels at the different colleges, affected equipment upgrades, and to some degree influenced each college’s level of engagement.

Successful implementation of the initiative depended on the effort of a broad range of individuals at each college, not all of whom received direct grant support. Among grant-funded staff members, some positions were at a set percentage of Full Time Equivalency (FTE), while other staff members were paid on an hourly or task-specific basis for work performed (such as curriculum development or teaching a non-credit class).

Exhibit 8 provides an overview of the numbers of staff members working on grant activities across the colleges, whether paid for by the grant or supported in-kind by the college.⁵

Exhibit 7: Total Grant Amount by College



⁴ Macomb’s \$9.6 million grant included funding for consortium coordinating activities, including expenses associated with reporting, convenings, third party evaluation, and technical assistance activities.

⁵ As of the time of the fourth-round site visits, in Spring 2017.

Exhibit 8: Number of Grant and Non-grant Funded Staff Members Supporting M-CAM at Each College

COLLEGE	GRANT-FUNDED STAFF MEMBERS	GRANT-FUNDED FTES	TOTAL FTES COVERED BY M-CAM	NON-GRANT-FUNDED STAFF MEMBERS
Bay	2	2	1.4	1
Grand Rapids	10	7	7.25	3
Kellogg	5	5	3.12	0
Lansing	8	5	6.5	0
Lake Michigan	2	2	2	0
Macomb	13	5	9	0
Mott	4	3	3.5	2
Schoolcraft	3	1	2.12	0

M-CAM activities at each college were managed via a dual-leadership model made up of M-CAM “leads” and grant managers. With the exception of the lead at Bay, the salaries of M-CAM leads were not paid for from the grant; rather, their time was funded by the college and considered an in-kind contribution to the M-CAM initiative. By contrast, grant managers were paid for by the grant. Leads were generally organizational leaders, with titles such as Director of Workforce Development or Dean of Career and Workforce Education. The M-CAM leads played important roles in M-CAM operations at each college, helping to establish lines of communication across credit and noncredit programs where programs were housed in different divisions, keeping senior administrators informed of grant efforts, and coordinating implementation and communication with the other consortium colleges. They also supervised the work of other grant-funded staff members and represented and promoted the M-CAM initiative to senior college leaders, such as the college president, and to industry partners. The grant managers dealt with the day-to-day management of the grant, ensuring budgets and reports were submitted in a timely basis, addressing student complaints, and overseeing the work of other grant-funded staff members.

Under the guidance of the designated M-CAM lead, M-CAM programs and activities at each college were primarily carried out by a team of grant-funded staff members and by college faculty members in each of the career pathways areas offered by the colleges (only a few faculty members received direct grant funding). The number of M-CAM staff members hired by the grant varied significantly from college to college, depending on both the size of the college and the level of its M-CAM grant funding. The smallest college in the consortium, Bay, had two M-CAM staff members who each played multiple roles within the grant, whereas the largest college, Macomb, had 10 paid M-CAM staff members (not including the staff members working to manage consortium activities).

Across the M-CAM colleges, seven categories of staff members were hired with M-CAM funds. Their roles are described briefly below. More information on the roles of these staff members is included in the chapters that follow.

- **Project managers.** All eight colleges hired a full-time M-CAM grant manager who supervised other grant-funded staff members, oversaw and managed M-CAM-related tasks, and assisted with grant-related reporting. At some of the smaller and more rural colleges, such as Bay and Lake Michigan, project managers played multiple grant-related roles. For example, at Bay College the project manager also acted as the career coach, helped with enrollment and intake, and was responsible for data entry and reporting.
- **Career coaches and job developers.** Most colleges hired staff members to play the specialized role of “career coach” or “success coach” (For the sake of simplicity, we refer to these staff members as career coaches throughout this report.) Some colleges also used M-CAM funds to hire separate job developers. Career coaches and job developers assisted with outreach and enrollment activities and helped students with job search and placement in internships and jobs. At colleges with larger M-CAM teams, the duties of the career coach were split among multiple individuals, with some “coaches” serving as intake and assessment specialists, others providing academic counseling and student support, and yet others serving as job developers who engaged employers to develop incumbent worker training programs and apprenticeship opportunities and provided job placement assistance.
- **Intake and enrollment personnel.** Seven colleges hired staff members whose primary responsibility was to assist students with the process of enrolling in M-CAM and the college. These staff members also recruited students into the M-CAM program and held orientation sessions. At some colleges, they also assessed what resources and supports students needed and what additional benefits students might receive based on specific eligibility criteria (e.g., veteran’s assistance, public workforce assistance, etc.).
- **Administrative, communications, and data entry personnel.** Six colleges hired staff members to provide administrative and data entry support to the program. These staff members, typically part-time, helped to manage the project, document progress, and input information into the grant’s ETO system. Two colleges hired communications staff members to help recruit participants and capture impact stories.
- **Instructors for Foundational Skills and Workplace Competencies.** Two colleges hired foundational skills instructors. These staff members taught basic skills, including study skills, and conducted some career and work readiness assessment.
- **Curriculum developers.** Three colleges hired individuals (or used grant funds to pay the salaries of existing staff members) to assist with developing new curriculum. In most cases, these staff members were paid for a specific period of time out of the grant and were not considered fulltime.
- **Faculty members.** Although most M-CAM training was provided by permanent faculty members, in some cases colleges hired instructors specifically for M-CAM or paid credit faculty to teach noncredit courses. Macomb, for instance, hired one full-time CNC machining instructor under the grant, used

the grant to pay full-time faculty members to teach noncredit courses, and contracted with a vendor (MH Technologies) to supply instructors to teach the remaining noncredit courses. Across all the colleges, at least 97 faculty members taught M-CAM courses, approximately 30 percent of whom were permanent and the remaining 70 percent adjunct faculty or contractors. Grant funds also paid for faculty time and travel associated with attendance at M-CAM meetings and industry certification training sessions (as well as tuition and fees associated with training events).

Exhibit 9 illustrates the distribution of these position types across the colleges.

Exhibit 9: Staffing Positions by College

	Project Managers	Career or success coaches and job developers	Intake and enrollment personnel	Administrative, communications and data entry personnel	Instructors for Foundational Skills and Workplace Competencies	Curriculum developers	Faculty members		
Bay									
Grand Rapids									
Kellogg									
Lansing									
Lake Michigan									
Macomb									
Mott									
Schoolcraft									

Staffing Challenges

The M-CAM colleges had some difficulty hiring and retaining staff members and instructors and keeping staff members' workloads manageable. All the M-CAM colleges faced these challenges to some degree, mostly for similar reasons.

- **Hiring.** Due mostly to slow and bureaucratic hiring procedures, colleges were not fully staffed for M-CAM until at least a year into the grant's period of performance. Colleges also found it challenging to recruit individuals with the right skill-sets for the positions. Many colleges attributed this difficulty to the fact that the M-CAM positions were term-limited and would expire at the end of the grant's period of performance. Since potential instructors, particularly those who would teach in noncredit training programs, could easily find employment within the advanced manufacturing sector due to the economic recovery underway in Michigan, few were attracted to the prospect of temporary employment at the colleges.
- **Retention.** Once colleges were fully staffed, they were confronted, to varying degrees, with turnover. Five colleges had turnover in the M-CAM grant lead or manager position, and six of the eight had individuals leave other key roles, such as career coach and job developer. During the early phases of grant implementation, Macomb also had turnover in the Consortium Manager position, which was followed by the departure of the Consortium Lead approximately 18 months into grant implementation. This instability in consortium leadership led to communication and coordination challenges across the colleges at a time when they were trying to develop key strategies and deliverables. Staff turnover was especially problematic at colleges with smaller grants, where staff members often played multiple roles and held a substantial amount of institutional memory. Retention challenges also led to inconsistency in how the college's intrusive case management design was implemented because key grant staff members were not available to guide and support students.
- **Workload.** Some of the staff members responsible for managing the grant found their workloads to be onerous, particularly in the first two years of the grant cycle. Although oversight of M-CAM was a relatively small part of the official job duties for college leads, for instance, it demanded a lot of their time. Grant managers, particularly at the smaller and more leanly staffed colleges, were often involved in managing the grant, providing career coaching to students, conducting employer outreach, and doing data entry. Even in the colleges that had more robust staffing, it was difficult for grant-funded staff members to keep track of "all the moving pieces" of the grant, including documenting progress and conducting the follow-up needed to document participant employment. A staff member at one college said, "We are literally talking all day long about various pieces of the grant."

These staffing challenges affected the roll-out and implementation of the initiative in numerous ways. Colleges with lower staffing capacity found it challenging to participate fully in the consortium activities described in the previous chapter or to meet all the grant reporting requirements.

The dual leadership model described above (having a grant “lead” and a grant manager at each college) helped to mitigate the implementation challenges posed by staff turnover and slow hiring processes. The grant leads had institutional knowledge and strong relationships with senior college leadership that helped the grant-funded staff navigate quickly through some difficult issues, such as coordination with financial aid and registrar for new programs, help with securing space for noncredit classes, coordination with president’s office, and assistance with obtaining approval for the M-CAM articulation agreement. The grant leads had a bigger picture viewpoint of how the grant fit into the colleges’ strategic design and were able to use this knowledge to drive institutional change, while the grant managers were able to focus on day-to-day management of the grant.

CHAPTER 4:

Recruitment, Enrollment, and Student Characteristics



Having set the goal of enrolling 2,740 students in M-CAM training programs, the M-CAM colleges developed outreach and recruitment strategies that would allow them to meet or exceed this goal (as well as their individual college enrollment goals) and to target veterans and TAA-eligible workers, the two populations prioritized for TAACCCT-grant-funded programs. The colleges also developed a common orientation, assessment, and enrollment process. This chapter describes these two important elements of M-CAM implementation; it begins, however, by presenting the enrollment numbers that resulted and then describing the characteristics of enrolled students.

Enrollment Results

As of July 1, 2017, 3,925 students had enrolled in M-CAM. This number is 143 percent of the cumulative enrollment goal for the entire grant. The success of M-CAM colleges in surpassing their overall enrollment goals for the grant was particularly impressive when one considers the broader context for enrollment at the colleges. Overall, college-wide enrollments across all eight M-CAM colleges *declined* over the course of grant implementation, mainly because of the thriving economy and the demand for labor among local employers. Exhibit 10 summarizes enrollment by college, employment status, and career pathway as of July 31, 2017.

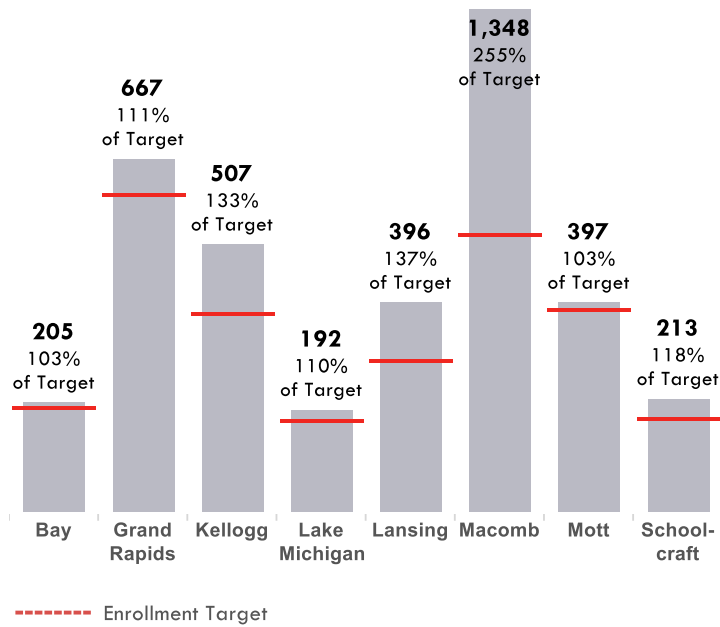
The key findings on enrollment are as follows:

- **All eight colleges exceeded their enrollment targets.** Macomb was the most successful at recruitment, in that it enrolled 1,348 students (255 percent of its target). Lansing and Kellogg also significantly exceeded their targets for enrollment. Variations in enrollment generally reflected the speed with which colleges got their programs off the ground. Colleges that developed entirely new programs were slower to enroll students than those that primarily expanded or revised existing programs.
- **Overall, slightly more participants enrolled in credit programs than in noncredit programs.** Fifty-one percent of participants enrolled in credit programs and 48 percent in noncredit programs (1 percent enrolled in both a credit and a noncredit course). Students in the CNC Machining and Welding/Fabrication pathways were more likely than those in Multi-Skilled/Mechatronics and Production pathways to be enrolled in a credit program.

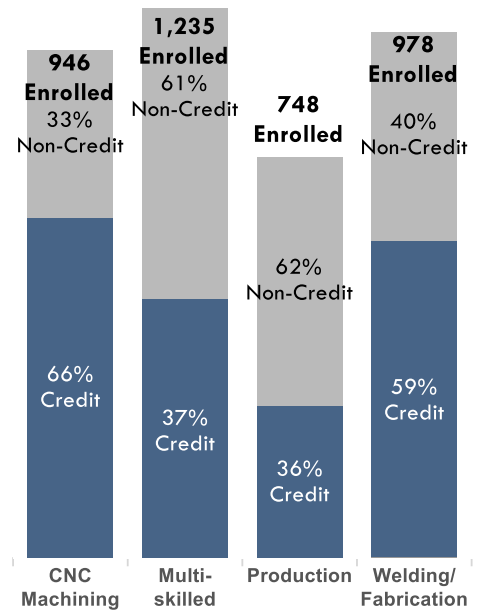
Exhibit 10: M-CAM Enrollment as of July 31, 2017

Enrollment by College

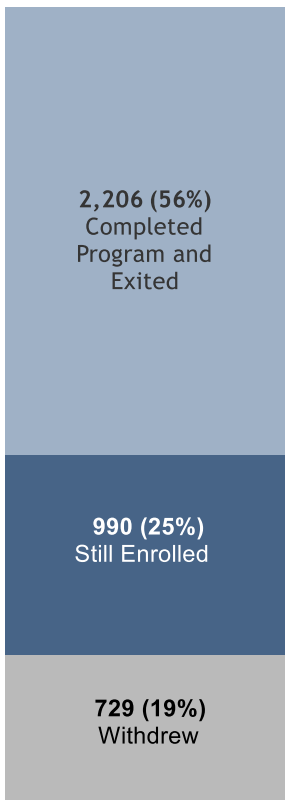
Number of Participants and Percent of Enrollment Target Reached



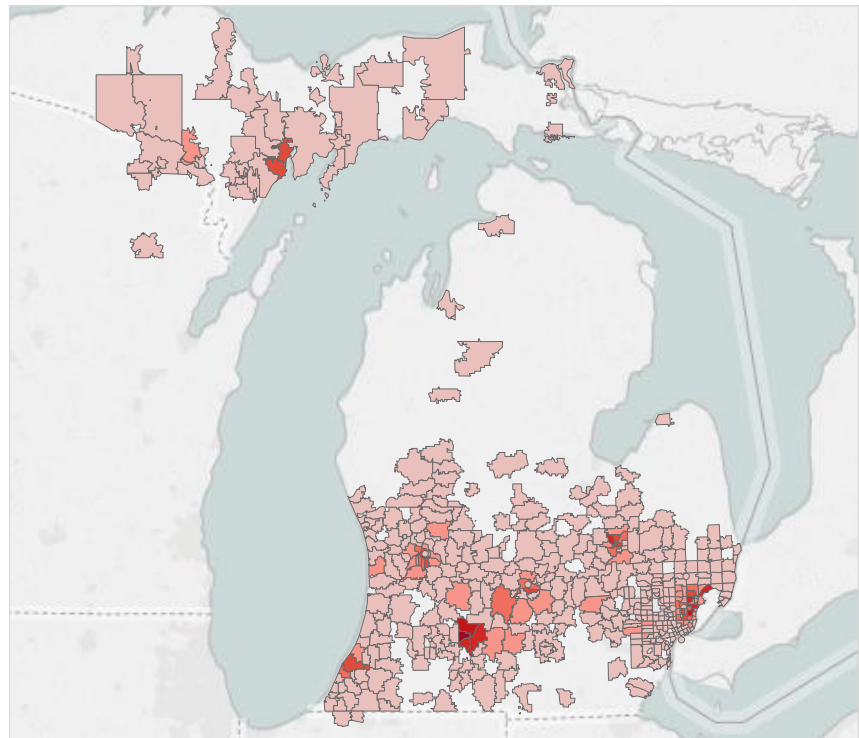
Enrollment by Career Pathway



Enrollment Status



Zipcode of Residence



Number of Participants by Zipcode



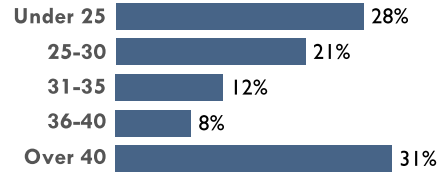
Student Characteristics

Sixty-eight percent of students enrolled in M-CAM were white males. Approximately one-quarter of students were African American and less than 13 percent were female. Student focus groups and case study interviews revealed that there was substantial variation in students' ages, employment statuses, and life experiences. Key themes on student characteristics are highlighted below.

- **There was broad variation in the age and life-experience “profile” of students.** As illustrated in the sidebar, 6 in 10 M-CAM students were either over 40 or under 25 years of age. Students in these two age groups typically had very different “profiles” in terms of their work experience, understanding of manufacturing trades, and life responsibilities, as noted below.
- **Participants over the age of 40 (30 percent of the total) tended to perceive M-CAM as a chance to re-train in a new industry or upgrade manufacturing skills to improve employment prospects.** These students generally fit one of the three types described below. Employment prospects varied considerably depending on which group they fell into (see Chapter 10 on student-level outcomes).
- **Career enhancers.** Older participants who sought M-CAM training frequently had a background in manufacturing and had faced repeated layoffs. We interviewed older workers who had seen their wages stagnate or drop over the course of 15 years. These students were seeking out additional training so that they could become more competitive in the job market and better support their families.
- **Career changers.** Career changers had worked for many years in other fields, ranging from construction to social services; unsatisfied with the low pay or the nature of the work in these fields, they pursued manufacturing training in search of either higher pay or better working conditions.
- **Career re-engagers.** Some participants over 40 were returning to the job market after a relatively long hiatus. They often had worked in manufacturing prior to having disengaged from the labor market for an extended period. This group included women who were returning to the work world after having raised their children and men who had been detached from the work world due to incarceration, disability, or

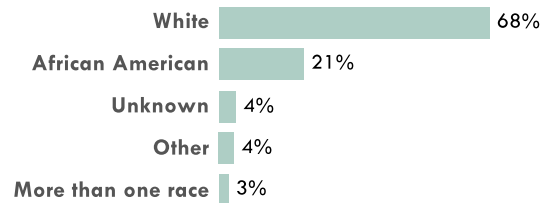
Exhibit 11: Student Demographics

Age



Average Age: 34.37

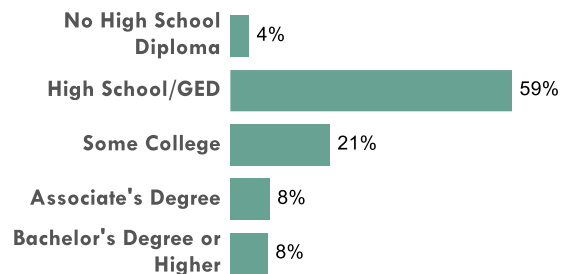
Race



Employment Status at Enrollment



Highest Level of Education



other life issues. The men that fit this description often faced significant life challenges, such as having a criminal record or having experienced periodic homelessness.

- **In contrast to those over age 40, participants who were under the age of 25 (28 percent of the total) tended to see M-CAM as an alternative to pursuing a traditional four-year degree.** We interviewed several students in this age range who were still exploring various career options; others were looking to acquire applied skills that could get them into the workforce more quickly than a four-year degree program. Some had been exposed to the trades in high school and found that they enjoyed working with their hands. They often expressed surprise and satisfaction that they were more successful at the community college than they had been in high school.
- **Women entering manufacturing programs tended to be older and more diverse than the men.** The average age for women entering M-CAM programs was 37, compared to 34 for men; women were also significantly more racially diverse (57 percent of women were white, compared to 70 percent of men) and more likely to have “some college” when entering the program. Our interviews showed that young women found it challenging to be in classes that were predominately male, even though they felt that their male peers treated them with respect. As will be discussed further in Chapter 10, discomfort in being in a mostly male environment also negatively influenced their desire to find a job in manufacturing. One 25-year-old female welding student enrolled in a two-year associates program told us the following:

The constant reminder or awareness of [being the only woman] could have some significant long-term impacts on my identity and my mental health... You're constantly adjusting yourself from the outside—like what other people see—and you don't blend into the background as much, which I would prefer to do... And there's really nothing I can do to stop that either. Like, race and gender, you can't hide those things so it's sort of an unsolvable problem unless other women decide to join [the field].

“I found out about the [M-CAM] program because I was underemployed. I had been working through a temp agency, Labor Ready, while I was trying to find a better job. Working there just didn't pay enough to be able to pay the bills. So, I was looking for some type of employment that paid better.”

Student, Macomb

“I always wanted to be a welder. I always liked the skilled trades. I was never really sure how I would do this, but I figured I would take a look and check out all the schools. I decided Bay was a good place to go. It's close to home... it's easy to get into considering my grades weren't that great in high school.”

Student, Bay College

“I had been unemployed since October 2014.... I got let go there because I was temporary. The plant...got rid of all the temporary employees. So I was unemployed since then. When I started this [M-CAM training program], my unemployment had [been] exhausted, and I was basically just surviving off what my wife was bringing in.”

Student, Macomb

- **An unexpectedly large number of participants (54 percent) were incumbent workers or were employed at the time of enrollment.** The post-recession surge in employment (described in Chapter 1) resulted in higher enrollment of incumbent workers than the colleges anticipated when they applied for the TAACCCT grant. Most of these incumbent workers were looking to upskill and move into higher-paying manufacturing jobs. A significant number were employed in non-manufacturing fields such as the service industry at the point of enrollment and were working their way through college.
- **For most students, M-CAM was the first exposure to a college environment.** Almost two-thirds (63 percent) of M-CAM students came to the program with no higher than a high school degree or the equivalent. When interviewed, M-CAM students often expressed surprise at how interested they were in the content of their courses, and many said the experience made them more likely to pursue higher education in the future.
- **M-CAM staff members and students reported that many students faced multiple life barriers and viewed M-CAM as a “second chance.”** As described below and in Chapter 8, some M-CAM programs actively recruited students with significant employment barriers, such as a criminal record or a history of homelessness. These students were very appreciative of the colleges’ efforts to recruit and train them. One case-study student said the M-CAM training programs at his college were “turning out a lot of good guys with my type of background” and that these students were “finding jobs.” These students viewed M-CAM as an opportunity for a new start. “To get out [of jail] and do something in the community, especially going to school,” said the student just quoted, “that made me feel good.”

STUDENT PROFILES: OVER-40 TRAINING GOALS

Career Enhancer: Emmett Sims (pseudonym)

Pathway: CNC Machining

Emmett Sims is a 43-year old white male who has lived in Michigan his whole life. Emmett had just earned an Associate's Degree in machine tool technology, and was one semester shy from obtaining a certificate in HVAC. His interest in advanced manufacturing stemmed from his 20 years of experience working with machines and a desire to move up into machine programming. Additionally, he hoped that getting a degree in machining would help him land a day-shift job, which he believed was more likely with programming positions.

"With my daughter being 11 years old at the time [I enrolled], I didn't want to lose the time I have with her because I'm getting thrown on second or third [shift]."

Career Changer: Carlos Ferguson (pseudonym)

Pathway: Multi-skilled

Carlos is a 54-year old white male with an Associate's Degree in Building Construction and a Bachelor's Degree in Construction Management. He had lived in Michigan all his life and lived with his wife and two children, both of whom are in college. He had worked several construction jobs throughout his career, most recently with a non-profit that fixes up homes. He was pursuing training to obtain a higher-wage job and to find employment that wasn't as physically demanding as construction.

"I was doing construction type of background work. And [after the job ended, I] went to the Michigan Works [career center] and they had me fill out a questionnaire, and they said, "You thinking about this?" Well, I'm kind of stuck where I'm at pay-wise, and so I'm thinking, well, maybe I'll look into it.... Let's try to do something different and get a little higher income."

Recruitment Practices

As the labor demand in Michigan increased during the grant period, M-CAM staff members had to be particularly aggressive in their recruitment efforts to ensure that programs were full and that they were reaching their enrollment goals. Staff members at one college estimated that, in the early phases of the project, they spent 40 percent of their time on outreach and recruitment activities.

The grant greatly increased the ability of colleges to market their programs. “M-CAM has helped to increase marketing... in industrial trade programs and occupations,” said a staff member at Kellogg. “The grant has put us on the map.” With the support of grant funds, most of the colleges distributed pamphlets, conducted presentations on M-CAM at partner organizations, presented at their local Michigan Works! Offices, and advertised M-CAM programs in local newspapers. Five colleges used their websites as recruitment tools, and two used their college list-servs to send emails to prospective students. All the colleges received referrals from partner organizations and benefitted from word-of-mouth referrals.

Several key themes emerged from our recruitment data:

- **Colleges found that having employers participate as speakers in their orientation sessions helped with recruitment.** Although not all colleges reported success for their orientation sessions, the two colleges serving the most M-CAM students indicated that the success of their sessions was due in part to having employers speak at the sessions about the types of jobs that students could get once they completed their training.
- **At least one college found it useful for orientation sessions to have faculty members describe the training in depth.** Because many students who attended orientations had a limited understanding of what the actual training and/or job would entail, it was useful to have faculty share detailed information on training and what work in the target occupations would look like on a day-to-day basis.
- **Many referrals came from partners with whom the colleges had close working relationships.** Four colleges worked closely with their Michigan Works! programs to recruit students for noncredit training programs. Colleges also worked closely with CBOs to assist in recruitment. Mott, for instance, worked closely with Alternatives in Action, a nonprofit focused on re-entry services. Kellogg worked closely with Goodwill Industries to serve students in a special EDGE program, which provided production training to parents who were living at 200 percent of the poverty level or below.
- **Word of mouth was a common source of program referrals.** Staff members and students at several colleges emphasized the value of word-of-mouth referrals in attracting students to the program. Program staff members “leverage former students to reach out to their family and friends” and their efforts seemed to bear fruit: participants in student focus groups often said that they heard about the programs from friends or relatives. Word-of-mouth recruitment seemed to increase over time as the individual training programs matured and students successfully completed the training and

transitioned to employment. When asked how he heard about Bay's welding program, one student said, "It was word on the street."

- **Colleges that significantly exceeded their enrollment targets made a concerted effort to reach out to members of vulnerable populations, such as homeless persons and ex-offenders.** Kellogg, for instance, conducted presentations at homeless shelters, re-entry programs, and halfway houses. College staff members at this school felt particularly passionate about reaching out to and engaging people in these populations because they believed it was a responsibility of community colleges to serve all facets of their local communities.
- **Although colleges actively sought to bring a more diverse pool of students into the advanced manufacturing trades, the disproportionate participation level of white men in the M-CAM programs suggested that more work could have been done in outreach to underrepresented groups like women and minority racial or ethnic groups.** Outreach pamphlets and other M-CAM materials intentionally featured images of diverse students, and colleges like Grand Rapids were actively reaching out to the Hispanic population by integrating English as a Second Language (ESL) support for Spanish speakers in their welding courses. Enrollment of women, Hispanics, and African Americans, however, remained low. The difficulty recruiting these groups could be due to several different factors. First, the perception that manufacturing is a white male field inhibited women and racial minority groups from pursuing it as a career. Second, some students felt that members of certain groups were less aware than the general population of the employment opportunities available in manufacturing. One African American student focus-group participant, for instance, said that M-CAM colleges needed to do more to target inner-city neighborhoods in their outreach and marketing:

In our neighborhoods, we're not talking about robotics. We're not even really talking about welding. I'm from the inner city.... I definitely think more outreach or more advertising or marketing should be centered towards the inner city and just information about what this opportunity is about. A lot of people don't know. I'm serious. There should have been a line wrapped around the corner to get into this [program].

STUDENT PROFILES: CAREER RE-ENTRY

Parent: Brooklyn McDonald (pseudonym)

Pathway: Multi-Skilled

Brooklyn is a 51-year-old white female, married and with a Bachelor's degree. She spent periods of her adulthood working while her husband completed college and other stretches of time out of work raising her children. After she had a third child she stopped working for a twelve-year period. After he was grown, she decided to return to the labor force and found that she had difficulty finding stable, long-term employment.

"So what I found in the job market, what I was missing were relevant job skills, current job skills. Even though I had had ten years' experience, nobody wanted to talk to me. And Michigan had gone through a huge slump. So, there weren't very many jobs, especially if you hadn't worked in a while."

Ex-Offender: Joseph Harris (pseudonym)

Pathway: Multi-skilled

Joe, a black male, had recently served 11 years in prison. After he was released from prison, he took a job in landscaping out of desperation. Once he left that job, he struggled to find another one. He learned about the M-CAM program from his cousin and signed up to pursue training.

"My circumstance is a little different. I had went to prison and I did 11 years, and so coming home from that I had a – trying to find jobs every which way. I ended up creating a landscaping and was doing pretty good with that, however I didn't have the full zeal for it because it was more or less created out of desperation ... So I struggled to get a job. After what I've been through I have to strive that much harder to prove [myself], to go above and beyond."

Recruitment of TAACCCT Target Populations

In addition to conducting the general outreach activities described above, M-CAM colleges made extensive efforts to recruit members of USDOL's priority populations for the TAACCCT grants: veterans and TAA-eligible individuals.

M-CAM career coaches and enrollment staff members used several strategies to recruit veterans and the eligible spouses of veterans. The first and foremost was to collaborate closely with the veterans' departments on their campuses. As illustrated in the figure at the right, most colleges had veterans' departments with specialized staff members who could help veterans access benefits and non-academic supports such as childcare and housing assistance. M-CAM staff coordinated with these veterans' departments, both in recruitment and as they sought to provide wrap-around services to veterans. The

existence of a Veterans Affairs office on the Macomb campus and the college's rating as a veteran-friendly school enhanced its success in enrolling veterans. Macomb also partnered with Cooper Standard, a private company, to provide additional grants to veterans who needed assistance with transportation, work attire, and books.

In addition to working with the veterans' departments on their campuses, M-CAM staff members conducted briefings at their local Veterans Administration office, made presentations at meetings of local veterans' organizations, and attended veteran-focused events such as career fairs.

Another core strategy that colleges used to recruit veterans was to work closely with community based organizations serving veterans. Several colleges, for instance, recruited from veterans' homeless shelters and other organizations serving at-risk veterans. "The college offered an excellent program to target homeless veterans," said a staff member from a homeless shelter provider. "A lot of guys that were homeless at the time when the program was introduced and who went through the program... [are] not homeless anymore."

These efforts to recruit veterans were fairly successful. Across all eight M-CAM colleges, the percentage of veterans among all enrolled participants (7%⁶) was roughly the same as the percentage of veterans in the population of the state of Michigan. Although all colleges enrolled veterans, Grand Rapids and Macomb were the most successful at reaching this special population.

Veterans were much more likely than were all students overall to have some college experience and to be over the age of 40. The majority (56 percent) of veteran students were unemployed at the point of enrollment. Veterans were less likely than other students to enroll in credit programs, opting instead for short-term non-credit programs.

Exhibit 12: Veteran Specific Supports



Specialized Department Focused on Veterans. Seven colleges had specialized department focused on veterans' services.



Specialized Veterans Coordinator. Eight colleges had specialized coordinator to assist veterans in navigating educational benefits and college enrollment process.



Veteran's Focused Website. Eight colleges had specialized website links for veterans on their college websites



Veteran's-Specific Services. Eight college provided veterans with specialized services such as early enrollment periods, referrals to outside organizations, reduced costs for event tickets, etc.



Student-Oriented Club. Three colleges had special student-oriented veteran's club that served as a support system for veteran-students.



Special Resource Room. Five colleges provided veterans with special resource areas, such as meeting and computer rooms.

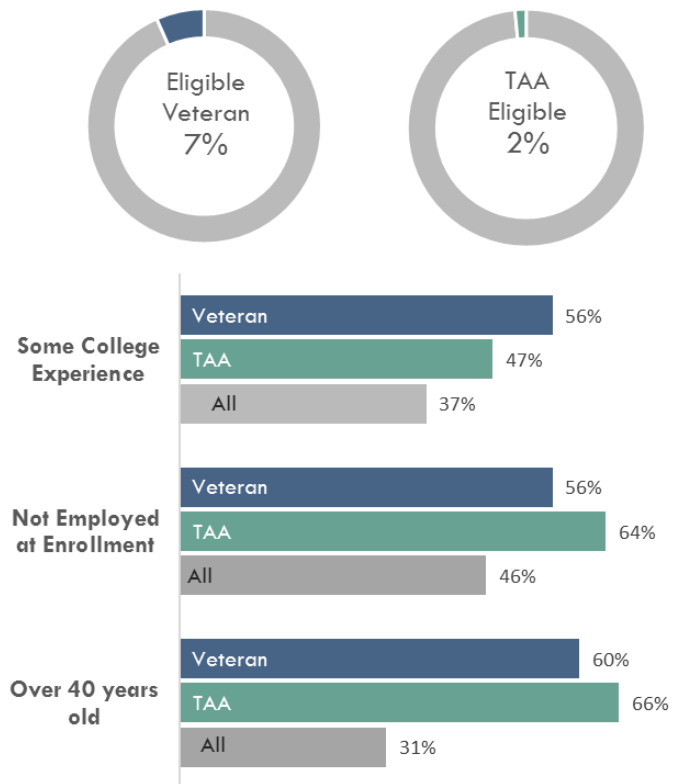
⁶ Here we use the formal DOL definition of veteran, which includes spouses of veterans. If we include only individuals who served in the military, then 6 percent of all M-CAM students were veterans.

In addition to recruiting veterans, M-CAM colleges worked with state and local workforce system partners to recruit TAA-eligible workers. For example, M-CAM staff members provided state and local-level TAA program coordinators with information about M-CAM and elicited guidance on how best to recruit this population. Despite ongoing outreach, however, only two percent of all M-CAM participants were TAA-eligible. M-CAM staff members and local Michigan Works! staff members repeatedly commented about the difficulties they faced in recruiting TAA-eligible workers. They attributed this difficulty to the fact that TAA certifications were down statewide, and many affected workers who were laid off from manufacturing jobs did not want to re-train for another job in the manufacturing sector. An M-CAM case manager at Lansing said this:

We are not finding TAA people. We have not had high rapid response rates in this area and very few TAA certifications [have occurred] ... We are not seeing TAA participants and even the state TAA representative is trying to figure out how to keep busy.

This observation is in keeping with the changing context for TAA workers in Michigan, highlighted in Chapter 1. When compared to the overall group of M-CAM participants, TAA-eligible students were much more likely to be over 40 years old and not employed at the point of enrollment, and to have some college experience.

Exhibit 13: Veteran and TAA Demographics



STUDENT PROFILES: MEMBERS OF TARGET POPULATIONS

Veteran: Carson Hunter (pseudonym)

Pathway: Multi-Skilled

Carson is a 49-year-old black male. He has lived in Detroit his whole life. He earned his GED and then did a “three-year stint” in the military in 1990. After returning from the military, he got a production job at American Axle in 1998, making \$24.00 an hour, the highest hourly wage he earned in his lifetime. He experienced multiple layoffs and had a short run-in with the law, which made finding a job more difficult. Prior to him entering the M-CAM program, he had been jobless for two years, and his wife had supported him and his two sons. He entered the M-CAM multi-skilled program, finished, and found immediate work making \$15 an hour. He was very appreciative of the program, particularly the additional benefits he received as a veteran, which helped support his family while he was in training.

“[The college staff] just basically filled out the paperwork for me. I let them know I was a veteran. And they got me in class – they jumped me in the first class, because I had privilege.

I have nothing but good things to say for the program. Because they really wanted to know: what would you need to keep you going? They were able to [provide extra money] to me – like my heater had went out. They fixed that. I needed clothes for the interview. They took care of that. And basically, got me through. And that’s basically how I made it– I was just basically living off of what my wife was making. She was working two part-time jobs at the time.”

TAA Eligible: Jeremy Wheeler (pseudonym)

Pathway: CNC Machining

Jeremy is a 48-year-old white male pursuing his Associates Degree. He had no formal education experience after high school; for 20 years, he had worked at a company that programmed and repaired CNC machines. The company closed and moved to Mexico, making Jeremy eligible for TAA benefits.

“Oh, I wouldn’t have been able to afford [the program] without it. If it wasn’t for [TAA], I wouldn’t have went [back to school]. I mean, I wouldn’t have been able to pay for classes or books or anything.”

He had little interest in any other program other than CNC Machining, which was his occupation prior to his lay-off. While TAA covered the cost of his college courses and certifications, Jeremy had to get a full-time maintenance job to cover his living expenses while in school. Fortunately, the position he found was in machine maintenance.

Recruitment Challenges

The colleges succeeded in reaching their enrollment goals despite several challenges:

- **Many young people and their families have negative perceptions of manufacturing as a career.** One of the most commonly cited barriers to recruitment was the lack of support from high school counselors and parents. Respondents said that the boom-and-bust cycle of manufacturing in Michigan, coupled with an educational climate that privileges four-year degree paths, contributed to negative perceptions of manufacturing as a viable career.
- **The low entry-level pay for manufacturing, particularly for production positions, turned off potential students.** Perhaps one reason that manufacturers in Michigan complain about a lack of qualified workers to fill available positions is that the starting hourly wage for manufacturing remains relatively low. In the region surrounding one college, starting wages hovered around minimum wage. By the middle of grant implementation, however, some faculty and M-CAM staff reported that the low unemployment rate was putting pressure on manufacturing employers to raise wages.
- **Overall college-wide enrollment levels were down due to a strong economy and a declining college-age population in Michigan.** As expressed by some faculty members, employers were hiring anyone with a “warm body” due to the thriving economy. Although the “warm body theory” was likely an exaggeration, enrollment in Michigan community colleges decreased 18 percent between 2010 and 2014.⁷ Part of that decline was attributed to the recovering economy and part was due to declines in the numbers of people of high school and college age in Michigan. One higher-education commission predicted that the number of new college graduates in the graduating class of 2019-2020 in Flint was on track to fall 20 percent from the current level.⁸
- **Dedicated recruitment staffing at most colleges was inadequate.** Only two of the colleges had a staff member dedicated solely to recruiting new students, which meant that the M-CAM-funded career coaches and other staff members added recruitment to their regular job duties. As stated earlier, some staff members estimated that recruitment absorbed at least 40 percent of their time, thus reducing the amount of time that they had to work directly with students.

“When I was coming out of high school, nobody was saying ‘I want to get into CNC.’You don’t hear anybody talking about trade schools.”

Student, Macomb

“School counselors still tend to paint a bad picture of advanced manufacturing industrial trade programs. High School guidance counselors still push students towards four-year college programs.”

Faculty Member, Kellogg

⁷ Troubling Times for Michigan’s Community Colleges. Retrieved July 24, 2016.

http://www.mlive.com/education/index.ssf/2014/09/troubling_times_for_michigans.html

⁸ http://www.house.mi.gov/hfa/PDF/HigherEducation/Declining_HighSchool_Graduation_Rates_UM-Flint.pdf.

Retrieved July 24, 2016.

Procedures for Orientation, Assessment, and Enrollment

One of the primary goals of M-CAM was to develop a common model for team-based intrusive orientation, assessment, and enrollment. Mott was the lead college for this activity; in the summer and fall of 2014, Mott worked with the consortium colleges to create a common application form that could also act as an Individual Development Plan (IDP) for each student. Mott also created a flow chart that illustrated the flow of students through the intake and assessment process. The model intake and enrollment process for M-CAM consisted of the following steps:

- **Participation in an information session.** Most M-CAM students participated in an information session, where grant-funded staff members shared detailed information on the grant, M-CAM training programs, and the job opportunities available with a college certificate or degree in one of the training areas. As stated previously, college staff members found that it was helpful to have employers participate in the information session so that they could answer student questions about career paths in M-CAM manufacturing trades.
- **Determination of eligibility for the M-CAM program.** Most of the colleges required that a noncredit student earn a minimum score on the Work Keys (or a similar assessment test) to be eligible for enrollment.⁹ Credit students were also required to reach a threshold score on the Accuplacer or Compass assessment to enroll in M-CAM training programs. Noncredit students who failed to reach the standard were often referred to foundational skills training, while at most colleges credit students who did not score high enough were required to complete transitional (noncredit) coursework in English and/or math.
- **Completion of hard-copy or online college application form.** Almost all credit students submitted an online college application form in addition to completing the M-CAM paperwork referenced below. Not all colleges, however, had online application forms for their noncredit students.
- **Completion of M-CAM registration packet.** Forms in this packet asked the student to consent to participate in the M-CAM program and evaluation, requested the student's social security number so that wage data could be collected, and requested demographic information, employment status and current wage, veteran's status, and TAA eligibility.
- **Completion of Individual Development Plan (IDP).** The IDP included a range of information that the career coach would use in providing guidance and support to the student. It initially included assessment scores, career planning, identification of short- and long-term career goals, educational history, employment history, and a barrier assessment. As discussed further in Chapter 8, career coaches and job placement staff members updated the IDP as they interacted and worked with students over the course of their participation in the program.

⁹ Students take the Work Keys assessments on math, reading, and locating information. Students at several colleges are awarded the National Career Readiness Certificate (NCRC) when they pass these assessments.

- **Assessment of barriers and obstacles.** The assessment of barriers and obstacles was an optional assessment used to identify issues that might influence student retention and successful completion of training. Career coaches and other M-CAM staff members used this information to identify appropriate supports that might help the student successfully complete training.
- **Administration of additional tools and assessments.** Colleges also administered additional tools depending on the program. These included a general career assessment such as Job Fit, Career Ready 101, or Edmentum. A few programs, such as Kellogg's production program, required that students pass a drug screen.

Each college adapted this model process to fit its particular needs.

It is important to note that the most significant change brought about by the grant was not the creation of a model intake and enrollment process, but the provision of a career coach who helped students navigate the grant and college enrollment process. The career coach at Grand Rapids remarked on the importance of the coach's role:

We are helping students make more informed decisions and [we] have continual contact with students. Coaches have relationships with students.... Week two is freak-out week, when reality kicks in that they have to manage work, life, and school. Now we have folks there to help them navigate that dynamic.

One of the largest factors influencing the student enrollment experience was whether students enrolled in credit or noncredit programs. The process outlined above was generally consistent across colleges for noncredit students, because in most cases colleges had flexible policies around the enrollment of these students. M-CAM staff members across the consortium colleges were involved in supporting noncredit students through the intake and assessment process. Almost all noncredit students, therefore, who enrolled in the manufacturing pathways created by or enhanced by the grant were formally enrolled in M-CAM.

Students interested in enrolling in credit-bearing programs, however, went through college-wide enrollment and intake procedures as well. Although most of the basic intake and enrollment steps (orientation, application, assessment) were the same, credit students usually took different assessments (e.g. Accuplacer or Compass instead of Work Keys) and worked with the respective college admissions offices to complete their college enrollment process. Credit students who entered M-CAM training programs through the admissions office may not have met the M-CAM staff members until after they were enrolled at the college. At some colleges, faculty or M-CAM staff members introduced M-CAM to already-enrolled students as an opportunity for them to access additional supportive services such as individualized job searches and placement assistance. See Chapter 8 for the types of student supports offered to M-CAM students.

Important information about each student was collected during the assessment and enrollment processes. To keep these data in a central location and combine them with data collected on the receipt

of services and outcomes, Mott, SPR, and Social Solutions Global¹⁰ adapted the Efforts-to-Outcomes database system to create a comprehensive data-collection system for the grant. This system was used to report outcomes as well as monitor grant progress. In creating this database system, the consortium fulfilled one of its key goals, which was to create a real-time, web-based longitudinal database to track student characteristics and outcomes for reporting and evaluation purposes.

¹⁰ Social Solutions Global (SSG) is the developer of Efforts to Outcomes (ETO) case management software. SPR subcontracted with SSG to create a common ETO system for the colleges. The system's features were developed with feedback and guidance from the colleges. SPR has managed the database functionality since the system was completed in the Fall of 2014.

CHAPTER 5:

Foundations for M-CAM Training

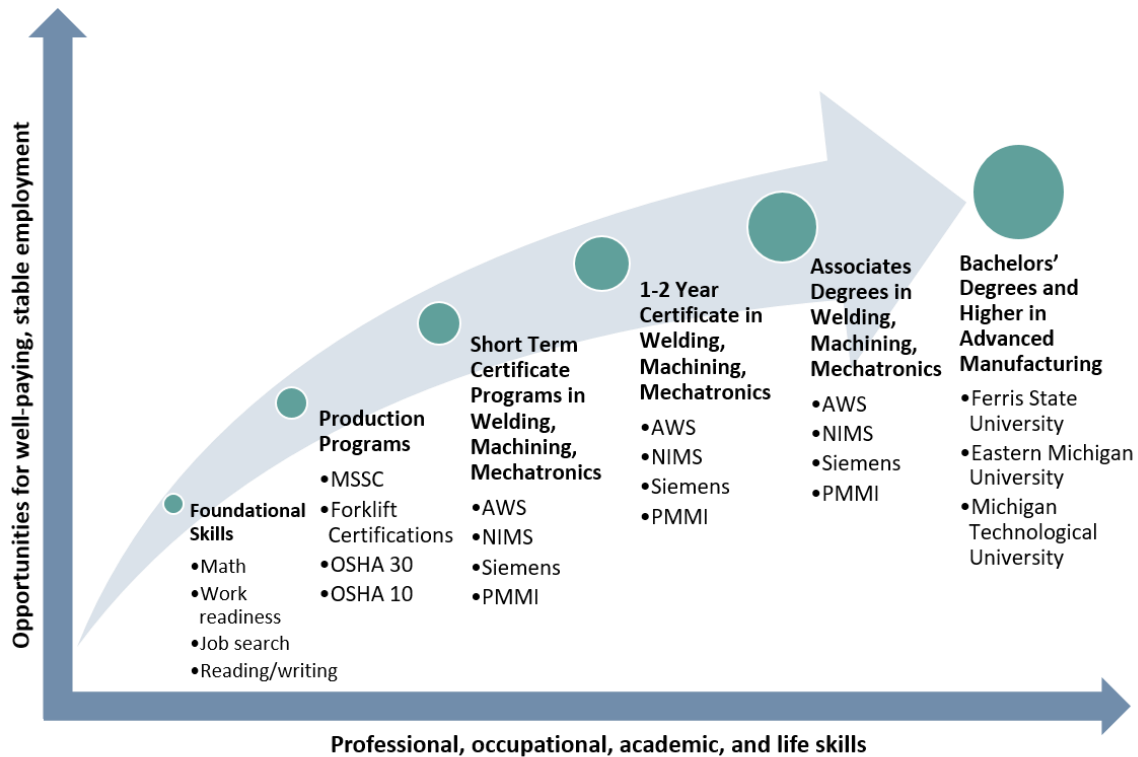


Although M-CAM’s training programs and curricula were created and administered at the college level, the members of the consortium coordinated with each other to conform the training programs to a common framework and align them with industry-recognized professional certificates. Other key components of M-CAM also helped lay the foundation for promoting a pathways model of training across the colleges: purchasing new equipment and engaging employers in curriculum development, equipment purchase decisions, work-based learning opportunities, and post-training employment. Much of this chapter is devoted to describing these foundations for M-CAM training; it concludes by summarizing students’ views of the elements of the training they received that are common to all the consortium colleges.

Career Pathways Model for M-CAM

M-CAM’s career pathways model was designed to progressively develop the occupational, academic, and life skills that students need to find well-paying, stable employment. Exhibit 14 illustrates the structure of this model in a way that highlights its relationship to the expanding career opportunities a student has as he or she progresses along a pathway and thereby enhances his or her skills and knowledge.

Exhibit 14: Progress Along an M-CAM Career Pathway and Its Relationship to Expanding Career Opportunities¹¹



As discussed further in Chapter 7, the M-CAM model assumes that skills in math, work readiness, reading/writing, and job search are foundational. Although they are represented in the model as entry-level skills, students continued to develop and revisit these skills throughout their training. Once the foundational skills are mastered, noncredit and credit production programs provide a key “on-ramp” to more specialized training in welding, CNC machining, and mechatronics. The training programs progress from short-term, often noncredit certificate programs to credit-based 1- to 2-year college certificate programs and associates degrees. Students’ advancement along their pathways was assisted by student support services, the ability to earn credit for prior learning, and the ability to articulate credit between institutions. Implementation of the core features of this model is discussed in subsequent chapters: certificate and associate’s degree programs in Chapter 6; the production programs, foundational skills, and technology-based learning in Chapter 7; supportive services in Chapter 8; and credit for prior learning and articulation of credit in Chapter 9.

¹¹ SPR adapted this model from Fein, David J. (2012). Career Pathways as a Framework for Program Design and Evaluation: A Working Paper from the Innovative Strategies for Increasing Self-Sufficiency (ISIS) Project. OPRE Report # 2012-30, Washington, DC: Office of Planning, Research and Evaluation, Administration for Children and Families, U.S. Department of Health and Human Services, p.3.

The key components of a pathways model

- **Sector-based strategies:** connecting learners to in-demand occupations in a specific industry with explicit steps in a career ladder.
- **Integrated education and training:** building basic skills and work readiness education into technical training programs and acknowledging prior learning through work or military experience as part of the training assessment.
- **Stackable and industry-recognized credentials:** Aligning curriculum with industry-recognized credentials that build on one another so that individuals can move step-wise through a career ladder in a growing industry sector and continue on a path of lifelong learning and advancement.
- **Contextualized learning:** Incorporating hands-on learning, internships, and other forms of experiential learning such that the training pedagogies engage individuals and help them understand the real-world relevance of what they are learning.
- **Multiple entry and exit points:** Enabling individuals to work step-wise through the tiers of a career ladder at their own pace, with the ability to leave at each point with documented skills that enhance employability.
- **Supportive services:** Providing individuals with assistance in exploring career options, arranging and paying for childcare and transportation, applying for financial aid, searching for jobs, and dealing with life issues.

Curriculum Development

To develop their training programs, the M-CAM colleges had to create new programs and courses and make enhancements to the existing training curricula in advanced manufacturing. To coordinate this process, M-CAM created a workgroup for each pathway made up of key faculty members, instructors, and staff members. The workgroups were supposed to meet according to a set schedule determined by the workgroup, usually monthly. In practice, most training area workgroups met monthly, but a few were slow to start and met on a bi-monthly basis. The goals were to make the curricula within each pathway more consistent and employer-focused across colleges in the consortium, identify appropriate professional certifications, enhance alignment with national professional certifications, identify core competencies that employers need, develop technology-enabled learning strategies (e.g., hands-on learning, online coursework, online communities), and incorporate updated technology into the course content. The workgroups helped establish a more unified approach to curriculum development across colleges in Michigan, providing an institutional framework for collaboration and coordination that did not exist previously.

New Courses and Programs

The five M-CAM colleges that had robust credit and noncredit training programs in advanced manufacturing often piloted new noncredit courses as a way to test the new material, especially the inclusion of third-party industry certification exams. They also built new noncredit options as a feeder or introductory step into credit programs. In many cases, M-CAM fostered stronger connections between the noncredit and credit divisions of community colleges, which historically tended to operate independently and through different lines of authority. Bay, Lake Michigan, and Kellogg had no or very few students enrolled in noncredit programs or courses in the M-CAM pathways when the initiative launched, so the process for developing new courses and programs in those colleges was focused from the start on having faculty develop new curricula and then getting the necessary approvals.

The administrative processes for approving new courses and programs varied a great deal across the consortium, given the differences in size, institutional structures, and funding mechanisms. In general, the approval process for new courses and new programs was lengthy—often taking more than a year for final approval. Typically, the approval process included approval from the dean, the registrar, and a curriculum committee, although in some colleges there were additional layers of approval needed.

Role of Faculty Members

In most cases, the colleges assigned specific faculty members to the task of creating and designing new courses and curricula. Although substitutes were hired in some of the colleges so that faculty members could participate in consortia meetings, faculty members were generally expected to develop curricula while also continuing with their regular teaching duties. This placed a considerable time burden on faculty members, which they said reduced their ability to participate consistently in workgroup calls and caused delays for some workgroup activities. The college president at Kellogg explicitly recommended that if they were to implement the grant over again, he would make sure that the assigned faculty had teaching releases so that they could concentrate their efforts on curriculum development and enhancement activities.

Despite the constraints on their time that faculty consistently reported, several said that the workgroup meetings benefited them personally more than any other aspect of M-CAM. They felt that the meetings provided an opportunity for the faculty members to learn from each other, gauge how much work the curriculum needed to be on par with that of the other colleges, and build lasting relationships for further knowledge exchange. For example, by reviewing and participating in discussions about which industry-recognized certifications to align with the curricula, faculty learned about how much employers value (or do not value) specific certifications and how rigorous the exam process is for many industry certifications. This opened an opportunity to base articulation from noncredit to credit programs on those exams in the consortium-wide articulation agreement.

“The biggest value [of the consortium industry workgroups] for me was... hearing experienced instructors talk about the challenges that they’re facing, what’s realistic content that you can deliver in a year at different levels—I was a sponge.... I was able to benchmark where [my college] sits statewide.”

Faculty member, Macomb

To continue the dialogues supported through these in-person meetings, M-CAM launched online learning communities for each of the pathways in late spring 2016 and piloted them with faculty and staff members in fall 2016. Lansing incorporated the mechatronics online learning community into its mechatronics curriculum, but deployment at other colleges was limited, due mostly to the late launch. The M-CAM online learning communities worked like other social media sites, with individual profiles, discussion posts, shared files, a directory, and the ability to ask questions and receive feedback. (See Chapter 7 for more detail on the design and early implementation of the online learning communities.)

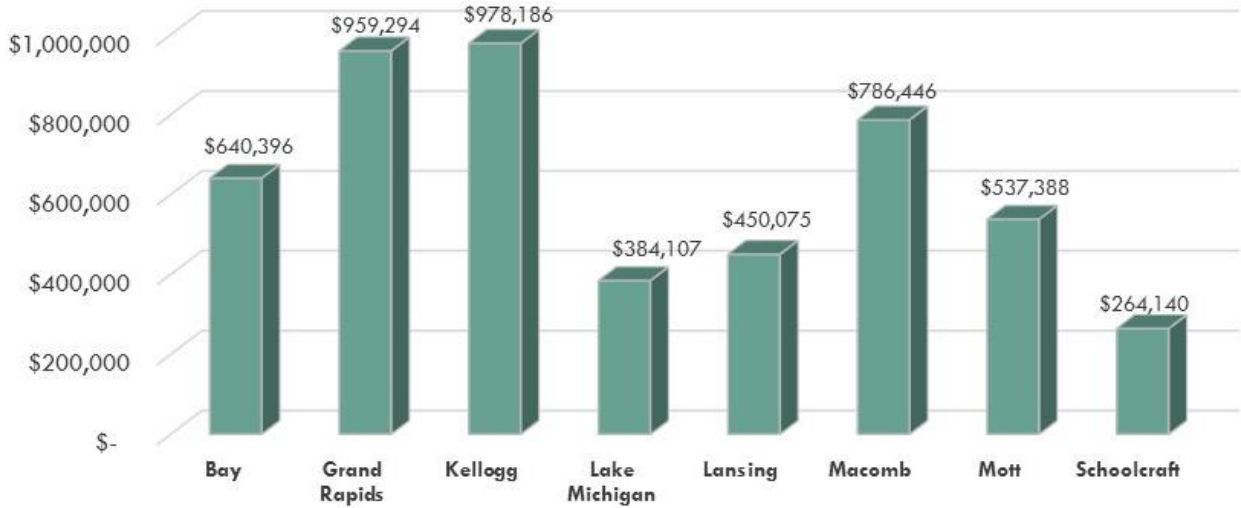


In addition to supporting their direct work on the curriculum, the M-CAM grant funded faculty to become certified instructors for several industry-recognized professional certifications. The evaluation has incomplete information on faculty certifications, but we know that at least six faculty members were certified in National Institute for Metal Working Skills (NIMS), eight in Packaging Machinery Manufacturers Institute (PMMI), four in FANUC, eight in Siemens, and eight in Manufacturing Skill Standards Council (MSSC). Most colleges had at least one faculty member certified in American Welding Society (AWS) prior to the launch of the grant, and at least one college (Schoolcraft) became an Authorized Testing Center (ATF) for AWS during the grant. In addition to allowing them to administer certification exams to students, the certification of instructors enhanced the ability of faculty members to align the new courses and programs with stackable credentials. It also helped to build buy-in from faculty on the value of professional certifications.

Equipment Enhancements

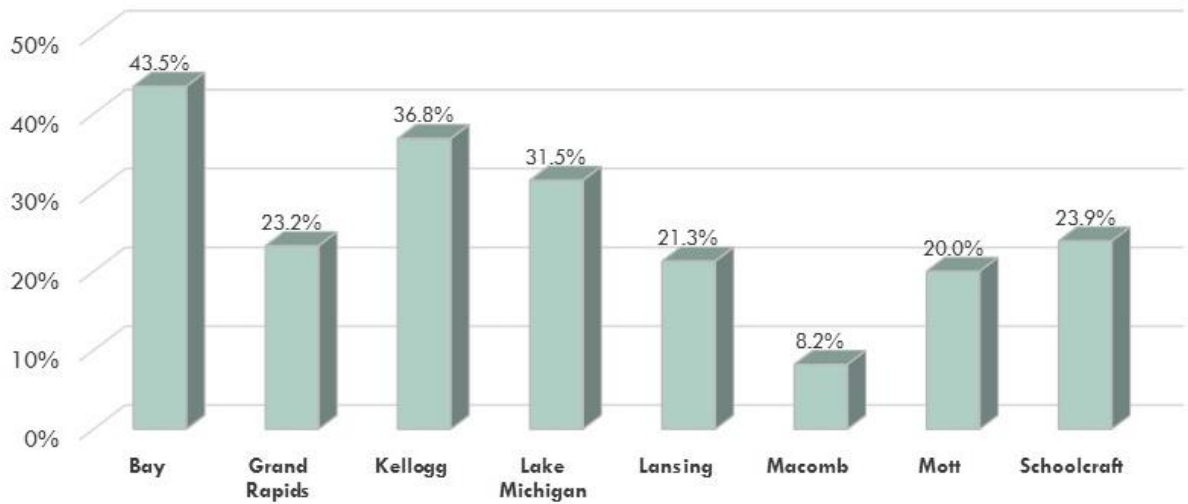
Equipment purchases went hand-in-hand with the development of new and enhanced curricula. New equipment was needed to increase the availability of hands-on, experiential learning for students and to bring the training into alignment with the types of equipment and newest technologies used by industry partners. Colleges spent the early phases of the grant consulting with employer partners and faculty members about what equipment to purchase, and the middle and the later phases of the grant installing equipment and incorporating it into the curriculum. We provide an overview of equipment purchases in this section and go into more detail about the specific equipment that was purchased within the discussion of each industry pathway in Chapter 6.

Exhibit 15: Equipment Purchases by College¹²



*Note: Amounts rounded to the nearest dollar

Exhibit 16: Equipment Purchases as Share of Grant Size

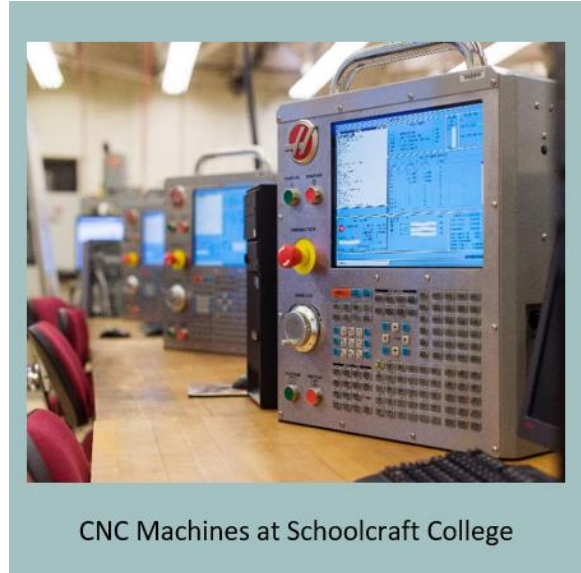


A number of key findings can be derived from the data presented in Exhibits 15 and 16:

- **Equipment expenditures ranged from a high of \$978,186 (at Kellogg) to a low of \$264,140 (at Schoolcraft).** These amounts represented a tremendous infusion of new equipment for colleges, most of which had limited opportunities to invest in equipment prior to the TAACCCT grant.

¹² At the time of the third site visit, Schoolcraft College had an outstanding request to purchase additional Multi-Skilled Technician/Mechatronics equipment. The costs for that equipment are not included in this analysis.

- **Bay spent the largest proportion (44 percent) of its grant funds on equipment, while Macomb spent the lowest proportion (8 percent).** Its relatively large investments in equipment may be one reason that Bay was not able to hire more staff members to assist with grant implementation. Given that Macomb led consortium-wide activities, it is not surprising that a lower proportion of its total grant was dedicated to equipment purchases. Equipment purchases accounted for 31 percent of the consortium's total grant expenditures through the end of July 2017.



CNC Machines at Schoolcraft College

- **Most colleges spent between 20 and 40 percent of their grant amounts on equipment purchases.** This allowed the colleges to dedicate the remaining 60–80 percent of their grant funds to personnel costs, professional development, recruitment and outreach, and material costs key to grant implementation.
- **The equipment purchased by colleges was highest in dollar value in the multi-skilled/mechatronics pathways.** Colleges spent almost \$2 million on multi-skilled/mechatronics equipment, which is 40 percent of all equipment expenditures. Forty-three items were purchased for this pathway overall. Mechatronics equipment included process logic controllers (PLCs), robotic equipment, and fluid power and hydraulics systems. It also included electronic systems and software that mimic assembly line processes.
- **The most equipment (in terms of number of items purchased) was purchased for the welding pathway.** Forty-three percent of the items purchased (80 out of 184 items) were for the welding pathway. Bay and Grand Rapids invested the most heavily in welding equipment, purchasing MIG welders, TIG welders, welding booths, and robotic welding cells. Several colleges also purchased welding simulators and virtual welders.
- **With the exception of production, the least amount of funding was directed towards purchasing CNC machining equipment.** Colleges spent just over half a million dollars on CNC machining equipment, for a total of 14 items. Commonly purchased equipment included lathes, milling machines, and 3-D printers.



Manufacturing cell at Macomb

- **Colleges purchased many items that were used in multiple pathways.** Over \$1 million was spent on equipment that the colleges used in multiple pathways. Forty-seven items were purchased for use in more than one pathway, which is the second highest after the number of items purchased only for the welding pathway.
- **There were no official equipment purchases for the production pathway alone.** Colleges did purchase supplies and materials for production pathways, but purchases were under the threshold of what is considered a “formal” equipment purchase, which is around \$5000. Many of the items that colleges determined were for “more than one pathway” were for the production pathway and another one of the core pathways.

“[The welding program has] definitely taken on a different view [due to the new equipment], I would say, in the public eye...You start seeing these guys who are clean and dressed nice, and they’re welding and working with robots and simulators and all this different nice equipment. ...Walking into a clean building—even if you’re just coming to check out the welding program, it just changes your connotation. You start thinking, “Well, geez, this isn’t what I picture an old dirty ship builder to be. You know, I can get in here and stay clean, and make a lot of money and get a good job.”

Faculty member, Bay College

In addition to using the M-CAM grant to purchase equipment directly, many colleges used the possession of the grant to leverage additional funding from the state of Michigan to buy additional equipment. The governor of Michigan created the Community College Skilled Trades Equipment Program (CCSTEP) grant in 2015, which provided multi-million dollar grants to help modernize Michigan’s educational programs in manufacturing. These funds were used by at least four colleges (Kellogg, Lansing, Macomb, and Bay) to upgrade their facilities. Bay purchased equipment from M-CAM and leveraged other funding sources to develop a new welding center on its west campus in September 2015. The main campus in Escanaba also doubled the size of its training cohorts through a combination of additional equipment, space, and materials labs.

Consortium college faculty members, students, and staff members generally felt that the ability to use M-CAM to upgrade equipment was extremely valuable for ensuring that the colleges could stay up-to-date and train students on the latest technology. Upgrading equipment, therefore, not only facilitated the training itself, but also helped the colleges market manufacturing careers to younger generations and push aside impressions of manufacturing as an outdated, dead-end sector.



CNC Machining class at Grand Rapids



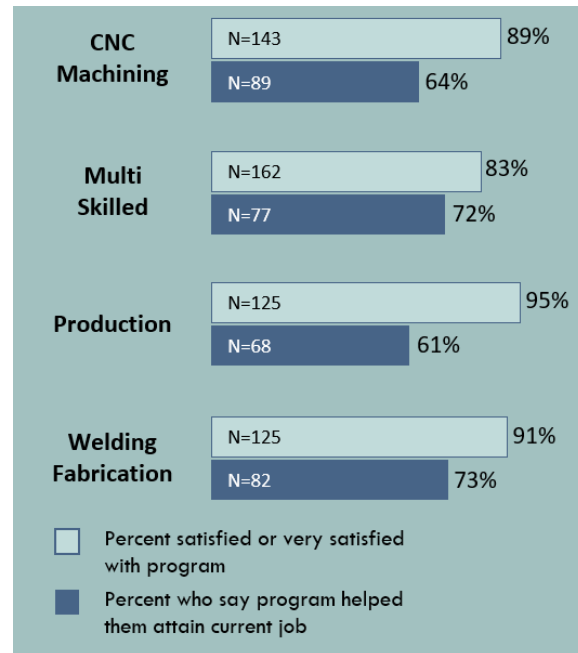
Ribbon cutting for the new welding center at Bay College

Student Perspectives on Training Quality

Students were asked to complete an exit survey for M-CAM when they completed their programs or withdrew from them short of completion. The most general of the findings from this survey shed light on how students perceived M-CAM training, as based on the foundational elements described above.

- Ninety percent of the 574 students who responded to the question on training quality said that they were satisfied or very satisfied with the training they had received.** There were some differences by college; the satisfied/very satisfied rate ranged from 82 percent at Macomb to 97 percent at Kellogg (note: all Kellogg students are credit students). Satisfaction levels varied somewhat across the career pathways as well, ranging from 83 percent in Multi-Skilled/Mechatronics to 95 percent in production.

Exhibit 17: Survey on Student Satisfaction



- **Credit students who responded to the survey were more satisfied with training and instruction than noncredit students.** Ninety-six percent of credit students reported being satisfied, while 86 percent of noncredit students felt the same.
- **Students who completed their programs generally felt that the training helped them get their most recent job, although there was a significant difference between credit and noncredit students.** Seventy-five percent of credit students felt that their training had helped them attain their current job, while only 64 percent of noncredit students felt that way. Noncredit production programs were the least likely to be perceived as being helpful, as 57 percent of noncredit production students who responded to the survey indicated that the training had helped them to get their current job. That is perhaps not surprising given that noncredit production programs are generally light-touch programs providing an orientation to advanced manufacturing.

Students who participated in the case study interviews and focus groups provided more in-depth feedback on the quality of their instructors and their training. Their perspectives are integrated into chapters 6, 7, and 8. In general, aside from some of the foundational skills training that they received, students felt that the quality of their instructors was very high, and they were pleased with how instructors brought their knowledge from working in industry into the classroom. Many students commented on how a particular instructor broadened their perspective and opened their eyes to the value of going to school. This feedback and praise was fully consistent with the survey results. The welding student profiled below highlighted the value of the hands-on experience and equipment for his learning.

STUDENT PROFILE: VALUE OF CUTTING-EDGE EQUIPMENT

Welding Student: *William Nelson (pseudonym)*

Pathway: *Welding*

William is new to Michigan, having moved from Arizona with his family about two years ago. Both he and his wife work part-time while attending post-secondary education. All his previous work experience has been in retail and the service industry, and he is working as a server at a restaurant while in school, but he doesn't expect that he will need to work service jobs much longer. He nurtures a long-term goal of starting a museum built around a 16th century forge, which would produce period armor and weaponry that he could sell. He sees welding as not only a stable and lucrative career option, but also as supportive of this long-term goal. Having found this career path, he's enthusiastic about the program.

"Honestly, I love class. I mean any class. I don't have a preference. I prefer – well actually I do have a preference. I like it when I have hands-on. So, like my welding classes, actually being able to weld and get my hands on a welder and all that kind of stuff. That is more enjoyable but I still like math. I still like metallurgy, I still like all that stuff. It doesn't matter."

CHAPTER 6:

Core Training Programs



M-CAM promoted important changes and improvements in the three core advanced manufacturing pathways: welding, CNC machining, and multi-skilled/mechatronics. In each pathway, colleges created new training programs for noncredit and credit students and enhanced existing noncredit and credit programs by adding new equipment, developing new courses, and aligning curricula with industry certification systems. In this chapter, we describe these programmatic changes, assess improvements in hands-on learning, and present the opinions about the programs that students shared in their focus groups and case study interviews.

Welding

Training in welding has a long tradition in most of the M-CAM colleges, a direct legacy of the demand from employers in automobile manufacturing and similar industries for workers with this skill. However, at the start of the M-CAM TAACCCT grant, the content of the welding curricula varied a great deal across colleges and, in most colleges, the equipment was old and the incorporation of AWS certifications uneven. While some schools, such as Grand Rapids, had very robust welding programs in place, with many options for specialization and advanced coursework, other colleges had more limited offerings when M-CAM started.

Therefore, the welding work group in M-CAM sought to accomplish three main goals: make the learning objectives more consistent across colleges, improve the integration of American Welding Society (AWS) certifications, and update equipment. The welding curriculum itself did not require many changes. The main exception—to adapt to the increased use of robotics within the welding profession—required the addition of robotic welding courses and course content. At least four colleges have made substantial enhancements to their curricula in the area of robotic welding.

“M-CAM, with other community colleges, finally put together the right people to sit down and talk about welding in order to expand our footprint in welding right across the middle of the state. And hopefully, we can pick up those manufacturers and get input and foster that input with the community across the middle of the state. That’s important. I think that’s probably one of the most important things we’ve been able to do. We’ve succeeded in that when you say with the term welding, it’s not just welding here at this Community College, it’s welding all the way across the center of the state.”

Faculty member, Mott

Faculty members generally found the welding work group valuable for improving coordination across colleges and building relationships with faculty members from other colleges. Compared to those in the other pathways, welding faculty members were more reluctant to change the existing training curricula in their pathway because they felt that the programs had been honed over a long period of time and still had a high level of employer demand. In short, they did not see a need to fix what was not broken. This explains why much of the focus was on updating equipment and building capacity to serve more students, rather than creating new courses and programs. There were differing opinions among faculty members about the value of AWS certifications and whether to adopt AWS for both credit and noncredit programs. However, even though the incorporation of AWS certification was contentious among some faculty members at first, it appeared that most faculty began, as the M-CAM initiative evolved, to view the AWS certifications more positively, due to the benefits it could have for students in terms of getting a job interview or finding employment in a new location.



Noncredit Training Programs

Two colleges implemented new noncredit programs in Welding (Exhibit 18). Generally speaking, the new noncredit basic welding courses were designed to provide students with an introduction to welding that could be the basis for entry into more specialized credit-based programs or apprenticeship programs in Welding. Most of these new noncredit programs enabled students to obtain credit for the coursework if they transferred to a credit-based program after completion.

Exhibit 18: New Noncredit Welding Programs

COLLEGE	PROGRAM	CREDENTIAL(S)
Lansing	Exploratory Welding	Certificate of Completion
Lansing	Welding Basics	Certificate of Completion
Schoolcraft	Welding Boot Camp	Certificate of Completion AWS OSHA 30

In addition to establishing new noncredit programs, many colleges also offered new noncredit customized training or incumbent worker training programs in welding on an as-needed basis. For example, as of April 2016, Lansing had offered four cohorts of a GM welding certification, and students in those programs took the GMAWS certification exams.

Four colleges enhanced their existing noncredit welding offerings (Exhibit 19). The most common enhancement was the addition of AWS Level 1 certification, which typically meant that M-CAM funded at least one faculty member to become AWS certified. With the AWS-certified instructor on board, the college could test and certify students. At least one of the schools also put articulation agreements in place to enable students to get credit for noncredit coursework if they decided to pursue further academic work in a credit-based welding program.

“M-CAM has provided an entry-level program that serves as a good feeder into our credit-based welding programs. We had a student that never touched a weld piece of equipment, and now because of going through the basic weld program he was accepted into the pipe fitters’ union and he is doing so much with the welding trade.”

Faculty member, Lansing

Exhibit 19: Enhanced Noncredit Welding Programs

COLLEGE	PROGRAM	CREDENTIAL(S)	ENHANCEMENTS
Grand Rapids	Welding Fabrication	Certificate of Completion AWS	Added AWS Certification
Lansing	Welding Fabrication	Certificate of Completion AWS	Added AWS Certification
Macomb	Welding Fundamentals	Certificate of Completion AWS	Added AWS Testing
Mott	Welding	Certificate of Completion AWS	Articulation to Credit Added Additional Cohorts

Overall the changes to noncredit curricula in welding were not substantial, and the most common change was adding AWS certification in colleges where it was not in place already. The colleges also increased the number of entry-level welding options by creating some new noncredit offerings to introduce more people to the field and to meet employer needs for customized training.

Credit-Based Training Programs

Only two colleges created new credit-based welding programs as part of M-CAM, which is not surprising given that welding was already well established in most of the M-CAM colleges. The new programs include one associate’s degree program and two new college certificate programs (Exhibit 20).

Exhibit 20: New Credit-Based Welding Programs

COLLEGE	PROGRAM	CREDITS	CREDENTIAL(S)
Lake Michigan	Welding Production Technology	61	Associate of Applied Science AWS
Lake Michigan	Welding Production Technology	17	Certificate of Completion AWS
Schoolcraft	Welding Pre-Apprenticeship	24	Certificate of Completion AWS OSHA 30
Mott	Welding Technology	62	Associate Degree AWS OSHA

M-CAM colleges enhanced many of their existing credit-based welding programs (Exhibit 21). The most common enhancements were to add AWS certification and new equipment. Some schools added new courses, such as Robotic Welding, and online learning modules. Schoolcraft added a welding internship class as an option for students in the associate degree program and a new pre-apprenticeship certification to both the certificate program and the degree program. The pre-apprenticeship certificate allowed completers to enter the local Ironworker’s Union.

Exhibit 21: Enhanced Credit-Based Welding Programs

COLLEGE	PROGRAM	CREDENTIAL(S)	ENHANCEMENTS
Bay	Welding	Welding Certificate AWS	Doubled Capacity Added Equipment New Welding Center
Grand Rapids	Welding	Associate of Applied Science AWS	New Robotic Welding Classes Added Equipment Added AWS Certification
Grand Rapids	Welding	Certificate of Completion AWS	New Robotic Welding Classes Added Equipment Added AWS Certification
Kellogg	Industrial Welding	Associate of Applied Science AWS	Added Equipment Online Learning (Moodle)
Kellogg	Industrial Welding	Certificate in Industrial Welding AWS	Added Equipment Online Learning (Moodle)
Lansing	Welding	Associate of Applied Science	Added AWS SENSE Added Equipment
Lansing	Welding	Certificate of Achievement	Added AWS SENSE Added Equipment
Lansing	Welding	Certificate of Completion	Added AWS SENSE Added Equipment
Mott	Welding	Certificate	Added Equipment Added Articulation
Schoolcraft	Joining Technology	Associate of Applied Science AWS	Added AWS Certification Added New Courses Added Pre-apprenticeship Welding Certification (WELD 225) New Internship Option
Schoolcraft	Welding Fabrication	Certificate of Completion AWS WELD 225	Added AWS Certification Added Pre-apprenticeship Welding Certification (WELD 225)

Enhancements to Equipment and Facilities

Many of the M-CAM colleges used the TAACCCT grant funds to purchase new welding equipment. Bay focused most of its TAACCCT grant funds on welding equipment purchases, which allowed Bay to serve more students. Program managers reported that the new equipment also began to change local perceptions of welding as a field, because the new equipment is not as dirty or polluting as the older equipment.

Grand Rapids is one of three colleges that used its equipment allocation to acquire new robotic welders and virtual welders, which represent the cutting edge of welding practices in the industry. Grand Rapids discovered that the virtual welders save on materials costs, because introductory students don't need to practice with real materials. Once these students get the hang of basic welding techniques, they can practice with real welders. The virtual welding simulators are also helping the colleges attract students, because colleges can take the virtual welders into local middle and high schools to introduce the students to the new technologies.

"The program has opened doors for me because of the different types of technology I've learned to use in welding. A lot of the machines are really new and have a lot of features on them that really help you find the right settings that we didn't have during the apprenticeship. So I thought that was kind of neat how the new machines are really helpful now."

Student, Bay

Examples of Welding Equipment Purchased by MCAM Colleges



Bay College added new welding booths, MIG welders, and TIG welders, which enabled them to double the size of each welding cohort. The new booths also improve indoor air quality, because they ventilate pollutants outside.



Grand Rapids, Lansing, Mott, and Kellogg purchased virtual welders. Faculty members at Grand Rapids said that having the virtual welders helped promote the program among prospective students and reduced materials costs.

Even small purchases in equipment can go a long way. For example, at Mott several students had complained during the initial site visit focus groups about the old welding hoods that they were given, saying that they made it very hard to see. In the round-three site visits, a faculty member announced that the college had purchased new, automatic change hoods that were much easier to use:

We bought some hoods; that was a very nice addition. It was very helpful in M-CAM. We could condense a timeline of almost two weeks down to almost three or four days in abilities to pick up and work with a hood, which is an automatic change hood for welding, as opposed to the old standard hood.

Some staff members have reported that these grant-funded program improvements in equipment have helped to change the perception of welding in Michigan from a dirty and outdated occupation to one that shows promise for job growth, decent wages, and more technologically sophisticated career ladders.

Hands-on Learning

Training in welding requires a great deal of hands-on learning, and generally the welding programs were already set up to provide this before M-CAM. Hands-on learning was important to students, and they generally praised the hands-on quality of their welding classes. Many M-CAM colleges added precision welding technology that allows students to use computer programs to determine which precise welding methods and materials are most suitable for the requirements of a given weld.

“I like the hands-on. I think that's what's going to benefit us the most, the hands-on, and then just...how they taught us how to recognize what a good weld is so we know how to make those adjustments.”

Student, Mott

At the same time, a handful of students felt that there was not enough opportunity for hands-on instruction. This appeared to be the result of high student-to-teacher ratios in some classes. Students in those classes felt that their teachers did not have time to check in with each student and make sure they were progressing within a reasonable time frame.

Hands-on Learning Opportunities in Welding



All the welding programs at M-CAM colleges reported high use of hands-on learning due to the nature of the field. This photo from Lake Michigan shows hands-on learning in one of the new credit-based welding programs at that college. Lake Michigan hired a new AWS-certified instructor in welding in order to be able to expand the credit-based offerings in the pathway.

Student Perspectives

Consistent with the exit survey results presented in Chapter 5, most of the students had very positive feedback about their welding program training experiences. There were even a handful of students who expressed that being part of the welding training program had a significant impact on their identity, ambitions, and sense of what is possible for them to achieve. The following samples represent these narratives of students' personal transformations:

[The welding program has] really opened up my eyes to what I really can do and where I'm setting my goals at... I haven't missed a day. My heart's been in there.

– Student, Mott

I started off welding on my own and learning from an apprentice, so you only get the bare minimum. [The welding program] has completely opened the door to all the different kinds of technology and experience.... It was just a lot to take in.

– Student, Bay

To be honest, I had not considered any training or school. This program has opened all that. This class did so much for me and [this college] has done so much for me that literally...it has opened up a whole new door for me.

– Student, Lansing

Welding is up-and-coming. We've had a chance to go and find out the job market... [Welders] make good money. It's a good field. It's a very good skill... I want to say thank you for the opportunity you all have given me just to be in the class.

– Student, Mott

Many of the students also commented on the high quality of their welding teachers. Across all M-CAM colleges, students felt that welding faculty members brought a lot of real-world experience to their jobs; not only were they “masters” at the trade, but also they knew how to teach the material to others.

And the way [the welding instructors] teach, they teach way different than any other instructor I've had [here].... They're actually pretty much like your bosses that you [work with] in the field.

– Student, Bay

[The instructor] would tell us little things that helped her out and said it may or may not work for you, but she shared it with us. I remember one thing she said is that welding is like finding your center and your rhythm. She was like Yoda. She taught us every little trick.

– Student, Lansing

Students also expressed some criticisms of their welding programs. The most common complaint was that the program was too short or that the pace was too quick for them to get fully prepared for the certification test. Some students remarked that a lack of extra catch-up time in the lab hampered their progress; others said that a lack of one-on-one time with instructors slowed some students down. At one college, many of the students who started the noncredit Welding program were no longer in the program by the end, signaling that the course wasn't providing the resources or support that most of the students needed to succeed.

Finally, some students expressed a desire to have more orientation to what a job would be like within the welding field. For example, a case study student in welding who came to the program directly from high school said that even though he liked his training, he was anxious about applying for jobs because he was not sure what they would entail or what the workplaces would be like. Similarly, several young women enrolled in welding that we interviewed expressed hesitance about pursuing careers in welding due to uncertainty about workplace conditions. This finding suggests that exposure to industry settings, through job shadows and internships, are particularly important for young people pursuing training in welding.

STUDENT PROFILES: PERCEPTIONS THAT CLASSES WERE FAST-PACED

Student: *Noah Johnson (pseudonym)*

Pathway: *Welding*

Noah was 19 years old, grew up in Michigan, and had recently graduated from high school. He first came into contact with welding while on a career explorations field trip during his junior year, and subsequently visited various welding programs at local colleges. While in school, he's supported himself through student loans and part-time retail work. Noah was hoping that through the course he would be able to land an apprenticeship. Ultimately, he hoped to build a career as a pipe-fitter. While he loves welding, he felt the class was rushed. At times, he found himself falling behind, and wished college faculty would allow him to work after hours to finish projects.

"A lot of people have never done welding in their life, they've never even heard of it. And [the instructor] expects so much from a person. It's like if you don't know anything about welding, you shouldn't even bother taking the class. That's why the classes are so small now. It's like nine people in a class, and there should be at least twenty."

STUDENT PROFILES: DESIRE FOR MORE EXPOSURE TO WORK SETTINGS

Student: *Karen Scott (pseudonym)*

Pathway: *Welding*

Karen, a 25-year-old, was born in Colorado and moved to Michigan in the early 90s. Her interest in advance manufacturing stemmed from working for a Boy Scouts camp as the Skill Trade Director. She was usually the only girl in her classes and liked the challenge of outshining her male peers. Overall, she felt that her peers were supportive and accepting. Karen had no prior work experience in manufacturing or in welding, and relied on her parents for housing and food. Although Karen loved welding, she expressed concerns about getting an industry job and she wished that the program had provided more exposure to work settings. She said:

"It would have been nice if there would [have been] more shop tours [for us to be] going to because there [are] so many local places that we could go or [people] that we could talk to or have them talk to us.... Everything else though is really amazing, like the equipment we use, the projects we do. The workload can be kind of intense but I think that I've gotten a well-rounded education."

CNC Machining

Machining, like welding, had a long history at many of the M-CAM colleges due to its importance in the automotive and food processing industries. However, until recently, many machining programs in Michigan had been scaled back or even eliminated due to low demand. The emergence of computer numeric control (CNC) machining, or automated machining, combined with the impending retirement of a large wave of highly skilled machinists has started to reignite demand for training in machining. In CNC machining, tools and parts are designed with computer assisted drawing (CAD) and other imaging software, and then machines such as CNC lathes, CNC mills, or 3-D printers are then used to fabricate the tools or parts from raw material.

The main focus of the M-CAM faculty work group in machining was on aligning curricula with NIMS certifications. However, faculty members had mixed reactions to the push to adopt NIMS certifications. Some faculty members felt that NIMS was sub-standard and in need of updating, so there was a lot of reluctance at first to align curricula with NIMS. As one informant said, “There are some real hot spots for NIMS across the country, but Michigan is not one of them.” However, by the third-round site visit, some of the faculty members who originally had reservations had come to see more value in NIMS.

“M-CAM has changed my opinion of the industry certification process, because the more paper a student has, there is value in that. I would still hire the guy with the credentials over a more experienced person. I know they had some formal education and obtained an outside standardized exam.”

Faculty member, Grand Rapids

Schoolcraft was the lead for the industry working group in machining, and faculty members from Macomb and Grand Rapids were engaged in aligning curricula with NIMS. Mott become more involved with the addition of a new full-time machining instructor in fall 2015, but the instructor departed that position to return to a position in industry and only remained part-time as an adjunct at the end of 2016.¹³ Neither Bay nor Lansing included machining in their M-CAM activities. As a direct result of M-CAM, Schoolcraft became a NIMS certification testing center, which was a significant enhancement for the college.

¹³ Note: college administrators and staff members at multiple colleges reported that community colleges tend to have difficulty retaining faculty in advanced manufacturing fields because the salaries offered by industry are much higher and curriculum development activities are often expected to take place without release from teaching duties, so the workloads can be extremely high when faculty are designing new curricula.



CNC machining instruction at Schoolcraft College (Right) and Grand Rapids (Left)

Noncredit Training Programs

Only two colleges, Schoolcraft and Grand Rapids, created new noncredit programs in CNC machining (See Exhibit 22). Grand Rapids created a new CNC Precision Machining Certificate program, an 18-week-long job-training program of 32 hours of instruction per week. Students could earn three NIMS certifications, OSHA 10 certification, and First Aid/CPR certification. Students could articulate 13 credits into a one-year credit certificate program or AAS degree at Grand Rapids, and at least three students had done this, according to faculty.

Schoolcraft developed a new 11-week noncredit CNC operator training program, which was originally developed for an employer, Loc Performance. It was first run in the summer of 2015 and included OSHA 30 certification and opportunities to get certified in NIMS Level 1. After completion, students could participate in interviews with the employer. The advertisements for the program listed a starting wage of \$10–14 per hour in the Detroit metro area.

Exhibit 22: New Noncredit CNC Machining Programs

COLLEGE	PROGRAM	CREDENTIAL(S)
Grand Rapids	CNC/ESL Pathways	Certificate of Completion
Schoolcraft	CNC Operator Boot Camp	Certificate of Completion NIMS, OSHA 30

Grand Rapids, Macomb, and Mott enhanced their existing noncredit CNC machining programs (Exhibit 23). Each college added new equipment and NIMS certification options. Grand Rapids added work-based learning opportunities. At Mott, the new machining instructor added a new precision machining component and the related equipment.

Exhibit 23: Enhanced Noncredit CNC Machining Programs

COLLEGE	PROGRAM	CREDENTIAL(S)	ENHANCEMENTS
Grand Rapids	CNC Technician Job Training Program	Certificate of Completion NIMS, OSHA 10, First Aid/CPR	Added NIMS Certification New Work-based Learning Opportunities Added Equipment Added Edmentum
Grand Rapids	CNC Apprenticeship Program (Autocam)	Certificate of Completion	Added Equipment Updated Curriculum; Articulates to 27 credits Added Tooling U
Macomb	CNC Program	Certificate of Completion NIMS	Added NIMS Certification Added Tooling U
Mott	Machinist Training Program	Certificate of Completion NIMS, OSHA 30	Added NIMS, OSHA 30 Certifications New Precision Machining Component Added Equipment

Credit-Based Training Programs

None of the M-CAM colleges created new credit-based programs in machining, which was most likely due to the long tradition of having machining programs already in place at most of the colleges. However, several of the colleges made enhancements to existing credit-based programs and courses (see Exhibit 24). The enhancements generally served to update the curricula and make them more consistent across colleges. Kellogg, Lake Michigan, and Macomb added online learning components, such as Tooling U. Schoolcraft also added a credit-based internship course to its associate degree program, which provided new work-based learning opportunities for students.

In fall 2015, Mott hired a new full-time machining instructor who focused his first-year efforts on updating course content and format, although he became part-time in 2017 and his full-time position had not yet been replaced at the time of the last site visit. While he was at Mott, he focused on adding content to the curriculum and making the courses more hands-on. Both he and a faculty member at Kellogg anticipated a need to enhance the tool and die components of their machining curriculum in order to meet growing employer demand.

Exhibit 24: Enhanced Credit-Based Machining Programs

COLLEGE	PROGRAM	CREDENTIAL(S)	ENHANCEMENTS
Kellogg	Industrial Machining Technology	Associate of Applied Sciences NIMS	Added NIMS Certification Added Equipment New Online Learning Options (Moodle) Added Tooling U
Kellogg	Industrial Machining Technology	Certificate NIMS	Added NIMS Certification Added Equipment New Online Learning Options (Moodle) Added Tooling U
Lake Michigan	Machine Tool Technology	Associate of Applied Sciences NIMS	Added Equipment Added Tooling U
Lake Michigan	Machine Tool Technology	Certificate NIMS	Added Equipment Added Tooling U
Macomb	Applied Technology Advanced Processes Program	Certificate NIMS	Added NIMS Added Tooling U
Mott	Mechanical Operations Technology	Associate Degree NIMS	Added NIMS Certification Added Equipment
Mott	Machine Tool Technology	Certificate NIMS	Added NIMS Certification Added Equipment Added Tooling U
Schoolcraft	Advanced Manufacturing	Associate of Applied Science NIMS	Added NIMS New Internship Option Added Immerse2Learn CNC Simulation Software
Schoolcraft	Advanced Manufacturing	Certificate NIMS	Added NIMS Certification
Schoolcraft	Advanced Manufacturing Skills	Certificate NIMS	Added NIMS Certification

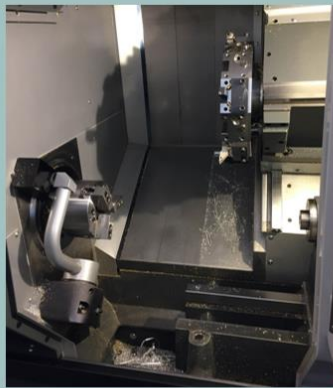
Enhancements to Equipment, Facilities, and Hands-On Learning

Although none of the M-CAM colleges made any major expenditures on machining equipment for M-CAM, several colleges made some upgrades to their machining equipment by, for example, purchasing new CNC lathes, CNC mills, and 3-D printers. At Grand Rapids, faculty members reported that it had been 20 years since the college was able to upgrade its machining equipment, so the new equipment helped improve the image of the program and enhanced the ability of instructors to offer hands-on instruction. Schoolcraft created a new machining lab and became a certified NIMS testing center, which included the purchase of 17 computers and equipment to support MasterCam and other online CNC software.

“KCC’s modules are very flexible, because most of the students in the Industrial Trades programs are industry-sponsored and we want to encourage them to complete their college certificate or degree, rather than only a few modules.”

Faculty member, Kellogg

Examples of Machining Equipment Purchased by MCAM Colleges



Mott, Kellogg, and Lake Michigan purchased CNC lathes to train students on how to transform raw material into tools and parts.



Mott and Kellogg purchased 3-D printers for their fabrication labs in CNC machining. The 3-D printers were used to design and produce tools and other sample parts.

Machining is generally a very hands-on-oriented pathway. At Kellogg, the machining program was hands-on—using real-world equipment—and modular, with some portions of the classes available online for completion. The modules were pass/fail, so a student could work on a module until he or she passed it. Students also received one-on-one instruction from a journeyman instructor.

Student Perspectives

Student participants from the CNC Machining pathway generally had positive feedback about their training. Students perceived the equipment and hands-on instruction components of the programs to be the most valuable aspects of training. For example, one student said that he was drawn to the program in part because of the equipment and the opportunity to learn how to use automated machining technologies:

[My current employer] is very old-school. The machines are very old. But I knew a lot of the companies in the area were going to computerized robotics.... And I knew if I was going to be able to hang on to my job, I better learn those computerized machines and how to program them and how to run them and how to keep them going. And having the CNC machines here and being trained with them (and the CNC lathes and the CNC machining centers), I knew was going to be beneficial for me. Because my job is starting – the company where I work is starting to upgrade their machines to be more automatic machines instead of manual ones.... So it is very beneficial for me to be able to have the hands-on and work with the machines here and learn them.

– Student, Lake Michigan

The students also praised the instructors, commenting on their ability to have the content build on itself over time and how they drew from previous industry experience. Students saw the instructors as very knowledgeable and hands-on. Students at Kellogg, which has a modularized curriculum in machining, also commented on how the self-pacing was helpful for giving students the flexibility they need to fit the program around their existing obligations. The students in the modularized curriculum did share the caveat, however, that self-pacing was challenging for students who need more encouragement and structure.

STUDENT PROFILES: RETOOLING FOR A CAREER IN MACHINING

Student: *Jeremy Wheeler (pseudonym)*

Pathway: *CNC Machining*

Jeremy is a 48-year-old white male pursuing his Associates Degree. Jeremy had no formal education experience after high school. For the previous 20 years, he had worked at a company that programmed and repaired CNC machines. As described in Chapter 4, Jeremy's company closed and moved to Mexico, making him eligible for TAA benefits. Jeremy believed the program had updated his professional skills and made him more employable, which contributed to his finding work:

"It [the courses] gives the information that I've been needing, some of the other stuff I didn't have any real knowledge in. Going through the electrical is one of the big ones 'cause I haven't really had any electrical experience. Hydraulics pneumatics, I had some experience [but the training] just expanded my knowledge."

Multi-Skilled/Mechatronics

The Multi-Skilled/Mechatronics pathway is different from Welding and CNC Machining in that it is concerned with a much more recent field of specialization within advanced manufacturing. In fact, it is so recent that at the time this report was written there was still some disagreement about what to call it. Several M-CAM colleges prefer the term "mechatronics," because, as one faculty member said, the term *multi-skill* is vague and lacks name recognition, and millennials think mechatronics "sounds more cool." Over time, the term mechatronics appeared to be growing in favor among consortium colleges but multi-skill was still very common. Thus, in this section, we will use "multi-skilled/mechatronics" unless a particular college is using a specific term to refer to its training program.

The Multi-Skilled/Mechatronics pathway covered a combination of several skill areas (hence the term multi-skill), including electronics, mechanics, computerized process control, and information technology. One student with previous work experience described the value of mechatronics in terms of helping to "connect the dots" between different systems and processes of production. "[It] sheds a little bit of light on how everything works and how to troubleshoot things." The growing demand in the Multi-Skilled/Mechatronics pathway reflects the broader shift toward automation in production processes and lean manufacturing methods, where there is less specialization of the workforce and more emphasis on ensuring that the system as a whole functions smoothly.

"When you graduate with our two-year degree in mechatronics, this is not our number, this is from the state of Michigan, the average salary after two years – so this is two years out of high school, is \$56,000.00."

Faculty member, Grand Rapids

Although the Multi-Skilled/Mechatronics pathway has elements of other long-established fields, it brings in a strong emphasis on robotics, as robot arms increasingly replace humans in performing the most repetitive tasks on assembly lines. In this context, the workers have to be trained in a wider variety of skill areas so that they can jump in to resolve different types of problems as they arise and monitor the information systems that track key performance indicators.

For the M-CAM Multi-Skilled/Mechatronics work group, adjusting training programs to meet the growing demand for skilled workers in this pathway involved the creation of several new noncredit and credit-based training programs, large-scale expansion of labs and purchases of new equipment, and the alignment of new courses with professional certifications.

Overall, the Multi-Skilled/Mechatronics pathway was an area of tremendous growth in training curricula in a very short period of time, in large part due to M-CAM. The TAACCCT grant enabled the consortium colleges to engage in much-needed debate and discussion about what a balanced curriculum that met employer needs would look like. Although each college customized its programs to meet the specific needs in its area and adapt to the resources available, M-CAM helped standardize curricula and ensure that decisions about certifications and equipment were well informed by perspectives from around the state.

“The M-CAM consortium... the obvious [contribution of M-CAM] was that they provided the equipment. The not as obvious [thing about M-CAM]...was the connections, the resources, and the verification that, ‘yeah, you’re doing the right thing,’ or, ‘You’re doing what we’re trying to do.’”

Faculty member, Bay

“We’re in automation alley, you know, there’s more engineers in this area than almost, probably anywhere in the world, believe it or not, but Grand Rapids is a lot different than Detroit and the Flint area. [It was interesting to] look at the course lists and see what people are doing or not doing.”

Faculty member, Mott



Multi-skilled Technician/Mechatronics classes at Bay College (Left) and Macomb (Right)

Faculty Perspectives

Multi-Skilled/Mechatronics faculty members were generally excited about the growth in the field and grateful for the opportunity provided by M-CAM to invest in the development of new programs and purchase new equipment. Although some faculty members found it frustrating to get new programs approved at their colleges because of the length of time it took, they appreciated the M-CAM work group because it provided an opportunity to learn from other colleges. They also found it relatively easy to convince deans and other decision makers about the importance of Multi-Skilled/Mechatronics—even if it took some time to obtain approvals in some cases.

“In terms of success, if you rate success as money, the certifications get your foot-in-the-door quickly, so you can make more money Over time we are stressing [certifications] more and more, and M-CAM was a part of that.... The real question would be, from an employer standpoint... I don't see a lot of these certifications in the job descriptions. “

Faculty member, Mott

There was a great deal of exchange and discussion in the Multi-Skilled/Mechatronics work group about how to build a balanced curriculum that meets a variety of employer needs. Several of the colleges went to great lengths to gather employer feedback on what the new Multi-Skilled/Mechatronics programs should cover and which certifications add value. Faculty members then took this feedback to the work group meetings, where they valued the opportunity to learn from other colleges, because it became clear that employers in each area expressed different training needs.

Although faculty members generally valued the M-CAM consortium work groups for Multi-Skilled/Mechatronics, there was vigorous debate about which third-party industry certification to align the curriculum with. Some faculty members had a strong preference for PMMI certifications, some preferred Siemens, and some wanted to incorporate both because they saw them as complementary. Most of the colleges chose certifications in accordance with what local employers identified as their key priorities. Siemens was a teaching and learning methodology, and thus used an integrated approach to approaching content, whereas PMMI was focused more on the development of specific skills.

“In my opinion, things are moving slow. It is clear which certifications we should go by. I am not sure why we are still discussing it because in Level 1 and Level 2 there is one certifications that is prominent and that is Siemens.”

Faculty member, Lansing

Some faculty members questioned the value of adding certifications altogether, while others saw it as beneficial for students but not necessarily for employers. In part, the controversy among faculty members over which certifications to choose and their value overall was reflective of the fact that the industry itself had not yet settled on a specific set of certifications or adopted industry-wide standards. This is not unusual in an emerging field, and it suggests that M-CAM provided a valuable venue for lead faculty members from several of Michigan's community colleges to begin forging a consensus that took multiple perspectives and economic regions into account. In the long run, the debate that took place as a result of M-CAM may strengthen the Michigan community college system as a whole and contribute to a regionally coordinated approach to economic development. Future work in this area would involve

more balancing out of programs with a variety of content areas, to allow them to move away from overspecialization in electronics or other specific fields. There also appeared to be a need for more integration of hands-on robotics instruction.

Noncredit Training Programs

Grand Rapids and Lansing created new noncredit Multi-Skilled/Mechatronics programs (Exhibit 25). The new noncredit program at Grand Rapids was called the Maintenance Automation Program (MAP), and it was run through the M-TEC department, a noncredit workforce development-focused department at the college. The Multi-Skilled/Mechatronics faculty members said that the process of developing the noncredit program helped strengthen the relationship between the academic (credit) side of the college and M-TEC.

Lansing’s new noncredit program was 10–12 months long and included Automotive Manufacturing Technical Education Collaborative (AMTEC) online training modules. Students who completed their training modules could test for PMMI Fluid Power 1, Mechanical Components I, and Siemens Level 1. Finally, Macomb added a new Manufacturing Essentials noncredit program to consolidate pathways that had the basic skill needs as a basis. This program was the foundation for students looking to move into one of Macomb’s more advanced technical pathways.

Exhibit 25: New Noncredit Multi-Skilled/Mechatronics Programs

COLLEGE	PROGRAM	CREDENTIAL(S)
Grand Rapids	Mechatronics/Controls Maintenance Automation Program (MAP)	Certificate of Completion
Lansing	Mechatronics	Certificate of Completion PMMI Siemens AMTEC
Macomb	Manufacturing Essentials	Certificate of Completion OSHA 10

Macomb was the only college that had an existing noncredit Multi-Skilled/Mechatronics program that it enhanced as part of M-CAM (Exhibit 26). Macomb had already built a fairly large Multi-Skilled/Mechatronics program prior to M-CAM—the largest in the consortium. As such, Macomb’s program became a model for the other colleges. At the start of M-CAM, however, this noncredit program was largely disconnected from the credit programs, so in addition to enhancing the program by adding some equipment and online components to existing courses, one of the major achievements was creating an articulation agreement. With this agreement in place, Multi-Skilled certificate completers who had earned the Siemens or PMMI certification could earn credits if they transferred into one of Macomb’s credit-based programs.

Exhibit 26: Enhanced Noncredit Multi-Skilled/Mechatronics Programs

COLLEGE	PROGRAM	CREDENTIAL(S)	ENHANCEMENTS
Macomb	Controls Robotics Technician	Certificate of Completion PMMI PLC 1 OSHA 10	Added Tooling U Added Equipment
Macomb	Quality Control Technician	Certificate of Completion	Added Tooling U Added Equipment
Macomb	UG – Catia NX 0.0	Certificate of Completion	Added Teamcenter Software New vendor
Macomb	Multi-Skilled	Certificate of Completion Siemens PMMI OSHA 10	Added Equipment Added PMMI & Siemens Certifications Upgraded Curriculum Articulates to Credit
Mott	Robotics	Certificate of Completion FANUC NOCTI	Added FANUC & NOCTI Certifications

Credit-Based Training Programs

Bay, Lake Michigan, and Schoolcraft all created multiple new credit-based programs in mechatronics as part of M-CAM (Exhibit 27). Given that the process of creating new curricula was often slow and very resource-intensive, having this many new mechatronics programs represented a substantial increase in the capacity of Michigan community colleges to offer various kinds of Multi-Skilled/Mechatronics training. Schoolcraft created a brand-new mechatronics lab and several colleges made major equipment investments to be able to offer courses with cutting-edge technologies. Each college allocated faculty resources differently to create the new programs. At Bay, a faculty member was moved from another department to create the new certificate and associate degree programs, while at Lake Michigan an existing electronics faculty member designed the program. Schoolcraft hired a new part-time instructor

who had experience at Ford production plants to create its new program. One faculty member described approaching the Dean to get approval for the new program as an easy argument:

I just had to put it down on paper and present it to the dean and say, “You know what, I think this makes sense. If we’re looking to create new programs to meet the needs of our industry, locally and nationally, because you have to understand, automation is taking hold across the country, not just here.”

– Faculty member, Lake Michigan

The instructor then had the program approved through a curriculum committee and the college’s board. Faculty members at other institutions described the process in a similar way, although in some colleges the process took longer than in others.

Exhibit 27: New Credit-Based Multi-Skilled/Mechatronics Programs

COLLEGE	PROGRAM	CREDITS	CREDENTIAL(S)
Bay	Mechatronics	24	Mechatronics Certificate PMMI
Bay	Mechatronics & Robotics Systems	60	Associate of Applied Sciences PMMI Added Articulation to Michigan Technological University
Lake Michigan	Mechatronics Technology	17	Certificate of Completion PMMI
Lake Michigan	Mechatronics Technology	63	Associate of Applied Sciences PMMI
Lansing	Mechatronics	34	Certificate of Achievement
Schoolcraft	Mechatronics Skills	18	Mechatronics Skills Certificate
Schoolcraft	Mechatronics	39	Mechatronics Certificate PMMI Siemens
Schoolcraft	Mechatronics	68–71	Associate of Applied Sciences PMMI Siemens

Both Bay and Lake Michigan opted to focus only on aligning their new curricula with PMMI, because Siemens was not highly utilized among the employer base in either region. Schoolcraft chose to align to both PMMI and Siemens, because employers in its area recognized and utilized both.

The other five colleges in the consortium used M-CAM funds to enhance their existing credit-based programs, typically by aligning them with industry certifications, adding new equipment, upgrading the curriculum, and adding online course components (Exhibit 28). Lansing changed the curriculum to a modularized format, based on the example that Kellogg had in place, and spent a large amount of its funds on an AMTEC learning system for Mechatronics. Mott upgraded its mechatronics offerings to be more balanced across multiple areas, because previously it was heavily focused on electronics. Macomb also used M-CAM funds to enhance two MAT² credit programs in multi-skilled/mechatronics that are based on a German pedagogical model (they were originally funded through another grant in cooperation with other community colleges).

Exhibit 28: Enhanced Credit-Based Multi-Skilled/Mechatronics Programs

COLLEGE	PROGRAM	CREDENTIAL(S)	ENHANCEMENTS
Grand Rapids	Electrical Controls/Mechatronics	Certificate of Completion PMMI	Added PMMI Certification Added Equipment
Kellogg	Industrial Electricity and Electronics	Certificate PMMI	Added Equipment Upgraded Curriculum Added Tooling U, Edfactor
Kellogg	Industrial Electricity and Electronics	Associate of Applied Sciences PMMI	Added Equipment Updated Curriculum Added Tooling U, Edfactor
Kellogg	Industrial Technology	Certificate PMMI MSSC	Added Equipment Updated Curriculum Added Tooling U, Edfactor
Kellogg	Industrial Technology	Associate of Applied Sciences PMMI MSSC	Added Equipment Updated Curriculum Added Tooling U, Edfactor
Lansing	Mechatronics	Associate of Applied Sciences PMMI Siemens	Updated Curriculum Modularized Curriculum Added Equipment Added AMTEC Added PMMI & Siemens Certifications
Lansing	Mechatronics	Certificate of completion PMMI Siemens	Added Equipment Added PMMI & Siemens Certifications
Macomb	Automated Systems Technology	Associate of Applied Sciences	Added Equipment

COLLEGE	PROGRAM	CREDENTIAL(S)	ENHANCEMENTS
Macomb	MAT2 Mechatronics	Associate in General Studies	Added Equipment Added Noncredit Courses
Macomb	MAT2 Production Design	Associate in General Studies	Added Equipment Added Noncredit Courses
Mott	Electronics and Electrical Technology	Associate of Applied Sciences PMMI Siemens	Added PMMI & Siemens Certifications Added New Courses Added Equipment Added Articulation to Credit
Mott	Electronics and Electrical Technology	Certificate of completion PMMI Siemens	Added PMMI & Siemens Certifications Added New Courses Added Equipment Added Articulation to Credit

Enhancements to Equipment, Facilities, and Hands-On Learning

The significant enhancements to the Multi-Skilled/Mechatronics curricula at each of the M-CAM colleges would not have been possible without a significant infusion of new equipment. The most common pieces of equipment that M-CAM colleges purchased were Amatrol learning systems, FANUC robot cells, programmable logic controller (PLC) machines, hydraulic trainers, fluid power trainers, AMTEC trainers, and computer equipment. The Amatrol learning systems are flexible assembly systems that mimic a real production line and can be recombined in various ways to teach different skills. Faculty members felt that the additional equipment was critical to making curriculum development possible.

Hands-on learning was a major emphasis of the new curricula, because students needed to practice on the machines to really understand how to use them. One student remarked on how the hands-on learning was used to reinforce what the teacher lectured on in the classroom:

Our class has a great balance of being in the class and being hands-on. When we cover it in the class, it seems to move a little quick. You're trying to absorb it all. But once we go out and practice it hands-on it all comes together. In that aspect, I think it's a great way to learn. It's also very practical because we need to know how to operate the robots and get a realistic view of what the control panels and components look like and how to troubleshoot. You can only do that by being hands-on.

– Student, Macomb

Examples of Multi-Skilled/Mechatronics Equipment Purchased by M-CAM Colleges



Several M-CAM colleges purchased FANUC robot cells to train students in mechatronics and multi-skill technician courses. Equipment, coursework, and faculty certifications also enabled them to certify students in FANUC. FANUC robots can be used in machining, robotics, mechatronics, welding, and other advanced manufacturing fields.



M-CAM colleges purchased flexible integrated assembly systems, which mimic production lines, for mechatronics and multi-skilled technician courses. The automated cell stations can be adapted for different production process configurations.

Student Perspectives

Student feedback in the Multi-Skilled/Mechatronics pathway was overwhelmingly positive, especially when students reflected on the experience of their instructors the quality of instruction they delivered.

[Our instructor has] got a lot of experience. He knows where we're coming from. You can tell that he was out on the floor working just like we were at one point.... He can put stuff into perspective.... And say, this is how it should have worked or this is how it is. He breaks it right down our level to where we know what's going on.

- Student, Grand Rapids

[My instructor] was amazing, the best teacher. I actually still stayed in contact with him afterwards... He really made [the content] relatable... He teaches the content in a way that is fun. He really knows what he is talking about as well, so, and that comes across and he did a great job with making it easy to understand.

- Student, Macomb

Although most students were satisfied with the training, some complained about the fast pace of Multi-Skilled/Mechatronics training programs. Some students found the amount of material covered to be overwhelming, and claimed that the ability of their instructors to help them keep up was mixed. In some of the newer programs, some students also said that having more courses to choose from would be beneficial, even if they were existing courses such as welding or basic mechanics. Given that these programs were still in the piloting stage, the offerings were likely to increase or adjust to student demand over time. Overall, students appeared to be very interested in their courses and inspired by the new technology that was available. One student who had graduated and was working in the field said that due to the hands-on experience he'd received, he felt more knowledgeable than the average new person coming into that position, even people coming from bachelors' programs.

STUDENT PROFILES: DEVELOPING A MULTI-FACETED SKILL SET

Student: *Carlos Ferguson (pseudonym)*

Pathway: *Multi-skilled Technician/Mechatronics*

Carlos is a 54-year-old white male with an Associate's Degree in Building Construction and a Bachelor's Degree in Construction Management. A Michigan native, he lives with his wife and two children, both of whom are in college. He has worked a number of jobs throughout his career including home rehab for a nonprofit organization; he even owned his own retail business. Carlos believed the multi-skilled technician and mechatronics program was a good fit for him because it provided him with a broad skill set that he hoped would help him transition to a new career. He said:

"They touched a little bit about everything which hopefully is what I'm going into. Rather than just going and doing one thing and that's all you're going to do.... And that's how kind of it works when you get out there. Instead of getting stuck just fixing robots...I can go and do pipe bending or something. I'm hoping."

Conclusion

Overall, M-CAM had a substantial impact on curricula in the three core pathways: Welding, Machining, and Multi-Skilled/Mechatronics. The Multi-Skilled/Mechatronics field expanded the most because it was a relatively new pathway, and it emerged in direct response to the broader shift in industry toward automating production processes. However, a number of programs in Welding and Machining were also enhanced in significant ways, particularly through the adoption of new technologies and alignment with professional certifications.

Despite the debate that arose in many colleges about the value of professional certifications, they became an integral part of the stackable career pathways system adopted by the colleges and a cornerstone of their approach for aligning programs and articulating credit across institutions (see Chapter 9 for more detail). M-CAM provided a forum for instructors to debate which professional certifications to use, learn the pros and cons of different certifications, and engage with employers to get their feedback on the different options. Instructors in colleges that were trying to make major enhancements to one of their pathways saw the work groups as a valuable resource for comparing and standardizing curricula as well as learning about new course formats – such as the modularized programs at Kellogg that are credit-based and self-paced.

There were also some challenges that colleges faced in enhancing their curricula in the core areas:

- **Institutional legacies of separation between noncredit and credit programs remained a barrier to a pathways approach at several colleges.** Because of this separation, noncredit-to-credit bridges were difficult to develop. Shifting to a systems perspective appeared to make a difference in the ability of faculty and staff members to implement innovative noncredit-to-credit bridges and provide more “on-ramps” into core programs and for college leaders to begin to promote these changes. In the last year of the grant at least two colleges made substantial efforts to improve bridges between noncredit and credit programs; the new Center for Manufacturing Excellence at Lansing was one example.
- **Faculty retirement and turnover affected the pace of implementation.** Although in some cases faculty retirement helped invigorate changes to curricula in a core pathway, the colleges had a high number of departures due to retirements, deaths, and other factors during the course of the grant and at times it took a while for new faculty to get up-to-speed.

Despite these challenges, the M-CAM initiative had a significant impact on standardizing, expanding, and updating training curricula in the Welding, CNC Machining, and Multi-Skilled/Mechatronics pathways. The new equipment not only allowed students to learn on the latest machines, it also changed the image of the colleges and the field of manufacturing in the local community as a whole. The M-CAM work groups also helped build stronger networks between instructors in the same field across different parts of the state, which may have lasting effects if some of the relationships are maintained. Specifically, the work groups helped equalize and standardize the training curricula in each pathway and provided a forum to exchange information and perspectives. Many of the instructors felt that this opportunity was the most valuable aspect of the grant.

CHAPTER 7:

Facilitating Career Pathway Access and Progress



M-CAM aimed to promote individuals' access to career pathways in manufacturing by making available to them foundational skills training (designed to strengthen their academic and “soft” skills), entry-level training in production, and online learning options. Taken together, these innovative design elements made M-CAM training in advanced manufacturing skills accessible to a broader range of students with varying prior education and work experience and life circumstances, in effect giving the career pathways system at the core of the M-CAM initiative multiple entry points. This chapter describes these three key features of the M-CAM initiative, highlighting how their adoption was a part of institutional shifts leading towards more flexible, easier-to-negotiate career pathways for students entering manufacturing programs.

Foundational Skills Training

In part based, on direct feedback from employers—who complained that many individuals seeking entry-level positions were not fully prepared to take on the responsibilities of the workplace and accomplish basic tasks—the M-CAM consortium colleges saw a need to enhance their educational offerings in foundational skills. Foundational skills training includes basic skills remediation (usually in math and reading) but also instruction in work readiness skills (often referred to as soft skills), financial literacy, and job search skills. Based on available evidence, the consortium assumed that, with stronger skills in these areas, students would not only be more likely to complete their training and educational programs, but would also be more prepared to advance along their education pathway and successfully enter employment. All eight colleges implemented some form of foundational skills training into their M-CAM programs, but the approaches and content areas varied significantly and there were challenges along the way that slowed implementation.

Approaches to Enhancing Foundational Skills

The M-CAM consortium colleges used five different approaches to offer and enhance foundational skills training:

1. **Harnessing and supplementing existing resources** – Referring participants to other providers of foundational skills training on campus and supplementing those offerings, as needed, with targeted workshops or cohort programs relevant to advanced manufacturing pathways.
2. **Contextualized learning**¹⁴ – Embedding foundational skills training into existing technical training courses through real-world applications.
3. **Online basic skills testing and remediation** – Offering students access to online skills training software packages (such as Edmentum) and other skills enhancement software, alongside their regular coursework.
4. **Boot camp-style pre-enrollment cohort programs** – Requiring noncredit students to complete an intensive preparation course—typically lasting 40–80 hours and covering a wide range of foundational skills—prior to enrolling in technical training.
5. **Supplemental workshops** – Holding voluntary workshops on specific topics, such as resume writing or financial management skills, to supplement the existing foundational skills resources on campus.

Prior to the TAACCCT grant, all M-CAM colleges had systems in place for remediating basic skills in math and reading, especially in credit programs, because students must typically meet certain skill standards to enroll in those programs. Therefore, colleges have required assessment during the enrollment process to identify students who might need to be referred to remedial courses on campus.

For noncredit courses, students usually do not have to attain a specific skill level before enrolling, but the colleges have on-campus resources for students who need extra help or tutoring. For example, the Federal TRIO program provides supportive services and tutoring in basic skills to students with disabilities, including learning disabilities. Many instructors, especially in noncredit, non-incumbent worker programs, already teach in a way that incorporates foundational skills instruction out of necessity, given that the individuals they teach tend to have more skill deficiencies than those in credit classes. Some colleges (including Grand Rapids, Kellogg, and Macomb) also had the ACT National Career Readiness Certificate (NCRC)¹⁵ programs in place before M-CAM to help document workplace skills for employers.

Given this assortment of existing resources, the consortium colleges did not want to duplicate efforts, so they leveraged and strengthened connections to these resources and added two or more of the other

¹⁴ In a contextualized learning environment, “students discover meaningful relationships between abstract ideas and practical applications in the context of the real world; concepts are internalized through the process of discovering, reinforcing, and relating.” <http://www.cord.org/contextual-learning-definition/>

¹⁵ NCRC is an assessment tool that evaluates a student’s performance on three WorkKeys® skills assessments—Applied Mathematics, Locating Information and Reading for Information. Scores on these three skills assessments determine the NCRC certificate level—bronze, silver, gold, or platinum—a student can earn. The NCRC is a portable credential that gives employers a uniform and objective measurement of key workplace skills and certifies that a student has workplace skills that are transferrable between industry sectors and occupations.

four approaches to enhancing foundational skills, as shown in Exhibit 29. Overall, all eight colleges were successful in offering content on communication skills, basic computer skills, reading skills, and math skills. Seven out of eight colleges offered study skills instruction as well.

Exhibit 29: Approaches Used to Provide Foundational Skills Training

COLLEGE	HARNESSING EXISTING RESOURCES	CONTEXTUALIZED LEARNING	BOOT CAMPS	WORKSHOPS OR COURSES	ONLINE SKILL REMEDIATION TOOLS
Bay					
Grand Rapids					
Kellogg					
Lake Michigan					
Lansing					
Macomb					
Mott					
Schoolcraft					

Key Findings on Foundational Skills Training Enhancements

The M-CAM colleges used TAACCCT funds to enhance foundational skills in the following ways:

- The colleges strengthened institutional linkages to existing resources on campus.** All eight M-CAM colleges made a concerted effort to develop stronger relationships and referrals between their advanced manufacturing programs and existing skills remediation resources on campus. For example, the M-CAM program manager at Bay College strengthened ties with the Federal TRIO program on campus, which provided tutoring to many Welding students who were in danger of dropping out. This resulted in a significant reduction in dropout rates and resulted in lasting institutional changes at Bay College using the TRIO program to assist students because college administrators were so impressed with the positive results. At Lansing, M-CAM staff members worked with the college’s Center for Transitional Learning to offer contextualized remediation for reading and communication skills and coordinated with the college’s Learning Commons to offer math tutoring at the college’s West Campus for M-CAM noncredit and credit students.
- M-CAM career coaches referred students to foundational skills training.** M-CAM career coaches worked closely with students during the M-CAM enrollment process to identify barriers to success, including financial literacy barriers. Instructors at most of the colleges felt that they were meeting

the intent of the financial literacy component of foundational skills by personally assisting students with financial matters and making referrals to financial aid and other community partners. Some M-CAM colleges have coordinated with MI Works! service centers to offer Federal Bonding Program services for individuals who had previously been incarcerated to improve their transition to employment.¹⁶

- **The colleges offered more remediation in technical math, the most common area of basic skills deficiency in advanced manufacturing.** In response to the math skills gap, M-CAM program managers at several colleges enhanced the technical math training that occurred alongside coursework in each pathway. For example, Schoolcraft launched a Technical Math course (Math 102) to help students enrolled in occupational programs master math concepts. Mott added four hours per week of technical math instruction to an existing welding class. Lansing worked with the college’s tutoring services unit to offer an open lab for math at its West Campus where all its industrial trades programs are housed.

- **All eight colleges used grant funds to purchase and deploy online skills remediation tools.** Macomb negotiated an agreement to purchase Edmentum licenses for all the consortium colleges to help enhance the foundational skills component of the M-CAM programs. Edmentum’s Plato Courseware provides online content including personalized instruction and assessments to help students prepare for college and career success. Bay, Grand Rapids, Kellogg, Lansing, and Schoolcraft utilized Edmentum to assist M-CAM students with developing

“A conscientious student in Kellogg’s KAMA program from the Eastern Calhoun Early College initiative struggled with peer relationships as well as with some of his coursework. The first time he took his NCRC math assessment, he scored only 27 percent. He was given the opportunity to remediate using Edmentum’s self-paced online tools and brought his math assessment score up to 82 percent!”

Faculty member, Macomb

foundational skills. According to one foundational skills instructor, “Edmentum has been a good tool for us because it helps address where [students] are deficient.” He added, “Edmentum is focused on contextualized [learning].” Although all eight colleges received funding for Edmentum licenses, not all have incorporated online remediation tools into their foundational skills programs. Some colleges preferred using Edmentum as a supplemental resource to augment their foundational skills modules or existing college tutoring and remediation resources.

- **Six colleges added specialized courses or workshops.** These add-on courses included voluntary workshops for credit programs at Bay and a required class for noncredit program students at Macomb. Macomb’s foundational skills noncredit modules were embedded into every noncredit TAACCCT-funded training program and included ten modules on Critical Thinking, Communication

¹⁶ The U.S. Department of Labor established The Federal Bonding Program in 1966 to provide Fidelity Bonds that protect employers against the perceived risks involved in hiring job seekers with criminal justice and drug-use histories. The bonds cover the first six months of employment. There is no cost to the job applicant or the employer. There are a few Federal Bonding Program limitations that can be found at <http://bonds4jobs.com/wp-content/uploads/2017/06/At-A-Glance.pdf>.

Skills, Problem Solving, Financial Literacy, Teamwork, Decision Making, Time Management, Learning Styles, Note Taking, and Career Research. Schoolcraft staff members created a career readiness course to supplement the technical material learned in the college's noncredit short-term welding training and CNC machining programs. The college found the content so valuable that it is being repurposed for Schoolcraft's pre-apprenticeship programs. Many of the colleges reported that foundational skills training helped their students stand apart from other job applicants and planned to continue offering these components after the end of the grant.

- **Some colleges brought employers in to the classroom to speak about soft skills.** Although previous foundational skills trainers got push-back from students who just wanted to dive into the technical content, Macomb staff members succeeded in communicating the value of foundational skills by having employers talk about soft skills during the orientation. This suggests that work-based learning opportunities and situating soft skills training in real workplace settings may offer promising pedagogical methods for non-traditional students and students with multiple barriers. Kellogg and Lansing staff members also spoke about the importance of having employers communicate their basic and soft skill needs to students and found that conducting informational and mock interviewing sessions allowed local employers to demonstrate the value of the foundational skills component to students and gave students the opportunity to practice communicating effectively with employers.
- **Foundational skills were integrated into the curriculum in Kellogg's Advanced Manufacturing Assembly (KAMA) credit production program.** Although foundational skills were part of another grant-funded program that Kellogg operated, M-CAM allowed the college to embed foundational skills into the college's entry-level credit KAMA program. Kellogg's KAMA program appears to be a best practice among the colleges because it emphasizes basic skills as well as soft skills. Students commented that the training helped them to understand the world of work and feel better prepared to encounter certain workplace situations like addressing conflicts with coworkers or managers in a professional manner by de-escalating the situation. Kellogg's entry-level credit production program includes an entire section on math skills that addresses unit conversions from metric to U.S. customary units using percentages, ratios, decimals, and pre-algebraic functions. A case study student said Kellogg's KAMA program changed his perspective on math, making him realize it was something he could be successful doing and that he could apply the concepts he learned to real-world employment situations.

Challenges

Although the colleges already had many resources in place to deliver foundational skills training through existing college departments and resources, and instructors often informally incorporated applied foundational skills training into their courses, the notion of integrating formal foundational skills training—especially soft skills training—into the existing curriculum was a new concept for many faculty members and students. This factor, along with others, resulted in several challenges:

- **Some faculty members were resistant to incorporating foundational skills into the existing curriculum.** Faculty members at some colleges felt that their classrooms were better suited for technical training rather than for teaching math skills or soft skills, so they resisted making any changes to their existing curriculum.
- **Attendance for optional workshops was low.** Program managers said that it was often difficult to get students to attend optional workshops because there were no clear incentives for them to go to an extra training on top of their normal coursework. Almost a third (32 percent) of all students enrolled in M-CAM advanced manufacturing training programs were over the age of 40 and had other obligations—dependents and work—that limited their ability to attend optional workshops. In addition, many colleges that housed foundational skills in a noncredit department had trouble getting credit students to take advantage of workshops or other supportive services that they organized on behalf of the grant.
- **Many students did not see the value of foundational skills training or feel they needed it.** Generally, students were very critical of their foundational skills training components, saying that math teachers confused them and that the soft skills sessions were not useful. This sentiment resulted in the soft skills and financial literacy components of foundational skills training being delayed at many M-CAM colleges. The colleges that did the most effective soft skills training already had those structures in place before M-CAM and built off that momentum for the grant.
- **Colleges had difficulty integrating key components of foundational skills instruction into existing credit programs.** For credit-based programs, it was difficult for the M-CAM program staff members to incorporate foundational skills content because it needed to go through a formal approval process (i.e., curriculum committee review). For example, at Grand Rapids, the project manager stated, “[M-CAM colleges] need to think about how institutions will contextualize it because it requires curriculum changes. [It is] hard to change existing programs because complete rewrite involves a lot of work. Staffing issues, aid issues, curriculum review, etc. made it a huge undertaking.” For this reason, many colleges found it easier to embed foundational skills training, including soft skills components, into their noncredit programs.
- **The colleges did not widely incorporate financial literacy skills into their foundational skills training.** Only four colleges provided robust training opportunities in this area. Kellogg’s program was the most robust, in that all students in its entry-level credit-bearing production program received six hours of financial literacy training. For some initial KAMA training cohorts, Kellogg had a representative from a local bank speak with students, but as time went on this was difficult to

schedule so the college turned to Goodwill Industries' Financial Opportunity Center to teach students about personal finance topics such as checking, savings, and retirement accounts, loans, credit reporting, budgeting, how to read a paycheck, and tax withholding.

- **Students often needed more guidance than online tools could offer.** Several faculty members observed that for students with deficient math skills, online tools are an inadequate substitute for in-person assistance. A career coach at Kellogg helped a production student improve his math skills by sitting with him after class to review course content one-on-one. The career coach stated, “The basic skills portion [of the foundational skills training] cannot be done completely online or in a [group session] because many students struggle with general concepts and need someone to help them navigate through these areas so they do not feel alone or isolated.”

Although employers are demanding technical skills, especially in the advanced manufacturing sector, they also want employees who have the “soft skills” and employability skills needed to succeed on the job. Even though most M-CAM program staff members and instructors agreed that foundational skills (many of which fit into the “soft skills” category) are important for student development and employability, there was little agreement on where or how these skills should be taught. In addition, students had very mixed perceptions about the foundational skills training they received, with some students suggesting they would have failed their programs without the assistance and others, particularly older re-entry students, saying that requiring them to attend such training was a waste of their time.

Production Operations Training

The production operations pathway in M-CAM differs substantially from the three other pathways (Welding, CNC machining, and Multi-Skilled/Mechatronics) because it fills an entry-level gap in the curriculum and is intended to make up the first rungs of any career pathways ladder. Generally, production operations programs focus on providing an overview of what manufacturing work involves and cover the established practices for managing safety, quality, and efficiency in different types of production processes (e.g., Fordist assembly lines, Six Sigma, and lean manufacturing). The M-CAM colleges that have entry-level training programs in production operations generally see them as “feeder programs” leading into the core career pathways and exposing students to different occupations and training options in advanced manufacturing. Because Michigan is so dependent on goods producing manufacturing, these training programs have been very popular with employers and have served as effective ways for students to quickly upgrade their skills and transition into employment.

Hands-on learning is a very important aspect of production training, especially when it is intended to serve as an on-ramp that opens doors for non-traditional students. Because important pieces of industrial knowledge are tacit and highly context-specific,¹⁷ they can only be learned inside a lab or through a work-based learning opportunity (e.g., facility tour) with an employer. According to the National Association of Manufacturers (NAM), effective hands-on learning programs are critical to

¹⁷ Gertler, 2001.

helping students understand the knowledge behind technology and its application to real-world environments and situations. For these reasons, all the new and enhanced production training programs at the M-CAM colleges incorporated hands-on learning components, where students contextualized and applied foundational skills to a production setting using cutting-edge technology.



Hands-on Learning in Production Operations

Students participate in Kellogg's KAMA production operations training program. This program prepares students for high-demand production jobs. The KAMA program includes a series of hands-on learning experiences using 88 component parts and 29 separate quality specifications. Students work on an actual manufacturing line to assemble an experimental model car and learn to apply a variety of skill sets and production concepts, including how to read charts, analyze unit time, and conduct quality inspections.

Four colleges—Grand Rapids, Kellogg, Mott, and Lansing—offered production programs as part of M-CAM. Most of the production training programs are noncredit, except for Kellogg's, which has a unique setup whereby students successfully completing the production program can earn 8.74 credits, which can be articulated to Kellogg's Industrial Trade programs.¹⁸ The consortium colleges operating production programs chose to align their production programs with the Manufacturing Skills Standards Council's (MSSC) Certified Production Technician (CPT) certification. The CPT certification has five modules: safety, maintenance awareness, production processes, quality practices and management, and green production. As part of the noncredit course repertoire, three M-CAM colleges have delivered production training programs as part of their workforce development, customized training, and/or incumbent worker training programs. Coordination of the production training programs through workforce development divisions provided the colleges with a unique opportunity to package the production training to meet the specific needs of local employers in their communities and meant that all or some combination of MSSC CPT certifications could be offered to an employer.

¹⁸ While considered an entry-level training program, Kellogg's KAMA production is listed as a credit program because students successfully completing the program receive academic credit that is transcribed onto their college record.

New Production Programs

Grand Rapids, Lansing, and Mott introduced a total of six new noncredit production training programs with M-CAM funding (Exhibit 30). Employer interest motivated the colleges to build capacity in this area. Grand Rapids created three new programs leading to an Industrial Sewing Certificate, a CPT Certificate, and a Manufacturing Readiness Certification and added ancillary certifications to the training, such as OSHA 30 safety, forklift, and first aid. Lansing and Mott both introduced new MSSC Certificate programs, and Mott added OSHA 30 safety as an ancillary certification. The production training programs at Grand Rapids varied in length from a one-week introductory class to an eight-week intensive training program for industrial sewing, which was developed specifically by Grand Rapids for a local employer.

Mott developed one production training program called Production Operations that led to a MSSC CPT certification and OSHA 30 certification whereas Lansing developed two new noncredit production training programs, one an introductory course lasting eight hours and built for a local employer and another more robust 164-hour training program leading to both a college certificate and the MSSC CPT certification.

Exhibit 30: New Noncredit Production Operations Programs by College

COLLEGE	PROGRAM	CREDENTIAL(S)	TRAINING PROGRAM DURATION
Grand Rapids	Industrial Sewing Certification	Certificate of Completion MSSC - Quality	8 Weeks
Grand Rapids	Manufacturing Readiness Certification	Certificate of Completion	1 Week
Grand Rapids	Certified Production Technician	Certificate of Completion MSSC – CPT OSHA 30 Forklift First Aid/CPR	5 Weeks
Lansing	Certified Production Technician	Certificate of Completion MSSC – CPT	164 Hours
Lansing	Simulated Production Environment	Certificate of Completion	8 Hours
Mott	Production Operations	MSSC – CPT OSHA 30	276 Hours

Enhanced Production Programs

Grand Rapids, Kellogg, and Lansing also enhanced four existing production training programs using TAACCCT grant funding (Exhibit 31). Three of the training programs were noncredit—one at Grand Rapids and two at Lansing—whereas Kellogg’s KAMA program was credit-bearing.

In response to employer demand, Grand Rapids added the MSSC-CPT quality certification to its Advanced Manufacturing Certificate program and added Amatrol online content to the course (i.e., videos, exercises and theory) as well. Lansing updated the curricula of its Problem Solving for Production and Team Building for Production certificate programs by adding new activities; it also added a leaders' guide to the curriculum for the Problem Solving program.

Kellogg enhanced its Kellogg Advanced Manufacturing Assembly (KAMA) credit program using M-CAM funds. KAMA is a manufacturing assembly training program that incorporates foundational skills and occupational skills training and runs from 8:00 a.m. to 4:30 p.m. Monday to Friday for four weeks. KAMA was originally created in 2013 through Goodwill's Essential Skills Demanded by Great Employers (EDGE) program as a partnership between the community college, Goodwill, Michigan Works!, and an economic development organization called Battle Creek Unlimited. It was funded by the W.K. Kellogg Foundation and targeted low-income residents in Battle Creek, MI for enrollment.

The KAMA program includes 32 hours of hands-on production simulation and 33 hours of soft skills instruction (covering professionalism, interviewing, stress management, financial literacy, time management, etc.), computer applications, workplace math, workplace writing, and then technical training related to production. The technical training covered workplace competencies (Introduction to manufacturing, 5-S, Kanban, value stream mapping, problem solving, and team building) and industry-wide entry-level competencies (OSHA 10 safety, Lock Out Tag Out, lifting and tool safety, and lean manufacturing). Upon successful completion, students received a total of 8.74 credit hours that articulated to other Industrial Trade and workforce degree programs at Kellogg. M-CAM funds were used to expand the foundational skills components of the KAMA program by adding Edmentum as an online tool for skills remediation. Over half of all M-CAM participants at Kellogg were enrolled in the KAMA production training program (269 out of 507 participants). The program was offered 17 times during the grant period, each with a cohort of 15–20 students.

Exhibit 31: Enhanced Credit and Noncredit Production Operations Programs, by College

COLLEGE	PROGRAM	CREDENTIAL(S)	TRAINING PROGRAM DURATION
Grand Rapids	Advanced Manufacturing Certificate Program	Certificate of Completion MSSC - Safety	Noncredit 4 Hour Modules
Kellogg	Kellogg Advanced Manufacturing Assembly (KAMA)	Certificate of Completion OSHA 10	Credit 164 Hours
Lansing	Problem Solving for Production	Certificate of Completion	Noncredit 8 Hours
Lansing	Team Building for Production	Certificate of Completion	Noncredit 8 Hours

PRODUCTION STUDENT CASE STUDY

Student: *Ashton Lane (pseudonym)*

Pathway: *Production*

Ashton is a 55-year old African-American male with a background in carpentry and custodial maintenance. He did not graduate high school and when he entered prison at 35, he tested at a third-grade reading level. Within his first year of incarceration he acquired his GED, and continued his occupational skills training. Prior to his incarceration he held a variety of temporary factory jobs, working for several employers in the region.

Ashton enrolled in an M-CAM production program and connected with an employer through a job fair hosted at the college, and that employer eventually hired him full time.

“I’m very satisfied. Actually, I feel like I’m just blessed because of that job and going through the...program at that time, um, I really was looking for work and I felt that since I hadn’t been in the field in a while it was gonna be hard for me to get one. Cause I had such a gap in my work history.”

The technology and equipment used in his training program was the same set-up he used on the job. Working with a familiar workplace set-up gave Ashton the confidence he needed at his current employer and allowed him to demonstrate his knowledge of the tools and production processes. After six months at the company, Ashton was promoted.

“[What’s] the best thing? Actually everything was the best. Everything was good, because a lot of it was new to me as far as the educational part.... It’s the part that made me feel inferior back in the day. That I couldn’t do it, I couldn’t achieve things...And I told my [parole officer], I’m going to be the success story. That’s what keeps me motivated. This program kept me motivated. This program helped me to know and feel comfortable that I can move forward.”

Enhancements to Equipment, Facilities, and Hands-On Learning

Grand Rapids used M-CAM funding to purchase industrial sewing machines and industrial surgers for its Industrial Sewing Certification program, but none of the other M-CAM colleges offering production training purchased any new equipment for this pathway. Most of the equipment that is used for production training is the same equipment that is used in the three other M-CAM career pathways—Welding, CNC machining and Multi-Skilled/Mechatronics—so M-CAM staff members assigned these equipment purchases to the other career pathways.

Student Perspectives

Based on feedback from students we spoke with in focus groups and for case studies, the production programs at M-CAM colleges appeared to be providing students an important bridge into training by broadening their horizons. “It made me want to go to college,” said one student. “[It] helped me get my foot in the door for college.” The program “kept me motivated,” said another student.

Several students also appreciated the quality of instruction, especially the hands-on and interactive style of teaching. Below, two students described what they valued about their production program instructors:

The best parts of the program were how the instructor interacted with everybody and worked with everybody. It made the content easier to get through. They would take people that were struggling and work with them. If they had questions every instructor was great about answering them and explaining. That is what made it easy.

– Student, Kellogg

I valued all the instructors; they encouraged everybody to step up and be a leader. Not to just sit back and let me get my work done and not care about someone else. They encouraged us to be team-oriented and help somebody and say, “What are you struggling with?”

– Student, Kellogg

Student survey data collected throughout the course of the M-CAM grant for students who completed their training programs showed that 95 percent of production students were satisfied with their training programs and many reported high levels of satisfaction with the counseling, academic support, and personal help they received from career coaches. Exhibit 32 provides a breakdown of student survey results for the production pathway.

Exhibit 32: Production Pathway Student Survey Responses

PRODUCTION PATHWAY	M-CAM AVERAGE (N = 126)
Satisfied with training	95%
Satisfied with counseling	87%
Satisfied with academic support	88%
Satisfied with personal help	91%
Satisfied with job search assistance	82%

Although there are limited data on exactly how students transitioned from production programs to more advanced and specific manufacturing pathways, student feedback indicated that the training had a positive effect on students' perceptions of education and its value for improving their future career options. Even though graduates of production programs were likely to earn less than their counterparts in the core career pathways, they were still in the early stages of career advancement and some were likely to return to climb higher up one of the career pathway ladders.

PRODUCTION STUDENT CASE STUDY

Student: *Billy Jones (pseudonym)*

Pathway: *Production*

Billy, a 44-year-old African-American male, was recruited to the M-CAM program through a community presentation conducted by the M-CAM career coach. He had no prior college experience and very little employment history, but desired a formal education that could help him achieve his life goals. The career coach guided him through the enrollment and application process and he was encouraged to enroll in the production training program.

After completing the entry-level production program in June 2015, Billy had a difficult time finding a job and was feeling discouraged. With assistance from the M-CAM career coaches he secured an entry-level position through an employment agency with a local automotive parts manufacturer. After working for a short period, Billy was hired on permanently by the company.

Billy decided to pursue additional skills training and enrolled in the college's Electricity/Electronics Certificate program, again with assistance and guidance from his M-CAM career coach. He completed his one-year certificate program and was starting his coursework for his Associate's degree. He credits the M-CAM production program with helping him realize his potential.

Online Learning

Offering online courses—including hybrid classes that have online components—is a strategy that has been shown to be effective in making training programs more flexible and accessible to non-traditional students. Because students can fit online courses into their schedules more easily and access them from anywhere with an internet connection, promoting this form of training is often a key strategy for community colleges that seek to broaden access to their training programs. Many colleges and universities across the country are currently shifting some of their curricula online, part of a larger trend towards greater use of distance education.

However, advanced manufacturing training is, by nature, more hands-on than education in other disciplines, so the M-CAM consortium found it challenging to implement training programs that were delivered purely online. Nevertheless, the consortium was determined to leverage the advantages of the online format. Several faculty members noted that some introductory-level content for training in advanced manufacturing—such topics as technical terms, standards, safety procedures, and computer aided drafting—is conducive to presentation in an online format. With this kind of content in mind, the M-CAM colleges, instead of developing online-only courses, incorporated online learning into their career pathways using learning management software from for-profit companies (i.e., AmatroL, Edmentum), non-profit organizations (i.e., Tooling U), and consortiums (i.e., AMTEC). As shown in Exhibit 33, M-CAM colleges integrated a wide variety of learning management software and online content into their advanced manufacturing programs.

Exhibit 33: Online Learning Management Software

COLLEGE	TOOLING U	EDMENTUM	AMATROL	OTHER ONLINE CONTENT
Bay				PLC Learn
Grand Rapids			 *	Lincoln Electric
Kellogg			 *	Arc Flash FANUC MSSC OSHA10/OSHA30
Lake Michigan	 *			
Lansing				AMTEC MSSC
Macomb			 *	Dassault Systems (CATIA)
Mott				MSSC
Schoolcraft				CNC Simulation Immerse2Learn

*Colleges using these applications prior to M-CAM

Usage of Tooling U online content varied considerably among the among the M-CAM colleges (see Exhibit 34). Macomb and Kellogg requested the most seats. Mott did not request any Tooling U seats because they used their own system (described below) and Bay requested 40 seats, but did not use any of its licenses as of January 31, 2016. In addition, some colleges requested large numbers of Tooling U seats, but as the exhibit shows did not use their allotted seat time for various reasons. The main reason seats were left unused is that many colleges used Tooling U to supplement existing content delivered in their noncredit and credit classrooms and many students did not feel the need to gain additional content knowledge through Tooling U. In contrast, Macomb’s CNC machining instructor took full advantage of the Tooling U content and integrated it into his classroom-based instruction, requiring students to use the online content in his class.

Exhibit 34: Tooling U M-CAM Usage

COLLEGE	REQUESTED SEATS	UNUSED SEATS	ACTIVE SEATS	COMPLETED CLASSES	AVERAGE STUDENT COMPLETION	PASSED CLASSES	AVERAGE STUDENT PASSED	AVERAGE STUDENT TIME IN CLASS (MIN)
Bay	40	40	0					
Grand Rapids	5	0	0	115	23	108	22	558
Kellogg	600	180	347	2,706	7	2,598	6	359
Lake Michigan	100	18	67	3,195	40	3,087	39	1635
Lansing	114	59	7	762	14	739	13	552
Macomb	544	97	301	4,317	10	3,977	9	587
Mott								
Schoolcraft	16	2	8	133	10	129	9	490

Requested Seats – Number of seats requested by facility

Unused Seats – Seats requested, but not activated

Active Seats – Number of activated accounts

Completed Classes – Total classes completed, both failed and passed

Average Student Completion – Average number of classes completed per student

Passed Classes – Total classes passed only

Average Student Pass – Average number of classes completed per student

Average Student Time in Class – Average time in class per student (started, completed, failed) in minutes

Colleges that had the most students completing classes included Grand Rapids (23), Lake Michigan (40) and Lansing (14). Colleges that used Tooling U reported that it was mainly used in noncredit production, welding, and CNC machining career pathway training programs and in credit welding, CNC machining, and multi-skilled career pathway education programs. Interestingly, Lake Michigan had been using Tooling U prior to the TAACCCT grant and thus was used to using the platform as part of its instructional design.

The reasons that Bay and Mott gave for not adding Tooling U included a lack of sufficient computer lab space near the manufacturing training area and resistance from faculty members rooted in a feeling that their students required a lot more one-on-one instruction to be successful.

The other commonly used online learning management software (used by Grand Rapids, Kellogg, Macomb, and Schoolcraft) was Amatrol.¹⁹ These colleges reported that they had either used M-CAM funding to purchase Amatrol training equipment in their labs or had existing Amatrol equipment that included online content and learning activities. These trainer systems came with interactive multimedia, print-based student learning materials, and instructor guides and manuals.

Seven colleges undertook independent efforts in the area of online instruction. Kellogg, Lansing, and Mott used MSSC-aligned online course content for their production pathway programs. This MSSC-aligned content is available in a hybrid form with classroom instruction and online components.

Lansing was part of the AMTEC collaboration of community and technical colleges and industry partners that had been working together to address automotive skills needs. Thus, Lansing purchased an AMTEC trainer that also had online and interactive course content for students and instructional materials for instructors, and this trainer was used to develop hybrid courses. M-CAM colleges also reported using other learning management software to provide online content, such as OSHA 10 and OSHA 30, Lincoln online welding content, and FANUC robotic online content.

Bay College embarked on an effort to create a new online gaming-inspired course in the Multi-Skilled/Mechatronics pathway, LearnPLC, which is open source and entirely online.²⁰ Bay used M-CAM funds to contract with Michigan Technological University (Michigan Tech) to create this interactive gaming-style course on programmable logic controllers (PLCs). As shown in Exhibit 35, Learn PLC has 12 modules: Binary and Decimal, Logic Gates, Hardware, PLC Simulator, Timers, Counters, Sequencers and Shift Registers, Program Control, Math Instructions, PLC Installation & Troubleshooting, SCADA, and Water Treatment. Users create a free account online, and then they can proceed in a self-guided manner through each module. Bay incorporated this curriculum into its new Multi-Skilled/Mechatronics certificate program and existing water technology program. The software is licensed as free software under a General Public License (GPL), which allows end users to run, study, share, copy, and modify it. Bay also has an online circuit fundamentals course that is online, but it was not developed using M-CAM funds. Bay incorporated this curriculum into its new Multi-Skilled/Mechatronics certificate program and existing water technology program. Bay also had an online circuit fundamentals course that was online, but it was not developed using M-CAM funds.

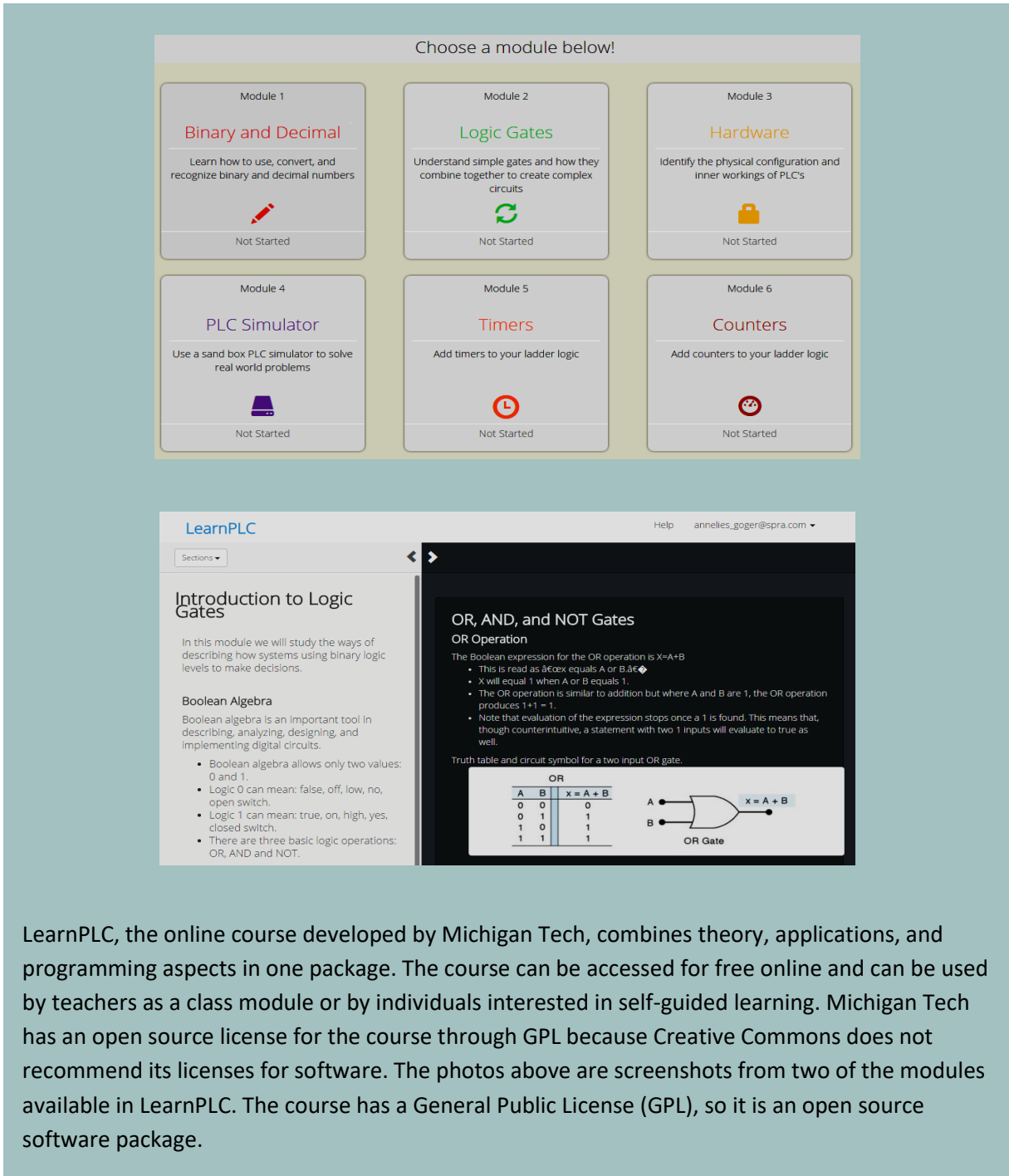
¹⁹ A private company, Amatrol provides skills-based, interactive technical learning. Amatrol's learning management system includes interactive multimedia as well as print-based student learning materials, virtual trainers, teacher's guides, industrial quality hands-on training equipment, and instructor training.

²⁰ <https://plc.csl.mtu.edu/>

Kellogg showed that online content delivery can be effective. Kellogg allowed students to take their content-related instruction via online modules and to practice exercises and work-related scenarios in an open lab environment. This instructional approach provided students flexibility to schedule and review technical content on their own schedule while also providing them the opportunity to practice the application of their theoretical knowledge in the lab. To complete Kellogg's training modules, students had to achieve an 80 percent competency level on quizzes and tests and exhibit mastery of key concepts by completing hands-on demonstrations for a faculty member. This training model was shared with the other M-CAM colleges, and Lansing decided to implement a blended instructional design approach with its newly developed mechatronics program. Lansing had students learn content via online modules and had open lab hours staffed by instructors where students could master content in a hands-on environment.

M-CAM colleges faced two main challenges in meeting their targets for the development of online and hybrid courses. First, many faculty members felt that online instruction was not compatible with their teaching or with the needs of local manufacturing employers, who preferred students with strong technical and hands-on learning experience. Faculty and instructors believed that the students they work with require one-on-one assistance and encouragement to stay motivated in advanced manufacturing coursework—especially older students, who often struggle with basic computer skills. Some faculty also held the view that manufacturing, by its nature, required a learning-by-doing approach that familiarized students with the machinery and the production process in a real-world setting. Second, faculty and staff members reported that they did not have sufficient time to work on multiple pieces of the TAACCCT grant at once, so they focused their efforts on curriculum upgrades, articulation, equipment acquisition and integration, and aligning programs to employers' skills needs. As Kellogg's project director said, "The same groups working on the Online Learning Communities and MOOCs are overburdened with curriculum alignment pieces."

Exhibit 35: Screenshots of Selected Modules in the LearnPLC Dashboard and Online Programmable Logic Controllers Course



Conclusion

Because the strategies the M-CAM consortium used to facilitate access to advanced manufacturing pathways—foundational skills training, entry-level production training programs, and the incorporation of online content—all required a high level of intra- and inter-institutional coordination to achieve, implementation was gradual and beset with a variety of challenges. Nevertheless, the consortium colleges made a significant effort to advance the adoption of a career-pathways model for their advanced manufacturing training programs. The TAACCCT grant was instrumental in providing the resources—staffing and funding—for the colleges to test new online foundational skills training content with a cohort of their advanced manufacturing students and to utilize new online content to help students understand technical content. Five of the eight M-CAM colleges found it valuable to respond to employers’ needs for skilled labor and created entry-level production training programs. As of the grant’s end, four percent of Production students (28 students) had pursued additional post-secondary training, which suggests that these programs can serve as a gateway for additional advanced manufacturing training.

CHAPTER 8:

Coaching and Student Support



Prior to receiving TAACCT funding, the M-CAM consortium colleges recognized that the career coaching and support services available to students interested in enrolling in advanced manufacturing programs were insufficient. To address this gap, all eight colleges instituted, as part of the M-CAM initiative, an intrusive case management and career coaching model under which students received a wide variety of counseling and support services, including academic advising, help with educational planning, career coaching, job search and job placement assistance, and referrals for supportive services.

This enhanced student coaching and support was considered essential to the M-CAM initiative's success because many community college students face significant barriers that can, if unaddressed, cause them to drop out.²¹ These barriers include, but are not limited to, being unprepared for college-level coursework, having competing work and family obligations, lacking experience in navigating complicated bureaucratic college enrollment and financial aid systems, lacking reliable transportation, and lacking the financial resources to cover their education costs.²² Several research studies have shown that additional counseling—especially when that counseling is required and provided throughout a program of study—is an effective way to improve student performance and increase completion rates.²³ Few community colleges, however, have the resources to provide such assistance.

TAACCT grant funding provided the M-CAM colleges the opportunity and resources to offer enhanced counseling and support by funding additional staff positions. These staff members developed closer referral linkages with workforce development agencies, community-based organizations, faith-based organizations, and other partners who provided supportive and counseling services to M-CAM students.

This chapter describes the methods used to deliver career counseling and student support, the staffing of this function, and the types of services provided to M-CAM students. It also discusses some of the challenges encountered by the M-CAM colleges as they implemented the intrusive case management

²¹ Of the cohort of students that entered a certificate or AAS program in 2010, only 19.5 percent completed their programs within 150 percent of the expected normal time. National Center for Education Statistics, *Digest of Education Statistics*, http://nces.ed.gov/programs/digest/d14/tables/dt14_326.20.asp.

²² Susan Schrivener and Erin Coghlan, "Opening Doors to Student Success: A Synthesis of Findings From an Evaluation at Six Community Colleges," MDRC (March 2011), www.mdrc.org/sites/default/files/policybrief_27.pdf. Community College Research Center, "What We Know About Nonacademic Student Supports," Teachers College, Columbia University (September 2013).

²³ Ibid. See also Eric Bettinger and Rachel Baker, "The Effects of Student Coaching in College: Evaluation of a Randomized Experiment in Student Mentoring," NBER Working Paper 16881, www.nber.org/papers/w16881.pdf.

and career coaching model and describes their plans for sustaining the counseling and student support positions and services.

M-CAM’s Career Coaching Model

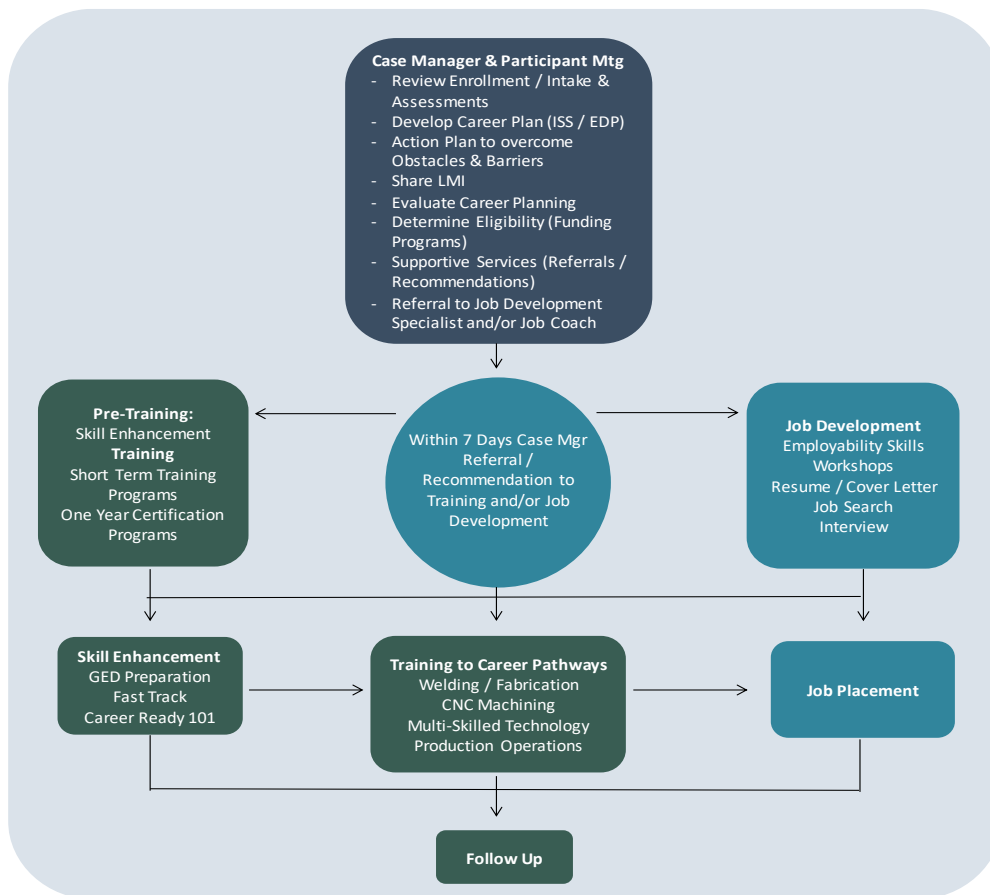
Working collaboratively, all eight M-CAM colleges identified key services that would be incorporated into the consortium’s intrusive case management and career coaching model. One of the main tenets of the model was that the delivery of student counseling and support should be focused on providing to a given student the help and support he or she needed to achieve academic success and improve his or her employability skills and job placement prospects.

“Students need to feel a connection with their college and staff and so the college needs to make students feel welcome and not like they are burdening anyone.”

Faculty member, Macomb

Exhibit 36 below provides a detailed diagram outlining the counseling and supports provided to M-CAM students under the TAACCCT grant’s career coaching model.

Exhibit 36: M-CAM Career Coaching Model



This diagram illustrates that existing college staff members and grant-funded career coaches worked closely with students to aid with intake and enrollment, assessment, educational and career planning,

financial aid, supportive service needs, pre-training and training activities, job search and job placement assistance, and follow-up for up to three months after training completion.

Under this model, counseling and support were not distinct from other college functions like enrollment and training. In practice, then, a variety of college personnel with different job titles participated in providing the counseling and support that students needed to succeed.

Team-Based Approach to Student Support

Under the team-based approach to student support envisioned by the M-CAM colleges, grant-funded college staff members collaborated with permanent college personnel (such as admissions counselors and college career center staff members) and entities external to each college (including employers, economic development agencies, Michigan Works service center staff members, and faith- and community-based organizations) to provide the full spectrum of counseling and support students needed to successfully complete their training and obtain employment.

Although students seeking counseling and support at most colleges might interact with any number of external agencies and non-grant-funded college staff members, it was the grant-funded staff members who made up the core of the academic advising and student support system at each college, providing academic assistance and job search/placement assistance services to M-CAM students and helping to coordinate individual students' access to other services, such as financial aid assistance and referrals for supportive services.

As discussed in Chapter 2, each of the eight M-CAM colleges hired, under the grant, a minimum of one staff member whose job description included student support and coaching. Many of the career coaches commented that they did not like to use the term “counselor” when referring to their position because it implied they were trained mental health professionals, which was not the case. For this reason, most of the student support staff members funded under the grant referred to themselves as career coaches, success coaches, or job developers. Although these individuals had a variety of different job titles, the term “career coach” is used throughout this chapter to describe these staff persons.

Five M-CAM colleges—mainly the larger colleges in terms of student population and M-CAM funding—hired additional staff members with grant funds, namely intake and recruitment specialists and specialized job developers, who worked with advanced manufacturing employers on identifying available job openings and work-based learning opportunities and provided counseling, job search, and job placement assistance to students. For example, at Kellogg, the TAACCCT grant funded two-and-a-half career coaches who coordinated all the student support services, such as recruitment, intake, career coaching, and job search and placement assistance. At Grand Rapids, the grant funded four staff positions, two concentrated on recruitment, intake, enrollment, and career coaching and two other positions concentrated on post-training completion services such as resume writing, job search, and placement assistance. At the smallest college, Bay, the project manager was tasked with performing multiple duties, including advising, scheduling and assisting students with job search and placement.

Exhibit 37 shows the broad variation in grant-funded staffing configurations that existed across the eight colleges based on information collected during the four rounds of site visits. Regardless of the number

of grant-funded staff members, each M-CAM college reported working closely with its on- and off-campus partners—mainly college admissions, advising and job placement offices, Michigan Works, Public Welfare Department, employer associations, and community- and faith-based organizations—to provide student assistance. One workforce partner affiliated with Mott stated, “*Our job developers worked with their [job developers] and [the students] all finished and got placed...Our approach is that we are a partnership and a team. We don’t care if Mott gets the credit or we get the credit. What’s important is that we’ve helped the community.*”

Exhibit 37: Grant-funded Counseling and Student Support Staff Members

COLLEGE	TOTAL NUMBER OF GRANT-FUNDED FTES	POSITIONS
Bay	.9	1 90% FTE project manager responsible for intake, career coaching, and job development
Grand Rapids	4	2 Fulltime Career Advisors 2 Fulltime Job Developers
Kellogg	2.5	2 Fulltime Career Coaches 1 Half-time Career Coach
Lake Michigan	1	1 Fulltime Intake Worker, Career Counselor, And Job Developer
Lansing	3	1 Fulltime Success Coach 1 Fulltime Career Coach 1 Part-Time Job Developer
Macomb	4.5	1 Fulltime Intake Coordinator 1 Fulltime Career Coach 1 Fulltime Job Developer 1 Fulltime Soft Skills Trainer 1 Part-Time Soft Skills Trainer 1 Part-Time Recruitment Coordinator
Mott	3	2 Fulltime Client Service Representatives 1 Fulltime Job Developer
Schoolcraft	1	1 Part-Time Career Counselor 1 Part-Time Job Developer/Employment Coordinator

While M-CAM career coaches were the main providers of student support, instructors at the M-CAM consortium colleges also advised students about academic planning and scheduling, provided them with instructional assistance and career advice, and, in some cases, helped connect them to jobs, internships, and apprenticeships. Instructors’ advice was valuable—many had industry experience—and during their scheduled office hours instructors gave students the opportunity to meet and discuss their education and career options. “*Everybody here does it at some level,*” said one faculty member from Lake Michigan, referring to instructors providing students with support and counseling. “*We’re working on those things with our students all the time.*” Bay, the smallest of the M-CAM consortium colleges, stated

that prior to M-CAM the college did not offer any systematic job search and placement assistance to students as the college did not have its own career assistance division, unlike many of the other larger community colleges in M-CAM that had a career services staff for their institutions. So, even though the TAACCCT grant only paid for .9 FTE for those tasks at Bay, TAACCCT participants were still given student support and job search and placement assistance that was not available to all Bay students.

Location of Career Coaches at M-CAM Colleges

The physical location of the M-CAM career coaches and job development staff varied across the consortium. Some colleges, like Macomb and Schoolcraft, initially wanted to locate the career coaches in their existing college student support units (e.g., advising departments, career and employment service offices) to help with the sustainability of these positions, whereas other colleges wanted the career coaches embedded at the advanced manufacturing training facilities so that they were closer to where students were taking their courses. At Schoolcraft, project management staff members thought it was important to have the coach shadow the existing career services staff members and in this way learn about all the available resources at the college, and they felt this best occurred by housing the career coach with the college's Career Services division. Soon, however, the college realized that in-depth student interactions were not taking place and decided it was better to have the career coach and job development staff members embedded where students were taking their classes, so it made the switch during the first year of grant implementation. Macomb had a similar realization and made the switch in the second year of grant implementation. Another college, Bay, had multiple training locations throughout Michigan's Upper Peninsula and found it difficult to serve students at their many college campuses. Bay's career coach stated that she visited multiple campuses, but found it challenging to build in-depth relationships with many M-CAM participants because of the distance between campuses.

Regardless of their location, many of the M-CAM career coaches became involved in serving on local community organization boards, college committees, and faculty workgroups, which helped them build knowledge about college and community resources, raised awareness about their positions and the value of the services they provided to advanced manufacturing services, and improved credit program usage of career coaching and job development services.

Interaction Between Student and Career Coach

The approach to providing students with support through career coaches was generally similar across the credit and noncredit programs, as well as across the consortium colleges.

The Initial Meeting

Generally, career coaches tried to meet with a student at least once, in person, to help the student make informed career choices, complete the enrollment process for the college and the TAACCCT-funded grant, complete and review the results of assessments, and develop an individual employment development plan before the student officially started his or her training program.

This initial meeting was important to building a successful relationship between the student and career coach for several reasons. First, the career coach could make sure that the student understood the

requirements of both the TAACCCT grant and the training program in which they wanted to enroll. Second, the coach could assess the student's academic readiness and determine whether the career the student sought seemed like a good fit. If a student was basic skills-deficient, especially in reading and/or mathematics, the career coach could counsel the student about academic remediation or tutoring services; the coach might also try to guide the student in a different direction in terms of career selection and training options based on the academic skills needed to complete the program. In one instance, a career coach helped a student decide to enroll in a noncredit Multi-Skilled/Mechatronics program based on his assessment results. The career coach stated that, when compared to the credit program, the noncredit program was a better fit for the student because it was self-paced and had multiple online tutorials built into the training modules, which the student could use to remediate. The student stated, "[the career coaches] are doing a really good job as far as making sure you have the tools that you need" to succeed.

Third, at some colleges, career coaches used these initial meetings to help students develop class schedules that were convenient and minimized commuting time and costs, and ensured that students did not enroll in classes that would not count toward program completion. Student focus group participants commented on how helpful this assistance was to them. For example, one focus group participant stated that his M-CAM career coach helped him to maximize credits earned from another college program so that he could complete an advanced manufacturing certificate program in a shorter period while still maintaining his employment.

Fourth, these meetings helped career coaches establish personal relationships with students. M-CAM career coaches stated that having an established relationship made students more likely to seek help from coaches after enrollment and provided an opportunity for coaches to collect needed follow-up information once students exited TAACCCT-funded services. Student focus group feedback suggested that many students did not feel they needed assistance from the career coaches and did not actively pursue services even if they were made available to them. Thus, M-CAM's model of being **intentional** and **deliberate** about providing student supports was beneficial because it helped students to understand the value of such services and created a non-threatening environment for beneficial interaction.

"I think the success coach function has been very successful in terms of providing students with the assistance they need to enroll in the college, make informed decisions and have the support system there if they do face challenges."

Faculty member, Grand Rapids

"[The career coaches] really take time out...they show[ed] us that they really care about us and want us to move forward and stuff. And there are times when they have to be stern and there are times when, you know they just they're real friendly. And it's just the hospitality of the program. It's just awesome."

Student, Lansing

Subsequent Interaction

Career coaches used a variety of methods, both formal and informal, to interact with noncredit and credit M-CAM students after the initial meeting. Once the initial face-to-face meeting occurred, a career coach might call a student on the telephone (the most common method), send an email, meet in-

person, send a text message, or use any combination of these methods. Staff members at Schoolcraft reported using an email newsletter to share program information with students and to encourage them to utilize the career counselor services. Another unique method of contacting students was using a list serv of students enrolled in M-CAM training programs to send group texts about available job openings.

The frequency and nature of subsequent interaction between students and career coaches was in part a function of coaches' accessibility. In general, student focus group participants stated that career coaches made themselves readily available and were always willing to assist them regardless of the issue. Many career coaches reported that they responded to phone calls and emails from students every day, including late at night and on weekends. While it was difficult for M-CAM colleges with small career coaching staffs to engage with students as frequently as desired, most M-CAM students we interviewed felt that career coaches worked hard to engage them and address their concerns and needs. Student focus group participants affirmed that career coaches were generally quite accessible, with one Bay student commenting that he and another student "*stopped at [the career coach's office] pretty much every Friday.*" Having this kind of "open door" policy was one way career coaches made themselves available to students. A student at Lansing who was enrolled in a noncredit production training program was re-incarcerated for 90 days for violating parole and as a result was unable to contact the career coach to let her know. The career coach contacted the student's mother, who explained his "mysterious disappearance" from the program. After he was released, the career coach helped him enroll in the next production training cohort so he could complete his training. The student was impressed that the career coach was willing to go so far to assist him and help him be successful.

Level of Interaction

The intention of the M-CAM intrusive case management model was to offer the same intensity of counseling and student support services to *all* students enrolled in the M-CAM career pathways at the respective colleges. In practice, the frequency of interaction with students varied significantly across colleges and between noncredit and credit program students. Most career coaches reported having contact of some kind with most students at least once a month. Some career coaches, especially those involved closely with noncredit programs, reported having daily to weekly contact with most students. This was the case in several colleges where the career coach played a role in also delivering portions of the foundational skills training associated with the noncredit training. Exhibit 38 documents the variation in the average amount of interaction career coaches at the different colleges had with students.

The four M-CAM colleges that offered robust noncredit workforce development programs in addition to credit training programs—Grand Rapids, Lansing, Macomb and Mott—found that noncredit students tended to have more frequent interaction with their career coaches than the credit students. M-CAM career coaches stated that the frequencies they reported are averages, and that some students required more frequent contact with career coaches to address academic and life situations. "The old rule of 10 percent of students take 90 percent of your time," applied to M-CAM training programs, according to a Grand Rapids career coach.

While the frequency of student interaction with career coaches tipped in favor of noncredit students for the colleges offering both types of programs, a few colleges noted this finding—as reported in the mid-

project report—and made a concerted effort to increase faculty members’ interaction with credit students. For example, Mott’s president made a deliberate effort to bridge the divide between how credit and noncredit students were treated at the college and worked hard to break down silos across the college’s workforce and academic program divisions.

Exhibit 38: Frequency of Career Coach Interaction with M-CAM Students

COLLEGE	CREDIT STUDENTS	NONCREDIT STUDENTS
Bay	Monthly	Not applicable; operated mainly credit programs
Grand Rapids	As Needed	3 Times Per Week
Kellogg	Monthly (Regular Industrial Trades Program) Daily (KAMA Production Program)	Not applicable; operated credit programs only
Lake Michigan	2-3 Times Per Semester	Not applicable; operated credit programs only
Lansing	As Needed	2–3 Times Per Training Program
Macomb	As Needed	5–6 Times Per Training Program
Mott	As Needed	Monthly
Schoolcraft	2 Times Per Week	Not applicable; operated mainly credit programs

The disparity between credit and noncredit students in the level of interaction with career coaches (at colleges that offered both types of programs) occurred for several reasons. Career coaches reported that one major reason was that credit students could bypass the M-CAM career counselor and enroll online under the colleges’ “open enrollment policies” whereas noncredit students were required to meet with a M-CAM career coach to enroll.

Another major reason cited by career coaches for the differing levels of interaction between credit and noncredit students was that many of the M-CAM noncredit programs included built-in interaction between career coaches and students. Career coaches helped noncredit students select a training program, complete assessments, and complete paperwork, and at the end of training assisted students with job search and job placement. In many cases, these student and career coach interactions were fostered through the foundational skills training component, which was either embedded in the noncredit training programs or offered as a separate workshop near the end of the industry-specific coursework.

“Thanks to all the [career counselor’s] help through the TAACCCT grant, I had all the support and help I needed and now I am ready to go forward a with a great resume and career help to get the job I want!”

Student, Bay College

College staff members identified at least three further reasons why noncredit students received the lion’s share of the career coaches’ time. Many career coaches commented that noncredit students required more attention than credit students because the training programs affiliated with noncredit workforce development programs were short and fast-paced and required career coaches to log daily

attendance and address absenteeism. In addition, they said, noncredit students tended to have lower basic skill levels than credit students and some noncredit students lacked strong work histories, so they required more support and intervention to succeed in training and obtain employment after training completion. Finally, career coaches said that many credit students received advice or support from faculty members and staff members in other college departments.

Although various factors favored noncredit students in terms of obtaining support from grant-funded staff members at Grand Rapids, Lansing, Macomb, and Mott, career coaches were aware of this systemic bias and tried to have at least monthly contact with credit students enrolled in M-CAM career pathway programs. Career coaches sometimes had to “track down” credit students to have them complete enrollment paperwork after they started attending advanced manufacturing classes enhanced by M-CAM. Career coaches reported making frequent visits to credit classes to discuss M-CAM services and to encourage students to schedule appointments to meet with them. Career coaches also spent time roaming the hallways to talk with credit students and see if they needed any assistance. Despite these pro-active strategies, however, many M-CAM career coaches reported that they relied on credit students to seek out services and assistance from the career coach when they needed assistance. (This was not the case in Kellogg’s cohort-based entry-level production program, where students received academic credit and were required to meet with a career counselor at the start of the class. Kellogg’s career coaches stated that they tracked students’ attendance and progress in the production program frequently and often.)

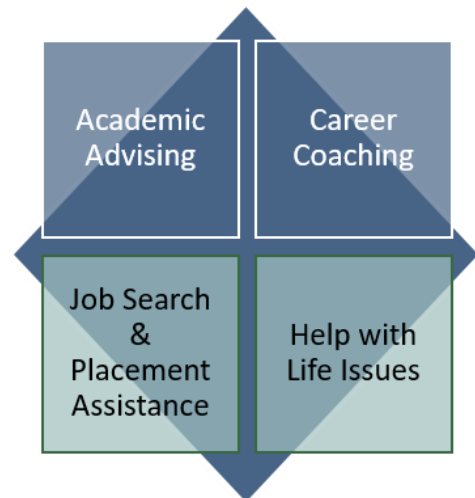
When career coaches were asked about their process of engaging students, noncredit and credit, they stated the following:

- **Visibility and accessibility are important facets of encouraging student interaction.** Career coaches stated that having offices near the places where students take classes, conduct labs, or congregate helped increase their visibility and made them accessible to students. Colleges that housed the career coach in separate buildings or on another campus found the distance impeded student interaction.
- **Being proactive with students helped increase interactions.** Several career coaches stated that waiting for students to come to their offices did not work, and that career coaches had to be deliberate about engaging students. Some career coaches stated that they would “roam” or “hang out in the hallways” to develop rapport and let students know they were available.
- **Taking time to get to know students helped build trust.** Spending time to establish rapport with students helped career coaches increase their interaction with students. Career coaches stated that it “takes time” to develop trust, so simple activities such as walking with students to their classes, taking them to the bookstore, and introducing them directly to college personnel were helpful in establishing relationships.

Types of Support Provided to Students by M-CAM Career Coaches

M-CAM career coaches provided support to students in four primary areas: academic advising, career coaching, job search and placement assistance, and life issues. Each of these areas is discussed in greater detail in this section. In addition to providing student services and supports, many career coaches also spent a significant amount of time documenting individual student services to meet grant reporting and evaluation requirements. Thus, case management was a large piece of the career coaches' position. In the initial phase of grant implementation, career coaches spent a large amount of time on recruitment, intake and career counseling functions, but as the grant was coming to an end the focus switched to job development, placement and documenting participant outcomes.

Exhibit 39: Supports Provided to M-CAM Students



Academic Advising







M-CAM career coaches provided students with several types of academic support. They helped students select a career pathway and training program and choose courses, set up class schedules, navigate the college enrollment process (e.g., college paperwork, assessments, financial aid), improve study skills, and access college tutoring services.

In the academic advising mode, career coaches assisted students in the following ways:

- **Helped students identify an appropriate career pathway and select a training program.** Using the career pathway models and other labor market information, career coaches helped students make informed decisions about their academic program of study. As part of the career pathway and training program selection process, M-CAM career coaches also gathered detailed information from students to develop an individual Employment Development Plan (EDP). The EDP included information about the student's skills, abilities, assessment results (if available), educational history, employment history, vocational and skills remediation needs, finances, demographics, and career goals (short and long-term). Career coaches documented EDP development in an electronic case file for students using the consortium's ETO data collection system. The EDP was created during the initial intake process and updated periodically as needed.

- **Assisted with placement in academic and career readiness programs (i.e. foundational skills programs).** As described in Chapter 7, all eight M-CAM colleges either developed or referred students to foundational skills programs. Career coaches played a key role in identifying which students would benefit from participation in a foundational skills program, as opposed to immediately enrolling in one of the career pathway training programs. In some instances, the career coaches even accompanied the student to the college tutoring center or remediation program office, which resulted in greater utilization of services and showed students the career coach’s willingness to assist the student.

Exhibit 40: Core Features of Academic Advising Services Provided to M-CAM Students

Career Pathway and Training Programs	
Career Readiness Programs	
Course Selection and Class Schedules	
College and/or TAACCCT Enrollment Processes	
Study Skills Assistance and Access to Tutoring	
Student Attendance and Achievement	

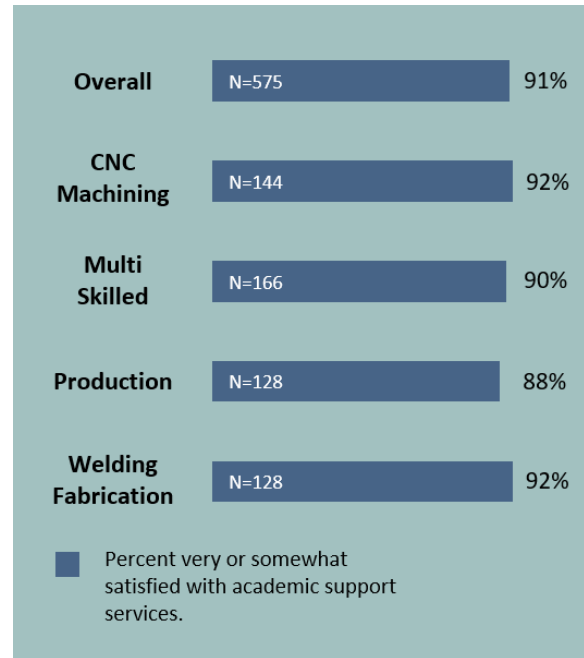
- **Assisted with course selection and class schedules.** M-CAM career coaches assisted students with making course selections and setting up class schedules that were as convenient as possible for students. At M-CAM colleges that offered credit programs, career coaches worked with students at the beginning of each semester to help them select classes and make course schedules. They did this to make sure that students did not waste time on classes that would not count toward completion of their programs of study and to accommodate students’ work schedules, given that so many students enrolled in M-CAM training programs were incumbent workers. This assistance was particularly important for students who were dealing with barriers such as significant work or family obligations or transportation difficulties.
- **Assisted with enrolling in a college and in the TAACCCT grant.** M-CAM career coaches helped students navigate the college and TAACCCT enrollment processes; this included helping students complete required college applications, schedule assessment exams, and complete financial aid documentation. Several focus group participants from across the M-CAM colleges reported that assistance with the college enrollment process was very valuable to them and helped to make their transition to college easier.
- **Provided study skills assistance and access to tutoring.** Career coaches helped students develop the study skills they needed to succeed in their training programs. For example, noncredit students usually received some information at the beginning of their programs about the importance of attending classes and the need to come to class prepared. Career coaches also commonly helped credit students access tutoring offered elsewhere on campus. One M-CAM student at Lansing commented that the career coach was instrumental in helping him to obtain additional time to take his exams due to his diagnosis of post-traumatic stress disorder (PTSD). Without this assistance, the student stated that he would have likely dropped out of the training program.

- **Provided information about career ladders and assisted students in understanding articulation opportunities.** In limited cases, noncredit and credit students also received valuable information about building a career ladder that could start out in noncredit programs and build to one-year certificates to two- and four-year degrees. Through M-CAM, the community colleges built pathways for their advanced manufacturing training programs, which career coaches used to hold meaningful discussions with students about advanced manufacturing career ladders and to help them make informed decisions about employment options.
- **Monitored student attendance and achievement.** Career coaches from six M-CAM colleges reported monitoring student attendance and achievement to identify students who were struggling in their training programs. Several career coaches commented that monitoring student attendance and progress from the start of training helped them to assist students in obtaining remediation before they fell too far behind and to overcome other challenges affecting their performance in class (e.g., childcare and transportation issues). The career coach at Lake Michigan, for instance, was instrumental in helping students maximize their educational credential attainment as she conducted in-depth reviews of students' completed coursework and filed needed paperwork for students to obtain their college certificate or degree. According to the college dean, "They need one class. [The career coach] went through and did grade-ups for every one of the [M-CAM] students, and they've been working with [students to identify class substitutions]. She would come to class and say, 'Hey, you have enough for a certificate.' Even so much that [the career coach] filled out the paperwork for them too. So really all they need to do is sign their name to it." The career coach stated that many students do not understand the process of substituting classes to receive academic credit and to apply that to a college certificate or degree program, but she was able to help students navigate that process and obtain their academic credentials.

Student survey data indicated that 91 percent of respondents across all four M-CAM career pathways were very or somewhat satisfied with the academic support services received through M-CAM. Satisfaction with academic support services varied slightly across the four career pathways: the percentage of respondents giving a rating of very satisfied or somewhat satisfied ranged from 92 percent for the Welding pathway to 88 percent for the Production pathway. Overall, satisfaction with academic support services varied slightly across credit and noncredit programs, with 93 percent of credit program respondents giving a very satisfied or somewhat satisfied rating versus 89 percent of noncredit students.

The survey data and qualitative student focus group data also suggest that noncredit and credit students had different academic advising needs. Noncredit students were often older incumbent workers with work histories and were not necessarily looking for academic advising services. Some survey respondents and focus group participants suggested that they simply enrolled in the noncredit training to help them get a job quickly and were not happy when career coaches suggested that they needed academic remediation services. “I come from a manufacturing background with 14 years’ experience,” said an incumbent worker from Mott. “I took the program because I was told it would be helpful for entry-level supervisors, which I feel is the next move in my career.” He thought that the basic academic remediation components of the production training were not necessary for someone like himself.

Exhibit 41: Student Satisfaction of Student Academic Support Services



Career Coaching






M-CAM-funded career coaches, success coaches, and/or job developers who prepared students for the job search process by assisting them with developing or improving their resumes and developing cover letters to accompany their resumes, and by providing information on how to look for jobs and succeed in employment interviews. M-CAM career coaches were also instrumental in helping to identify work-based learning (WBL) opportunities with local employers for students enrolled in M-CAM programs.

In the career-coaching mode, career coaches helped students in the following ways:

- Assisted with resume writing and developing cover letters.** At all M-CAM colleges, career coaches worked with students to create or revise their resumes and to develop customized cover letters. For most M-CAM students, this assistance was provided either individually or through group workshops. In Lake Michigan’s M-CAM program, grant-funded staff members coordinated with the college’s Work-Based Learning Manager and Career Center Coordinator to conduct workshops for students on the fundamentals of developing a resume and then worked one-on-one, as needed, to refine and customize students’ resumes based on available job opportunities. At Grand Rapids, M-CAM students worked one-on-one with one of two M-CAM-funded job developers two weeks prior to completing their training programs to develop resumes and cover letters. In some instances, M-CAM career coaches referred students to Michigan Works! or their college career centers for resume and cover letter assistance, but then worked with students to refine their resumes to be specific to advanced manufacturing employment positions.

- Provided information on conducting job searches.** Career coaches across all eight M-CAM colleges provided M-CAM students with training on, or information about, how to conduct successful job searches using the colleges' online job portals, the State of Michigan's Talent Bank, and proprietary websites like LinkedIn and Monster. At some M-CAM colleges, this training was embedded in the foundational skills curriculum, whereas at other M-CAM colleges career coaches conducted workshops for students or provided this assistance one-on-one. One employer partner commented that M-CAM students from Kellogg were prepared for their interviews and understood the products and services delivered by his company before even meeting with him, which set these students apart from other job applicants.

Exhibit 42: Core Features of Career Coaching Services Provided to M-CAM Students

Resume Writing and Cover Letters	
Job Searches	
Course Selection and Class Schedules	
Employer Interviews	
Work-Based Learning Opportunities	

- Prepared students for interviews with employers. Career coaches often helped M-CAM students prepare for employer interviews by holding mock interviews and hosting dress-for-success events.** A few colleges coordinated with local advanced manufacturing employers and employment agencies to conduct mock interviews with students, thus preparing them in advance for employer interviews. Students at Kellogg reported that having the opportunity to practice and prepare ahead of time helped them to be successful in their actual job interviews and feel less stressed. "We did mock interviews," said one student from Kellogg, "and then they would tell us what we did wrong and we would have actual interviews." Students at Macomb had the opportunity to interview with local employers immediately after completing their training programs, and career coaches worked with students to help them prepare for these interviews. A Macomb student affirmed the value of the mock interviewing activities: "We also did simulations, interview simulations. A lot of people haven't been on interviews in a while, so we did as a group where we would interview in front of an audience so that way we could critique each other and possibly develop each other to actually succeed on interview day."

"[The career coach] knows how things are working out there as far as hiring process...she works the resume side. Which you know, I learned it the old way. So, she helped me modernize it."

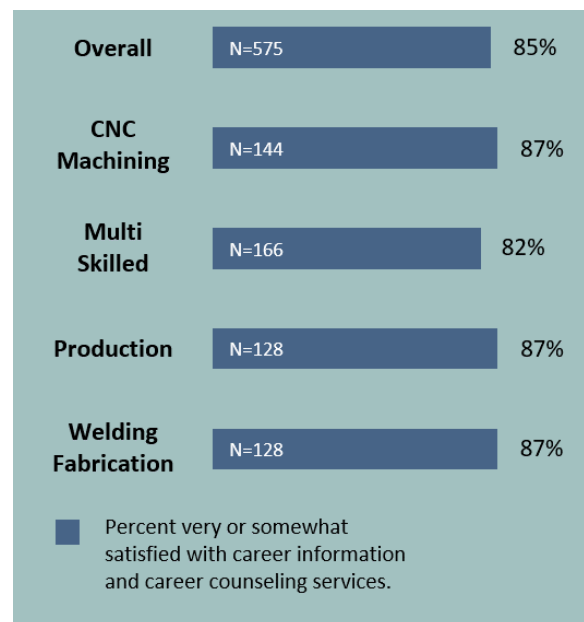
Student, Schoolcraft

- Developed work-based learning opportunities.** Career coaches from all eight M-CAM colleges worked closely with faculty members and employers in their local communities to identify work-based learning opportunities (WBL) for students in M-CAM programs. M-CAM colleges provided students with work-based learning experiences such as work-site tours, guest speakers, demonstrations, on-the-job training, internship and apprenticeship opportunities, and incumbent worker training programs. While the depth of these opportunities

varied significantly across the M-CAM consortium, grant-funded counseling and job development staff members at most colleges worked to create stronger relationships with employers, and this led to more work-based learning opportunities being integrated into the advanced manufacturing programs. M-CAM staff members reported that WBL opportunities provided students with a variety of benefits, including better knowledge of career options, increased self-confidence, real workplace experience, and improved employability skills. Career coaches from all eight M-CAM colleges stated that M-CAM brought increased awareness of the need to offer WBL opportunities to students and allowed them additional time to engage faculty and employers in providing these experiences. In the case of one college, Grand Rapids, M-CAM helped fund faculty members to go out and meet with industry leaders and attend industry events, which made them better advocates for WBL activities at their college. In another college, Schoolcraft, the college created a credit internship program for students in the welding program, which helped students acquire work readiness skills and “real-world experience.”

Based on student survey data, 85 percent of respondents across all four M-CAM career pathways were very or somewhat satisfied with the career information and career counseling services they received through M-CAM. Satisfaction with career information and career counseling varied slightly across the four career pathways, with 87 percent of Welding, CNC Machining, and Production program respondents giving a rating of very or somewhat satisfied compared to 82 percent for Multi-Skilled/Mechatronics pathway students. Overall, satisfaction with career information and career counseling varied slightly across credit and noncredit programs, with 89 percent of credit program respondents giving a very or somewhat satisfied rating versus 84 percent of noncredit students.

Exhibit 43: Student Satisfaction of Career Information and Counseling Services



CAREER COACHING STUDENT CASE STUDY

Student: Avery Butler (pseudonym)

Pathway: CNC Machining

Avery is a 50-year-old white female pursuing her Associate's Degree in Industrial Technology. She obtained her first factory job at the age of 18 and has worked on production lines in factories her entire life. In her early 30s, Avery attended college in the hopes of advancing her career prospects, but had to drop out due to financial difficulties and a pregnancy. Now that her daughter is older, Avery decided to return to college to improve her technical skills and to obtain a higher-paying job. While taking classes, she met individually with M-CAM-funded career counselors who helped her develop a resume and improve her interviewing skills.

"[At my mock interview] she asked me questions that I would have been asked during an interview...and kind of coached me on how to answer them properly to make myself look better."

The coaching paid off for Avery, who not only landed a job, but after her probationary period, received a raise and health benefits for herself and her family.

"They hired me out at exactly what I was making when I left my other job, and once I got my 90 days in, I was given a raise...I was making the same leaving one place after 10 years and getting into another, and now I'm making a little bit more, and they give annual raises.... And I have insurance, I have Blue Cross/Blue Shield on myself and my daughter."

Assisting Students with Job Searches and Providing Placement Assistance

Career coaches provided M-CAM students with assistance in finding suitable jobs or work-based learning opportunities. In this mode, career coaches helped students in the following ways:

- **Provided job announcements and assisted students with their own independent job searches.** At all M-CAM colleges, career coaches conducted online job searches and created lists of available advanced manufacturing positions and shared these with M-CAM students in binders, on bulletin boards, via email, and through online college search engines. Career coaches also coordinated with Michigan Works! and other community organizations to collect job leads to share with M-CAM students. Students were then encouraged to contact these employers and to apply for the positions independently.
- **Coordinated hiring events such as job fairs, speed networking events, and onsite interviewing sessions.** Career coaches at all eight M-CAM colleges coordinated with college career offices, Michigan Works!, and employer associations to put on job fairs, speed networking events, and onsite interviewing sessions for M-CAM students. In some cases, these events were specific to M-CAM, but in other instances the M-CAM career coaches coordinated with the college to host larger job fairs that cut across multiple industry sectors, including advanced manufacturing. For example, the career coach at Lansing hosted multiple speed networking events at which students presented themselves in 10-minute interviews with local employers. To prepare for these events, the career coach met individually with students to hone their resumes and help them develop brief introductory speeches about their skills and abilities.
- **Matched students to appropriate jobs or work-based learning opportunities.** Career coaches and/or job developers at all M-CAM colleges matched M-CAM students with appropriate jobs, internships, or apprenticeship opportunities. Career coaches worked closely with students to identify their employment needs (including minimum starting wage, preferred location, and desired work hours/shifts) and their transportation limitations before working to match students to job openings. Career coaches and/or job developers then contacted suitable employers that they had relationships with, or cold-called those that had appropriate open positions, to suggest that they consider hiring particular students from the M-CAM programs. In many instances, because the supply of skilled workers was so limited, employers contacted the colleges directly to place “job orders” and to obtain appropriate referrals from M-CAM career coaches. Career coaches from five M-CAM colleges—Grand Rapids, Kellogg, Lansing, Macomb, and Schoolcraft—worked closely with private placement agencies in their local communities to help M-CAM students obtain employment. Career coaches indicated that it was very common for advanced manufacturers to utilize staffing service agencies to coordinate their hiring, especially for entry-level positions.

Based on student survey data, 83 percent of respondents across all four M-CAM career pathways were very or somewhat satisfied with the job search and job placement services they received through M-CAM. Satisfaction with job search and job placement assistance varied slightly across the four career pathways, with 87 percent of CNC Machining and 86 percent of Welding pathway students giving a rating of very or somewhat satisfied compared to 82 percent of Production students and 80 percent of Multi-Skilled/Mechatronics students. The 80 percent overall satisfaction rating for the Multi-Skilled/Mechatronics pathway was perplexing given that these jobs are in high demand among local employers and pay higher wages compared to Production and Welding positions. The relatively lower satisfaction rating for job search and placement assistance among Production pathway students was more in line with expectations because many of the positions appropriate for training completers are entry-level and do not pay as well as those available to the completers of the other career pathways.

Exhibit 44: Common Features of Job Search and Job Placement Assistance Provided to M-CAM Students



Exhibit 45: Student Satisfaction of Training Help in Obtaining Job

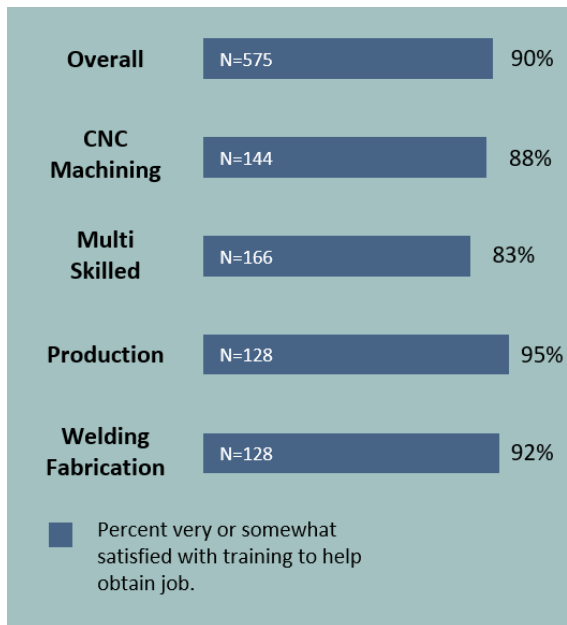
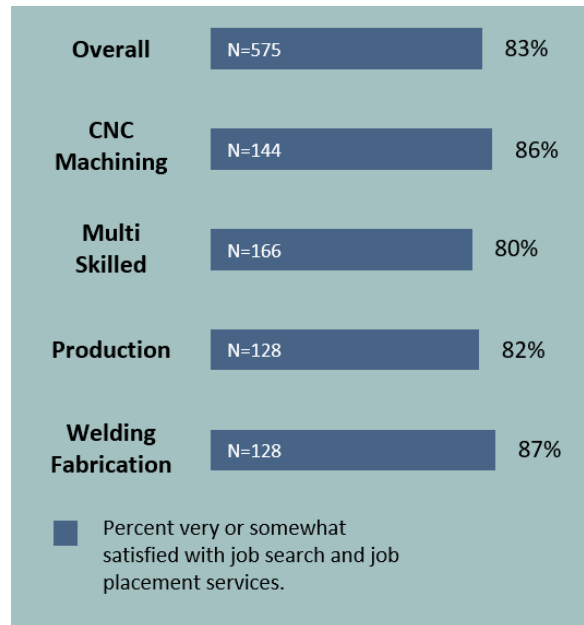


Exhibit 46: Student Satisfaction of Job Search and Job Placement Services



The comment section of the student survey revealed that a subset of students, approximately 17 percent of those that responded to the survey, have not found work and feel relatively strongly that M-CAM job placement services were not adequate. Students were asked about their satisfaction with their existing jobs, and for those who reported low satisfaction, 72 percent stated it was because of low pay and 51 percent said it was because the working conditions were poor. One student stated, *“The training was fine. [I] need more help finding a job. I don't think they should wait until the last week to send out resumes to their contacts.”* Negative comments like these suggested that some of the M-CAM colleges could have done a better job of following up with students after graduation to ensure they had found employment, but satisfaction levels were still high among survey respondents as a group.

“The lady at the M-TEC Building, she's almost a student advisor, she's come to us and talked about jobs that are hiring and opportunities that help – anytime there's an opportunity, she lets everybody in the welding class know.... This last week, she came into class and offered everybody to sign up for a résumé workshop that Bay was holding, and our whole class went.”

Student, Bay College

“It is always nice to have someone who is handling the little things for you and trying to make things easier. [The career coach] is always on it a with emails and calling. If you don't respond, she is on it and there a comfort level to know someone has your back. I have never had that kind of support before.”

Student, Lansing

JOB SEARCH AND PLACEMENT ASSISTANCE STUDENT CASE STUDY

Student: *Brooklyn McDonald (pseudonym)*

Pathway: *Multi-Skilled*

Brooklyn is a 51-year-old white female, married and with a Bachelor's degree. She spent periods of her adulthood working while her husband completed college, and she was out of work for stretches of time raising her children. After she had a third child she stopped working for a twelve-year period to raise that child. After he was grown, she decided to return to the labor force and found that she had difficulty finding stable, long-term employment. To improve her skills and be more competitive in the labor market, she enrolled in a noncredit multi-skilled technician program. Brooklyn was impressed by the college's engagement with local employers and the M-CAM career counselor's ability to find students job leads before they completed their training programs.

“So, one of the ladies that works here had just received, from an employer...a job listing. She brought it into class...the next day I had my resume to her. And she passed it on. And I was called within a day of that to come in for an interview.... And I had a job before class finished.”

Addressing Life Issues

A final type of student support provided by M-CAM career coaches was assistance in dealing with challenges related to finances, living arrangements, transportation, and family obligations. Career coaches reported that these life issues usually arose as emergency situations for students and required immediate attention to address. One career coach from Macomb estimated that 70 percent of students enrolled in advanced manufacturing training programs encountered some kind of life issue that could impede their successful training completion and employment if left unaddressed. Career coaches from other consortium colleges as well indicated that life issues were major barriers for many students.

When career coaches worked in this mode, they helped students in the following ways:

- **Assisted students with personal or family issues.** M-CAM career coaches provided advice and counseling about how to deal with difficult life issues, typically through one-on-one meetings with affected students. For example, one career coach at Kellogg helped a student obtain a birth certificate, which in turn helped him obtain his driver's license and facilitated his being able to obtain transportation to and from college. M-CAM focus group participants commented that this kind of assistance was particularly helpful and made them feel like they were not alone in addressing life issues and challenges.
- **Referred students for appropriate supportive services such as financial aid, childcare, and transportation assistance.** Working in close collaboration with Michigan Works! service center staff members, Public Welfare Department, and community- and faith-based organizations, M-CAM career coaches provided M-CAM students with supportive service referrals. In some instances, colleges had their own supportive services available on campus. For example, Macomb offered students access to a food bank twice a month and even assisted some students with accessing SOS funding for utilities and car repairs. Macomb also had a "food cupboard" at the M-TEC center, that provided snacks to students during their training. Career coaches found that many students needed help obtaining scholarships or financial aid, accessing childcare, arranging transportation, and finding suitable housing. Because TAACCCT funds could not be used to provide supportive services to M-CAM students, many colleges used other resources from their college foundations or from other organizations to assist students. Students received funds or vouchers to help pay for childcare, transportation, utilities, books, tuition, and school supplies from a wide variety of organizations,

"The college has its own foundation, which funds some supportive services for students, including a food bank that can be accessed by students twice per month."

Faculty member, Macomb

"Being a veteran it was a veteran's service, called SOS. They gave me money to get my hub repaired on my car as well as some gas money once and it definitely helped."

Student, Macomb

"They were able to fund some monies to me, like my heater went out; they fixed that. I needed clothes for the interview, they took care of that. And basically it got me through."

Student, Macomb

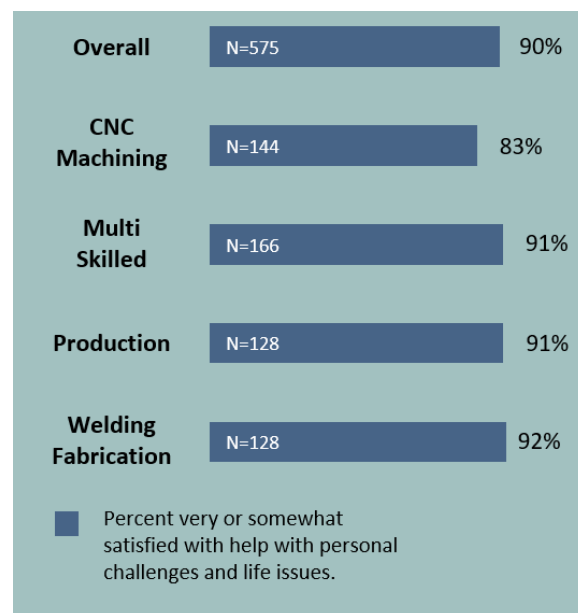
including Michigan Works! service centers, Public Welfare offices, housing departments, churches, and community-based organizations (e.g., Goodwill, Legal Services, etc.). Career coaches from four M-CAM colleges reported that their colleges have foundations that help students cover the cost of tuition, supplies, housing, transportation, food, books, clothing, and supportive services. M-CAM career coaches were very proactive in helping students obtain assistance from their respective college foundations. Many of the career coaches brought prior experience and knowledge of community and faith-based programs to their grant-funded positions and many also had professional connections with these providers, and so they proved very effective in connecting students with the appropriate supports. For example, one of Kellogg’s career coaches had worked as a social worker for Goodwill prior to coming to the college and had vast experience with local service providers in the area, including homeless shelters, food banks, and transportation services.

Based on student survey data, 90 percent of respondents across all four M-CAM career pathways were very or somewhat satisfied with the help they received with personal challenges and life issues. Student satisfaction results varied only slightly across the four career pathways: at the high end, 92 percent of Welding students gave a somewhat or very satisfied rating, and at the low end, 83 percent of CNC Machining students gave a somewhat or very satisfied rating.

Although students overall were satisfied with the assistance they received in dealing with life issues, many M-CAM focus group participants felt that more could be done to connect them to services providing financial assistance. This sentiment was shared by many M-CAM faculty and program staff members, one of whom from Macomb stated, *“If there was a thing I wish we could do, it would be to add a little more umbrella to the people who are desperately financially burdened, [giving them] gas money, or lunch money, or transportation so that they can get there. [For] some of these people, literally, we take a collection, give them gas money, give them all the empty bottles [to recycle].”*

Interestingly, some M-CAM colleges recruited students from hard-to-serve populations (e.g., ex-offenders, homeless, etc.) for their training programs (mainly the welding and production pathways) and student focus group results showed that over 90 percent of students in these pathways were very or somewhat satisfied with the personal help and assistance they received from M-CAM career coaches.

Exhibit 47: Student Satisfaction of Help with Personal Challenges and Life Issues



The student survey data attest to the value of the M-CAM career coaches position and the valuable support they provided to M-CAM students.

DEALING WITH LIFE ISSUES STUDENT CASE STUDY

Student: Ashton Lane (pseudonym)

Pathway: Production

Ashton is a 55-year-old African-American male with a background in carpentry and custodial maintenance. He was recently released from prison, where he had spent the last twenty years. During his incarceration, he obtained a GED and engaged in occupational skills training in the construction trades. He worked in the prison's construction work program and built walls and beds for Habitat for Humanity.

Ashton enrolled in a production program, and with the extra support he received from the M-CAM career coaches ultimately landed a fulltime job. In addition to receiving help to develop a resume and cover letter, a grant-funded career coach helped Ashton to secure important identification records that he needed to ultimately apply for and land his job.

"I didn't have my birth certificate. I never had one. [The career coach] took the time out to really do some research to help me get my birth certificate, which I have today."

After participating in interview training, the career coach coordinated a job fair where Ashton was interviewed by several employers. Ashton stated that he had tried to find work on his own, but was always turned down because of his criminal background. However, with the help of the M-CAM coach, who vouched for his skills and work ethic, he secured fulltime employment and was even promoted after working with the company for six months.

"Coming out of prison you have this stigma. And with that stigma on you, you feel like everybody is [looking] down on you...But [the career coach] welcomed not just me, [but] everybody...Pretty much anything you come to her with, she's willing to go out on a limb to try to help you."

Recordkeeping Responsibilities

Career coaches and job development staff members funded by the grant played vital roles in collecting, documenting, and reporting individual-level data on each student served under the grant, including demographics, enrollment, services, training completion, and employment outcomes. The M-CAM colleges used a web-based reporting system called ETO to collect the student-level data, including the development of an EDP, in an electronic case file. Career coaches and job development staff members from across all eight colleges reported using the ETO system. Career coaches reported that keeping track of required and optional data elements to support federal reporting requirements, including data for the third-party evaluation, was time-consuming. Some career coaches reported that it took up at least a quarter of their time each week or month.

Challenges in Providing Students with Counseling and Support

M-CAM colleges faced several challenges related to providing M-CAM students with academic counseling, career coaching, job development and job placement assistance, and help with life issues.

- **Delays in hiring and turnover in the career coach positions resulted in disruptions in service delivery.** At least five colleges experienced turnover in career coaching positions after the beginning of the grant, which resulted in diminished career counseling and job search and placement assistance to many M-CAM students while a replacement staff member was found and trained.
- **Challenging workloads prevented career coaches from more proactively reaching out to M-CAM students to ensure they had sufficient support.** As discussed in Chapter 4, some M-CAM colleges implemented both credit and noncredit training programs across multiple career pathways. In some instances, as the training programs grew, some career coaches' workloads became unmanageable, which limited the time they could spend with individual students. In the case of Bay, the project manager had to manage grant implementation requirements along with student support services, which she found very difficult. At Schoolcraft, the career coach and job development positions were both funded at a part-time level, which limited the amount of time these staff members had to serve students and engage employers. Although staff members taking on multiple roles or working part time worked diligently to maximize their effectiveness, they felt that fulltime positions would have helped them be more successful.
- **Employment verification was time-consuming and difficult to manage. Career coaches and job developers across the M-CAM colleges reported that verifying student employment and wages required a great deal of time and effort.** Many staff members stated that they spent a tremendous amount of time contacting students who had completed their training to inquire about employment outcomes to no avail. A career coach stated, "the biggest challenge is with [the] follow-up requirement, because once students obtain employment it is harder to stay in touch with them." (With assistance from SPR, the third-party evaluator, the M-CAM consortium gained access to wage

data that allowed colleges to report employment and retention outcomes for students they could not personally track down.)

- **Due to enrollment processes for credit students, not all students were connected to a career coach.** With open enrollment policies at each of the colleges, credit students were not required to see a career coach. Many credit students opted not to enroll in M-CAM because they did not see the value of the additional support services available under the grant. For credit students who completed the M-CAM enrollment process and became M-CAM students, some did not pursue career coaching services because they did not feel they needed the additional supports. M-CAM career coaches and intake staff members conducted multiple information sessions and recruiting events to improve participation among credit students. However, there was still concern among many career coaches that they were not reaching the full cohort of students in their credit training programs.
- **Types of student engagement varied considerably across colleges.** The TAACCCT grant solicitation specified the role of the career coach, but the level of engagement across colleges varied. For some colleges the term “career coach” served as an impediment to marketing their services to students and faculty because some students who had already decided on a career path believed they did not need assistance with career planning. In addition, while the role of the career coach was to provide intrusive case management to M-CAM students, career coaches found that not all students were amenable to this type of interaction. Some coaches also indicated that while career planning and academic advising were assigned roles, they spent much less of their time on these activities than assisting students with financial aid, life issues, and employability challenges.
- **Documenting student services was time-consuming.** The ETO database system was set up so that career coaches could document enrollment, student services, and outcomes in a comprehensive system. ETO could also be used by career coaches to document student interactions or “touchpoints.” While the ETO system was beneficial as a data collection and reporting system, many career coaches stated that the task of documenting student interactions and outcomes was time-consuming enough to detract from their direct work with students.

College Efforts to Sustain Student Support Services

M-CAM college presidents, administrators, staff members, employers, and enrolled students all stated that the additional student support services offered to advanced manufacturing students under the grant were one of the biggest successes of the M-CAM initiative. Consortium colleges unequivocally welcomed and supported the roles of the grant-funded career coaches and job development staff members, and they recognized the impact the career coaches had on student success. As documented above, there was tremendous anecdotal evidence that the coaches helped students, especially older students, navigate the college enrollment, scheduling, and financial aid processes. As is described further in Chapter 12, the career coaches also played a key role in connecting with college personnel, employers, industry associations, MI Works service center staff members, and community- and faith-based organizations. Kellogg’s Dean of Workforce Programs stated, “The utilization of the career coaches at [Kellogg] has been a huge success and benefitted the students greatly.” She added that it is a “tried and true” model, but because it is costly to operate and many colleges in Michigan have experienced declining enrollment and budget cuts, it may be difficult to fund these positions in the future. Many of the M-CAM colleges, however, have succeeded in garnering funds to sustain some of their career coach and job development positions in the short term (i.e., 1–3 years).











As of June 2017, seven colleges (Grand Rapids, Kellogg, Lake Michigan, Lansing, Macomb, Mott, and Schoolcraft) had retained individuals serving as M-CAM-funded career coaches and/or job developers. Many of the M-CAM project managers stated that having data to document student-level outcomes associated with grant allowed them to “make a case” to the leaders of their colleges for keeping staff members after grant funding ended. The project director at Grand Rapids stated that it was “easy to show the value of the job development staff” because they collected employment, wage, and retention data on all students served under the grant. The job developers were also able to document engagement activities with local employers, which further helped staff members show their value to the college president and Board of Trustees.

Career coaches who solely conducted outreach and recruitment activities, academic advising, and career awareness activities were less likely to be kept on than career coaches who coordinated outreach to employers and provided job search and placement assistance or who provided the full continuum of services. The colleges that decided to maintain the career coaches/job development staff members have funded these positions in different ways. Exhibit 48 shows whether the positions are college-funded, funded by a grant (e.g., America’s Promise, foundation grants, etc.), or a combination of both.

“They loved the [job developers] and the work they’ve done. I think partially cause we didn’t have a lot of metrics before and now we have metrics like how many employers we’re interacting with and just the kind of things our president gets excited about.”

Project Lead, Grand Rapids

Exhibit 48: Career Coach Positions Retained

COLLEGE	COLLEGE-FUNDED	GRANT-FUNDED	POSITION(S) RETAINED
Grand Rapids			1 Job Developer
Kellogg			2 Career Coaches
Lake Michigan			1 Career Coach
Lansing			22 Career Coaches
Macomb			1 Career Coaches 1 Job Developer 1 Recruitment Coordinator
Mott			2 Career Coaches
Schoolcraft			1 Part-Time Job Developer

Four colleges—Lake Michigan, Lansing, Mott, and Schoolcraft—decided to use general funds or departmental funds to support the positions. In the case of Lansing, college administrators decided to alter the way student support services are delivered college-wide and hired 22 success coaches to assist students. These positions were partially funded through a slight increase in student fees for the academic year. The only drawback to this approach was that new positions were initially to be housed at the main campus, whereas the M-CAM career coach had been housed at the college’s advanced manufacturing training facility. Two colleges—Grand Rapids and Macomb—garnered grant funding to support the continuation of their M-CAM career coaches. In the case of Grand Rapids, which had separate staff members assigned to case management and job development, only the job developer position was being sustained with the America’s Promise grant. At Macomb, the college supplemented funding from a private foundation to sustain the training and student services model developed through M-CAM for one year. Including funding for the outreach coordinator, career coach and employer developer positions. Kellogg used college funding to support its two career coaches for a six-month interim period and was working closely with a private foundation to obtain funding to sustain the positions for the next three years.

CHAPTER 9:

Credit for Prior Learning and Articulation with Other Programs



Well-designed career pathways include opportunities for students to earn credit for prior learning and clear, straightforward processes for transferring credit between colleges and programs. These features, which facilitate entry into and movement along career pathways, did not exist in fully developed or optimal form at all the M-CAM colleges prior to the awarding of the M-CAM grant, so the colleges included in their objectives for the grant plans to increase use of Prior Learning Assessments (PLAs) in advanced manufacturing programs and develop articulation agreements and processes that would allow students to easily transfer credit between colleges and to four-year institutions.

Prior Learning Assessment

Prior Learning Assessment (PLA) is an emerging strategy for building on-ramps into training for a wide range of individuals. PLA processes allow students to earn college credit for college-level knowledge, skills, and competencies that they learned in a noncredit setting, in high school or a secondary-level vocational technical program, or outside of a formal educational setting, such as in previous employment or military service. Evidence suggests that PLA processes help adults achieve higher graduation rates, lower time to degree completion and improve persistence in training programs.²⁴ Strengthening PLA policies was a goal shared by the consortium colleges, but as a consortium they made minimal progress in advancing the use of prior learning assessment among advanced manufacturing students. The colleges did, however, help manufacturing faculty and staff members achieve a better understanding of how PLA policies and procedures work at their institutions through an environmental scan and college-level survey conducted as part of the evaluation. Gaining a better understanding of the colleges' policies and procedures positioned faculty and staff members to market the availability of PLA to their manufacturing training program students, both noncredit and credit. While the colleges began with vastly different PLA approaches, a few colleges progressed in their use of portfolio assessments to award academic credit to advanced manufacturing students.

²⁴ Council for Adult and Experiential Learning. (2010). "Fueling the Race to Postsecondary Success: A 48-Institution Study of Prior Learning Assessment and Adult Student Outcomes." Chicago, IL. With Funding from the Lumina Foundation for Education. <http://files.eric.ed.gov/fulltext/ED524753.pdf> (accessed August 12, 2016).

Existing PLA Practices within M-CAM Institutions

Our analysis of PLA across the M-CAM colleges showed that all eight M-CAM colleges had existing policies and procedures in place that pre-dated the grant. This review of existing PLA policies and procedures across the M-CAM consortium indicated there were five primary methods used across the colleges to assess a student's existing knowledge, skills, and competencies and award academic credit, as outlined below:

1. Assess the student's scores on standardized exams (e.g., Advanced Placement [AP] exams, College Level Examination Program [CLEP] tests, Excelsior College exams, and DANTES Subject Standardized Texts [DSST]).
2. Have the student take a challenge exam, usually developed by college faculty for specific courses.
3. Arrange for a third-party to evaluate corporate or military training (e.g., National College Credit Recommendation Service [NCCRS] or American Council on Education [ACE] evaluations of corporate training and military training).
4. Evaluate the student's receipt of industry-recognized certifications, including apprenticeship programs.²⁵
5. Conduct a portfolio review or arrange for a third party to evaluate the student's portfolio (e.g., as conducted by CAEL's LearningCounts.org)

Generally, M-CAM college faculty and staff members were familiar with using formal testing mechanisms—standardized exams and challenge exams—to award credit because these are considered by academicians to be effective ways to document and assess an individual's grasp of knowledge and content. A qualitative assessment of standard PLA policies and practices across the M-CAM colleges revealed significant variations in how PLA policies and processes worked at each of the institutions. Exhibit 49 provides a breakdown of the types of PLA used across the M-CAM colleges prior to M-CAM implementation. These assessment methods were used college-wide and were not necessarily specific to the college's advanced manufacturing training programs.

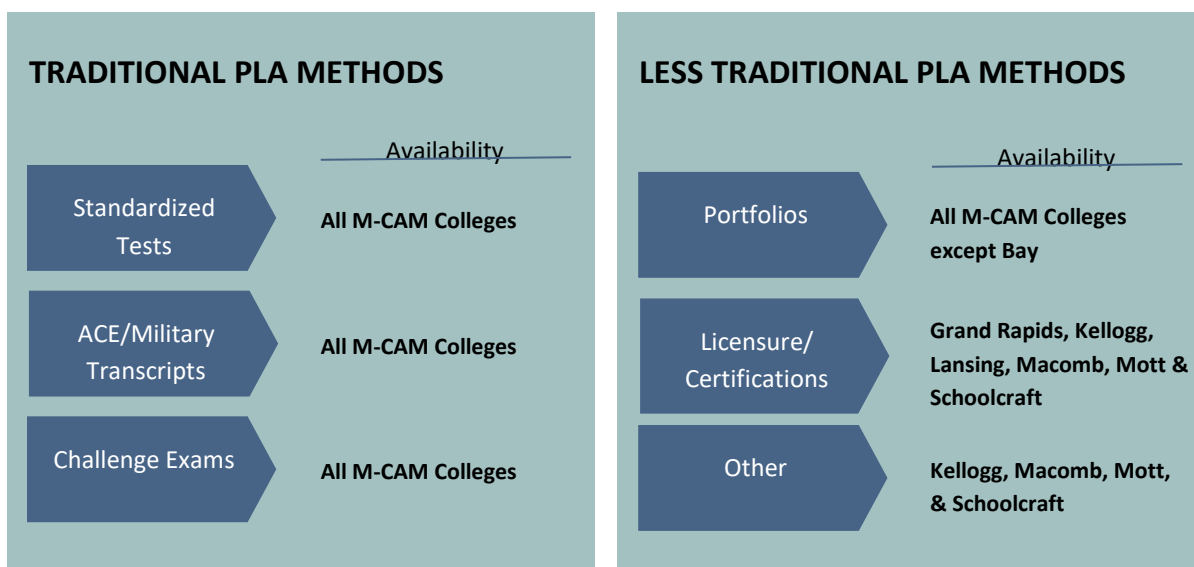
As shown in Exhibit 49, existing PLA policies and procedures across the M-CAM colleges included the following:

- **Seven of the eight M-CAM colleges had policies and procedures allowing the use of portfolio assessments to award prior learning credit to students in their advanced manufacturing programs.** At the start of the grant, Bay was the only college that did not allow the use of portfolios for assessing students' prior learning.
- **Six M-CAM colleges had PLA processes in place to accept state licenses and national/state industry certification exams as evidence of prior learning deserving of credit.**

²⁵ The use of third-party industry certification exams to award academic credit was mainly for nursing, automotive and computer science certificate and degree programs.

- **Three M-CAM colleges allowed less formal PLA methods, such as student interviews, to be used to award academic credit for prior learning.** Kellogg, Macomb, and Schoolcraft all awarded credit based on student interviews conducted by faculty members.
- **All eight M-CAM colleges allowed high school students to receive credit for coursework completed through dual enrollment programs and also through successful completion of AP exams.** In the case of Lansing, the college hosts a local high school’s industrial technology training programs on the college’s campus. Lansing and the local high school have a formal agreement in place that awards these dual enrolled students a one-year college certificate for successful completion of their high school programs. In most cases, M-CAM colleges required a minimum score of 3 or 4 to obtain AP credit and limited the use of AP credit to introductory courses in their degree programs.
- **All eight M-CAM colleges required students to be enrolled in one of their college’s credit programs before they could apply for credit under the PLA process.**

Exhibit 49: Assessment of Pre-M-CAM Methods Used to Award Prior Learning Credit



Seven M-CAM institutions allowed portfolio development as a form of PLA. Portfolio reviews provided a way for adult students to translate the learning they had gained through their experiences to college credit. These systems of assessment sometimes required the student to attend a portfolio class and/or develop a detailed written portfolio that demonstrated that the student had knowledge, skills, and experience aligned with the learning objectives in a college’s course catalogue. Staff members at Mott reported that their Applied Technology AAS program was “*designed for students who have progressed in their careers and achieved an advanced classification/status*” in a technical field.²⁶ To achieve an advanced work classification and

M-CAM project managers and faculty reported that the portfolio assessment process is arduous and “drawn-out,” thus limiting the number of advanced manufacturing students that apply for college credit using this PLA method.

²⁶ Source: http://catalog.mcc.edu/preview_program.php?catoid=3&poid=266&returnto=77

be granted 20 credits towards his or her degree program, a student must have had a minimum of five years of full-time work experience and show proof of advanced status. For the latter, the student had to complete a portfolio that included a detailed employment history, employer documentation of classification, validation of hours, and a current job description that identified required skills. While portfolio development was a common PLA method across seven of the eight M-CAM colleges, M-CAM project management and faculty reported that this form of assessment was arduous and took a long time for students to complete, which sometimes served as a deterrent to students developing a portfolio. A representative from Mott stated that portfolio reviews, while available, were all but “non-existent” in their manufacturing training programs; an opinion shared by many of the faculty and staff members of the other M-CAM colleges.

Among the M-CAM colleges, Kellogg had a very interesting PLA approach, which included a student interview and a demonstration of skills. Kellogg instructors stated that they met individually with prospective industrial trade applicants and used a detailed interview process to ascertain whether academic credit should be awarded based on knowledge, skills, and competencies gained from prior work experience, military service, community service, etc., a procedure that worked well with their modularized Industrial Trades programs. This student interview was the basis upon which faculty would document in writing the prior experience of the student and make a formal recommendation to the college’s registrar that the student be awarded academic credit. In most cases, the student would also need to demonstrate their skills and abilities while performing a faculty-assigned task in Kellogg’s lab. The combination of the student interview and the faculty member’s written and visual assessment of the student’s skills would be used to award academic credit.

Our key findings regarding the similarities and differences in PLA among the eight M-CAM colleges are presented below:

- **The awarding of credit for prior learning went by a variety of names across the eight M-CAM colleges**—prior learning assessment; credit by experience; credit for previously acquired knowledge and learning experiences; credit for prior education, advanced testing and workplace experience; and credit for prior learning.²⁷
- **All eight colleges had some form of PLA prior to M-CAM**, and used it to award credits for work at in-state and out-of-state accredited colleges and foreign institutions, for courses taken as a dual-enrolled student, for passing advanced placement exams, and for successfully passing a college challenge exam.
- **The processes used to assess and award credit varied substantially by M-CAM institution.** Some M-CAM colleges had policies in place to award credit for third-party industry certification exams in disciplines such as healthcare and information technology, whereas others did not. One M-CAM college—Macomb—was very proactive in awarding credit to students participating in noncredit advanced manufacturing training programs (i.e., noncredit to credit bridge programs), whereas the other M-CAM colleges that offered noncredit training programs awarded no or little credit prior to

²⁷ For Bay College and Mott Community College it was difficult to find any information on prior learning credits and/or assessments on the college website.

the grant.²⁸ At most colleges, the process required the student be aware of the option to obtain credit for prior learning and that he or she request or initiate the approval process (as opposed to an automatic award process or college faculty or staff initiating the process on behalf of advanced manufacturing students).

- **All eight M-CAM colleges awarded credit for military experience, but some used only military transcripts for assessment purposes.** This latter policy of awarding credit based on military transcripts may limit the amount of credit veterans and active duty military can receive because it does not include review of individual portfolios where students can document all their learning. In some instances, M-CAM colleges allowed credits for prior learning in the military to be used only to meet elective or physical education requirements, and not for academic courses within a degree program.

Efforts Under M-CAM to Improve PLA Policies and Procedures

While all eight M-CAM colleges had PLA processes and procedures in place prior to the grant, new methods of awarding credit based on PLA were developed under M-CAM. Prior to M-CAM implementation, faculty and staff across many of the consortium colleges' advanced manufacturing departments were not discussing how PLA could be used to help students advance in their post-secondary educational attainment. One of the most significant advancements under M-CAM was the creation of a forum through which the colleges discussed their PLA methods and procedures. These discussions led a few colleges in the consortium to adopt new PLA methods and helped colleges learn about the importance of actively marketing PLA and its availability to students, rather than waiting for students to address it with faculty or staff. The list below highlights the effects M-CAM had on PLA policies and procedures across the colleges.

- **M-CAM colleges agreed to use their colleges' existing PLA policies and procedures to award academic credit to noncredit students for successful completion of third-party industry certifications.** Interestingly, the third-party industry certifications adopted by the M-CAM colleges were not initially on the colleges' PLA lists (e.g., American Welding Society [AWS], The National Institute for Metalworking Skills [NIMS], Manufacturing Skill Standards Council [MSSC] and Siemens).
- **Bay developed new policies and procedures related to awarding credit for prior learning based on portfolio assessments.** While not fully implemented by the end of the grant's period of performance, Bay project staff stated that the discussions held with other M-CAM colleges helped them to identify a gap in their PLA methods and college staff and administrators were working on developing a formal portfolio assessment policy for the college.
- **Lake Michigan piloted the use of CAEL's LearningCounts for assessing prior learning using portfolio reviews, but found that it was too costly and arduous for faculty and students to use and**

²⁸ This does not apply to Kellogg where all their Industrial Trades training programs are modularized and students can obtain fractionalized credit.

abandoned its use. Lake Michigan plans, however, to use a less rigorous process for awarding credit for prior learning based on portfolio reviews with students.

- **Grand Rapids instituted noncredit transcripts to document courses and skills attained by students.** The noncredit transcript identified course duration, timing, and completion, along with any college certificates or industry certifications received. The intent of the noncredit transcripts was to make the process of obtaining credit for prior learning easier for students to complete because students could show institutional documentation of participation in learning and skills gains.
- **Identified and actively engaged adult learners in individualized PLA discussions.** Many of the grant-funded college career counselors were instrumental in providing individualized assistance to help M-CAM students learn about college PLA policies and procedures and in encouraging students to apply for academic credit using PLA.
- **Created general outreach and marketing materials about PLA.** While M-CAM colleges had existing policies and procedures governing PLA, focus groups and interviews with M-CAM students suggested that many adult learners were unaware of PLA opportunities and processes at their respective school, suggesting that additional outreach and marketing of available PLA processes was needed. To address this concern, Lansing created a one-page flyer that advertised PLA throughout its advanced manufacturing training center. In addition, industrial trades faculty members were briefed on the value and importance of PLA for their adult learner population. These same faculty members were encouraged to discuss PLA opportunities with students in their classrooms and labs.

To address the lack of transparency around prior learning policies and processes, Lake Michigan began requiring all new students to attend an orientation event in which “credit for experiential learning” was discussed in detail (July 2016). Students were provided with examples about how the process could reduce the cost of tuition and accelerate the completion of certificate and degree programs.

Challenges in Improving PLA Policies and Processes

One of the M-CAM goals was to improve the ability of adult learners returning to college to have their prior learning recognized so that they could maximize their educational attainment and accelerate their time to completion. Realizing this goal required consistent and straightforward policies for prior learning assessment as well as clear communication about the availability and value of PLA. M-CAM staff members reported many challenges in improving the use of PLA within their institutions’ advanced manufacturing training programs during the grant period:

- **PLA processes required a high level of communication and coordination across college departments and divisions.** There were many methods for awarding prior learning credit, such as standardized exams, challenge exams, third-party evaluations and portfolio reviews. Each of these PLA processes required different forms and levels of engagement between students and faculty and across academic departments and administrative offices (e.g., Provost, academic advising, registrar).

- **There was a lack of consistent and accessible information on PLA.** The terminology for PLA varied significantly across the M-CAM colleges, which created confusion among students and staff members about what it was and how it worked. Colleges could do more to actively and consistently market PLA to students, guidance counselors, and the public.
- **There was a lack of data to assess the effectiveness and usage of PLA among students at M-CAM colleges.** M-CAM faculty and project staff members were unable to provide detailed estimates on the extent of PLA use within their manufacturing training programs. The colleges could have done more to increase usage of PLA within their institutions by sharing information at the program, departmental, and college-levels with faculty and staff members.
- **Fees associated with PLA inhibited its use.** Many of the M-CAM colleges charged students for PLA, on either a per-course, per-exam, or per-credit-hour basis. For example, fees ranged across the M-CAM colleges from \$25 per credit hour to \$100 for individual portfolio assessments. These fee structures may have dissuaded students from pursuing PLA to obtain academic credit. Six of the eight M-CAM colleges charged a per-credit hour rate to students pursuing PLA through portfolio review and credit by exam methods that was commensurate with in-state tuition rates.
- **Decision-makers were concerned about preserving student seat time and avoiding lost revenue from students gaining credit without registering for and completing courses.** Faculty and administrators at some colleges were concerned that increasing use of PLA would reduce student “seat time” and result in lost revenue. With community college enrollment levels already suffering, some faculty saw PLA as another loss to revenue for their colleges and/or departments. Many M-CAM colleges that operated their training programs using structured schedules feared that courses might not meet minimum student enrollment levels if PLA was used more widely to award academic credit.

Articulation

Articulation is the set of policies and procedures contained in an inter-institutional agreement that defines how a student may receive credit for coursework completed at one college (or high school) when transferring to another institution. Articulation may also describe the means, by which, a student can receive credit for work completed in a noncredit program when transferring to an academic division at the same college to pursue credit-bearing coursework. Articulation agreements are formal agreements (or some might say partnerships) between two or more colleges documenting the credit transfer policies for a specific academic program or degree. Because they increase the portability of learning, articulation agreements enhance the ability of students to progress in their education and gain the knowledge, skills, and competencies needed for higher quality employment. Establishing new articulation agreements is a complex process in career pathways development, because it requires coordination between people in multiple roles at different institutions who draft and approve the agreements. Under the M-CAM grant, the colleges worked on three levels of articulation for their advanced manufacturing programs: (1) noncredit-to-credit articulation within a single M-CAM college,

(2) college-to-college articulation within M-CAM, and (3) articulation between M-CAM colleges and four-year institutions (i.e., universities).

M-CAM's Vision for Articulation

The consortium's vision for enhancing articulation was to make it easier for individuals to move in and out of training and shift between different training sites, as required by the exigencies of their lives. Realizing this vision was an ambitious process, organized around four sequential steps:

1. **Lay the groundwork for articulation.** Establish a consortium-wide process for coordinating articulation across career pathways, colleges, and universities. Help staff members, faculty members, and registrars understand their roles and the timeframe for completing activities.
2. **Create noncredit-to-credit bridges.** Enable noncredit students who are interested in transferring to a credit program in the same college to obtain credits for noncredit coursework. This is beneficial for students who start out in noncredit entry-level training but later decide to pursue further educational training that leads to a college certificate or degree.
3. **Establish articulation agreements across M-CAM colleges.** Allow students who wish to take classes at another M-CAM consortium college to transfer credits between M-CAM colleges. This helps students who wish to transfer to another M-CAM college because it offers training in a specific career pathway that is not available at the college of origin or because it offers more advanced courses. It is also beneficial for students who relocate for work or other reasons.
4. **Establish articulation agreements with four-year institutions.** Facilitate transfers from an associate degree program at one of the M-CAM colleges to a four-year degree program in a related field at a bachelor's degree-granting institution in Michigan. This is beneficial for students who seek to pursue the education they need for high-wage, higher-skill, and supervisory positions in advanced manufacturing.

Exhibit 50: Example of the Importance Accorded Articulation within M-CAM

Join Us

M-CAM
Michigan Coalition
for Advanced Manufacturing

**Michigan Coalition for
Advanced Manufacturing (M-CAM)
Articulation Agreement Signing**

Thursday, September 8, 2016 | 8:30-10:00am | Signing at 9am
Lansing Community College Downtown Campus
419 N. Washington Square, Lansing, MI 48933

M-CAM ARTICULATION AGREEMENT SIGNING:

The Michigan Coalition for Advanced Manufacturing (M-CAM) consists of eight community colleges throughout the state of Michigan that are collaborating to provide students with the necessary certifications, industry credentials and employer connections to create careers in the rapidly growing advanced manufacturing industry.

For the first time in Michigan's history, within these four advanced manufacturing areas, these eight colleges will sign an articulation agreement intended to provide a smooth and seamless curriculum transition for students participating in an M-CAM sponsored program to transfer between the M-CAM institutions.

We invite you to attend this historic event.

Please RSVP by calling or emailing Beth Cacciapalle at
586.445.7517
cacciapalleb96@macomb.edu

RSVP TODAY:
586.445.7517 | cacciapalleb96@macomb.edu

Thursday, September 8, 2016 | 8:30-10:00am | Signing at 9am
Lansing Community College Downtown Campus
419 N. Washington Square, Lansing, MI 48933

This workforce solution was funded by a grant awarded by the U.S. Department of Labor's Employment and Training Administration. The solution was created by the grantee and does not necessarily reflect the official position of the U.S. Department of Labor. The Department of Labor makes no guarantee, warranty, or assurance of any kind, express or implied, with respect to such information, including any information on linked sites and including, but not limited to, accuracy of the information or its completeness, timeliness, usefulness, adequacy, continued availability, or ownership. Macomb Community College and M-CAM assume full responsibility for any program or service. Auxiliary paths and devices are available upon request to individuals with disabilities. TTY: (517) 487-8788 or visit www.michigan.gov/etdc.

Macomb Community College
Education • Environment • Economic Development
Discover. Connect. Advance.™

To complete these steps, it was necessary for the consortium to coordinate with faculty and staff members in multiple positions across four pathways at eight colleges and two four-year universities. The complexity of this task also required a great deal of coordination and collaborative effort with college registrars, academic advisors, provosts, and presidents to ensure that the articulation agreements were sound and met the requirements of college accreditation bodies (i.e., The Higher Learning Commission). Lake Michigan was the lead for this component of the grant. Its M-CAM faculty and staff members worked collaboratively with Macomb and the technical assistance provider, Corporation for a Skilled Workforce, to develop a detailed roadmap and timeline for working through the tasks needed to forge new agreements on each front. Two consortium-wide in-person meetings were held—in September 2015 and February 2016—to bring together faculty members, program staff members, college registrars and student advising staff to discuss each college’s articulation processes and methods. While these consortium-wide meetings helped set the stage for the work to be accomplished under the grant, project staff members stated that it took months to develop crosswalks for courses and industry certifications at their respective institutions and to work out the finer details of the cross-college articulation agreement. The articulation efforts culminated in one final consortium-wide meeting where the college presidents signed an agreement allowing for seamless curriculum transition for M-CAM students among the eight M-CAM colleges.

Exhibit 51 summarizes the status of the consortium’s efforts to enhance articulation under M-CAM. At the September 2016 Articulation Agreement Signing, the colleges’ M-CAM staff members and presidents celebrated the signing of a cross-college Memorandum of Understanding (MOU) for transferring credits between M-CAM colleges. The consortium marketed this as a historic event for community colleges in the State of Michigan, since Michigan community colleges operate under a decentralized system and it was the first-time community colleges in the state had come together to agree on an articulation process using industry certifications as the basis for transferring credit across advanced manufacturing training programs.

Exhibit 51: Status of Articulation in Four Key Areas

1. Laying the groundwork for articulation

- Faculty members participated in pathway workgroups to select common industry-recognized certifications and aligned these industry-recognized certifications to their college programs and coursework.
- The consortium established a consortium-wide timeline and set of activities through which to coordinate the process across colleges, and shared resources related to articulation using the M-CAM Dropbox site.

2. Creating noncredit-to-credit bridges

- Within each college, faculty members and registrars aligned industry-recognized certification to coursework internally within each M-CAM career pathway.
- College registrars established equivalency values for each industry-recognized certification and created crosswalks across each M-CAM pathway (i.e., CNC Machining, Multi-Skilled, Welding and Production).
- Within each college, Prior Learning Assessment (PLA) or transfer policy protocols were updated to reflect the use of industry-recognized certifications to award academic credit and to articulate credit.

3. Implementing articulation with other M-CAM colleges

- Colleges shared completed cross-walks and equivalency tables with other consortium colleges to identify gaps and similarities.
- Colleges exchanged PLA and transfer policy protocols to familiarize themselves with policies at each college.
- Colleges worked together to update and finalize the cross-college Memorandum of Understanding (MOU) for transferring credit between M-CAM consortium colleges, to be formally signed in September 2016.

4. Implementing articulation with 4-year universities

- The M-CAM consortium engaged Eastern Michigan University and Ferris State University to establish articulation agreements for transferring credits from associate degree programs to bachelor degree programs at these universities.

Developing and Refining College Bridge Programs

To help make the transition from noncredit to credit training programs easier for students to achieve, a few M-CAM colleges refined their existing training programs or designed new training programs with entry-level skills that could help students transition into one-year certificate and associate degree programs. There were two types of bridge models under M-CAM. The first model awarded students a minimal amount of academic credit for entry-level credit programs compared to the second model where students had to apply for academic credit based on noncredit program completion. For example, Kellogg's cohort-based KAMA program was essentially a credit-to-credit bridge program. Students enrolled in KAMA received 8.74 college credits that could be used towards one of Kellogg's certificate or associate degree programs. Macomb added several non-credit to credit articulation agreements based on common outcomes and objectives.

Articulation Within and Across M-CAM Colleges

Through their coordinating efforts—workgroup and consortium-wide meetings—the M-CAM colleges made a key decision to move away from course-to-course articulation, which had a great degree of variability in terms of academic credit awarded across consortium colleges, and focused on using third-party industry-certification exams to award academic credit to students. This is not to suggest, however, that the decision to use industry certifications was without its own challenges.

Although the community colleges had made great strides in creating seamless career pathways, the adoption and embedding of industry certifications into noncredit and credit training programs was difficult. Many colleges in the consortium had never focused on industry certifications and faculty members were reticent to adopt them. Using the M-CAM grant as a catalyst for exploration, the M-CAM career pathway workgroups discussed the duration,

“The articulation agreement is a competency-based model that focuses on a participant’s documented skill level without concern for how that demonstrated skill was acquired, either in a noncredit or credit program.”

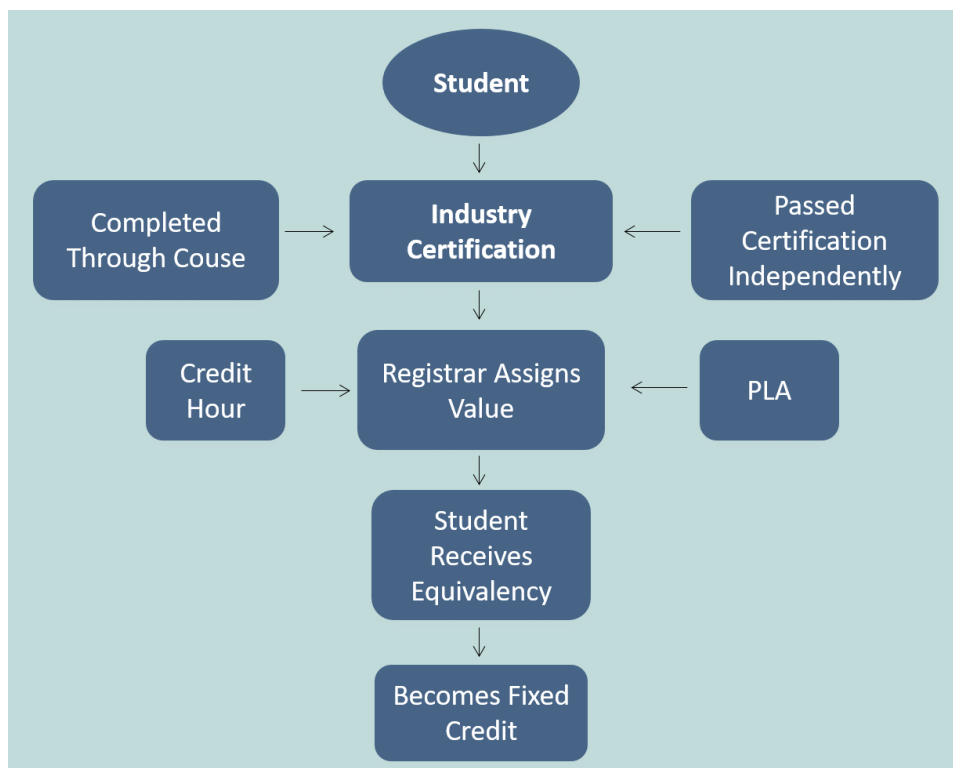
Staff member, Mott

frequency, learning objectives, and assessment methods of their courses at length and found that there was a tremendous amount of variability across the eight colleges in how information was taught and course credit assigned. Based on these M-CAM career pathway workgroup meetings, a few colleges suggested the use of third-party industry certifications as a method for aligning noncredit and credit programs and possibly for aligning credit across consortium colleges. The M-CAM consortium brought in the Ivy Tech Community College round 2 project lead to discuss ITCC's use of industry certifications to articulate credit. It was through these brainstorming sessions and dialogues that alignment to industry certifications adopted as a method for articulation across the M-CAM colleges. Kenneth Flowers, Interim Dean of Career and Workforce Education at Lake Michigan and the manager of the articulation process, said that this decision was the “turning point in the articulation-enhancement process” and allowed the process to move smoothly because faculty members, program staff members, and employers had already spent innumerable hours identifying industry certifications that provided valid measures of skill

attainment. In addition, the fact that faculty members in each of the four career pathway workgroups had focused attention on aligning curricula with third-party industry certifications and had themselves taken the industry-certification exams lent validity to the entire articulation process undertaken by the M-CAM colleges. It helped registrars and academic advisors see the value in using industry certification exam results as valid and appropriate proxies for student attainment of course-based knowledge and skills. Further, the decision to articulate credit based on industry certification exam results did not close the door on course-based articulation across the M-CAM colleges: students who did not pass an industry certification assessment were still eligible to go through a college’s PLA process to earn academic credit.

Under the system set up through the process described above, the process for articulating credits among M-CAM colleges begins when a student who has attained a professional certificate seeks credit within his or her existing college or at another M-CAM college. The student approaches the registrar for the department he or she wishes to transfer to and applies to convert the professional certificate to credit (Exhibit 52). If the student has not received a professional certificate, he or she can also go through the college’s PLA process to receive credit as well. Once the registrar approves the student’s application, the requested credit becomes fixed.

Exhibit 52: M-CAM Articulation Flowchart



Articulation with 4-Year Institutions

During the time when the eight community colleges were developing a process for articulating credit between their noncredit and credit programs and across the eight M-CAM colleges, the M-CAM leads

were also working in parallel to complete articulation agreements with four-year universities. Determining the factors for successful partnerships with universities in the State of Michigan required the community colleges to evaluate existing transfer relationships with four-year institutions and to assess the universities on ease of transfer, existing PLA policies and procedures, K-12 initiatives, and most importantly, their appreciation of applied technology and manufacturing and apprenticeship training programs. As there were no four-year institutions linked specifically to the grant when the proposal was developed, the M-CAM colleges individually reviewed their existing relationships with universities and came to consensus on which universities to approach about articulating credit for the four career pathways.

The M-CAM consortium selected Eastern Michigan University and Ferris State University as potential partners in the endeavor. These four-year institutions were selected because they had long-standing relationships and existing collaborations with many of the M-CAM community colleges. Each school already had many joint partnerships with community colleges throughout Michigan focused on helping to facilitate career pathways and community college students' successful transfer into four-year degree programs. In addition, both four-year institutions valued the opportunity to position students for advanced skilled trades occupations, like engineering, robotics, and automation. Given that articulation processes take a significant amount of time to develop, negotiate, and approve, the M-CAM colleges thought it best to coordinate with universities with whom the process had already been successful to minimize any obstacles that could slow progress. The colleges developed a four-year articulation agreement that allows associate degree completers from one of the M-CAM colleges to transfer 30 credit hours into Eastern Michigan University's Bachelor of Science in Technology Management. The articulation agreement with Ferris State University's Bachelor of Science in Product Design Engineering Technology states that the number of credit hours eligible for transfer varies by community college program.

Challenges with Enhancing Articulation

Due to the complexity of implementing a robust articulation process across several colleges and pathways, the consortium encountered several challenges:

- **Coordinating across multiple institutions and actors in a relatively short time frame was difficult.** Because the M-CAM TAACCCT grant involved multiple pathways and departments on each campus, the task of bringing all these actors together within the time frame of the grant was monumental. The consortium engaged the support of a technical assistance provider to help keep this process on schedule, but progress was slow.
- **The goal of standardization was controversial.** Some faculty members were resistant to focusing too much on standardization across colleges because they felt that the different employer bases and labor markets in each region require customization. Finding a way to manage these debates took some time and required flexibility and compromise on the part of all stakeholders.

Promising Practices Related to Articulation

In advancing the use of articulation within and among their institutions and between the coalition members and four-year institutions, the M-CAM colleges instituted two practices with good promise for being applied effectively elsewhere and in the future:

- **Select a lead college to drive the process and coordinate the effort across consortium colleges.**

Lake Michigan, as the lead college, created open communication channels among M-CAM project directors and managers, career coaches, faculty members, and registrars to discuss articulation policies and procedures. Lake Michigan held both individual and collective meetings with key stakeholders to address processes and timeframes for the articulation efforts, which kept the initiative moving. Furthermore, Lake Michigan's registrar took the lead in drafting language for the M-CAM cross-college articulation agreement, which helped to drive the articulation initiative as well.

"If it wasn't for the dedicated, innovative and flexible mindset of college administrators and faculty, creating this agreement aligned with industry certifications would not have been possible."

Staff member, Kellogg

- **Using third-party industry certifications as the basis for articulation frees colleges from the need to coordinate course-to-course articulation agreements.** Rather than getting bogged down in course-to-course articulation agreements, M-CAM colleges worked collaboratively towards identifying third-party industry certifications to administer in their advanced manufacturing programs that could be used to crosswalk knowledge and skill attainment and award academic credit. The focus on industry certifications also facilitated M-CAM colleges' efforts to establish a means for awarding credit hours to noncredit students when they transfer to one of their college's academic programs.

Conclusion

Providing the impetus for convening faculty members, college registrars, legal advisors, and others to discuss options for articulating credit among the M-CAM colleges and between the colleges and four-year institutions, the M-CAM initiative set in motion institutional-level changes that clearly improved the way that career pathways functioned among the colleges. Coming to agreement on using third-party industry certifications as the basis for articulation and awarding credit for prior learning was a huge advancement for these eight community colleges, allowing them to side-step complex course-to-course articulation processes. While some individuals connected with the grant may have seen these advancements as "baby steps," others saw the use of third-party industry certifications as a major improvement in the way the colleges award academic credit to students.

CHAPTER 10:

Participant Outcomes



The primary goal of M-CAM was to prepare students for well-paying advanced manufacturing jobs. This chapter explores how far the consortium came in realizing this goal, by looking at various participant outcomes. To assess program completion rates and degree/certificate/certification completion rates, we drew on ETO data. To assess employment rates and wage increases, we drew on both ETO and wage record data from Michigan’s Workforce Development Agency (WDA) and Unemployment Insurance Agency (UIA). For both sets of analyses, we used student interview and survey data to contextualize outcomes and their patterns. Appendix C includes an overview of the consortium’s progress in reaching the DOL performance outcomes for the TAACCCT grants.

Program Completion

Completing a program of study is the crucial first step to a living-wage job. As discussed in Chapter 4, at the end of active grant implementation in March 2017, 56 percent of all M-CAM participants had completed a program of study and exited, 25 percent remained enrolled in advanced manufacturing pathways, and 19 percent had withdrawn from M-CAM services without completing their programs. Sixty-one participants completed programs in multiple career pathways.

We observed differences in completion rates across the colleges in the consortium, which reflect differences in the structure and length of programs at different colleges. Participants from Lansing and Kellogg were the most likely to complete and exit an M-CAM program. Participants from Schoolcraft were the most likely to stay enrolled in advanced manufacturing programs after earning a college degree or certificate.

Certain demographic groups were more likely to complete their programs of study than were others. For instance, 76 percent of students over 55 years old completed their programs, compared to 53 percent of students 39 and younger; this is probably in part, because older students were more likely than younger students to be enrolled in short-term training programs. Women, veterans, and justice involved individuals were also more likely to complete their programs than were other demographic groups.

“One of the people in our class had to drop because he was homeless. He couldn’t find a place to live up here. He ended up going back to Chicago. He was staying at shelters, bouncing around from shelter to shelter.... I felt bad for the guy. He was a really good guy, really smart, knew his stuff. He was picking everything up really quick. I was really sad to see him go and not be able to finish and get a career.”

Student, Macomb

According to results from the M-CAM Exit Survey, life conflicts, rather than dissatisfaction with the programs, were the major factor influencing non-completers' decisions to leave the program (72 percent of respondents reported a life conflict as their reason for leaving the program, while 93 percent reported they were satisfied with their training and instruction).²⁹ Other common reasons for leaving a M-CAM program prior to completing included financial difficulties (36 percent), transportation barriers (27 percent), and academic challenges (19 percent). Forty percent of non-completers who responded to the survey indicated that they left in part because they found a non-manufacturing job, while 17 percent said they left because they found a job in manufacturing. College faculty and staff members cited employment as a common reason that students withdrew from programs, particularly those students in noncredit programs, which tended to be more full-time.

Credentials (Academic Degrees or Certificates and Professional Certifications)

College and professional certifications can put participants on a path to a living wage because they signify to employers the possession of specific skill sets and bodies of knowledge. M-CAM programs provided students with the opportunity to earn several types of credentials, including college degrees, college certificates, and professional certifications. M-CAM participants across the eight colleges earned 2,854 college certificates, 2,094 professional credentials, and 157 degrees. By the time they exited M-CAM services, most participants (79 percent) left their colleges with at least one of these credentials.

Almost three-quarters (73 percent) of participants received a college certificate, 25 percent received one or more professional certifications, and four percent received a degree. Twenty percent of exited participants earned both an academic certificate (degree or college certificate) and a professional certification, while a small number of participants (one percent) earned both a college certificate and a degree. While noncredit students were more likely than credit students to earn a college certificate, credit and noncredit students earned professional certifications at similar rates, demonstrating M-CAM's success in providing students with access to these certifications which are highly valued by students. As shown in Exhibit 53, the percentage of exited participants who received any credential varied across the M-CAM colleges from 93 percent to 49 percent.

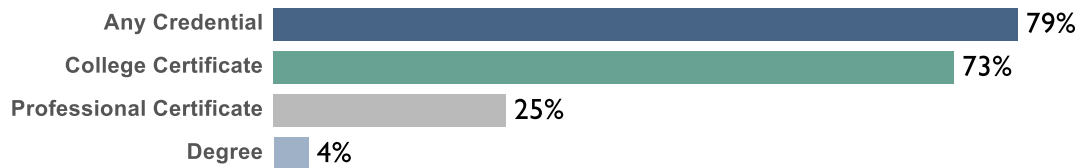
"Yeah, [the American Welding Society certifications] definitely means a lot to me. It also means a lot to employers because that shows that you went through the time to get the actual certification...by the actual governing body of welding. They write all the code – the AWS writes all of the welding codes for all of the companies in the U.S. and standards. So if you're certified through them, then that shows that you know what you're doing."

Student, Grand Rapids

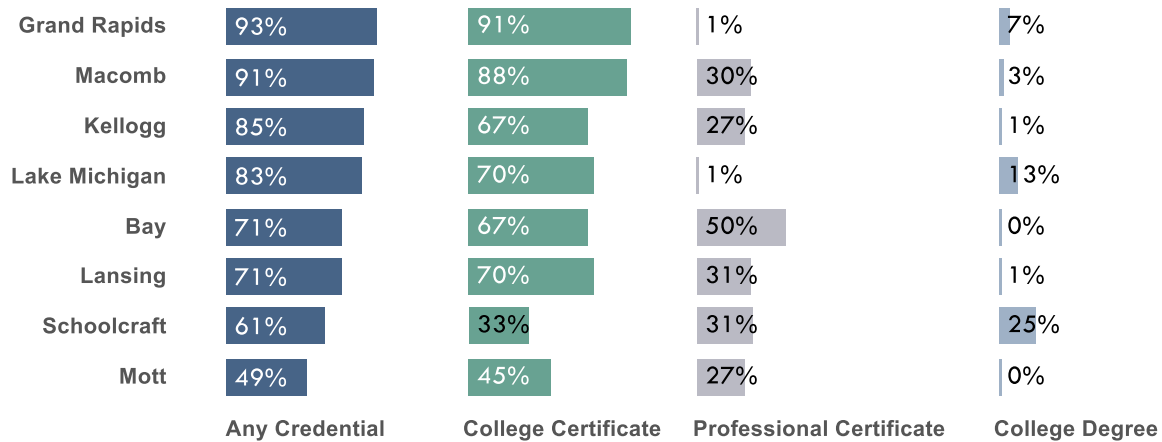
²⁹ Because only 12 percent of non-completers who were invited to participate in the survey responded, and only five percent responded to the question related to their decision to leave their program of study, these results may not be representative of all non-completers.

Exhibit 53: Completion of Credentials³⁰

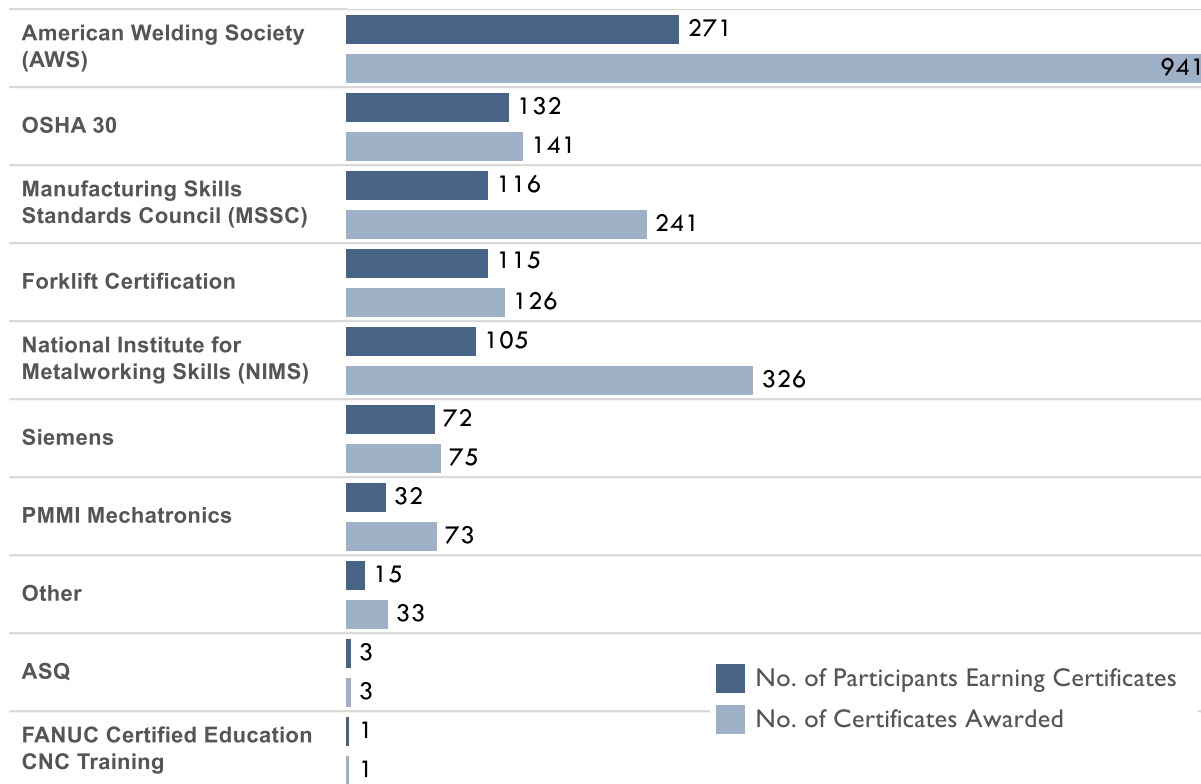
Percent of Exiters Completing Credentials, Overall



Percent of Exiters Completing Credentials, By College



Number of Participants Earning Professional Certificates and Number of Certificates Earned



Across the consortium colleges, there were differences in the types of certifications received by participants. Participants from Lake Michigan and Schoolcraft were the most likely to receive college degrees, those from Grand Rapids and Macomb were the most likely to receive a college certificate, and those from Bay were the most likely to receive a professional certification. These findings are consistent with the fact that each college offers a distinct set of programs, as shown in Appendix E.

As was true of program completion, some groups of participants, as defined by demographic characteristics or career pathway, were more likely than others to receive certain certifications. For example, although participants older than 40 were significantly more likely than younger students to earn a college certificate, they were less likely to complete a college degree. This finding makes sense given that older workers were less likely than younger students to be enrolled in longer-term credit programs. For reasons that are less clear, women were more likely than men to earn a college certificate and African American participants were less likely than others to receive a college degree, regardless of pathway.³¹ Finally, likely due to the design of Multi-Skilled/Mechatronics programs, few participants in these programs received a professional certification (16 percent).

Employment Outcomes

Although program completion and attainment of credentials were significant outcomes for M-CAM colleges, the consortium's primary objective was to connect participants with stable, well-paying employment. Two different employment-related outcomes provide relevant information about M-CAM's success in helping its participants attain this goal: employment rates and wage levels.³²

³⁰ Forklift Certification may also include certifications for heavy equipment operator.

³¹ One percent of African-American participants received a college degree, compared to 5 percent of non-African-American participants. One percent of participants older than 40 received a degree, compared to 4 percent of other participants. Seventy-four percent of women who completed their programs earned a credential, compared to 63 percent of men.

³² To calculate employment and retention rates, we drew on both ETO data and individual-level wage records from WDA through the 2nd quarter of 2017 to determine if an individual was employed during the quarter of program exit, as well as the first, second, and third quarters after exit. Note that, because of lags in wage data reporting, wage data on employment for participants who exited later during the grant period may not be complete, so employment outcomes for these participants, if not based on ETO, should be considered lower bound estimates. To calculate wage levels, we used the placement data entered into ETO by college staff members.

Employment Placement

Using employment placement data in ETO and wage records from the WDA, we calculated the employment rate of participants who successfully completed their M-CAM programs. We counted as employed anyone who had been employed by one quarter after exit (Exhibit 54). Several key findings emerged from our analysis of employment placement data:

- **Eighty-three percent of M-CAM completers were employed by the end of the first quarter after exit.**³³ Our data show that one percent of participants were enrolled in further education and not employed, though this is likely an undercount given that we do not have good data on the number of students that transferred to other colleges. About fifteen percent were neither employed nor enrolled in further education.
- **Sixty-eight percent of exited participants who completed our survey felt that their training helped them obtain their most recent job.**³⁴ The number of participants expressing this belief varied somewhat across career pathways and program type (i.e., noncredit versus credit). Overall, participants in credit programs were more likely than those in noncredit programs to believe that their training helped them obtain their most recent job (75 percent versus 64 percent).

“I went from looking for a job to jobs looking for me now.... It changed my life, because I went from, like I say, from unemployed and the job I had before that one I was getting about \$16.00 or \$17.00 an hour and that was, I thought that was good. But, I went from that to \$22.00 an hour plus per diems because I’m on a traveling team, so, it was, it’s definitely life altering.”

Student, Macomb

“The job that I took as soon as I got out of school, I went there and was totally overwhelmed. I wasn’t going to be a CNC operator.... Well, let’s just say I don’t work there anymore, and I got another job. I am a CNC operator. I’m at a machine all day long, and that’s what I wanted to do.”

Student, Schoolcraft

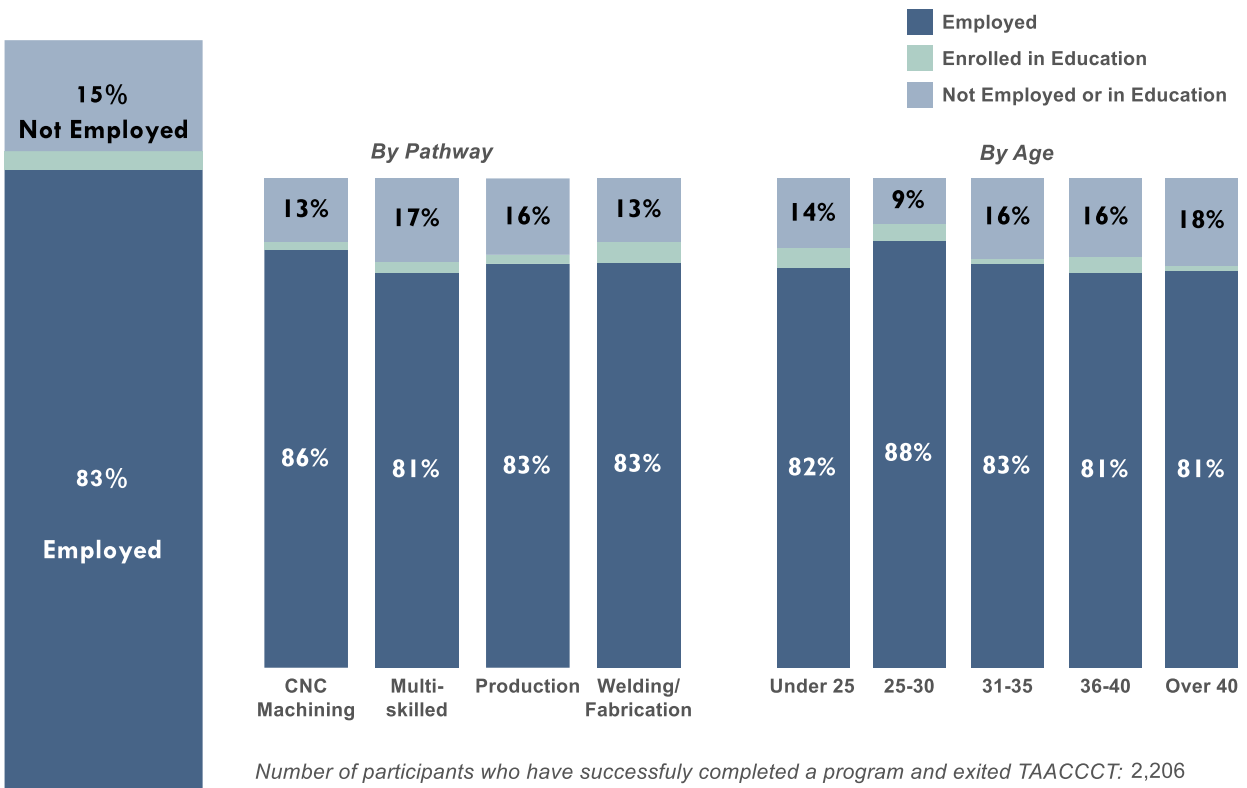
“[I like my job because I like] working on a team and being able to use my creativity to come up with solutions. Sometimes it's a lot of different jobs we do so it's changing.... It gives me a feeling of accomplishment, purpose like I guess I could do anything.”

Student, Kellogg

³³ We counted as employed anyone who had been employed the quarter of exit or the quarter after exit.

³⁴ Calculated from M-CAM Student Exit Survey results (which had a 29% response rate) and only including participants who were employed at the time of the survey. Because of the low response rate, these findings may not be representative of all exited M-CAM participants.

Exhibit 54: Employment Outcomes of Completers by End of 1st Quarter after Exit³⁵



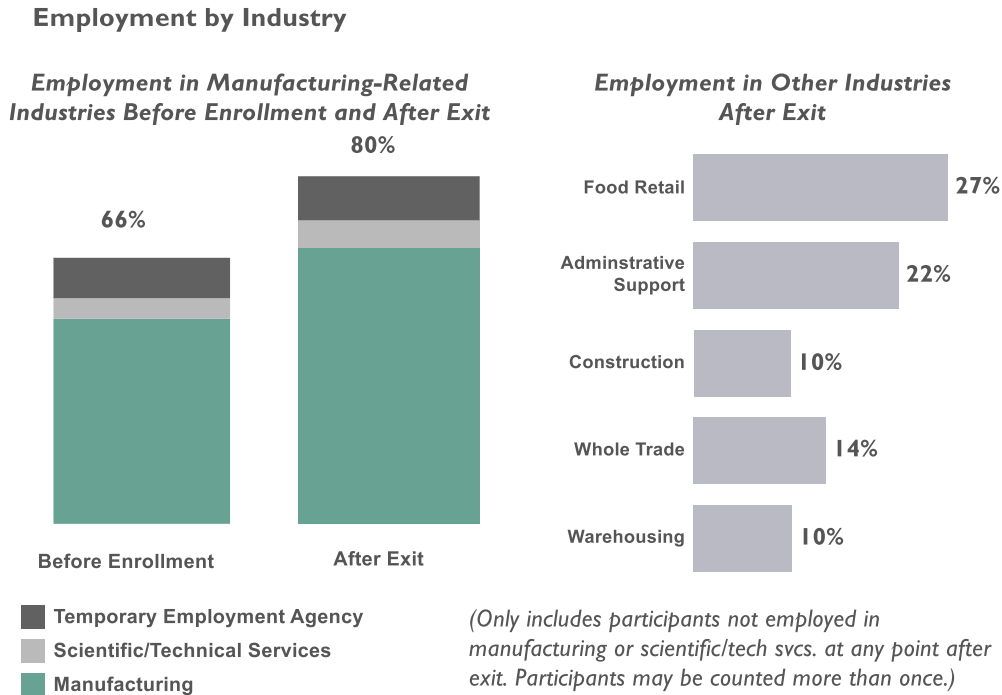
- **Participants from all four career pathways and among all age groups attained high employment rates.** The employment rate was over 80 percent in all career pathways and there was no significant difference between them. Participants between 25 and 30 years old were employed at the highest rate.³⁶
- **M-CAM completers who earned a college degree were more likely to be enrolled in further education.** Close to one-quarter (24 percent) of degree earners were still enrolled in post-secondary education, compared to five percent of completers who did not earn a degree. Among those who were not enrolled in further education, there is no significant difference in employment rates between those who earned a degree and those who earned a college certificate.
- **Eighty percent of those completers employed by the end of the quarter after exit were employed in manufacturing-related industries.** In comparison, only 66 percent of participants had been employed in manufacturing-related industries prior to enrolling in M-CAM programs, suggesting that participating in M-CAM increased the likelihood of a participant being employed

³⁵ Includes incumbent and non-incumbent workers.

³⁶ Statistically significant at p= 0.1.

in manufacturing. Exiters not employed in manufacturing were likely to be employed in food retail or administrative support jobs.³⁷

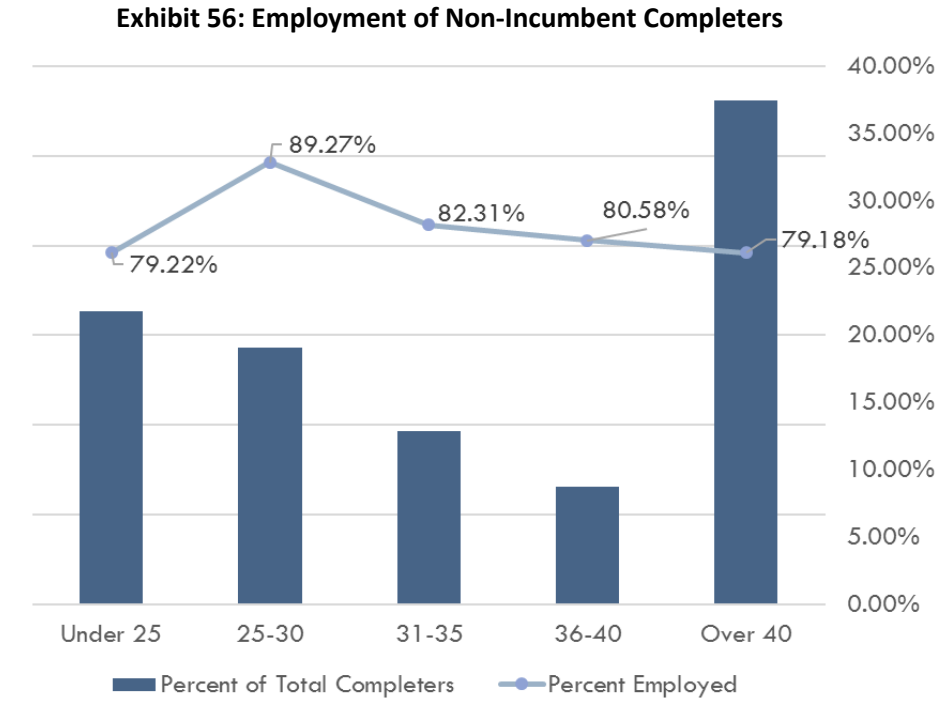
Exhibit 55: Employment by Industry



- As illustrated in Exhibit 56, M-CAM participants under 25 and over 40 had slightly lower levels of employment than did those in other age groups. Employment rates were over 80 percent for all non-incumbent student age groups, except students over age 40 and under 25, for whom it was 79 percent. For those 55 and older, the employment rate declined to 78 percent and they had the largest number of students not employed or in education, at 21 percent. Survey and qualitative data indicated that older workers who were looking to make a “career change” were less likely to find work than those looking to enhance their skills, in part because they did not want to take positions at low pay. The student profiles in the box at the end of this section provide examples of how the distinct experiences of students over 40 years of age contributed to their opportunities for employment.
- The employment rate for non-incumbent workers aged 25–30 was nearly 90 percent. Non-incumbent participants between twenty-five and thirty had placement rates higher than those of any other group. This pattern contrasts with statewide employment figures that indicate that

³⁷ This figure only includes 3,162 participants who had wage records for at least one quarter during or after program exit. The number includes participants employed in manufacturing, scientific/technical services, or temporary employment agencies. We included temporary employment agencies because, during site visits, M-CAM staff members and students said that manufacturers often do all of their hiring through temporary agencies and are frequent employers of M-CAM graduates.

people in the 25–30 age bracket generally had higher rates of unemployment than those 30 and older.



- Most employed participants who responded to our survey³⁸ were satisfied with their new jobs.** Eighty-five percent of participants who were employed during the first quarter after exit were satisfied with their jobs. There was little difference in satisfaction rates across career pathways or credit versus noncredit programs. In focus group interviews, participants indicated that they liked the fast-paced nature of their jobs and the potential to learn new technologies. Some were very pleased at the level of training that their employers were providing and the opportunities for advancement at their companies.
- Of those not satisfied with their jobs, most were unhappy with their pay or felt they weren't using their training.** In focus group interviews with program completers, some students suppressed dissatisfaction with the types of jobs into which they were initially placed. For instance, one Mott student said, "I'm still waiting to actually do what I'm certified to do. They hired us, but... they put us on a mini-probation just to see how it would go."
- Those who did not find employment after their training were often looking for jobs with better pay or better working conditions.** Some case study students, such as Carlos who is profiled in the following text box, and focus group participants indicated that they had turned down jobs due to low pay or because the job required extensive travel. A Macomb student who was still

³⁸ The survey had a response rate of 28 percent.

looking for a job said, “[Manufacturing employers are] going to low-ball the world out of you. I can go work at Costco and make, you know, more money than that.”

STUDENT PROFILES: OVER-40 EMPLOYMENT EXPERIENCES

Career Enhancer: *Emmett Sims (pseudonym)*

Pathway: *CNC Machining*

Emmett, a 43-year-old single father, had enrolled in a CNC Machining program with a desire to upgrade his skills and land a machine programming job. He hoped that getting an advanced degree in machining would help him land a day-shift job with better pay, allowing him to spend more time with his daughter.

“[It] is one of the best programs. The open enrollment is very helpful for family and to work around a busy schedule, or just come in and be able to train in a certain segment [module] of something that you’re lacking [instead of taking an entire course] ...It’s amazing. Not very many schools have that.”

Career Changer: *Carlos Ferguson (pseudonym)*

Pathway: *Multi-skilled*

Carlos, a 54-year-old married father, enrolled in a noncredit mechatronics program with the aim of transitioning into a new career, hopefully enabling him to earn a higher income. He held a Bachelor’s Degree in Construction Management, but after years in the field was hoping to do something different. Six months after completing his program, he had not been able to find work. He had been offered several positions but turned them down due to the low pay and poor working conditions. In our interview, he said that his age and limited factory work experience were working against him.

“My understanding is that there’s a lot of jobs out there. I mean I could have had jobs doing not what I wanted to do. And I said, ‘No I went to school. I’m not going to do that.’ Because I took the class to not do that. It was an assembly line thing. I can do assembly line something like a high school kid, but I didn’t take this class to do assembly line. So I don’t know maybe I’m over shooting what I’m looking for.”

Career Gap: *Brooklyn McDonald (pseudonym)*

Pathway: *Multi-skilled*

Brooklyn, a 51-year-old married mother of three, enrolled in a noncredit mechatronics program hoping to return to the workforce after a twelve-year employment gap. Before enrolling, she found that even though she had experience, she was missing current job skills, and competition for available positions was strong in the aftermath of the great recession. After going through the program, she started using the job search tips passed on by the career coach, and was almost immediately hired.

“The only...training that I used was how to look for a job and getting a résumé done.... They had told us to make sure you use keywords. They had given me a résumé format.... [The career coaches] were pretty clear that you needed to get LinkedIn and keep it up to date. So I did that. And I had everything together to do a job interview....And then I made a point of mentioning that I’d read about this company on LinkedIn as far as receiving that award. Cause that had just come out recently. And that was something that they were promoting quite heavily within their company.”

Employment Retention

Landing a job after program exit is an important achievement, but employment does little good if it does not last. To assess employment retention, we calculated the percentage of those employed during the first quarter after exit who were still employed during the second and third quarter after exit using employment placement data in ETO and wage records from the Workforce Development Agency.³⁹ Below we list the key findings emerging from this analysis:

- **Of those employed at program exit, 81 percent were employed three quarters later.** Thus, slightly over 8 in 10 students placed into their jobs were retained approximately 9 months later.
- **Employment retention varied across colleges.** The lowest retention rate was 42 percent, while the highest was 95 percent. Of the participants who successfully completed their programs and were employed during the quarter after exit or quarter one after exit, 70 percent remained employed through the following two quarters. Retention was highest among participants at Kellogg (34 percent) and Grand Rapids (24 percent).
- **Older participants had the lowest retention rates.** Seventy-seven percent of participants aged 55 and older remained employed, compared to 82 percent of participants under 25. Older participants generally came to the program with more work experience and may have had clearer ideas about retirement. Younger participants were more likely to be beginning their careers, and thus may have been more likely to stay employed over the long haul.

“Without a diversified skill set, it’ll be difficult to maintain employment...Companies are not loyal to individuals any longer. And you do have to have a diversified background and skill set. And this multi-skill program, it provides that opportunity. So I’m really thankful for this opportunity.”

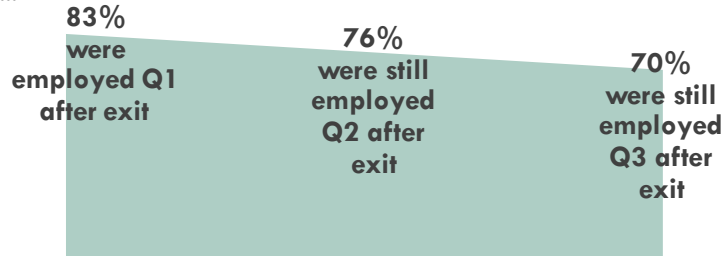
Student, Macomb

³⁹ Employment did not have to occur at the same employer. Participants had to show evidence of some employment in the first, second, and third quarter after exit through ETO or wage records.

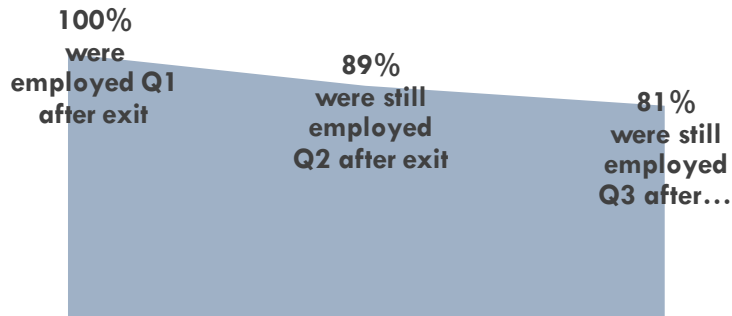
Exhibit 57: Employment Retention Through Third Quarter after Exit

(Includes participants who were employed the quarter as of second quarter of 2017)

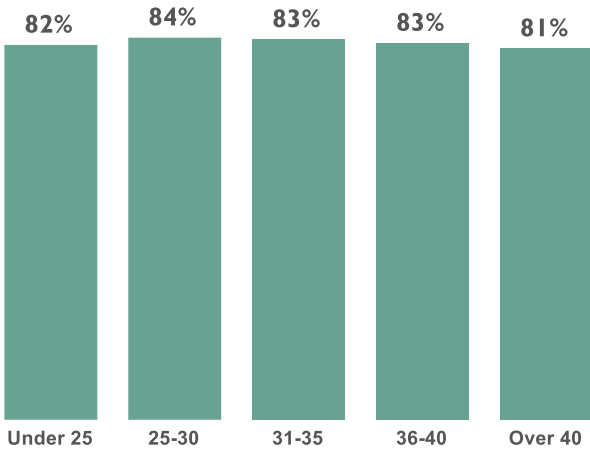
Of All Completers...



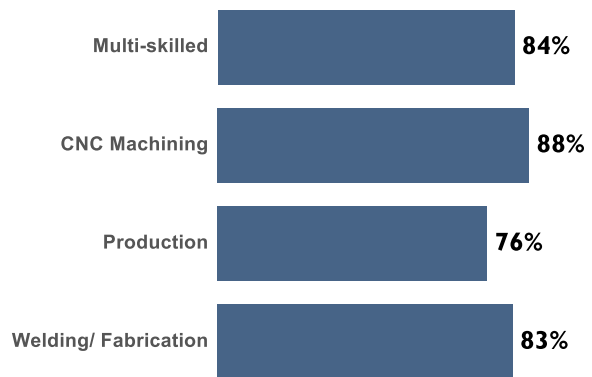
Of All Participants Employed Q1 After Exit...



Retention through Q3 by Age



Retention through Q3 by Pathway



Wages

The M-CAM consortium strove not only to connect participants with jobs, but to connect them with jobs that offer a family-sustaining wage. To assess the wages received by M-CAM participants after enrollment, we calculated two outcomes using placement data from ETO: (1) for all employed exiters, the highest wage received in job placements after enrollment, and (2) for participants employed at the time of enrollment, the wage at enrollment compared to the highest wage after exit.⁴⁰ Findings revealed by this analysis are listed below:

- **Wages for job placements were generally well above the state minimum wage.** The average placement wage for non-incumbent workers that received training was \$13.66, while the minimum wage in Michigan was \$8.90 as of January 2017. The average wages for M-CAM completers exceeded the living wage estimate of \$10.24, which was the estimated hourly wage that an individual must earn to support themselves in Michigan.⁴¹
- **Seventy percent of incumbent worker participants who successfully completed their programs earned a wage increase after enrollment.** On average, these incumbent workers received a 11-percentage point wage increase after completing M-CAM training. The percentage of incumbent workers who earned a wage increase was highest at Bay, Schoolcraft, and Kellogg.⁴²
- **Like placement and retention outcomes, average job placement wages varied across colleges and career pathways.** Participants from Schoolcraft and Macomb received the highest wages and participants from Mott and Lake Michigan received the lowest. This pattern, which was

"I'm going be honest, \$18.00 [an hour] don't even exist to me. I wouldn't even answer the phone. I wouldn't reply to emails for no less than \$25.00. But the thing is, you got to have the confidence."

Student, Macomb

"We getting \$11.00 [an hour]. That's what I'm saying: "When is y'all gonna train us for the robotic technician?" Because then it'll bump up to \$14.00. They said a month or two. We'll see. But, to be honest...I wanted to be hired for what I was certified for."

Student, Mott

"It's the job of American business to get the most bang for your buck. Do less with more.... It's the American way."

Student, Schoolcraft

⁴⁰ Because the wage records from the Workforce Development Agency do not include hourly wages, we relied exclusively on ETO data to analyze placement wages. At the time of this report, we had placement wage data for 81 percent of the participants that we know were employed at any point after enrollment.

⁴¹ The living wage calculator developed by MIT indicates that an individual adult can live on \$10.24 an hour in Michigan. A sole breadwinner in a family of four, however, must earn \$23.66 an hour to support a family. In a dual earner family of four, each parent would need to make (on average) \$14.92 an hour. See: <http://livingwage.mit.edu/states/26>. Accessed 8/04/17.

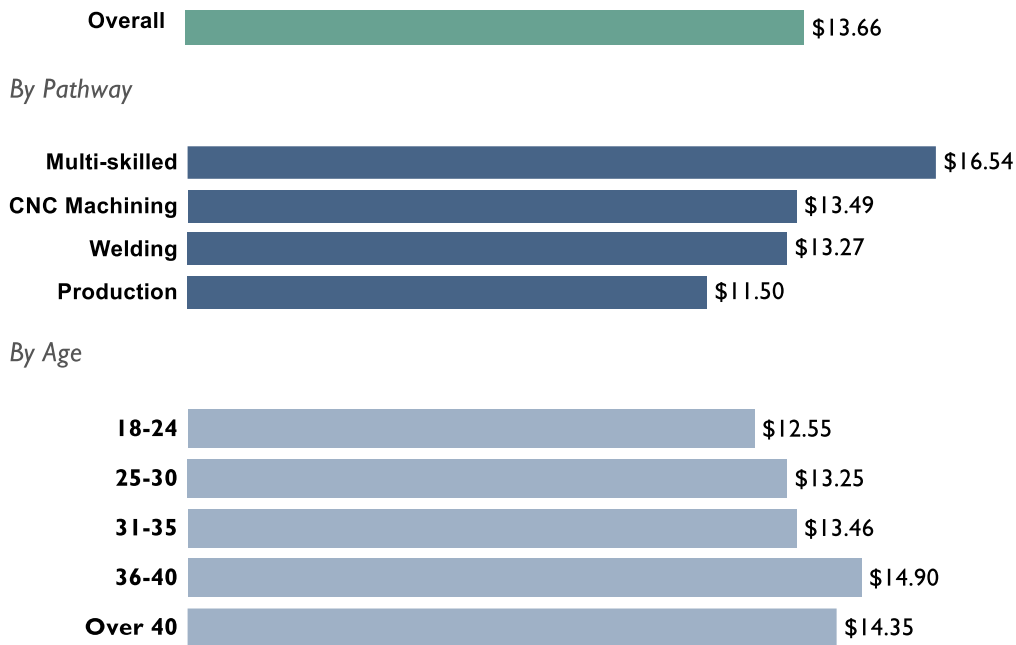
⁴² Mott and Schoolcraft have only a handful of incumbent workers who have successfully completed their programs (four and six participants respectively).

consistent across different career pathways, reflects variations in local labor markets. For example, in the Detroit Metropolitan Area, where both Macomb and Schoolcraft are located, machinists made an average of \$21.35 per hour, compared to an average wage of \$18.72 in the Upper Peninsula, where Bay is located.⁴³ Overall, M-CAM participants in Multi-Skilled/Mechatronics programs received the highest wages, followed by CNC Machining.

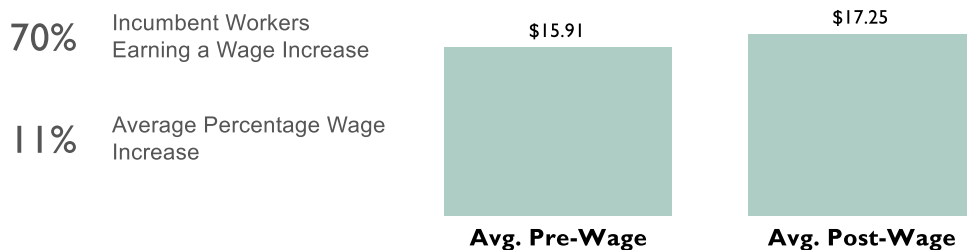
Exhibit 58: Wages

Employment Placement Wages

(Only available for participants with employment data in ETO)



Wage Increases for Incumbent Workers



(Only available for participants with employment data in ETO)

- **Older M-CAM participants generally received higher wages compared to younger participants.** Participants over 40 made an average of \$14.36 per hour, compared to \$13.21 among other participants. The youngest M-CAM participants, those under 25, earned an average of \$12.55 per hour. This age-based variation was especially noticeable among participants in Multi-

⁴³ Bureau of Labor Statistics. <http://www.bls.gov/bls/blswage.htm>. Accessed 8/04/2017.

Skill/Mechatronics programs, where participants over 40 earned more than \$3.00 per hour more than those under 25. Generally, older participants had work experience that made them more valuable to prospective employers than younger applicants.

- **Among incumbent workers, the value of participating in M-CAM programs seemed to be highest for workers under the age of 25.** Eighty-three percent of incumbent worker participants in the under 25 age group who completed their program of study received a wage increase compared to 72 percent of their counterparts age 25 to 30 and 61 percent of their counterparts over age 35.
- **African American participants earned lower wages on average than their white counterparts.** The difference in wages persisted across colleges and career pathways; the average post-wage for incumbent African Americans was \$14.84 compared to \$17.85 for Whites. Sixty-eight percent of African American participants received a wage increase, compared to 70 percent of white participants.
- **Women earned lower wages, on average, than did men.** Women graduating from M-CAM programs made lower average placement wages than men. For non-incumbent workers, the average hourly placement wage for women was \$12.75 compared to \$13.83 for men. For incumbent workers, women made \$17.17 compared to \$17.26 for men.

“I was a 1.5 GPA student in high school and now I have a 3.8-something GPA and it's really helped me get my confidence back and made me realize what I did wrong in high school. It's like a second chance and shows that I'm actually smart I guess, for lack of a better word.”

Student, Bay

“Before I got into the program, I was aimless. I had a job, but I did not have big goals. From being in the program, I now have goals for myself and they are pretty big, which is awesome. This class has made me think about where I want to be and pushed me towards that.”

Student, Lansing

“When I first came to this class, I just planned on finishing it, going to work. But now that I've come here, I've changed my mind. I want to get a degree in machining manufacturing. Something like that. And [my instructor] says teaching jobs are opening up for this. A lot of the teachers are getting old, quitting and retiring. So, I think that might be what I do. I might go back to school now.”

Student, Grand Rapids

Continuing Education

One of the core goals of M-CAM was to create an educational “step ladder” that would help students pursue further education, as needed, to advance their careers. Thus, in addition to employment, a key measure of program success was the degree to which students pursued further education.

Of the 28 percent of exited students who completed the survey, 41 percent indicated that they planned to pursue further education and training. In keeping with this finding, in interviews, many students said that M-CAM programs influenced their interest in pursuing further education, saying that M-CAM

helped to increase their self-confidence and their belief in their own ability to succeed academically. This finding is notable given that most M-CAM students had no previous experience with post-secondary education prior to grant enrollment.

Although limited, the data in ETO provide some insight into the types of further education M-CAM students enrolled in:

- **A total of 565 M-CAM students (22 percent) enrolled in multiple M-CAM programs or in further education after completing a TAACCCT-funded program of study.** Students were often attracted to other TAACCCT-funded programs during their tenure and moved to and from different pathways.
- **Of those in further education programs, 256 completed a professional certification, an academic certificate, or degree program and then enrolled in other programs.** Most of these students enrolled in community college programs, though roughly a third of students enrolled in programs at other technical schools, universities, or other non-specified institutions. Students enrolled in these other institutions were overwhelmingly white, and on average they were younger than the typical student enrolled in M-CAM programs.
- **Most students engaging in education at institutions other than community colleges pursued strongly related, technical fields.** Of the small number of students that reported their area of study, most reported pursuing an engineering degree or related field.
- **Almost half of all students were continuing in a community college pursued related, technical areas of study.** These fields included prerequisites for engineering fields, such as mechanical and electrical engineering, and construction.

Conclusion

Likely as a result of the initiative's successful service delivery and business engagement, M-CAM participants were generally quite successful in achieving positive educational and labor market outcomes. For example, approximately 81 percent of M-CAM grant participants had either completed their M-CAM programs or were still working toward completion as of the end of the grant period. M-CAM participants were generally very satisfied with the outcomes they achieved from the program. They appreciated the quality of training and most felt that it had helped them to get a job. Non-incumbent workers were placed into jobs at a high rate and most incumbent workers received a wage increase after having completed their programs. In the next chapter, we draw on comparison data from each of the eight M-CAM colleges to understand the impact of the program.

"The bottom line is the program did everything that I wanted it to do in every category. So here I am less than one year [out of the program] and I'm eight months into a welding fabrication job. I mean, in my opinion, that's pretty good...I knew what I wanted to do and these people were helpful enough to make it happen."

Student, Grand Rapids

CHAPTER 11:

Program Impacts



An important way of assessing the quality of the M-CAM programs is by determining whether they met the employment needs of the students who participated. The previous chapter addressed this question partially, by reporting participants' employment outcomes. The present chapter goes further by benchmarking these outcomes to those for comparison cohorts. Two comparison groups are used.

- **Contemporaneous comparison group.** The colleges provided us with data for students who enrolled about the same time as M-CAM students in non-M-CAM programs of study that were believed to serve similar types of students in roughly similar fields. A contemporaneous comparison can tell us whether M-CAM students fared at least as well in the labor market as these other students.
- **Historical comparison group.** For programs of study that were enhanced through M-CAM, we can compare outcomes for cohorts who participated in M-CAM with outcomes for cohorts who participated in the same fields of study at the same colleges prior to the TAACCCT grant award. This analysis provides inferential evidence of whether the enhancements introduced through M-CAM yielded better performance outcomes and, therefore, what the impact of the TAACCCT grant was on students' performance. To strengthen the comparison, we also use data for students in comparison programs of study both before and after the TAACCCT grant award, which permits a more refined analysis.

Data Used for the Analysis

Data on the characteristics of M-CAM students come from ETO. We selected for the analysis in this chapter only those M-CAM participants with a program enrollment date between July 2014 and August 2016.⁴⁴ Of these, we excluded students whose sole program of study was Production (except for Production students enrolled at Kellogg), because Production at the other colleges was a short-term program without suitable comparison at these colleges. Data for students in comparison programs were provided by the colleges and included students enrolled in automotive and heating, ventilation, and air conditioning (HVAC) programs (comparison programs), as well as students enrolled in M-CAM programs of study but before the TAACCCT award was granted. For the pre-grant period, we included students who had a program start date of 2012 or 2013; as with the M-CAM students, comparison students in the contemporaneous period had a program enrollment date anytime from July 2014 through August 2016. Some colleges provided comparison data for either the historical period or the contemporaneous period, but not both. With the data we were provided and the restrictions just described, our analysis file includes 2,562 M-CAM students and 4,169 comparison students.

We had social security numbers (SSNs) for nearly all the M-CAM students and about two thirds of the comparison students. We submitted the SSNs to the state Talent Investment Agency for matching with the state's Unemployment Insurance (UI) wage files, which provided information on sample members' quarterly earnings from the first quarter of 2012 to the first quarter of 2017. This employment information was then compared against the students' program start dates to create an employment timeline for each individual, beginning with the second quarter prior to program enrollment through the eighth quarter after enrollment. In other words, employment outcomes are dated from the date of program enrollment (not the exit date),⁴⁵ and, given the nature of UI wage data, outcomes are measured in calendar quarters from the enrollment quarter (earnings were adjusted to 2016 dollars using the Consumer Price Index). Based on the student's date of enrollment and the date range covered by the UI wage matching, information for each of the eight post-enrollment quarters is not available for all individuals.

The first column of Exhibit 1 in Appendix D, included at the end of this report, shows the colleges and programs that contributed data and for which we have at least one quarter of UI wage data. Programs for which we have pre-grant and post-grant data are shown in the subsequent two columns.

⁴⁴ Earlier M-CAM enrollees were excluded because M-CAM was in a start-up phase during early 2014, so these students would not have had the full benefit of M-CAM services; later M-CAM enrollees were excluded because we would not have sufficient time to observe outcomes. These date restrictions served to exclude approximately 800 M-CAM students.

⁴⁵ This represents a departure from the previous chapter, which dated outcomes from the date of exit. That approach was not possible for this chapter, because exit date was not consistently available for comparison students.

Contemporaneous Cohort Analysis

We begin with the contemporaneous comparison, by examining outcomes for M-CAM students and students in Automotive and HVAC in the post-grant period. Exhibit 59 shows these results.

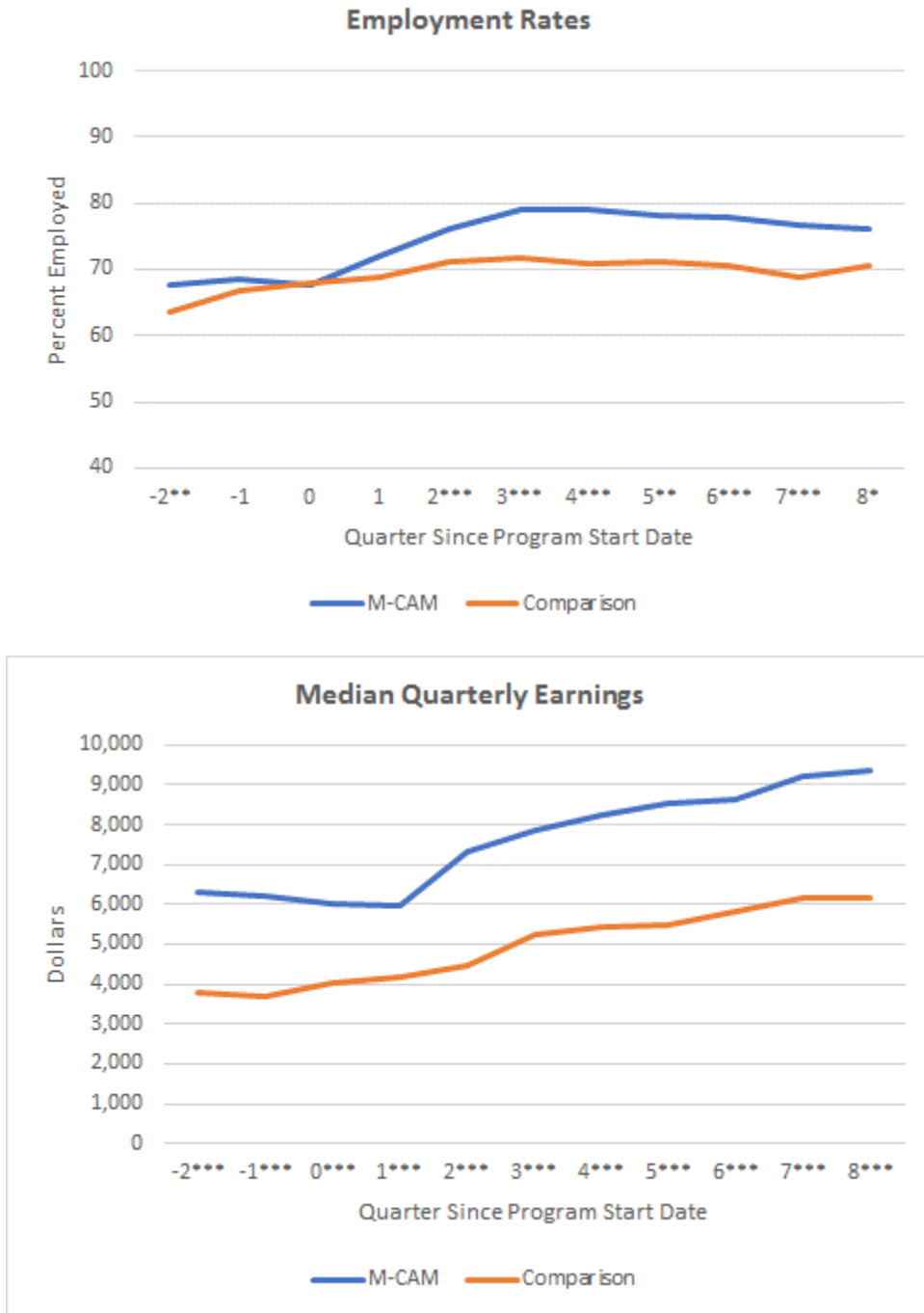
M-CAM students have significantly higher employment rates and higher earnings than those in comparison programs of study.

- **M-CAM and comparison students start out with roughly the same employment rates, but M-CAM students have significantly higher employment rates later on.** In the quarter in which they enroll in their programs, the M-CAM and comparison groups both have employment rates of just under 70 percent. The employment rates for the comparison groups increases only slightly through the eighth quarter, but M-CAM students show a much sharper increase.
- **Median earnings are higher for M-CAM students in all quarters.** Among those employed, median earnings are significantly higher for M-CAM students than comparison students both before and after program enrollment, and the gap widens over time.⁴⁶

The fact that M-CAM students who were employed had significantly higher earnings in the period before enrollment suggests that M-CAM and comparison students are dissimilar in important ways. Exhibit 60 confirms this: M-CAM students are significantly older, are more likely to be female, are more likely to be white, and were more likely to be enrolled in 2015 rather than 2014. They are also drawn from all eight colleges, while only five colleges provided data for comparison students in the contemporaneous period.

⁴⁶ Sample composition varies by quarter, because, based on their program start dates, fewer students have employment and outcome data observed in each successive quarter after the quarter of program enrollment. Changes over time in employment and earnings could therefore be an artifact of these compositional differences rather than truly reflecting employment and earnings trajectories. As a sensitivity test, we replicated the analyses in Exhibit 59 restricted to the subset of M-CAM and comparison students that had at least eight quarters of post-enrollment data, which means that their program start dates were no later than the first quarter of 2015 (of course, there are still compositional differences in earnings, because zero earners are excluded each quarter). These results are shown in Exhibit 2 in Appendix D, provided at the end of the chapter. Substantive conclusions do no change.

Exhibit 59: Employment and Earnings for M-CAM and Comparison Students



Notes: Comparison students were enrolled in the same colleges as M-CAM students over the same period of time, with the restrictions described in the text. Median earnings are shown after excluding those with no employment during the quarter. Quarter 0 represents the quarter of program enrollment.

Source: UI wage data

*/**/** Statistical significance at the .1/.05/.01 level.

Exhibit 60: Characteristics of M-CAM and Contemporaneous Comparison Students

	M-CAM	COMPARISONS	DIFFERENCE
Age (in years)	31.6	26.0	5.6***
Female	10.1	5.4	4.8***
Hispanic ethnicity	4.7	6.4	-1.7**
RACE			
Black/African-American	20.0	22.4	-2.4
White	73.3	69.7	3.6**
Other or more than one race	6.8	7.9	-1.1
PRE-ENROLLMENT EMPLOYMENT AND EARNINGS			
Prior first quarter employment rate	68.5	66.9	1.6
Prior second quarter employment rate	67.6	63.6	1.9*
Prior first quarter median earnings	6224	3,698	2,526***
Prior second quarter median earnings	6320	3,764	2,556***
CALENDAR YEAR OF ENROLLMENT			
2014	18.9	25.4	-6.6***
2015	58.2	54.1	4.2**
2016	22.7	20.5	2.2
COLLEGE OF ENROLLMENT			
Bay	5.7	3.1	2.5***
Grand Rapids	18.9	32.8	-13.9***
Kellogg	14.4	0.6	13.8***
Lake Michigan	5.4	0.0	5.4***
Lansing	6.8	0.0	6.8***
Macomb	32.2	40.7	-8.5***
Mott	10.0	22.8	-12.9***
Schoolcraft	6.8	0.0	6.8***
N of cases	2,562	1,156	

Notes: All variables are measured as percents, except age, which is measured in years, and prior median earnings, which is measured in dollars. Median pre-enrollment earnings was calculated after excluding those not employed.

Source: UI wage data and data from ETO (for M-CAM students) or administrative data provided by the colleges (for comparison students)

*/**/*** Statistically significant at the .1/.05/.01 level.

One way of adjusting for these differences in baseline characteristics is to attempt to control for them. Doing so serves to “equalize” M-CAM and comparison students on background characteristics (including pre-enrollment employment rates and earnings), so that the difference on outcomes attributable to being in an M-CAM program can be more fairly assessed. We used three different methods of control. First, we used regression analysis—ordinary least squares (for continuous variables) and logit (for dichotomous variables). All the variables shown in Exhibit 60 were included as covariates, including college fixed effects, which adjusts for differences in local labor markets to some degree.⁴⁷ Second, as a sensitivity test, we ran these analyses excluding the four colleges that provided no (or minimal) data for comparison students; excluding these colleges means that only colleges that provided data for both M-CAM and comparison students are included.⁴⁸ As an additional refinement, we conducted propensity score matching (PSM) to improve the correspondence between M-CAM and comparison students. Like regression adjustment, PSM attempts to equalize differences on baseline characteristics between treatment and comparison groups to make comparisons as fair as possible. It does so by identifying students from the comparison group who are most like M-CAM students and giving them added weight.⁴⁹ All these results are shown in Exhibit 61.

- **M-CAM students have significantly higher employment rates than comparison students, even after the statistical adjustments.** Before adjusting for covariates, M-CAM students have employment rates that are in the range of three to eight percentage points higher than the rates for comparison students. The various statistical adjustments do not diminish these differences after the first quarter.
- **Earnings differences change markedly after the statistical controls, but, even after the adjustments, M-CAM students have significantly higher earnings.** The unadjusted differences in mean earnings among those employed are on the order of \$2,000 to \$3,500 per quarter in favor of M-CAM students.⁵⁰ After taking into consideration baseline differences between the M-CAM and comparison groups, the post-enrollment earnings differences diminish considerably. However, the differences are still sizable and significant in favor of M-CAM students in every quarter except the first quarter.

⁴⁷ The pre-enrollment earnings variables included zero earners.

⁴⁸ For the regression models including all colleges, sample sizes vary depending on the quarter and the outcome, ranging from a sample size of 3,547 for the first-quarter employment rates, to a sample size of 970 for earnings in the eighth quarter. Sample sizes are smaller when the four colleges are excluded.

⁴⁹ The matching used pre-enrollment earnings, Hispanic ethnicity, race, gender, age, and program enrollment date as the matching variables. We imputed missing data before conducting the matching. We used one-to-one matching with replacement. Differences across the groups on the matching variables are shown in Exhibit 3 in Appendix D. Comparison-group sample sizes are smaller the further out one goes from the program enrollment rate, making it harder to find good matches in the eighth quarter than the first quarter. For this reason, the PSM analysis was restricted to the first four quarters after program enrollment. After eliminating those with missing data on outcomes, there are fewer comparison group members in the sample than M-CAM group members, which is undesirable when conducting PSM. Therefore, the PSM results should be viewed as exploratory.

⁵⁰ Throughout this chapter, quarterly earnings above \$50,000 were capped at \$50,000, to minimize the influence of a very small number of outliers.

Exhibit 61: Differences in Employment and Earnings Between M-CAM and Contemporaneous Comparison Students in the Eight Quarters after Program Enrollment

	DIFFERENCES ADJUSTED FOR COVARIATES			
	UNADJUSTED	ALL COLLEGES	EXCLUDING FOUR COLLEGES	PSM MODELS
EMPLOYMENT RATES				
First quarter after enrollment	3.3**	-0.3	0.9	5.1**
Second quarter	4.9***	5.9**	6.4***	11.0***
Third quarter	7.1***	8.9***	8.6***	13.9***
Fourth quarter	8.0***	9.5***	9.5***	11.5***
Fifth quarter	7.0**	6.9**	7.5***	---
Sixth quarter	7.5***	7.8**	7.9***	---
Seventh quarter	7.8***	10.1***	11.5***	---
Eighth quarter	5.7**	7.8**	7.1**	---
QUARTERLY EARNINGS (FOR THOSE EMPLOYED)				
First quarter after enrollment	1,930***	-202	-319*	-44
Second quarter	2,568***	431***	400**	633***
Third quarter	2,707***	797***	798***	841***
Fourth quarter	2,593***	783***	719***	729***
Fifth quarter	3,001***	1,049***	931***	---
Sixth quarter	3,071***	880***	800***	---
Seventh quarter	3,300***	804**	726**	---
Eighth quarter	3,491***	1,023***	902**	---

Notes: Numbers shown represent the difference in employment rates or earnings between M-CAM and comparison students, using different model specifications: the first column shows gross (unadjusted) mean differences, the second column shows differences after adjusting for covariates using a regression model, the third column adjusts for covariates and also excludes data from the four colleges that provided minimal comparison data, and the final column shows results after using propensity score matching and also adjusting for covariates. Sample sizes vary depending on the quarter after exit, on whether data for the four colleges that provided minimal comparison data are excluded, and because (for earnings outcomes) zero earners were excluded. The differences associated with being in M-CAM that were estimated from the logit models of employment were converted to changes in the predicted probability of employment when assessed at the mean value of all covariates.

Source: UI wage data and data from ETO and administrative data provided by the colleges.

*/**/** Statistically significant at the .1/.05/.01 level.

In short, M-CAM students have significantly higher employment rates and earnings in the quarters after program enrollment, even after adjusting for differences between the groups in baseline characteristics. These differences should not be thought of as “impacts” per se, because we cannot assume that M-CAM implementation caused students to select M-CAM programs of study rather than comparison programs. But these findings do convincingly demonstrate that M-CAM students are very competitive in the labor market—they are more likely to be employed and earn more than students with similar background characteristics who enrolled in these same colleges in related fields of study. This finding is especially notable given that M-CAM was still maturing during the first year or two of implementation.

After adjusting for covariates, M-CAM students are about 5 percentage points more likely to be employed in the third through eighth quarters after program enrollment than comparison students, and M-CAM students who are employed earn on average about \$500 to \$1,100 more per quarter.

Historical Comparisons

The analysis above demonstrates that M-CAM participants are succeeding in the labor market. But, this gives rise to another interesting question—for programs that were enhanced under M-CAM, what difference did the enhancements make? In other words, given the enhancements brought about by M-CAM, do participating students realize better outcomes than would have been the case if the program enhancements had not occurred?

General Approach

We address this research question through an over-time analysis. We observe outcomes for M-CAM participants, which, as a shorthand, we will call the M_{post} group. We also observe outcomes for students who participated in the same programs of study, but before the M-CAM enhancements; we call this the M_{pre} group. For example, Mott had a Welding program that existed before the TAACCCT grant, and used its grant funds to enhance this program and provide ancillary services to students; students who enrolled in Welding in the years before the TAACCCT group represent an M_{pre} group, and those who enrolled after the TAACCCT grant are in the M_{post} group. We also observe outcomes for students in comparison programs of study both before and after M-CAM implementation, which we call the C_{pre} and C_{post} groups. Using another example from Mott, students who enrolled in Automotive Technology prior to the TAACCCT grant are assigned to the C_{pre} group and those enrolled in Automotive Technology after the grant was awarded are in the C_{post} group. The post-grant groups include students who enrolled in programs of study from July 2014 through the summer of 2016, and the pre-grant groups include students who enrolled in calendar years 2012 or 2013, which is before the TAACCCT grant was awarded.

A simple comparison of outcomes for the M_{post} and M_{pre} groups tells us if students who enrolled in (for example) Welding at Mott after the TAACCCT award did better than students who enrolled in Welding at

Mott prior to award. However, there have been marked changes in the labor market over the years,⁵¹ so a change in outcomes for different cohorts of students over time (for example, M_{post} students compared with M_{pre} students) could be due to this fact rather than to any improvements brought about by M-CAM. A double-difference, or difference-in-difference design, can account for these temporal changes, by having the C_{pre} versus C_{post} comparison serve as a benchmark. If improvements in outcomes between the M_{pre} and M_{post} groups were greater than the improvements in outcomes between the C_{pre} and C_{post} groups, we have greater evidence that some part of the improvements for the former were due to the implementation of M-CAM and were not just due to temporal changes in the labor market as a whole.

Analysis

We start with the simpler analysis, which compares students enrolled in M-CAM programs before and after grant award (i.e., the M_{pre} and M_{post} groups described above). This analysis includes data we were provided for any student who enrolled in Welding, CNC, or Multiskilled (or Production, at Kellogg), regardless of whether the student enrolled before or after the TAACCCT award. Exhibit 62 presents these results. The top panel shows employment rates for the two groups in the quarter of program enrollment (quarter 0) and the eight quarters afterwards, and the bottom panel shows median quarterly earnings among those employed.⁵²

- **Employment rates are persistently higher for students who enrolled in M-CAM programs after the grant award.** Employment rates were 10 to 22 percentage points greater for the M_{post} group in the eight quarters when compared with the M_{pre} group. The gap narrows somewhat by the eighth quarter, but is still sizable and statistically significant.
- **Median earnings are also persistently higher.** Median earnings among those employed were \$2,859 greater for M-CAM students in the first quarter, with their earnings advantage growing to about \$4,000 by the eighth quarter.

This simple comparison demonstrates that M-CAM students did consistently better than students enrolled in the same programs prior to the awarding of the TAACCCT grant.

However, this comparison is not entirely fair: there could be differences in background characteristics between the groups and, as already discussed, the labor market improved markedly over these years. Regression adjustment, coupled with the power of the difference-in-difference design, can help overcome these challenges.⁵³

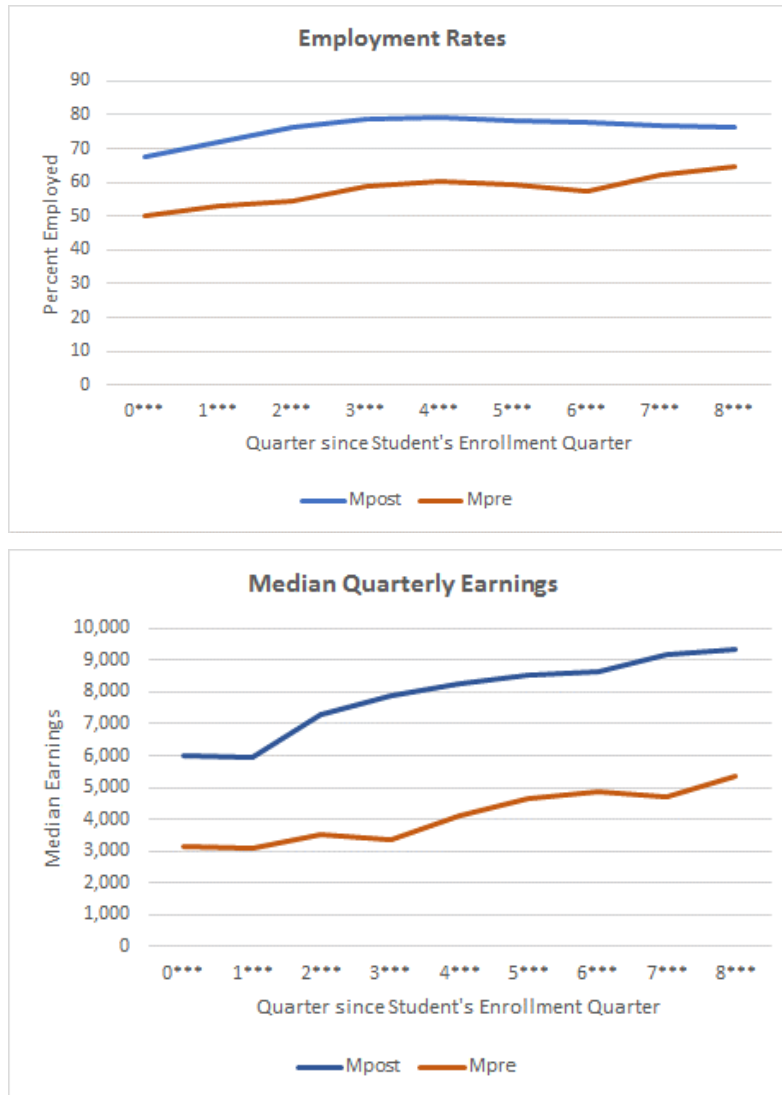
⁵¹ Michigan's unemployment rate stood at 9.2 percent in January of 2012 and fell to 4.8 percent by June of 2016. See <https://data.bls.gov/timeseries/LASST26000000000003>.

⁵² As noted, earnings have been adjusted to 2016 dollars.

⁵³ The model we estimate takes the form $Y = \beta_0 + \beta_1 \text{Time} + \beta_2 \text{Group} + \beta_3 (\text{Time} * \text{Group}) + \sum \beta_c X_c + u$, where Y is the outcome of interest, Time represents a dummy variable denoting whether a student enrolled prior to or after M-CAM implementation, Group is a dummy variable denoting whether the student was in an M-CAM program of study, X_c is a vector of covariates, u is an error term, and β_0 , β_1 , β_2 , β_3 , and β_c are coefficients to be estimated. The coefficient β_3 is the treatment effect, as it captures the effect of being in an M-CAM program in the post-implementation period.

The first column of Exhibit 63 presents results that make use of all the M-CAM and comparison students in either the pre-grant or post-grant periods who have non-missing data, regardless of which programs they were drawn from. These results again confirm that M-CAM students have done consistently well.

Exhibit 62: Employment and Earnings for M-CAM Students and Students in M-CAM Programs Prior to M-CAM Implementation



Notes: The M_{post} group consists of students who enrolled in M-CAM anytime from July 2014 through mid-2016; the M_{pre} group consists of students who enrolled in M-CAM programs of study in 2012 or 2013, prior to grant award. Outcomes are measured in the quarter in which the student enrolled in their programs and the eight quarters afterwards. Earnings have been adjusted to 2016 dollars.

Source: UI wage data

*/**/** Statistically significant at the .1/.05/.01 level.

Exhibit 63: Difference-in-Difference Estimates of the Effects of M-CAM Implementation on Employment and Earnings

	USING DATA ON ALL PROGRAMS	RESTRICTED TO PROGRAMS WITH DATA IN BOTH PRE AND POST PERIODS
EMPLOYMENT RATES		
First quarter after enrollment	5.2*	25.9***
Second quarter	6.2**	10.5***
Third quarter	8.2**	14.1***
Fourth quarter	10.3***	14.6***
Fifth quarter	12.4***	---
Sixth quarter	14.4***	---
Seventh quarter	12.5***	---
Eighth quarter	5.8	---
QUARTERLY EARNINGS (FOR THOSE EMPLOYED)		
First quarter after enrollment	-1,163***	-1,533***
Second quarter	224***	-285***
Third quarter	514***	397
Fourth quarter	-46***	-442
Fifth quarter	618	---
Sixth quarter	555	---
Seventh quarter	529	---
Eighth quarter	1,144**	---
N of cases	4,803	3,067

Notes: Numbers shown represent the effect of M-CAM implementation as estimated from regression models. The first model uses data for students in all M-CAM and comparison programs of study. The second model restricts the sample to students with at least four quarters of post-enrollment employment data and who were in programs for which we have data in both the pre- and post-implementation periods. This model also weights the sample to equalize the distribution of students across programs of study in the pre- and post-implementation periods within each college; because the weights were developed to equalize the distribution for students with data in the fourth quarter after enrollment, this model was not used to generate results for later quarters. Significance tests were calculated after adjusting standard errors for this weighting. Sample sizes shown in the table represent the number of students with employment data in the first quarter after enrollment. The treatment effects estimated from the logit models of employment were converted to changes in the predicted probability of employment associated with being in an M-CAM program in the post-implementation period rather than not.

Source: UI wage data and data from ETO and administrative data provided by the colleges.

*/**/** Statistically significant at the .1/.05/.01 level.

- **When M-CAM students are compared to a broader pool of students both prior to and after grant implementation, M-CAM students have better employment outcomes even after statistical adjustments.** M-CAM has a positive and statistically significant effect on employment rates that seems to grow over time, at least through the sixth quarter. Effects on earnings (excluding zero earners) are more variable but are statistically significant and sizable in the eighth quarter after program enrollment.

The models used to estimate the results shown in the first column of the exhibit have the advantage of making use of all students with non-missing data. However, the programs that make up the sample could change over time, which weakens the difference-in-difference comparison. For example, a college might have provided us with data for students who enrolled in HVAC in the post-grant period, but not in the pre-grant period. Since the estimate of the effect of M-CAM uses the changes over time in outcomes for the comparison group as a benchmark, this compositional difference undermines the value of the benchmark. To make the estimate of the effect of M-CAM implementation more precise, we refined the analysis by including only programs of study that had cohorts of students in the sample in both the pre-grant and post-grant time periods and for whom we had UI wage data up through the fourth quarter after enrollment. This improved precision comes at the substantial cost of excluding from the analysis the students in programs of study that were newly created with M-CAM and excludes comparisons programs from colleges that did not send us both pre-grant and post-grant data.⁵⁴ To further improve precision by minimizing the role of compositional differences, we weighted the sample so that the distribution of students across programs of study in the pre- and post-grant periods within each college was similar (for example, to ensure that the weighted number of Welding students from Kellogg is the same both before and after the grant award).

- **There are strong and significant effects of M-CAM on employment rates.** The treatment effect of M-CAM on employment rates estimated using this model are statistically significant and sizable in each or the four quarters after the enrollment quarter—even as late as the fourth quarter after enrollment, M-CAM improved employment probabilities by at least 10 percentage points over what would have been the case otherwise.

The changes brought about by M-CAM improved the probability that a student would find employment by at least 10 percentage points. There are no consistent effects on the earnings among those who were employed

- **There are no consistent effects on earnings.** Effects on earnings among those employed are highly variable across the quarters and are not positive and statistically significant in any quarter.⁵⁵

⁵⁴ Collectively, these restrictions eliminate approximately 1,800 students from the analysis. The final list of programs included for this DID analysis is shown in the final column of Exhibit 1 in Appendix D.

⁵⁵ Given that M-CAM improves employment probabilities, one limitation of excluding zero earners from the earnings models is that the pool of those employed is expanded under M-CAM and could thereby include those with less favorable earnings prospects. Notwithstanding this potential selectivity effect, we chose to exclude zero earners from the results on earnings so that earnings results would have a clearer interpretation.

Conclusion

We have used various comparisons to examine the effectiveness of M-CAM in providing students with suitable employment and earnings. Conclusions are generally robust to various model specifications and the use of different comparison groups. Based on the results we have described in this chapter, M-CAM seems to have met its promise. Compared with similar students who enrolled in these colleges, M-CAM students were significantly more likely to find employment and their earnings were considerably higher. We also have evidence that the improvements specifically brought about by M-CAM increased employment probabilities, but effects on earnings are not as clear.

CHAPTER 12:

Institutional and Systems-Level Outcomes



The big picture goal of the TAACCCT grants, which explicitly adopted a *career pathways* approach, was to better align sector-based job training programs with employer demand and the specific needs of adult learners and displaced workers through systems-level investments. In this context, investing in systems means focusing on enhancing and coordinating several facets of the retraining process, rather than just one thing—such as equipment. Therefore, the M-CAM colleges worked on a variety of “system-level” fronts including, but not limited to, fostering collaboration and communication among their respective colleges’ faculty and staff members, enhancing standardization and articulation of curricula across programs throughout the state, increasing industry engagement, improving data-driven decision-making, and improving coordination with local workforce agencies, nonprofit organizations, and educational institutions.

Besides carrying out its other tasks, the evaluation focused on studying these individual and cross-college efforts to affect change at both the institutional and state-wide levels—what we refer to as systems change. To measure the amount of change in relationships with employers and other partners, SPR conducted a baseline assessment using a social networking framework at the beginning of the M-CAM grant (Fall 2014) and then compared the results to those of a post-grant assessment (March 2017). SPR also conducted twelve in-depth interviews with representatives of the statewide workforce agency, the economic development agency, chambers of commerce, and community-based organizations to gather information about M-CAM’s effects on the way the colleges do business and engage with partners. This chapter draws on these data sources and others to provide an analysis of the institutional and systems change that developed over the course of grant implementation.

Since these key principles are common across a wide range of systems-change initiatives, they are used to demonstrate the effects M-CAM had on the colleges’ business practices and partnerships.

What Is Systems Change?

Several key principles are common across a wide range of systems-change efforts:

1. **Advances policy, practice, and funding processes.** M-CAM worked to achieve these advancements by leveraging funds, creating new administrative processes (e.g., prior learning assessment and articulation), and developing standardized curricula.
2. **Strengthens collaboration and relationships.** M-CAM colleges worked to increase their relationships with several key actors including employers, public workforce system, community- and faith-based organizations and other educational providers to address the needs of employers and workers. This included expanding employer engagement and deepening employer relationships.
3. **Achieves multi-level change within and among consortium colleges.** M-CAM altered the way colleges do business, both internally and externally.

Advance Policy, Practice, and Funding Processes

M-CAM helped the colleges to independently and collectively advance their policies, practices and funding processes, which resulted in several systems-level changes including improved career pathway models, increased leveraging of funding, and increased use of data to improve programs and services.

Improved Career Pathway Models

Since the early 1990s, the educational and public workforce development systems have worked closely to create programs that help students develop the skills and abilities to succeed in the workforce, especially in high-demand industries and occupations like advanced manufacturing. The Pathway Model, which has been widely supported by the Department of Education and Department of Labor, builds on these efforts by creating an integrated, institution-wide approach to student success based on well-designed, coherent and structured educational experiences that guide students, especially nontraditional students, from entry into training through to attainment of postsecondary credentials that lead to successful careers in the labor market.⁵⁶ Prior to M-CAM, most of the colleges reported that they already had stacked and latticed training programs, but few could clearly communicate the relationship between advanced manufacturing noncredit training and credit programs.

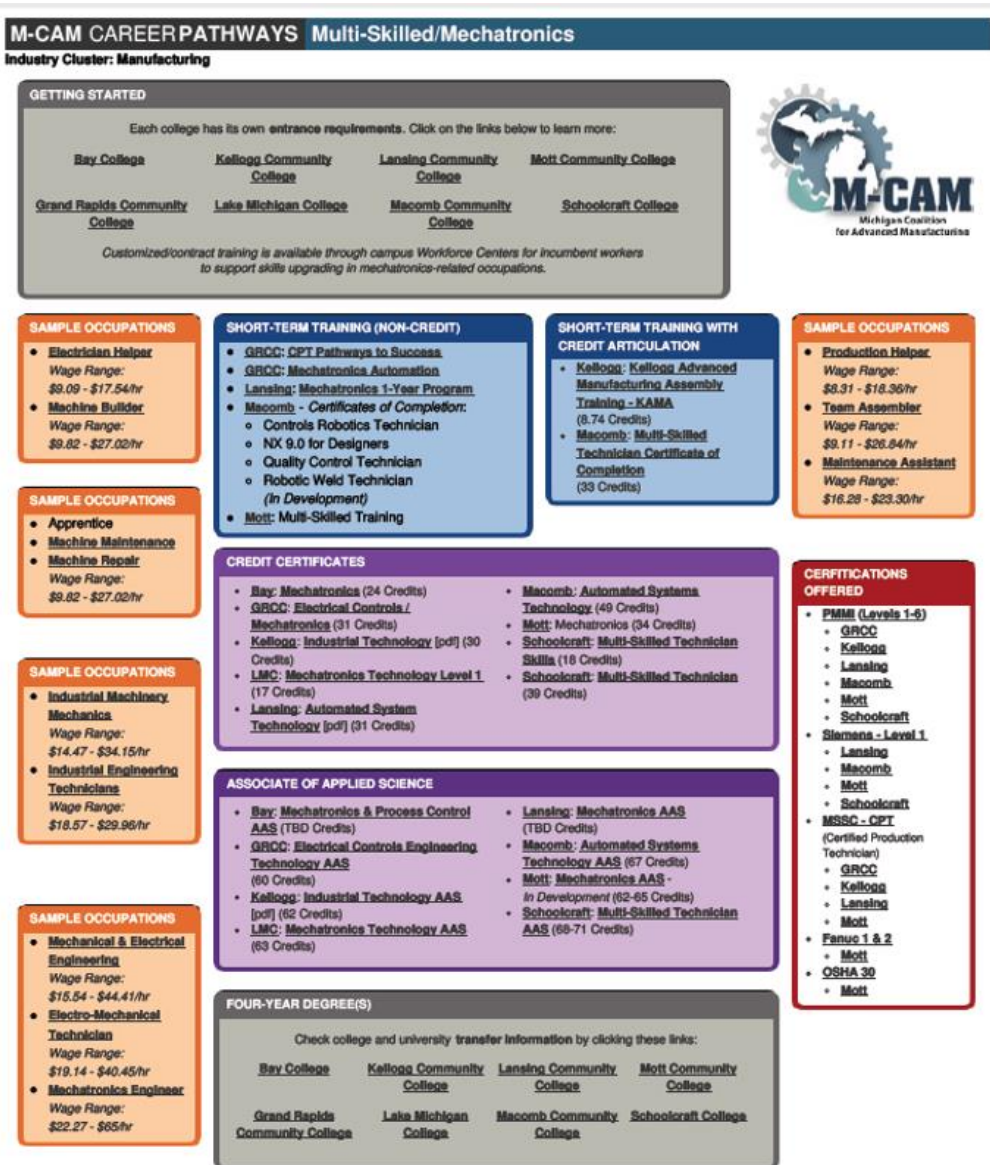
Through M-CAM, the community colleges were given the resources to build career pathways for their advanced manufacturing training programs. As part of the process of developing these pathways, M-CAM college staff members held meaningful discussions about advanced manufacturing career ladders with students, high school guidance counselors, and public workforce system partners. In addition, the colleges were provided with an opportunity to document existing advanced manufacturing training programs at their respective institutions and to design clear, coherent models for M-CAM's four career pathways—Welding/Fabrication, CNC Machining, Multi-Skilled/Mechatronics, and Production. These

⁵⁶ <http://www.aacc.nche.edu/Resources/aaccprograms/pathways/Pages/ProjectInformation.aspx#model>

industry-specific pathway models included information on entrance requirements, third-party industry certifications, short-term noncredit training programs, short-term training with credit articulation, credit college certificates, associate degree programs, and four-year degrees available through transfer agreements with colleges and universities.

The illustration below represents a summary of the Multi-Skilled/Mechatronics pathway and serves as an example of the stacked and latticed career pathway maps developed under M-CAM. The pathway model includes sample occupations by training program—noncredit and credit. These graphic models can be easily updated with new training programs and have embedded links that redirect students to additional content on the respective colleges’ websites.

Exhibit 64: Illustration of M-CAM’s Stacked and Latticed Career Pathways Model

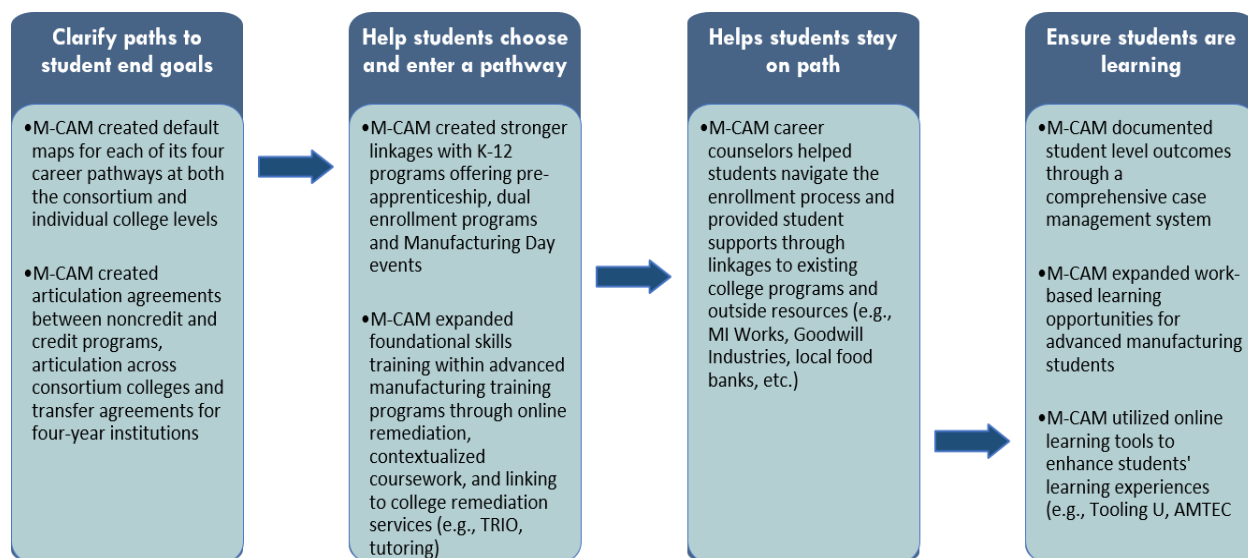


Source: <http://www.m-cam.org/pathway-mech.html>

A key function of the career pathways model is to help students navigate entry into the college system and assist them in selecting a training program that meets their educational and employment goals. M-CAM provided the colleges with the funding to hire career coaches and job developers. These staff assisted M-CAM students in making decisions about their training options and career decisions and supported students while they were enrolled in training, which helped alleviate barriers impeding training completion.

Based on years of research and evaluations, the American Association of Community Colleges has concluded that the ideal pathways model has four dimensions, each with a set of “essential practices.”⁵⁷ The career pathways model developed under M-CAM for the advanced manufacturing training programs at the consortium colleges includes all the essential practices, as illustrated in Exhibit 65.

Exhibit 65: Four Dimensions of the Career Pathway Model and the Essential Practices for Each Developed Under M-CAM



Leveraged Resources

The colleges leveraged the M-CAM grant to get additional resources, which in turn allowed them to purchase and upgrade equipment, expand facilities, and coordinate intrusive case management services for advanced manufacturing students. As described below, participation in M-CAM positioned each college to work more closely with state agencies, college and private foundations, non-profits, industry associations and unions to leverage resources.



⁵⁷ <http://www.aacc.nche.edu/Resources/aaccprograms/pathways/Pages/ProjectInformation.aspx#model>

- **M-CAM made it possible for consortium colleges to braid various funding streams to advance improvements in their curricula, equipment, facilities, and student services.** For example, Lake Michigan leveraged connections with local employers, as well as college-level funding, to build the Hanson Technology Center, a modern facility that houses Lake Michigan’s advanced manufacturing and technology programs as well

as its large-scale interactive manufacturing simulation labs. College administrators and faculty members stated that the M-CAM funding provided the institution with an opportunity to coordinate the development of its new technology lab. In another example, Mott braided several funding sources from local, state, and federal grants to maintain staffing levels and fund workforce development programs at the college.

- **Colleges leveraged other federal, state, and local resources to purchase equipment and sustain career coaches and job development staff members.** M-CAM colleges stated that the grant illustrated their competitiveness in addressing advanced manufacturing skills gaps and allowed them to capitalize on the state’s Skilled Trades Training Fund (STTF). With assistance from the Michigan Manufacturing Technology Center, colleges worked with Michigan Works! agencies to develop training programs that aligned with the needs of small to mid-sized manufacturing companies. Macomb, Kellogg, and Lansing each leveraged this funding to improve their advanced manufacturing training programs. Lansing also leveraged funding from Advanced Manufacturing Technical Education Collaborative (AMTEC). Bay partnered with Michigan Tech to leverage grant funding from the National Science Foundation and developed an articulation agreement for students of their new mechatronics program. College staff members hoped that the new mechatronics program, which includes robotics, will have a lasting presence and will help advance the employment options for their students. The mechatronics equipment helped to transform the perception of Bay’s training programs, allowing them to be seen as cutting-edge and the go-to place for training employees on Michigan’s Upper Peninsula. As discussed in Chapter 8, seven colleges obtained college or private grant funding to maintain their career coaching and/or job development positions. Four colleges—Lake Michigan, Lansing, Mott, and Schoolcraft—decided to use general funds or departmental funds to support the positions. The remaining three colleges—Grand Rapids, Kellogg, and Macomb—garnered grant funding to support the continuation of their M-CAM career coaches.

“Of this grant, we did a capital campaign, and so we’re able to talk about what we’re doing with this and we raised about \$7.5 million from our local communities, so I think having this grant helped us with that, no question about it.”

College President, Lake Michigan

“Resources from the college, community, state and federal government were all leveraged together over the last five years at LCC, which resulted in a major upgrade and expansion to the West Campus facility, improved career pathways at the college for advanced manufacturing programs, improved curriculum and major upgrades to equipment, which is one of the most important pieces to any industrial trades program.”

Project Manager, Lansing

Increased Data-Driven Decision-Making

Postsecondary educational institutions, like those represented by M-CAM, are increasingly being asked to document and report students' training completion outcomes as well as post-completion outcomes like employment, retention in employment, and earnings. Efforts to adequately and reliably track M-CAM student outcomes led to improved—even transformative—changes in how the colleges gather, report, and use program-level data to document employment-related outcomes, document growth in partnerships, and inform decision-making.

- **M-CAM improved colleges' understanding of the value of evaluation research.** Evaluation involves collecting and analyzing information about a program's activities, characteristics, and outcomes. The purpose of evaluation research is to make judgments about a program, to improve its effectiveness, and/or to inform subsequent programming decisions.⁵⁸ Through the third-party evaluator, the M-CAM colleges received frequent feedback on program performance, implementation successes, and barriers that impeded grant success and used these data to inform decision-making at their colleges and within the consortium.
- **The colleges recognized the value and importance of using a consortium-wide data collection system to document student demographics, training completion, and employment outcomes.** One of M-CAM's key goals was to develop a real-time, web-based longitudinal database to track student outcomes for reporting and evaluation purposes. All eight colleges adopted a common intake process and entered administrative data on student characteristics, participation, and outcomes in a common data collection system called Efforts To Outcomes (ETO). This common data collection system allowed the colleges to collectively and systematically document individual student-level outcomes, which proved valuable for overall and cross-site comparisons. The M-CAM project director and evaluation team found that having a common intake and data collection system was very helpful because it ensured that all eight consortium colleges collected data in a comparable way and tracked student outcomes consistently.

"The relationship between workforce programs and credit programs has improved. We are better able to understand each other's strategies and customer base and credit understands that the 4,000 students we train on our side of the college can easily become students in their credit programs with the right marketing and guided pathways. M-CAM allowed us to understand each other's worlds and created opportunities for us to engage with one another in meaningful discussions about curriculum and industry certifications."

*Bo Garcia, Lansing Community College,
Dean of Community Education and
Workforce Development*

⁵⁸ Patton, M.Q. (1987). *Qualitative Research Evaluation Methods*. Thousand Oaks, CA: Sage Publishers.

- **M-CAM colleges recognized the value of analyzing data on both noncredit and credit training programs.** The ETO data collection system helped the colleges develop a greater appreciation of the need to track similar types of data across noncredit and credit programs alike. Two colleges (Grand Rapids and Schoolcraft) developed new data collection systems to track student outcomes in noncredit programs. M-CAM also helped the colleges realize the importance of collecting Social Security numbers on *all* enrolled students, as this is the only unique identifier that can be used for wage data matching. The ability to assess data by program type (e.g., noncredit and credit programs) also allowed the M-CAM colleges to evaluate the demographics of the participants they served in each type of program and allowed them to track educational and employment outcomes for noncredit students, which were a large percentage of the students served under the grant.

“This level of investment is unusual for Lansing; however, this process has helped the college to appreciate the benefits of collecting follow-up data to learn about the employment outcomes of students.”

Lansing Project Director

- **M-CAM motivated college presidents to advocate for the use of state-level wage data to support analysis and reporting of employment-related outcomes.** During the TAACCCT period of performance, the presidents of all eight M-CAM colleges met with representatives from the Governor’s Office to address their concerns about sharing wage data to analyze employment-related outcomes. Their efforts were instrumental in helping to garner support for statutory changes to Michigan’s Social Security Act. On behalf of M-CAM, Dr. Jacobs, President of Macomb Community College, testified before the Michigan State Legislature in support of House Bill No. 4545, which clarified that community colleges may have access to wage data for certain research purposes, and House Bill No. 4546, which required the state’s Unemployment Insurance Agency to develop a process that colleges and universities could use to request such data. These bills would also clarify responsibility for misuse of wage data, allowing that liability to be assigned to the employee who handles the information, rather than a public official. The bills passed both the House and Senate subcommittees and were due for a final vote by November 2017, and at the time this was written processes were being developed to request and share wage data for future continuous improvement efforts. In addition, the Unemployment Agency and Workforce Development Agency divisions within TIA signed a Memorandum of Understanding with Social Policy Research Associates, the third-party TAACCCT evaluator, to share wage data for employment, retention, and wages. The ability to access wage data was instrumental in helping the colleges demonstrate positive employment outcomes and wage increases for M-CAM participants. Without this data, employment outcomes would have been significantly under-reported.

Strengthened Collaboration and Relationships

Strengthening collaboration and relationships is a key principle of systems-change initiatives and the M-CAM colleges worked to both increase their collaboration with key partners and organizations and to improve the quality of those relationships. This level of collaboration and engagement allowed the colleges to develop new relationships with other consortium colleges, employers, public workforce partners, community- and faith-based organizations and other non-consortium educational entities. The M-CAM colleges' efforts also led several colleges to deepen the quality of their relationships with these groups as well, which is a fundamental component of systems-change.

Improved Collaboration across M-CAM Colleges

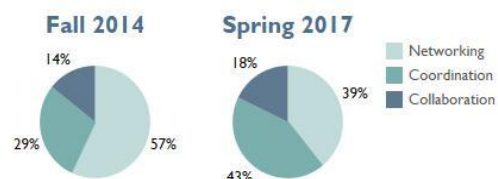
One of the systems-level accomplishments of M-CAM was increased coordination and collaboration among the eight community colleges in the consortium. Because Michigan is a “non-system” state,⁵⁹ collaboration and coordination among community colleges are not givens. Community colleges in Michigan operate independently, tailoring their programs to the needs of their local communities, and thus rarely have a need to work collaboratively. M-CAM was a unique opportunity for the colleges to work together to address the training needs of employers throughout the state. SPR gathered information about relationships among the consortium colleges at the beginning and at the end of the grant period; core findings are highlighted below.

- The level of coordination between the colleges increased significantly over the course of grant implementation, as illustrated in the figure at the right.** At the beginning of the project in 2014, the most common type of connection among consortium colleges was networking (57 percent of connections), followed by coordination (29 percent) and collaboration (14 percent). By Spring 2017, coordination (a deeper form of relationship than networking) had become the most common type of connection (43 percent of all college partnerships). In addition, the number and percentage of connections reported at the collaboration level (the highest level) increased during the same period

Exhibit 66: Partnerships with Consortium Colleges

Number of Partnerships		
Fall 2014	Spring 2017	Change
56	56	0%

Strength of Partnerships			
	Fall 2014	Spring 2017	Change
Networking	32	22	-31%
Coordination	16	24	+50%
Collaboration	8	10	+25%
Total	56	56	0%



⁵⁹ Community colleges in Michigan are governed by locally elected boards and are subject to controls from the Boards of Education. Funding comes in part from taxpayer dollars (through revenue from property taxes and some general state appropriations) and in part from student tuition and fees. State policy sets a minimum of 60 credit hours for associate degree programs, but community college programs are approved by the locally elected boards.

modestly, from 14 percent of connections to 18 percent. The strength of relationships between the M-CAM colleges also improved from the lowest networking level to collaboration from 2014 to 2017, which shows an improvement in the level of engagement and partnership across the consortium colleges. These data show that some consortium colleges built strong partnerships with their counterparts across the state during M-CAM implementation.

- **The consortium workgroups (described in Chapter 2) and monthly strategy and operations meetings supported the development of stronger cross-college relationships.** The workgroup structure of the grant, coupled with the monthly in-person strategy and operations meetings, increased coordination between consortium members, promoted collaboration and sharing of best practices among college leads and faculty members, and promoted consistency in program development.
- **By aligning curricula to industry-recognized standards, the colleges built consortium-wide consistency in content and student assessment into their training programs.** As described in several places in this report, all eight colleges incorporated third-party, industry-recognized standards and credentials into their advanced manufacturing programs. Through alignment with these industry standards, the colleges brought about a higher level of accountability and consistency in how advanced manufacturing programs are taught across the colleges and helped Michigan employers see the value of incorporating third-party industry certifications into noncredit and credit training programs to validate students' learning. Using third-party industry-certification exams brought consistency to the colleges' student assessment process.
- **Colleges developed a plan for articulating credit within and across their institutions.** The decision to use industry credentials as the basis for awarding credit for prior learning at all colleges brought consortium-wide consistency to the PLA process, while a carefully worked-out articulation plan allowed students to more easily transfer between consortium colleges. This successful collaborative process resulted in three colleges—Grand Rapids, Kellogg and Lansing—considering the use of third-party industry certificates to articulate credit within other training program areas such as healthcare, information technology, and construction trades.
- **College staff and faculty members collaborated in overcoming challenges and shared their promising practices.** “One of the key things that we’ve talked about with the M-CAM group is the networking stuff that we’ve done,” said one college lead. “In terms of other schools, [we want to] continue to work with them, and learn and grow from what they’re doing.” This sentiment was echoed by many of the M-CAM college leads, faculty members, and staff members. A good example of colleges learning from each other is provided by Kellogg’s sharing of its open entry/open exit, competency-based training model and the details of how it negotiates contracts with instructors, develops online course curricula, and monitors student performance towards

“We found that we’re doing a lot of the same work, and you really want to learn from one another in relation to different strategies that we implement in our colleges, in our campuses, whether it be around recruitment, instruction delivery, or whatever.”

Project Lead, Mott

certificates and degrees. As one result of this sharing, elements of Kellogg's model were adopted by Lansing for its credit mechatronics programs. Similarly, a few colleges negotiated better equipment rates with vendors because of information shared by consortium colleges at workgroup and consortium-wide meetings. In terms of benchmarking, college leads and faculty stated that they benchmarked their college's programs and activities against other consortium colleges, which helped to drive the design of training programs, improve student services, increase completion rates, and improve employment outcomes.

Improved Engagement and Collaboration with Employers

The employers we interviewed were gravely concerned about the talent pipeline. They felt the shortage in skilled labor would hinder their ability to sustain and grow their businesses. To address this concern, the consortium colleges worked closely with employers and chambers of commerce to identify demand occupations and adapt their training programs to better meet employers' needs.

The colleges all had relationships with employers prior to M-CAM, but the M-CAM grant required that they reconnect with their employer base and strengthen those relationships. M-CAM staff and faculty members worked with employers to inform all aspects of the implementation of the pathways model, particularly alignment of curricula with industry practices, standards, and credentials, and development of employment and work-based learning opportunities. Throughout this process, the career coaches and job development staff members were instrumental in helping colleges reach out to employers and increase their participation, particularly in job placement-related activities. SPR gathered detailed information on the number and quality of employer partnerships, with core findings highlighted below.

- **Across the consortium, the number of reported employer partnerships nearly doubled, from 204 in Fall 2014 to 392 in Spring 2016.** Six of eight consortium members reported growth in the number of employer partners, with Bay, Lake Michigan, Macomb, and Schoolcraft reporting the most growth. Most new partners were engaged in assisting with work-based learning opportunities and job placement, including conducting mock interviews and attending job fairs.
- **300 employers (77 percent of total employer partners) were engaged in planning for and developing training programs across eight colleges.** This was a common role for employers to play prior to the grant, but colleges increased the pool of employers that they were working with to identify core competencies, equipment needs, and opportunities for hands-on learning activities. At the time of the Spring 2016 site visit, 70 percent of the programs in the pathways at each college (18 out of 26) were actively working with industry representatives to ensure that course content met their needs. Employers also responded to surveys from some pathway working groups. Through those mechanisms, the colleges gathered input on decisions such as which third-party industry certifications to select and align coursework to and what equipment to purchase. During the final round of site visits, colleges reported that engagement with employers around Multi-skilled /Mechatronics training programs substantially increased and led to the creation of new noncredit and credit programs as well as the identification of new pre-apprenticeship and apprenticeship opportunities for employers.

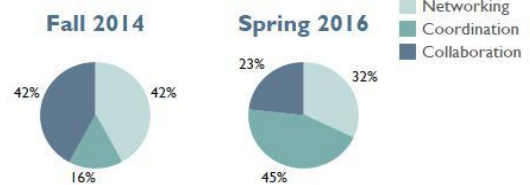
- **158 employers (38 percent of total employer partners) were engaged in helping to recruit students into the M-CAM program at seven colleges.** Although recruiting students into M-CAM was the area of least involvement for employers, it is notable that nearly a third (28%) of all employers offered tuition assistance to employees who were potential M-CAM students. Employers also referred employees to the colleges for training and participated in orientation sessions to educate students on what kind of jobs they would be eligible for upon completion of training.
- **278 employers (71 percent of all employer partners) were directly engaged in enhancing training quality across the eight colleges.** These employers provided job site tours to students, served as guest speakers in classes, provided job shadowing opportunities, provided mock or practice interviews for students, and critiqued student resumes. Many colleges also worked closely with employers to provide customized trainings and incumbent worker training classes or programs.
- **356 employers (91 percent of total employer partners) assisted with job placement for students across the colleges.** These employers interviewed participants at the college, participated in job fairs, and actively coordinated with M-CAM staff members to hire students. Two of the most common roles were posting job listings and coordinating with M-CAM job developers to hire students.

Exhibit 67: Partnerships with Employers

Number of Partnerships

Fall 2014	Spring 2016	Change
204	392	+92%

Strength of Partnerships



Top Roles

Posted job listings at college	75%
Provided information on the needs of employers	69%
Actively coordinated with M-CAM job developers to hire students	50%
Interviewed participants at college	43%
Provided worksite access for training, tours, demonstrations	36%
Participated in a job fair	35%
Provided labor market/industry information	34%
Critiqued student resumes	30%
Identified necessary skills and competencies for M-CAM training	30%
Provided mock interview(s) for students	28%
Offered tuition assistance to M-CAM employee students	28%

Growth in employer partnerships over the life of the grant speaks to the consortium’s deliberate efforts to actively engage employers in strengthening their career pathways. Consortium colleges engaged at least 188 new employers whom they had previously not worked with and leveraged those connections in meaningful ways. As a result of M-CAM, over 60 percent of employers supported colleges in five or more ways, reflecting a deep level of engagement.

For example, Lake Michigan engaged in deeper discussions with employers and enhanced its mechatronics programs by adding additional content on robotics into the course curriculum to align with employers’ needs. “They’re always involved in terms of telling us what they need from an employee’s perspective,” commented the M-CAM project lead. “It’s usually pretty incredible.”

Prior to M-CAM, Schoolcraft College’s engagement with business was not well coordinated and lacked cohesiveness. Faculty in the advanced manufacturing department engaged individually with employers and industry associations, but the feedback from these meetings was not well-documented nor was it always well communicated with the departmental dean or Career Services division. Because of M-CAM, Schoolcraft College administrators, faculty members, and staff members developed an employer engagement protocol that clearly defined the process for engaging employers and outlined the roles that specific college staff members, faculty members, and outside organizations (i.e., MI Works and economic development) should play in the college’s employer engagement efforts. At the close of the grant, Schoolcraft had a core team that conducted business outreach and recruitment to share information about the college’s training programs and worked closely with employers to identify contract training opportunities for their incumbent workforce. The core team met bi-monthly and was made up of representatives from the college’s workforce training division, credit division, faculty, AMCAI, and the public workforce development agency. In addition to the bi-monthly meetings, college representatives shared information about employer and partner engagement at quarterly college meetings with the above core team members and representatives from Career Services, Schoolcraft Foundation, Student Services, and the college’s marketing department. Stakeholders reported that these efforts have positively impacted the college’s reputation among and engagement with employers.

“I think the most important aspect is that [the college] is meeting industry needs. We have a real skills gap that we’re hearing from our businesses and primarily manufacturers, looking for welders, and looking for experienced workers who understand operations and manufacturing to begin with. I think that’s the most important part is that it’s filling that gap, it’s bringing the education and training facilities in closer collaboration with our manufacturers.”

MI Economic Development

In addition to coordinating with individual employers, consortium colleges also actively engaged with industry associations, chambers of commerce, and economic development agencies. Representatives from chambers of commerce and employer associations reported that M-CAM has helped to increase colleges’ awareness of employers’ needs and that the colleges responded positively in terms of enhancing and developing training programs that were aligned with manufacturing employers’ labor needs.

Through improved employer engagement, M-CAM has helped the colleges identify and place students in demand occupations, facilitate engagement with incumbent worker and apprenticeship training programs, align curriculum with industry needs, attract future instructors and faculty members who possess industry experience, and obtain in-kind resources such as equipment donations and supplies. Employer associations, chambers of commerce, and economic development agencies affirmed that community colleges have engaged advanced manufacturing employers and have responded to their needs by enhancing and creating noncredit and credit training programs, and that these programs are helping to support a pipeline of skilled labor and improve the skills of the incumbent workforce. Even with these accolades, however, there is room for improvement. One economic development agency representative stated that colleges could be doing more to *actively* and *consistently* engage with employers and employer associations. *“I think it feels like it's more me bringing the information to the college, rather than the college really seeking it out,”*

stated one economic development agency representative. This comment suggests that while employer engagement was a huge focus of the M-CAM grant, colleges need to remain proactive and attentive in maintaining and building employer relationships.

“I don't hear manufacturers anymore saying that the colleges are not developing the right type of people, or the curriculum is off or doesn't line up with the occupation.... The community colleges have been very responsive, and have listened to employers, other talent needs, and have aligned their curriculums and programs to deliver that. And when I started in this job six years ago, I heard that, all of the time.... I believe that the community colleges are far more responsive as a segment of the post-secondary education system.”

Employer association representative

“I think the M-CAM grant has spurred a lot of new activity and efforts by the community college in aligning with employers needs for advanced manufacturing talent needs. So, I think it has helped to accelerate the alignment.”

Employer association representative

EMPLOYER ENGAGEMENT CASE STUDIES

Employer: *Tribar Manufacturing*

College: *Mott*

Over the course of a year, Mott workforce development center staff members developed a strong relationship with a decorative badging company located outside Flint, Michigan. After having a difficult time finding qualified workers due to a rapid expansion at its plant, Tribar Manufacturing considered relocating its plant to another state. The plant manager stated:

“Even though the hiring drives me crazy, we are in the – in a time now where there’s about eight different manufacturing companies that share a 20-mile radius with us. No one can find enough people. Everyone is understaffed. Everyone is scrambling to get people. We have done everything – we’re doing everything we can to automate at all these facilities.”

Mott, in collaboration with its local MI Works! and economic development organization, helped train and refer individuals to Tribar Manufacturing for employment. Given that the company is located 45 minutes outside Flint, the partners worked together to provide bus transportation services to workers four times per day (transportation to and from the facility for each of two shifts). In addition, the partners provided subsidized employment (up to \$5,000 per worker) and post-placement support from the M-CAM career counselor. The partners are continuing to work with the employer to develop a registered apprenticeship program.

Employer: *PA Solutions*

College: *Macomb*

Macomb M-CAM staff members worked closely with this employer to develop an entry-level six-week training program for new hires. With funding from the state of Michigan and M-CAM, Macomb enhanced its existing curriculum and created customized training programs for the employer, which were offered at the college’s training center.

In addition to developing employer-sponsored training programs, Macomb worked closely with this local employer to host interviewing events for M-CAM students.

“We’ve been to two already and we actually hosted one at our company for [M-CAM]. It’s been a success. We’ve actually just wrote up six offers within one week for M-CAM students.”

The employer commented that the M-CAM job developer was a valuable addition to the college’s services because she made frequent visits to meet with the employer and worked hard to address the company’s hiring needs.

“The good thing about the M-TECH students is that they have an overall knowledge of the – I would say a brief overall knowledge of what we are looking for. As far as PLCs and controls positions, they’ll have that, and they’ll also have a little knowledge about robots and robot programming and different types of robots we use here. I mean, other candidates will probably just have one specific thing off the job description. M-TECH students will have a little knowledge of each thing off the description.”

Improved Engagement with Public Workforce Partners

Most M-CAM colleges developed stronger relationships with public workforce partners over the course of grant implementation. During grant start-up, Michigan’s public workforce system was consolidating smaller local workforce investment areas into larger Regional Prosperity Regions. At that time, several M-CAM colleges reported that their relationships with the state Talent Investment Agency and the local MI Works! service centers (i.e., American Job Centers) had lapsed and that they were looking to “re-engage” and re-build relationships.

SPR gathered information about the consortium colleges’ relationships with public workforce partners at the beginning and at the end of the grant. Core findings on how these relationships changed during the grant period are highlighted below.

- On average, workforce partnerships, which tended to be the strongest partnerships at the beginning of the project, grew only moderately in number and strength over the course of grant implementation.** In some cases, the M-CAM grant resulted in a few colleges developing a better understanding of the public workforce system. For example, Lansing college staff members improved their knowledge of the workforce system, including the rules and regulations governing their Title I Workforce Innovation and Opportunity Act (WIOA) programs. The only college that reported a significant increase in workforce partners was Schoolcraft. Schoolcraft staff members worked closely with their workforce partners to create entry-level training boot camps and develop new apprenticeships and OJT opportunities.
- Increased collaboration with the public workforce system led some colleges to tailor their training programs to low-income and special populations, such as homeless persons and those in need of basic skills education.** For example, Kellogg and Michigan Works! collaborated on a foundation grant to expand the

Grand Rapids’ project director joined the Michigan Works Discover Manufacturing Leadership Team, which helped to set a strategic direction for engaging industry and attracting skilled labor to the area. Lansing had two college-funded staff housed at their local MI Works! service center to share educational information about the college’s program with jobseekers and worked with local WIOA service provider staff to assist Lansing students with job placement services.

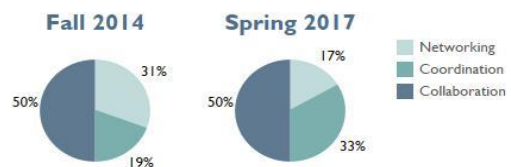
Exhibit 68: Partnerships with Public Workforce

Number of Partnerships

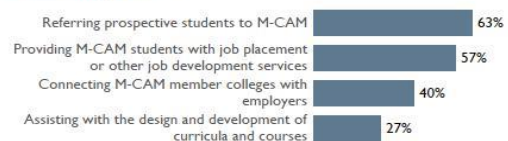
Fall 2014	Spring 2017	Change
26	30	+15%

Strength of Partnerships

	Fall 2014	Spring 2017	Change
Networking	8	5	-38%
Coordination	5	10	+100%
Collaboration	13	15	+15%
Total	26	30	+15%



Partnership Roles



career pathways program and case management model into the college’s healthcare and information technology programs and to continue to offer free entry-level training programs to participants.

- **Public workforce partners played a vital role in the initiative, helping M-CAM colleges recruit prospective students, providing job search and placement assistance, and funding supportive services.** The state workforce agency, Talent Investment Agency, and the local MI Works! service centers played a vital role in helping the colleges recruit among two grant-required target populations—trade-affected workers and veterans. The state agency provided the colleges with detailed information about the trade-affected worker population and areas within the state most heavily impacted by trade-related efforts.
- **The state workforce agency, Michigan Talent Investment Agency, played an important role in helping the colleges access wage data for employment and wage verification.** The state agency provided the colleges with detailed information about the trade-affected worker population and was instrumental in helping the colleges negotiate the use of wage data to support grant outcomes reporting requirements.
- **The public workforce system and community colleges were invested in sustained partnerships across their educational and workforce systems.** Interviewees from both the state Talent Investment Agency and colleges expressed the importance of sustaining strong partnerships to meet the needs of both students and employers in Michigan.

Some colleges reported that there is still room for improvement in terms of collaboration with the public workforce system, but acknowledged that M-CAM helped them build stronger linkages with their systems partners. Many colleges noted that formal and frequent communication channels would facilitate stronger and more sustainable connections with the public workforce system.

“Each stakeholder is doing their own thing...It would be great if there was a big communication system to be able to coordinate and plan that.”

Grand Rapids Respondent

Increased Collaboration with Community-Based Organizations and Other Partners

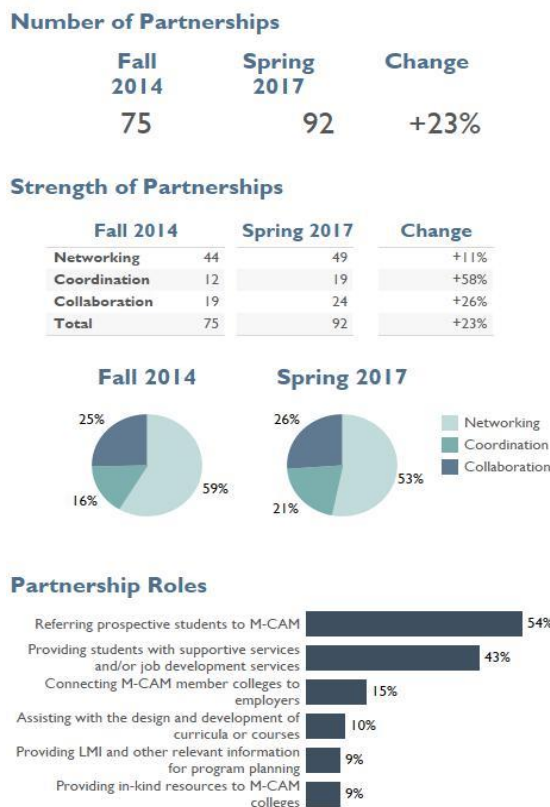
M-CAM resulted in increased collaboration between consortium colleges and a wide range of community-based organizations and faith-based organizations. Many colleges reported that the additional grant staffing allowed for the college to engage with such organizations on a larger scale. Organizations such as emergency shelters, associations, and churches referred individuals seeking employment to the colleges’ job training programs and some of these community partners in turn provided a strong referral network for the colleges. For example, Grand Rapids coordinated with its local Literacy Center and Hispanic Center to recruit students, and the center provided these individuals with transportation assistance, child care, and food. These additional services provided a support system for

the colleges' M-CAM students and helped them address barriers that would have otherwise impeded their academic and employment success.

SPR gathered information about the consortium colleges' relationships with community-based organizations and other partners at the beginning and at the end of the grant; core findings on the changes that occurred during the grant period are highlighted below and summarized in the accompanying graphic.

- Partnerships with CBOs and “other” partners increased significantly over the course of the grant period.** Between Fall 2014 and Spring 2017, the number of these partnerships increased by 23 percent. The increase was driven by Kellogg, Macomb, and Schoolcraft. There was also a slight increase in the strength of these partnerships.
- Representatives of CBOs and other partners played a vital role in the initiative; they referred students to the colleges’ training programs, provided supportive services, and connected colleges to employers and industry organizations.** For example, Kellogg worked closely with the Michigan Department of Corrections (MDOC) to recruit and train ex-offenders in its entry-level production programs. College grant staff members participated in Transition Team meetings with service providers and MDOC staff members to share information about the college’s educational opportunities. At the close of the grant, MDOC intended to build a similar relationship with Lake Michigan to serve ex-offenders.
- At least three colleges (Bay, Kellogg, and Schoolcraft) increased their engagement with unions.** For example, Bay’s new mechatronics equipment attracted interest from the Ironworkers Union, which now rents the welding lab for apprenticeship training. The M-CAM colleges generally engaged unions with the goal of providing students with apprenticeship opportunities.

Exhibit 69: Partnerships with CBOs and Other Organizations



Improved Coordination with Non-Consortium Colleges

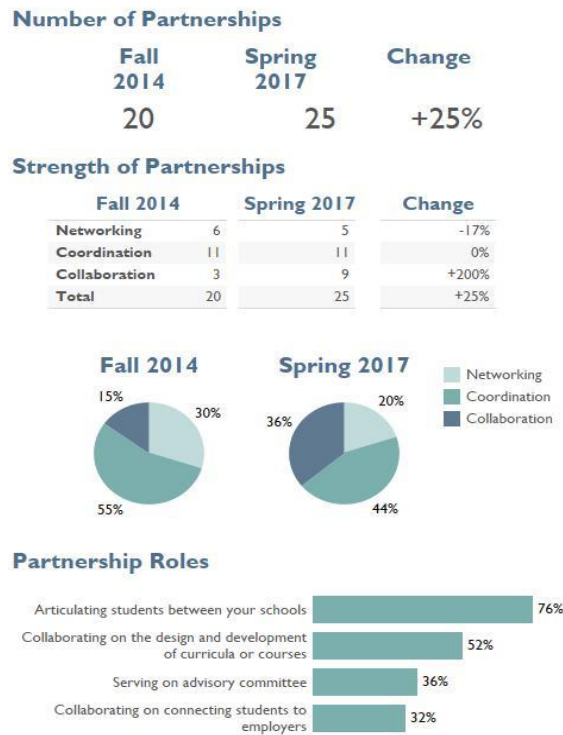
M-CAM resulted in improved partnerships with non-consortium colleges including four-year institutions, which are a key component in the career ladder approaches developed for the college’s advanced manufacturing training programs. Prior to M-CAM, the colleges each negotiated separate articulation and transfer agreements with four-year universities in their geographic regions. As described in Chapter

9, M-CAM helped the community colleges collectively work together to negotiate a single articulation and transfer agreement with two four-year universities—Eastern Michigan University and Ferris State University.

The core findings about the changes that occurred in these relationships during the grant period are highlighted below and summarized in the accompanying graphic.

- The number of partnerships between M-CAM colleges and non-consortium colleges increased by 25 percent.** This increase was driven by Grand Rapids (+2 partnerships), Kellogg (+2) and Schoolcraft (+3). The strength of the partnerships with non-consortium colleges increased as well, with more relationships reported as collaboration, the highest level of partnership.
- The M-CAM consortium formed new partnerships four-year universities and other two-year community colleges.** These new university/college partners included Eastern Michigan University, Ferris State University, Grand Valley State University, Montcalm Community College, Muskegon Community College, Pennsylvania College of Technology, West Shore Community College and Western Michigan University.
- Representatives of four-year universities and other 2-year community colleges played key roles in the initiative as partners.** They helped M-CAM colleges develop articulation agreements (reported by 75 percent), collaborated on the design and development of curricula and courses (reported by 52 percent), served on M-CAM colleges’ advisory committees, and helped connect students to employers and work-based learning opportunities.

Exhibit 70: Partnerships with Non-Consortium Colleges



Multi-level Change

M-CAM helped facilitate change at multiple levels, including how advanced manufacturing programs were perceived by college administrators, faculty and K-12 students. It brought about significant change in the way college departments work with one another by helping to bridge the divide between academic and workforce development program faculty and staff.

Awareness of the Importance of Advanced Manufacturing Programs

While the grant was not equally divided across all eight colleges, the awarding of \$24.9 million over four years placed the M-CAM colleges on a higher-level playing field because it brought needed resources to the colleges and opened the opportunity to test new methods of training and service delivery. The grant also captured the attention of college leaders. Macomb Community College, the lead college for grant administration, had the support of a strong workforce development proponent in Dr. Jim Jacobs, the college president.⁶⁰ Dr. Jacobs was instrumental in coordinating meetings with consortium college presidents and supporting discussions about system-level changes that the grant intended to bring about, such as improved linkages between noncredit and credit programs, increased student interventions to support stronger training completion and employment outcomes, and improved relationships with employers, industry associations, the public workforce system, and community partners. The consortium college presidents met quarterly in the first year of the grant and periodically thereafter to discuss their advanced manufacturing training programs and ways they could be improved to better equip students for the labor market.

Bo Garcia, the Dean of Community Education and Workforce Development at Lansing, said that as a result of the grant, the presidents were “listening” to their local employers and to one another about the need to revitalize their training in new ways. Lansing’s president, for example, wanted to be updated on grant implementation every quarter, which helped to ensure that grant-funded efforts would be given the focus and attention they warranted.

“The relationship between workforce programs and credit programs has improved. We are better able to understand each other’s strategies and customer base and credit understands that the 4,000 students we train on our side of the college can easily become students in their credit programs with the right marketing and guided pathways. M-CAM allowed us to understand each other’s worlds and created opportunities for us to engage with one another in meaningful discussions about curriculum and industry certifications.”

Bo Garcia, Dean of Community Education and Workforce Development

⁶⁰ Dr. Jim Jacobs retired as Macomb Community College President in July 2017.

Improved Linkages among College Divisions and Physically Isolated Facilities

M-CAM funding helped drive the institutional-level changes needed to bridge the divide that existed at most colleges between noncredit and credit programs. A good example of this fundamental institutional-level change is the new Center for Manufacturing Excellence at Lansing, which launched in June 2017 and operates as a unifying umbrella for the once-separate workforce development division and the college's academic credit-based programs. The Center uses an integrated service model that creates a seamless pathway for students to move from noncredit to credit programs. The Center would not have come into being without the high-level leadership support described in the previous discussion.

Lansing's senior administration also encouraged coordinated cross-departmental meetings between apprenticeship, career services, credit faculty members, and non-credit instructors to support further integration of the college's workforce, continuing education, and credit programs.

Over half of the M-CAM colleges had advanced manufacturing programs located in separate facilities apart from the college's main campus and found that coordination with senior administrators was difficult because of the lack of geographic proximity. Several of these colleges reported that M-CAM helped them build stronger linkages with their main campus administrators and student resource departments. Jan Karazim, Kellogg's Dean of Workforce Programs, illustrated the disconnect between the main campus and off-campus programs and explained how M-CAM helped to bridge the gap: *"I will tell you, I have been at [the college] for 18 years and the [training facility] is a mystery land to the rest of the college. I think largely due to the grant, and partly due to my persistence as Dean, there is a better understanding and value of what goes on out here."* The Dean went on to say that M-CAM staff members kept senior administrators and staff members at the college's main campus apprised of grant activities and accomplishments by distributing briefing memos and conducting presentations for the President and senior leadership. This communication strategy helped grant staff members build a deeper rapport with main campus personnel and increased awareness of advanced manufacturing programs among all members of the campus community. Similarly, increased cohesion was built at other colleges. For example, at Macomb, staff members across

"The biggest challenge is getting families and getting high school graduates to realize this is where the jobs are at... and it is that continued messaging when things will get better and that is not just Schoolcraft College's problem, it is a business community and chamber challenge. It is a societal problem... So, there is a social status issue to go to certain universities, yet 16 percent of bartenders have a Bachelor's degree or more. So, there is a disconnect out there. We need to continue the conversation with parents and students about where the jobs are and what type of training they need to make it happen... We are getting more of a breakthrough, but it has been fifty years of telling kids to get a Bachelor's degree to get a good job. ... So, you have kids being steered away from their passion [vocational programs] because of social stigma and bias by parents."

Respondent, Grand Rapids

multiple college units and divisions established stronger linkages with one another and developed a greater appreciation for each other's roles during the grant period.

Improved Perception of Advanced Manufacturing Industry among High School Students

M-CAM was viewed by employers as an opportunity to change the perceptions students and parents often have of the manufacturing industry. Manufacturing is perceived as dirty, not technologically advanced and low-paying, an image that contributes to some of the low enrollment in colleges' training programs. One way M-CAM addressed these misconceptions was by engaging and partnering with k-12 schools to expose students to advanced manufacturing. M-CAM colleges supported special events and robotics programs at their colleges as well as specialized dual enrollment programs where high school students could receive college credit for coursework. Schoolcraft partnered with the Livonia Chamber of Commerce and Michigan Manufacturing Technology Center to host National Manufacturing Day. The goal was to showcase modern, high-tech manufacturing facilities to middle school students. These programs helped promote and educate students and parents about the value of technical careers and the opportunities for employment in their communities. By their nature, such activities went beyond improving the perception of advanced manufacturing to recruiting students for advanced manufacturing programs. Kellogg identified new opportunities to partner with local high schools and vocational educational schools to bring dual enrollment, early college, and alternative high school education programs to the community. M-CAM resulted in several high schools and career education training centers in the Battle Creek and Kalamazoo areas coordinating courses and transfer agreements with Kellogg. In response to low enrollment, Bay launched an aggressive campaign to promote the new mechatronics programs at a variety of community fairs and events, and even built a new dual enrollment program with the technical schools and high schools in its local area. Bay coordinated an agreement with the Ironworker's Union to operate its apprenticeship program on campus, which generated new enthusiasm for the college. These are only a few examples of the ongoing efforts on the part of colleges to coordinate with k-12 educational providers to create a viable pipeline of students for advanced technical training programs and improve the visibility and perception of advanced manufacturing at the same time.

Barriers to Systems Change

M-CAM colleges experienced several barriers trying to alter the way their institutions conduct business and securing the financial resources needed to maintain M-CAM program design elements.

- **Colleges lacked funding to maintain the ETO data collection system purchased under the grant.** Several colleges—Kellogg, Lansing, Schoolcraft—stated that the system helped them track and document enrollment, services, and outcomes for both noncredit and credit students and was a valuable resource for tracking program success. While several colleges worked to secure funding to maintain the ETO system, many reported that it was cost-prohibitive and could not be maintained without grant funding.

- **Colleges lacked resources to pay for industry certification exams.** All eight M-CAM colleges used their grant funding to offset the cost of students' industry certification exam fees. With the grant's end the colleges will no longer be able to offset the cost of these exams for their advanced manufacturing students. While some of these fees are modest, others are high enough to be out of reach for some students. The American Welding Society, for example, charges non-members \$850 to take the weld inspector certification exam.
- **Employers did not embrace the idea of helping to pay for students' training.** Given the demand for skilled labor, consortium colleges hoped that local employers might be willing to help offset the cost of training for students by offering scholarships or monetary incentives to enroll in advanced manufacturing training programs. Many employers, however, did not want to pay for students' training and would only consider funding incumbent worker training programs, apprenticeships, or on-the-job training.

Conclusion

Systems-change is important because colleges need well-coordinated systems to effectively serve individuals and to align training programs to employers' needs. The M-CAM consortium piloted and tried to achieve several systems-level changes, but not all of them worked. However, the M-CAM colleges learned at an institutional-level and a consortium-level what the challenges were, how to track their progress, and how to build on their successes. Given the short duration of grant implementation—three years—the colleges achieved quite a bit in terms of systems change. They improved career pathways for their advanced manufacturing programs, increased and strengthened their partnerships with employers, industry organizations, public workforce partners, community and faith-based organizations, other non-consortium educational entities, and each other. From the beginning of the grant in 2014 to 2017, the total number of non-employer partnerships increased from 177 to 203, a 15 percent increase over three years. The colleges recognized the importance and value of improving their partnerships and were committed to remaining engaged and growing these partnerships into collaborative relationships whereby partners develop a shared vision and a coordinated approach to serving workers and employers. Through increased collaboration with each other, the consortium colleges implemented a shared data collection and reporting platform that was used to drive college- and system-level decision making and to inform programmatic improvements. M-CAM also paved the way for many colleges to demonstrate the value of blending funding sources to improve the accessibility and scalability of their advanced manufacturing training programs and pathway models. However, additional systems-level investments will be necessary to maintain engagement among consortium colleges and to address future career pathways development.

"I think it's a pretty significant achievement, that the community colleges have been very responsive, and have listened to employers, other talent needs, and have aligned their curriculums and programs to deliver that."

Industry Association Representative

CHAPTER 13:

Conclusion



The outcomes and impact of the M-CAM initiative cannot be understood without attending to its broader economic context as well as the fundamental role that manufacturing has played historically in Michigan’s economy. As described in Chapter 1, M-CAM launched in 2014, as the Michigan economy was emerging from the Great Recession. At the end of the M-CAM initiative, in 2017, the state’s unemployment rate had fallen to 3.8 percent and total employment neared its 2007 level of 4,700,000.⁶¹ There were also signs of upward pressure on wages, though this remained an area of weakness in the economy. The 3.1 percent rate of wage growth in Michigan was higher than the national average of 2.9 percent, while still being lower than the growth target of 3.5 to 4 percent that economists see as an indicator of “full employment.”⁶²

As the economy grew during the grant period, employers seeking to hire workers found that there was a “skills gap:” they could not find enough workers with the skills needed to fill jobs, in part because many of the new jobs in advanced manufacturing required workers with unique technological and problem-solving skills. Because employers needed workers and perceived the colleges as a source of them, they were ready to collaborate with the colleges to select equipment, consult on curriculum, and participate in job readiness and placement activities. Similarly, in some areas, employers were willing to collaborate with the colleges to create apprenticeships as a way of attracting talent.

The strong economy created challenges for the colleges as well as the benefits just described. Most of the challenges were related to recruitment. Because most people who wanted a job could find one, the colleges ended up serving more incumbent workers—individuals with jobs who wanted to upgrade their skills and careers—than they anticipated, and they had to work harder to recruit dislocated workers and other target populations (e.g., trade affected workers and veterans).

Working within this economic context, the consortium colleges adapted to the challenges they encountered and took advantage of the conditions motivating employer collaboration. By the end of the grant period, the colleges had succeeded in realizing most of the objectives and goals of the initiative.

- **The consortium exceeded its TAACCCT enrollment goal, and each college exceeded its individual enrollment goal.**

⁶¹ Bureau of Labor Statistics. <https://www.bls.gov/eag/eag.mi.htm> Accessed 8/17/17.

⁶² Economic Policy Institute on stagnant wage growth. <http://www.epi.org/nominal-wage-tracker/> Accessed 8/17/17.

- **The coaching and student support services provided by the grant proved effective for promoting training completion and employment retention among students who, for the most part, had not experienced any post-secondary training.**
- **M-CAM students were generally very pleased with the quality of M-CAM training and most felt that it helped them to further their educational and career goals.**
- **The consortium engaged nearly 4,000 students in training, over half of whom completed their programs of study.**
- **Eighty three percent of students who completed and exited their programs were placed into jobs.**
- **The M-CAM colleges helped incumbent workers expand their skills so that they could move into higher levels of employment: nearly 70 percent of incumbent workers who completed M-CAM training received a wage increase (with an average increase of 11 percent).**
- **M-CAM students had significantly higher employment rates and higher earnings than those in comparison groups of study, even after adjusting for differences between groups in baseline characteristics.**

In addition, M-CAM had a significant influence on improving institutional and systems-level structures. The colleges used the M-CAM grant to strengthen their collaborative capacity and partnerships, modernize their equipment, enhance and create new programs in advanced manufacturing, and strengthen inter-organizational communication. The M-CAM consortium also made significant advancements in data sharing by coordinating with the Michigan Talent Investment Agency (TIA) to access wage data. The college presidents were instrumental in helping TIA officials understand the need for and value of sharing wage data with community colleges and universities and led the effort to garner support for the pilot agreement, which helped secure wage data for M-CAM-enrolled students. Accessing wage data to verify employment was a value-add for the M-CAM colleges and helped to dramatically improve their entered-employment counts for the TAACCCT-grant.

Several key findings from the evaluation of the M-CAM initiative warrant further research and inquiry:

- **Use of professional certifications to facilitate the awarding and transfer of credit.** How often will students take advantage of this opportunity? Will colleges continue to offer industry-recognized professional certifications to students after the sunset of the grant? How do colleges address the cost issues associated with alignment to professional certifications, such as the cost of exams and cost of a college serving as an approved testing center? How well will colleges be able to disseminate information about the opportunity to obtain academic credit for professional certifications to their students?
- **The effectiveness of regional sector based approaches to job training.** What is it about these particular approaches that makes a difference for job seekers? What difference does employer engagement have relative to having dedicated staff dedicated to job placement?

- **Career pathways for adult learners.** Because most studies of career pathways have a limited time frame and assume learners have a single point of entry and exit, it is difficult to understand whether career pathways for adults work the way that they are intended to work. Community colleges have open enrollment, which makes it very challenging to assess whether an individual student is pursuing a particular career pathway. Thus, it would be worthwhile to explore, how frequently do students intersperse work and schooling? How often do they stack credentials to reach higher level jobs? How often do workers take breaks from work in order to pursue higher education? How practical is it for them to combine work with learning? Can they afford to drop out of the labor market in order to pursue another credential? How can programs make the ideal of stackable credentials and lifelong learning more feasible for working parents who also need to support their families.
- **Characteristics of those pursuing advanced manufacturing.** Thirty-one percent of the students served by M-CAM were over the age of forty. Our study was able to explore the different profiles that older students have and how that, in turn, influenced their prospects for employment. What more can be learned about the characteristics of older students pursuing training in advanced manufacturing and other trades? In particular, what differences in outcomes exist between “career enhancers,” “career changers,” and those adults who have gaps in their work history due to family responsibilities, disability, or incarceration? What can be learned about how colleges can more effectively recruit, train, support, and assist with employment placement for these distinct populations of older students?

APPENDIX A: Evaluation Research Questions and Detailed Data Sources

Research Questions

What contextual factors influenced the implementation of the initiative?

- What factors facilitated implementation?
- What challenges did Coalition partners face? How did they address these challenges?

What administrative and partnership structures were established to guide the initiative?

- What was the program and administrative structure? What was each college's role? What activities did Macomb Community College take on in order to coordinate and provide oversight for the M-CAM program?
- What roles did partners (workforce partners, employers, non-profit organizations, etc.) play in program design, curriculum development, recruitment, training, placement, program management, leveraging of resources, and program sustainability?
- How did partners communicate and coordinate their activities?
- What factors contributed to partners' involvement or lack of involvement in Coalition efforts? Which contributions from partners were most critical to the success of the grant program? Which contributions from partners had less of an impact?
- How effective was the website at serving as a communication hub for the initiative?

What was the nature of outreach to and assessment of eligible participants?

- What effective strategies did Coalition colleges use to recruit eligible participants? What were the characteristics of those engaging in each of the M-CAM training programs?
- What role did Michigan Works! play in referring potential students to the program?
- Were in-depth assessments of participants' abilities, skills, and interests conducted to select participants into the grant program? Who conducted the assessments? Were the assessment results useful in determining the appropriate programs and course sequences for participants?
- What strategies or methods did colleges use to assess prior learning?
- What role did career counselors and other intake staff play in helping to identify stacked educational pathways for students? Was career guidance provided? If so, through what methods?

How was each of the initiative's major components developed and launched?

- How were programs and program designs improved or expanded using grant funds? What delivery methods were offered?
- How was the particular curriculum selected, used, and/or created?
- What lessons were learned during the development and expansion of key programs?
- What influence did the career service model and Educational Development Plans (EDPs) have on students' educational experiences?
- What support services were offered?
- What work-based learning opportunities were developed? How did WBL opportunities differ across Coalition colleges?
- What technology-enabled courses (MOOCs, Mobile Labs, etc.) were developed? How did these courses expand educational pathways and opportunities for students?
- What services were offered by job search and placement programs? What role did Michigan Works! play in facilitating job search and placement?
- How did Coalition colleges link to other educational institutions? What influence did these linkages have on students' experience?

What were the initiative's outputs?

- What new programs of study were developed and which of these will be sustained after grant funding expires? What new curricula were disseminated beyond the Coalition?
- How satisfied were students with various components of the M-CAM program?
- What were employers' assessments of the skills of the students they hired?
- What factors contributed to the success of the grant initiative overall?

Outcomes Study

What were the enrollment outcomes of M-CAM programs?

- How many participants were enrolled in each of the M-CAM training programs?
- How many participants actually completed their programs during the study period? How many completed required numbers of credits and sequences of courses?
- How many individuals discontinued their studies before program completion?

What were the educational outcomes of M-CAM participants?

- How many participants earned credentials? What different credentials did they earn?
- How many M-CAM completers enrolled in further education?

What were the employment outcomes of M-CAM participants?

- How many M-CAM participants were employed after program completion?
- How many were retained in employment?
- What were the average earnings of M-CAM participants?
- For incumbent workers, what wage gains did they obtain?

Impact Study

- After controlling for baseline characteristics, are there statistically significant differences between students in the treatment and comparison groups in terms of credit hours earned, program/certificate completion, transition to further educational programs (to the extent this is reliably captured across partner colleges), employment, and earnings after exit?
- Does the size of the impact vary by socio-demographic characteristics or program of study?
- How do impacts vary for students in each of the three types of programs of study?

Detailed Data Sources

DATA SOURCE	DESCRIPTION
Efforts To Outcomes (ETO) Database	ETO is used to track student characteristics, services received, and outcomes. The M-CAM program staff members at each college regularly enter data into ETO. As of July 27, 2017, the ETO system had a total of 3,925 students enrolled in M-CAM.
Data on comparison group members	SPR developed data use agreements with each of the eight colleges, requesting comparison data on students enrolled in (1) M-CAM programs prior to the start of the grant, and (2) automotive technology and heating, ventilation, and air conditioning (HVAC) programs prior to the grant and concurrently with M-CAM. SPR received administrative comparison data on 4,169 students.
Unemployment Wage data from State of Michigan	SPR received wage data on 3780 M-CAM participants, from Quarter 1 of 2012 through Quarter 2 of 2017 and 4,169 comparison group members. We also received and analyzed the North American Industry Classification (NAIC) codes for all participants, which provide insight into the types of jobs that participants have been placed into. Note that SPR is missing Social Security Numbers (SSNs) for 94 participants. Another 197 M-CAM participants do not have any wages in the Michigan UI system.
Site Visits	Each site visit entails interviews with M-CAM college presidents, program staff members, faculty members, student support counselors, job development and placement staff members, employer partners, workforce development partners (Michigan Works!), and other community partners. SPR also conducted focus groups with students and observed classroom activities while on-site. SPR conducted four rounds of multi-day site visits to each of the colleges. Visits were conducted in fall 2014, spring 2015, spring 2016, and spring 2017.
Student Exit Surveys	The student exit survey gathered students' perspectives on the quality of the supportive services and training they received, as well as information about whether they received a job in their field of training and the wages they were earning. The survey was administered to completers and non-completers once every quarter (note: students who were still enrolled in college programs were not surveyed). A total of 2,065 M-CAM students were surveyed: 575 students (28 percent) completed the student exit survey.
Student Case Studies	The purpose of the case studies was to gather in-depth information from students about their experiences with receiving training in the M-CAM pathways and finding jobs in the manufacturing trades. SPR selected 24 case study students at random from the ETO system and then secured consent from the students to participate in case study interviews. SPR conducted round 1 interviews with 22 students and conducted round 2 follow-up interviews with 15 students. Interview information was supplemented by administrative data in the ETO system.
Participant Observation of Consortium Meetings	The SPR evaluation team participated in regular consortium meetings, including monthly conference calls, strategy and operations meetings, two full grantee meetings per year, and other meetings in the targeted industry areas. SPR participated in at least 50 consortium meetings outside the context of site visits.
Web-based surveys and feedback forms	Web-based surveys of M-CAM program managers and staff members allowed us to assess satisfaction with communication, collaboration, and progress towards meeting consortium goals. Two web-based surveys were conducted. The feedback forms allowed us to gather data on how consortium activities and workshops went; the data from these forms were also analyzed to provide guidance to the consortium leadership.
Other tools	Several data collection tools (a fidelity tool, checklists, and a partnership engagement social networking tool) enabled us to assess and describe consortium structure, courses, and progress towards consortium goals at the time of each site visit. The data collected with these tools allowed us to track changes in these aspects of the initiative.

APPENDIX B: M-CAM Fidelity to TAACCCT Model

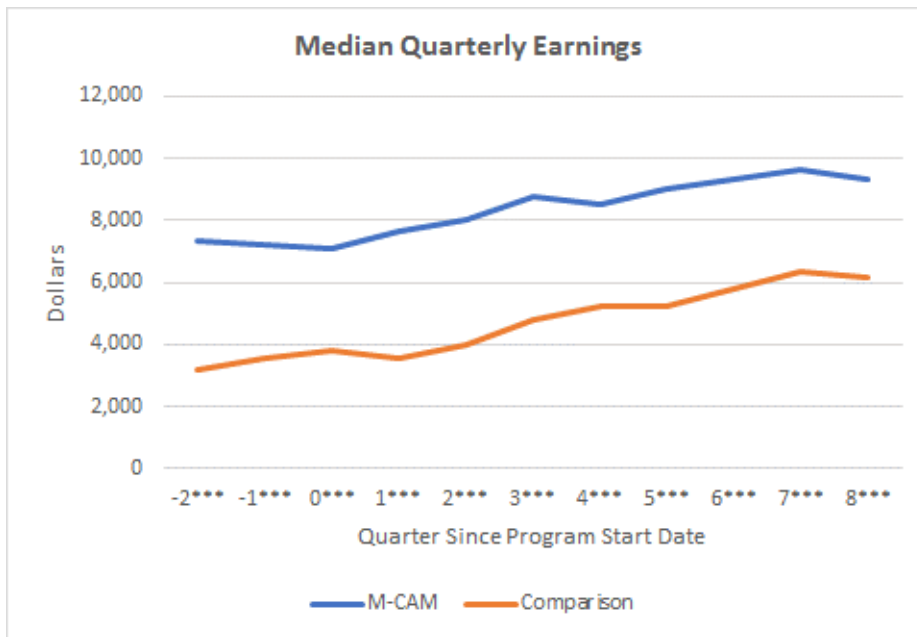
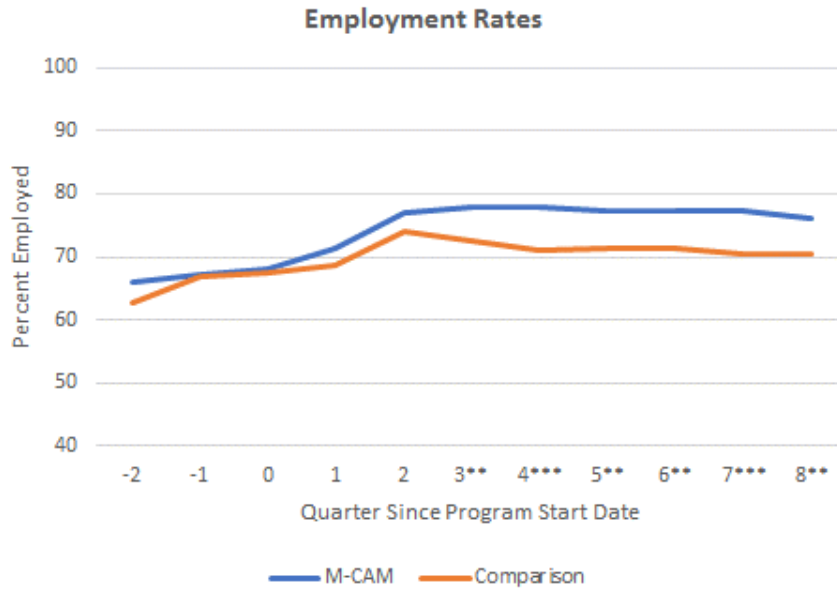
1. Evidence Based Design	5.8	10
Share evidence on the effectiveness of new approaches	5.6	10
Use data for continuous improvement	6.9	10
2. Stacked and Latticed Credentials	7.0	8.1
Demonstration of skills or competencies through observable methods	9.4	10
Use prior learning assessments	5.6	6.9
Use best practices related to stacked credentials	6.3	7.5
3. Transferability and Articulation of Credit	3.4	6.9
Increase linkages with 2 year and 4 year colleges	3.8 (no change)	
Articulation agreements with other M-CAM colleges	0	10
Articulation agreements with 2 year and 4 year colleges	3.8	8.1
Bridges between credit and noncredit courses	5.0	5.6
4. Advanced Online and Technology Enabled Learning	3.2	8.3
Integrate online or technology-based learning in program design	5.0	10
All curricula and materials licensed under Creative Commons	0	10
Online courses include formative assessments	3.1	5.6
Integrate best practices related to online learning	3.1	7.5
5. Strategic Alignment	7.1	9.6
Partnerships and outreach efforts directed at TAA eligible participants	6.9	7.5
Effort not to duplicate other services in the community	7.5	10
Collaboration with public and private philanthropic efforts	8.1	10
Employer involvement in developing curriculum for each career pathway	7.5	10
Employers provide resources, commit to hire, and are on advisory boards	6.3	10
Collaboration with workforce system	6.9	9.4
Collaboration with nonprofit partner or labor organization	7.5	10

APPENDIX C: DOL Outcomes

ANNUAL PERFORMANCE REPORT - CUMULATIVE-TAA ELIGIBLE PARTICIPANTS TAA COMMUNITY COLLEGE AND CAREER TRAINING GRANTS	
B. CUMULATIVE PARTICIPANT OUTCOMES (TAA Eligible PARTICIPANTS)	
1. Unique Participants Served/Enrollees	3925
2. Total Number of Participants Who Have Completed a Grant-Funded Programs of Study	2329
2a. Total Number of Grant-Funded Program of Study Completers Who Are Incumbent Workers	1124
3. Total Number Still Retained in Their Programs of Study (or Other Grant-Funded Programs)	990
4. Total Number Retained in Other Education Program(s)	3
5. Total Number of Credit Hours Completed (aggregate across all enrollees)	52493.35
5a. Total Number of Students Completing Credit Hours	1891
6. Total Number of Earned Credentials (aggregate across all enrollees)	4879
6a. Total Number of Students Earning Certificates - Less Than One Year (aggregate across all enrollees)	2219
6b. Total Number of Students Earning Certificates - More Than One Year (aggregate across all enrollees)	396
6c. Total Number of Students Earning Degrees (aggregate across all enrollees)	140
7. Total Number Pursuing Further Education After Program of Study Completion	400
8. Total Number Employed After Program of Study Completion (start employment in 1st quarter after quarter of exit)	925
8a. Total Number Employed After Program of Study Completion (start employment in any quarter after enrollment)	1880
9. Total Number Retained in Employment After Program of Study Completion	685
10. Total Number of Those Employed at Enrollment Who Receive a Wage Increase Post-Enrollment	1502

APPENDIX D: Impact Outcomes

Appendix D Exhibit 1: Employment and Earnings for M-CAM and Comparison Students, Restricted to Those with Eight Quarters of Data After Enrollment



Notes: All students had sufficient time for us to observe their employment and earnings at least eight quarters after they enrolled. Other restrictions are as described in the text. Median earnings are shown after excluding those with no employment during the quarter.

Source: UI wage data

*/**/** Statistically significant at the .1/.05/.01 level.

Appendix D Exhibit 2: Mean Values on Covariates for M-CAM and Contemporaneous Comparison Students Before and After Matching

	M-CAM	COMPARISON GROUP	
		BEFORE MATCHING	AFTER MATCHING
Age (in years)	31.2	25.8***	31.8
Female	10.4	5.3***	9.2
Hispanic ethnicity	5.1	7.2**	3.4***
RACE			
Black/African-American	18.6	22.2**	21.3**
White	74.6	68.0***	73.0
Other or more than one race	6.8	9.8***	5.8
First quarter pre-enrollment earnings	5,282	3,189***	4,864**
CALENDAR YEAR OF ENROLLMENT			
2014	21.6	28.2***	19.4*
2015	65.8	59.9	69.3**
2016	12.6	11.9	11.3

Notes: Sample is restricted to those with non-missing data on employment and earnings in the fourth quarter after program enrollment. Results after matching are based on one-to-one matching.

Source: UI wage data and data from ETO and administrative data provided by the colleges.

*/**/** Statistically significant at the .1/.05/.01 level.

Appendix E: College Certificates, Associate’s Degrees, and Professional Credentials Earned

COLLEGE	CAREER PATHWAY	NO. EARNING COLLEGE CERTIFICATE	NO. EARNING ASSOCIATE'S DEGREE	TYPE OF PROFESSIONAL CREDENTIAL EARNED	NO. EARNING PROFESSIONAL CREDENTIAL
Bay	Unknown	1	0	American Welding Society (AWS)	1
	Multi-skilled	2	0	PMMI Mechatronics	3
	Welding/Fabrication	53	0	American Welding Society (AWS)	89
Grand Rapids	CNC Machining	103	1	National Institute for Metalworking Skills (NIMS)	1
	Multi-skilled	105	6	PMMI Mechatronics	2
	Production	106	0	Forklift Certification	3
				OSHA 30	3
Welding/Fabrication	122	24	American Welding Society (AWS)	10	
Kellogg	Unknown	0	0	Forklift Certification	75
	CNC Machining	8	2		
	Multi-skilled	27	0	Manufacturing Skills Standards Council (MSSC)	8
	Production	231	0	American Welding Society (AWS)	14
				Forklift Certification	8
				Manufacturing Skills Standards Council (MSSC)	6
			OSHA 30	10	
Welding/Fabrication	69	3	American Welding Society (AWS)	13	

COLLEGE	CAREER PATHWAY	NO. EARNING COLLEGE CERTIFICATE	NO. EARNING ASSOCIATE'S DEGREE	TYPE OF PROFESSIONAL CREDENTIAL EARNED	NO. EARNING PROFESSIONAL CREDENTIAL
Lake Michigan	CNC Machining	46	5	American Welding Society (AWS)	1
	Multi-skilled	6	7	American Welding Society (AWS)	1
	Welding/Fabrication	69	3		
Lansing	Multi-skilled	3	0		
	Production	239	0	ASQ	3
				Manufacturing Skills Standards Council (MSSC)	80
	Welding/Fabrication	100	5	American Welding Society (AWS)	18
				Forklift Certification	20
			Manufacturing Skills Standards Council (MSSC)	2	
Macomb	CNC Machining	158	20	National Institute for Metalworking Skills (NIMS)	80
	Multi-skilled	913	21	CATIA V5 Associate- Part Design	1
				FANUC CERT I Handling Tool Operations and Programming	109
				PMMI Mechatronics	31
				Siemens	72
	Production	5	0	Manufacturing Skills Standards Council (MSSC)	6
Welding/Fabrication	88	0	American Welding Society (AWS)	76	
Mott	CNC Machining	16	0	American Welding Society (AWS)	1
				Manufacturing Skills Standards Council (MSSC)	2

COLLEGE	CAREER PATHWAY	NO. EARNING COLLEGE CERTIFICATE	NO. EARNING ASSOCIATE'S DEGREE	TYPE OF PROFESSIONAL CREDENTIAL EARNED	NO. EARNING PROFESSIONAL CREDENTIAL
	Multi-skilled	8	0	OSHA 30	11
				FANUC Certified Education CNC Training	1
				OSHA 30	5
	Production	106	0	Manufacturing Skills Standards Council (MSSC)	1
				OSHA 30	38
	Welding/Fabrication	78	0	American Welding Society (AWS)	24
				Manufacturing Skills Standards Council (MSSC)	11
				OSHA 30	26
				American Welding Society (AWS)	2
				Forklift Certification	2
Schoolcraft	CNC Machining	37	27	National Institute for Metalworking Skills (NIMS)	20
				OSHA 30	12
				Other	6
				National Institute for Metalworking Skills (NIMS)	1
				American Welding Society (AWS)	30
	Welding/Fabrication	16	12	Forklift Certification	8
				National Institute for Metalworking Skills (NIMS)	3
				OSHA 30	28
				Other	9

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