Final Evaluation Report

September 2017

Cincinnati State Technical & Community College

Greater Cincinnati Manufacturing Careers Accelerator (GCMCA)

TC-25147-13-60-A-39

Acknowledgements

Thank You

To the leadership of Cincinnati State Technical & Community College and the Greater Cincinnati Manufacturing Careers Accelerator program for your support and active engagement.

To the staff, faculty, and instructors of Cincinnati State Technical & Community College for your hard work in implementing the Greater Cincinnati Manufacturing Careers Accelerator program and your valuable insights about the program.

To stakeholders and contributors from key divisions within the college for your dedication to developing and implementing the Greater Cincinnati Manufacturing Careers Accelerator:

- Center for Innovative Technologies
- Humanities & Sciences
- Workforce Development Center

To the employers, community partners, and participants who met with the Evaluation Team and provided valuable feedback about the program.

To the U.S. Department of Labor for financing this program and evaluation.

The Evaluation Report

This Final Evaluation Report was developed in collaboration between Thomas P. Miller & Associates and the Indiana Statistical Consulting Center. Evaluation report contributors included:

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Executive Summary

GCMCA

In 2013, Cincinnati State Technical and Community College (CSTCC) received a grant of $2,750,000 through the U.S. Department of Labor (USDOL) Trade Adjustment Assistance Community College and Career Training (TAACCCT) program to fund the Greater Cincinnati Manufacturing Careers Accelerator (GCMCA) initiative. GCMCA was designed to prepare Trade Adjustment Assistance (TAA)-eligible workers, veterans, and others for employment in the manufacturing industry through the development of stacked pathways of study, integrated student support services, and state-of-the-art equipment and facilities.

Key elements of the GCMCA initiative included:

Training Programs

GCMCA training took place in three program areas:

- Workforce Development Center (WDC) manufacturing-related short-term trainings, including Manufacturing Skill Standards Council (MSSC) Certification, Machine Operator I (MO I) Certification, Machine Operator II (MO II) Certification, and Apprenticeship program
- Center for Innovative Technologies (CIT) Computer Numerical Control (CNC) Certificate and Mechanical Engineering Technology (MET) Associate Degrees
- CIT Welding Certificate and Associate Degree

Student-Centered Learning

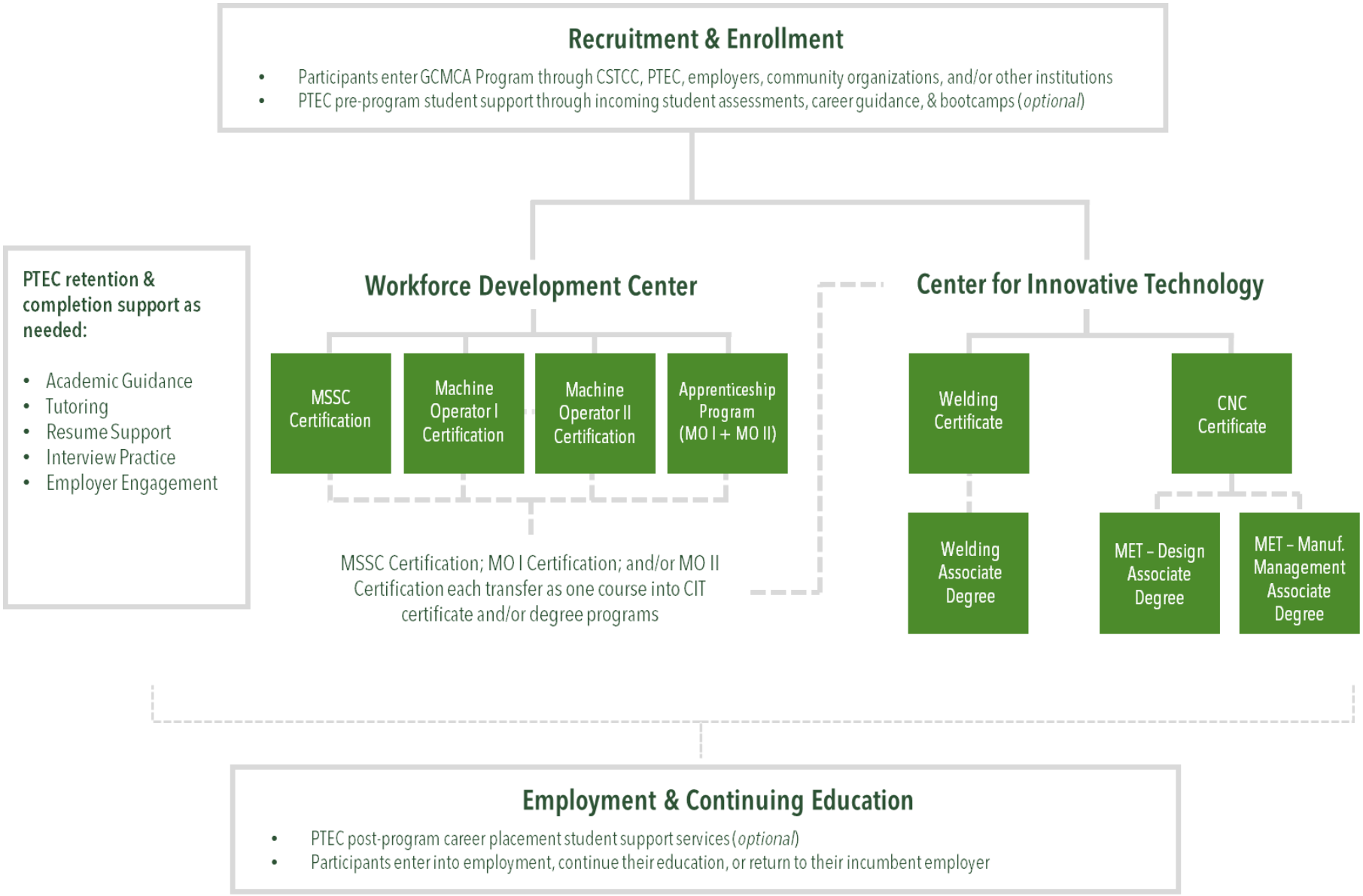
Contextualization and adaptive learning was incorporated into the GCMCA student experience. Adaptive learning approaches supported students who tested at the lowest levels of COMPASS proficiency through tutoring, self-paced online learning, and half-to-full day Bootcamps. Additionally, Welding math and English classes were contextualized and offered concurrently with introductory Welding coursework. The approach for the adaptive learning and contextualization could allow students to begin their program of study sooner. Ideally, these students could be more likely to persist through and complete their chosen program of study in a shorter timeframe.

Pathway to Employment Center (PTEC)

PTEC provided support to GCMCA students as needed throughout their time with the college. This support included recruitment and enrollment (e.g. job fairs, advising and enrollment for Welding students), retention (e.g. tutoring, intrusive advising), and employment (e.g. resume review, interview preparation).

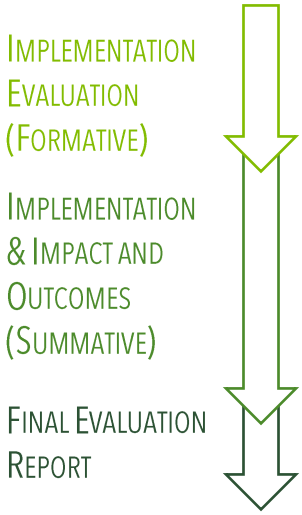
Each of the GCMCA components – training programs, student-centered learning, and PTEC – came together to support students at CSTCC. The diagram below is a visual representation of participant experience options through GCMCA.

Figure i: GCMCA Participant Diagram



Program Evaluation

CSTCC contracted with Thomas P. Miller & Associates, LLC (TPMA) to serve as an independent, third-party evaluator. The evaluation design included a mixed-methods approach:



The formative Implementation Evaluation was conducted throughout the delivery of the GCMCA initiative. Through this evaluation, the Evaluation Team documented program progress, successes, challenges, and provided ongoing recommendations to GCMCA staff.

The formative Implementation Evaluation provided context for the Impact and Outcomes Evaluation by documenting the timing and nature of adjustments to program design. The Impact and Outcomes Evaluation used this to understand whether changes to the program might affect various participants, and then conducted descriptive and statistical analyses for GCMCA programs.

At the conclusion of the evaluation, and presented within this report, are the findings from the summative (cumulative) Implementation Evaluation and Impact and Outcomes Evaluation.

Implementation Evaluation

The Implementation Evaluation began January 2014 and continued through March 2017, to document program progress, monitor program outcomes, and provide recommendations for continuous improvement of program operations. The Implementation Evaluation focused on a series of research questions (see *Appendix A*) to explore the development of the GCMCA training programs and services provided by PTEC, employing principles of a utilization-focused framework.[1] This evaluation was primarily qualitative and used a general inductive thematic approach,[2] with influences of applied phenomenology,[3] to analyze the qualitative data including calls, phone and in-person interviews, and document reviews.

Impact and Outcomes Evaluation

The Impact and Outcomes Evaluation focused on three primary research questions around GCMCA participant persistence and completion (see *Appendix B*). To respond to these questions, TPMA conducted both a quasi-experimental design (QED) to determine impact for GCMCA Welding and MET programs, as well as an outcomes-focused design to provide a descriptive picture of student results for the GCMCA WDC programs. The QED approach used propensity score matching[4] and analyzed changes in persistence and completion for GCMCA participants, compared to similar individuals in similar programs of study, through chi-square (χ^2) tests, and logistic regression analyses.

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[1] Patton, M.Q. *Essentials of Utilization-focused Evaluation*. Thousand Oaks, CA. SAGE Publications, Inc., 2012.
[2] Thomas, D.R. (2006). *A general inductive approach for analyzing qualitative evaluation data*. American Journal of Evaluation, 27, 237-245.
[3] Guest, Greg, MacQueen, K.M., and Namey, E.E. *Applied Thematic Analysis*. Thousand Oaks, CA. SAGE Publications, Inc., 2011.
[4] Rosenbaum, P.R. and Rubin, D.B. (1983). The central role of the propensity score in observational studies for causal effects. *Biometrika. 70*, 41–55.; Rosenbaum, P.R. and Rubin, D.B. (1985). Constructing a control group using multivariate matched sampling methods that incorporate the propensity score. *The American Statistician. 39.* 33–38.

Summary of Evaluation Findings

Accelerators

Between September 2013 and March 2017, CSTCC developed and implemented the GCMCA initiative. Factors that accelerated GCMCA success included:

Engaged College Leadership	An important foundation for GCMCA was the support and engagement from college leadership. Leadership from across the college were actively engaged in program start-up and implementation. Having buy-in and ongoing support from college leadership helped GCMCA maintain momentum and progress through initiative challenges.
Strong Employer Base	Starting from a strong employer base, and continuing to grow employer connections, was key to receiving ongoing feedback. This allowed for innovations within the grant, including the creation of an Apprenticeship program.
Grant Structure	The GCMCA grant's operational structure also helped lay the groundwork for successful implementation. Knowledge sharing across CSTCC's several TAACCCT grants was facilitated by placing one director over all TAACCCT grants, and sharing staff across programs (e.g. PTEC). Also, GCMCA's focus on data quality was key for demonstrating the program's effects. To support quality data collection, tracking, and analysis, CSTCC hired internal staff and an external Data Specialist Consultant.

Challenges

The key accelerators of buy-in and structure have supported GCMCA and CSTCC leadership, staff, faculty, and instructors in progressing through the phases of program start-up and implementation. Challenges experienced during the grant included:

Program Start-Up	As with any new initiative, launching GCMCA took time. These start-up elements included hiring and training staff and instructors, launching Welding at a new location, and creating new approaches to developmental education. The length of start-up time led to delays in program implementation, which can lead to fewer program completers during the grant period.
Marketing & Enrollment	GCMCA stakeholders reported a diverse approach to marketing, including networking with personal business contacts, attending career fairs, and outreach to community organizations. However, transitioning marketing efforts into college enrollments was challenging, even in programs with higher volumes of enrollment.
Shifting Environmental Factors	A key external factor effecting GCMCA was the shifting local and national economy. As the US economy improved and more jobs became available, leadership reported that fewer individuals enrolled in at CSTCC. Additionally, there were fewer TAA-eligible individuals in CSTCC's service area during grant implementation than during grant application submission, which led to challenges identifying TAA-eligible participants.

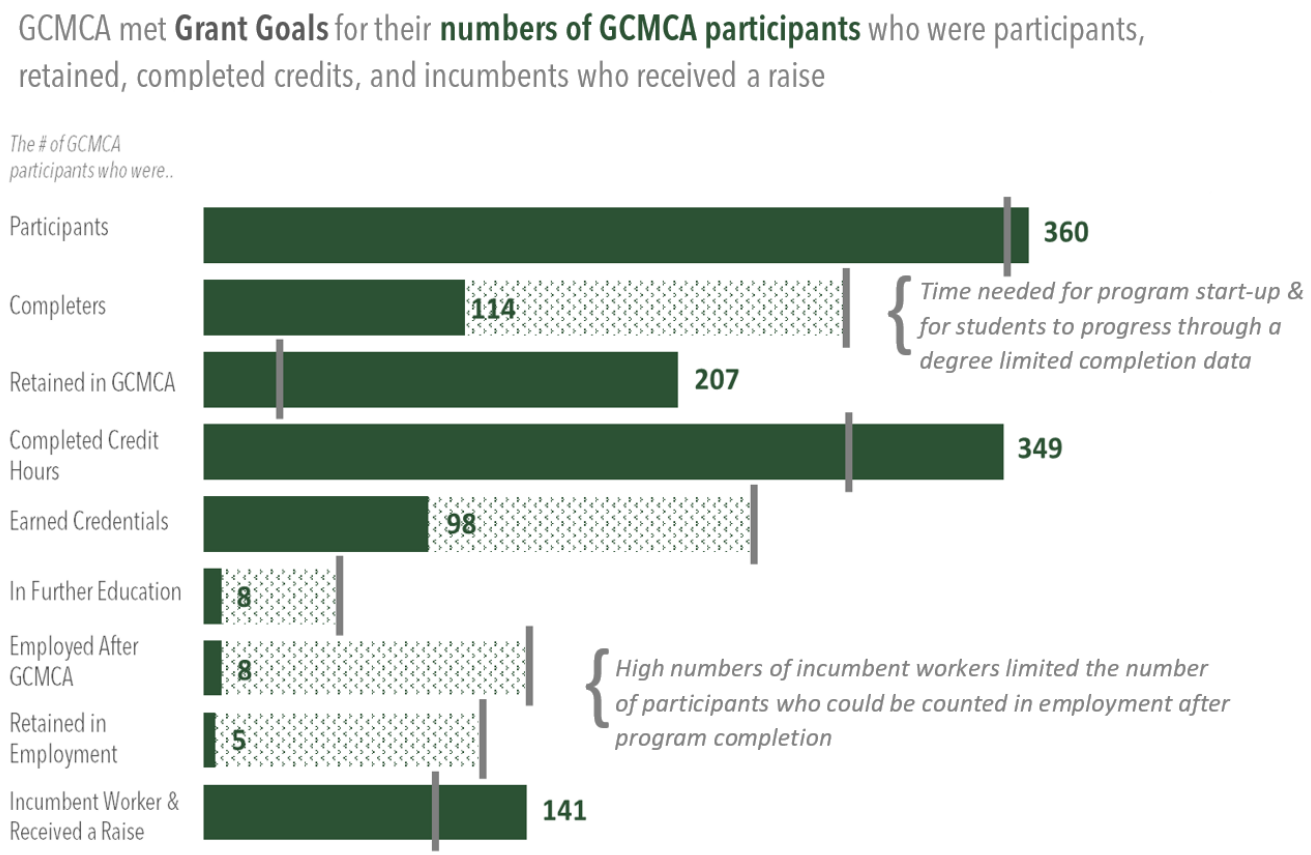
Successes

Through grant implementation, the GCMCA initiative has achieved the following successes:

Welding	The first Welding program at CSTCC was offered through GCMCA. This extended the reach of the college into the western area of Hamilton County, Ohio and helped fill a training gap in the community.
Machining	Strengthening and adding new machine-related trainings (e.g. MET, CNC, MO I, and MO II) has increased training opportunities across Hamilton County and fostered increased collaboration between CIT and WDC.
Student-Centered Innovations	Additionally, GCMCA has supported innovations in student-centered learning through adaptive learning and contextualization, and in supportive student services (i.e. PTEC). Stakeholders have highlighted the value and benefit these innovations have provided to students, instructors, and the college as a whole.

GCMCA also achieved progress toward the TAACCCT Required Performance Outcomes, as highlighted in the figure that follows.

Figure ii: GCMCA TAACCCT Required Outcomes



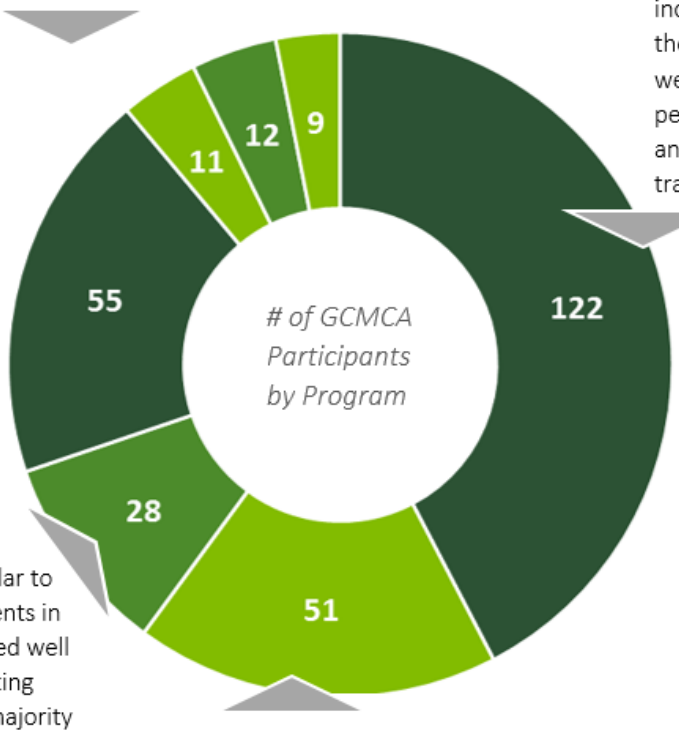
GRANT PARTICIPANTS

Highlights from the Impact and Outcomes Evaluation[5] for GCMCA participants include the following:

Figure iii: GCMCA Participants by Program

MO I, MO II, APPRENTICESHIP, and MSSC. Individuals in WDC GCMCA training programs had a greater range of ages and increased diversity in race, in comparison to GCMCA CIT programs. WDC's trainings also had the highest rates of persist to completion (78%), likely supported by the shorter-term nature of WDC's certifications. MO I, MO II, and Apprenticeship also showed trends of extremely high rates of an individual being employed at intake and a broader spread of educational attainment backgrounds.

MET DEGREES. The majority of individuals in the GCMCA MET program were 30 years old or younger and scored well on their COMPASS testing (above a 91). Almost two-thirds of individuals were not employed at intake. When comparing GCMCA MET students to individuals who were in MET before the grant, GCMCA MET students were more likely to consecutively persist from semester to semester and persist throughout the traditional academic year.



CNC CERTIFICATE. Similar to students in MET, students in the CNC program scored well on their COMPASS testing (above a 91) and the majority had some college but no credential or below. Similar to WDC programs, most CNC students were employed at intake. Also, the age at intake for CNC was higher than for MET, with the majority of students ranging from 22 to 40 years old.

WELDING. The majority of individuals in the GCMCA Welding group were male, white, and 30 years old or younger. When examining across other GCMCA groups, Welding participants had the lowest COMPASS scores for English/Language Arts and Math (i.e. majority received a score of less than 60), and the lowest levels of incoming educational attainment for CIT programs. These lower educational levels paired well with the additional adaptive learning and contextualization designed specifically for lower-scoring individuals in the Welding program.

[5] Data in the Impact and Outcomes Evaluation comes from the 315 GCMCA participants who signed consent forms to allow the Evaluation Team to use their data. Note that this is different from the total 360 GCMCA participants.

Beyond the Grant

As a result of the grant, CSTCC has been able to expand the college's reach and programmatic capacity through several key areas:

Leveraging GCMCA

After creating the GCMCA Welding program, the college was able to leverage their experience with and exposure to Welding to add additional Welding trainings through a TAACCCT Round 4 consortium. This Round 4 funding has allowed CSTCC to create an accelerated Welding training that was aligned with the GCMCA Welding degree and located at the Clifton Main Campus.

The focus on machine-related trainings (e.g. MET and MO II) fostered increased collaboration between CIT and WDC and led to new opportunities for enhancing machine-related training, especially in the area of additive manufacturing. This has included leveraging GCMCA when applying for funding. GCMCA has also provided staff capacity and expertise to create a new employer-driven technical advisory committee for WDC, which has played an important role in identifying the need for additive manufacturing training.

Enhancing GCMCA Innovations

Contextualizing math for GCMCA Welding students opened up the opportunity to build contextualization into additional program pathways within the college. For programs where students did not need to be on an algebra-based pathway to be successful, such as business or healthcare, CSTCC has been working to create additional math contextualization pathways for Fall 2017.

CSTCC is also exploring the concept of a meta-major, which would continue the intent of the GCMCA initiative in re-tooling developmental education. The meta-major concept involves re-purposing the time that a student needs to spend taking pre-requisite or remedial coursework, by incorporating career exploration.

Collaboration efforts that began with the GCMCA pathways for WDC and CIT have led to the creation of pathways between WDC and other academic programs within CSTCC. Examples of these pathways include already existing WDC programs in chemical operator and child development, as well as the development of the Welding short-term pathway through TAACCCT Round 4.

Building Sustainability

CSTCC's President, leadership, and staff recognized that short-term trainings offered by the college, especially through WDC, would face challenges around sustainability after the grant ended. In an effort to sustain these opportunities, the President established a workforce-focused fund through CSTCC's Office of Development. Also, in preparing for the end of grant funding, CSTCC leadership reported working within each grant-funded program to build that program into the division's budget.

Additionally, CSTCC has received several million dollars in capital funds from their recent funding request to the State of Ohio. College leadership reported this will go toward creating the physical space and architecture for PTEC-like services.

FUTURE RESEARCH

It is beyond the scope of this evaluation to make value judgments about whether the degree of tangible and intangible success obtained as a result of GCMCA was sufficient to warrant the amount of public investment made. Early findings from this report about GCMCA show promise about the program's effects. However, it takes time to start-up and implement programming, especially new programs, and it can take between 3.8 and 5 years[6] to complete an associate degree. As a result, there has not been enough time to follow all of the students impacted by GCMCA funding through their college career to completion (and ultimately the workforce). More time for program implementation and evaluation would have been valuable when determining a program's impact. Future research could:

- Follow GCMCA students to determine how, and the extent to which, programming impacted students' likelihood of completion and their progression through the workforce;
- Build upon findings in this report to explore promising practices in program start-up by examining start-up and implementation activities across a number of institutions; and
- Engage with CSTCC leadership, staff, and faculty (and other TAACCCT grantees) during their sustainability efforts to identify promising practices in program sustainability.

[6] Complete College America (2011). *Time is the Enemy: The surprising truth about why today's college students aren't graduating … and what needs to change.* Washington DC: Complete College America. Retrieved from http://www.completecollege.org/docs/Time_Is_the_Enemy_Summary.pdf

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Greater Cincinnati Manufacturing Careers Accelerator (GCMCA)

GCMCA

Grant Purpose

In 2013, Cincinnati State Technical and Community College (CSTCC) received a grant of $2,750,000 through the U.S. Department of Labor (USDOL) Trade Adjustment Assistance Community College and Career Training (TAACCCT) program to fund the Greater Cincinnati Manufacturing Careers Accelerator (GCMCA) initiative. GCMCA was designed to prepare Trade Adjustment Assistance (TAA) -eligible workers, veterans, and others for employment in the manufacturing industry through the development of stacked pathways of study, integrated student support services, and state-of-the-art equipment and facilities.

Core Elements

A required component for all TAACCCT grantees, was to integrate the grantee's program concept and vision with core elements[7] determined by USDOL to be key factors for successful program development. CSTCC's approach for the TAACCCT core elements was as follows:

Stacked and latticed credentials[8] were created for new and enhanced GCMCA programs in collaboration with industry partners.[9]

Transferability and articulation of credit used previously established articulation agreements for CSTCC's Mechanical Engineering Technology program with regional four-year colleges and new agreements for the Welding program with technical education organizations.

Advanced online and technology-enabled learning through contextualized remedial education, adaptive learning technology, and hybrid learning, backed by evidence-based research about online and technology-enabled learning and accelerated and contextualized remedial education. [10][11]

Strategic alignment with state priorities, regional employers, the public workforce system, and regional/community organizations.

Alignment with previously-funded TAACCCT projects, including CSTCC's TAACCCT R1 grant that created the Pathway to Employment Center (PTEC) and has been enhanced through the GCMCA grant, as well as alignment with other TAACCCT grantees (including R4).

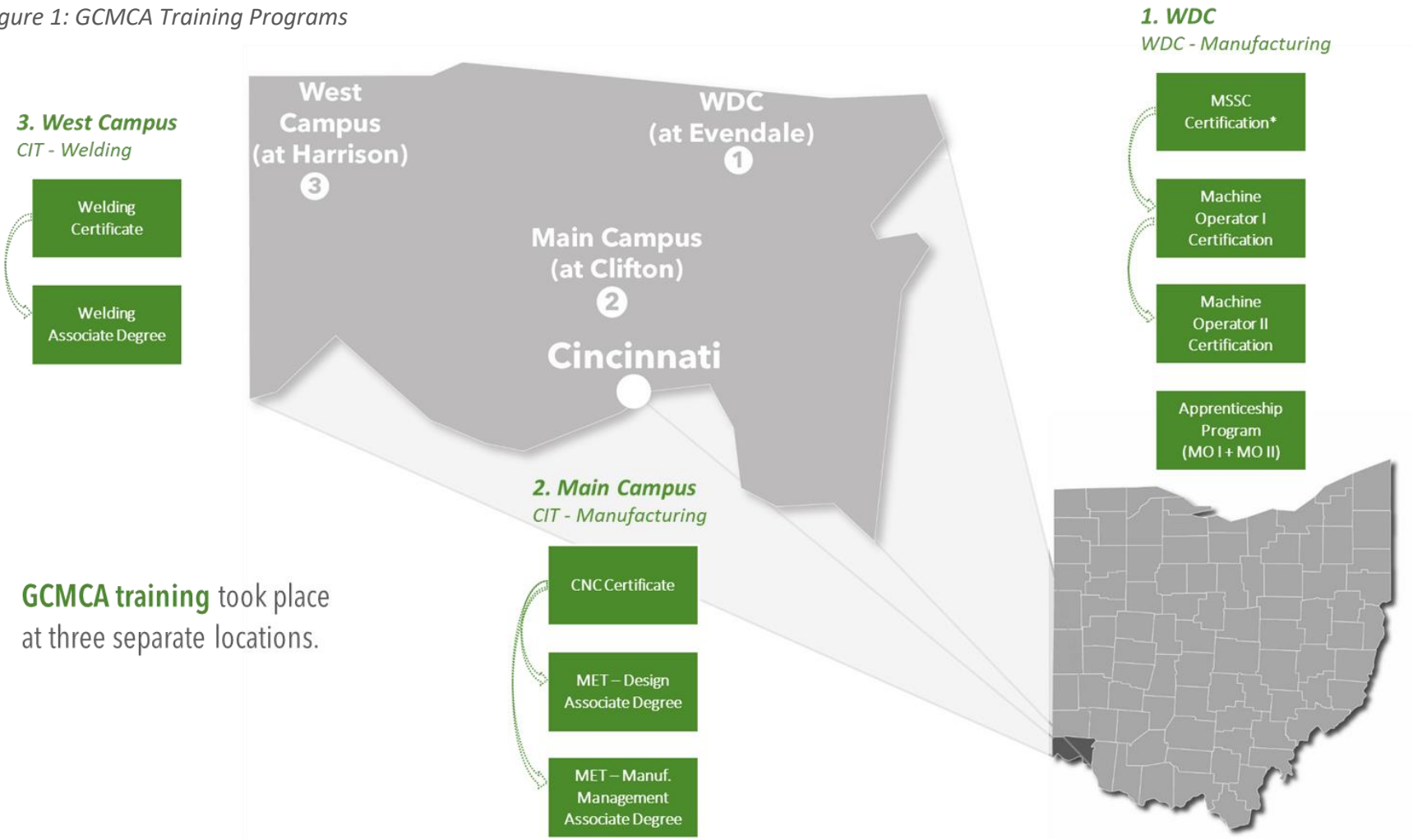
These core elements will be highlighted by their icons as they appear within the sections that follow.

[7] TAACCCT grantee core elements were specified in the Solicitation for Grant Applications (SGA) Funding Opportunity Number SGA/DFA PY-12-10.
[8] Stacked credentials are credentials that can be earned in sequence, building on previously learned content. Latticed credentials allow for side-to-side credentialing. For example, as students' progress through a degree plan, they may want to add or shift to another related field of study.
[9] Due to the realities of grant implementation, the development and implementation of a system of Prior Learning Assessments (PLAs) for program participants did not take place. See *Implementation Evaluation* section.
[10] PLAs were also an anticipated part of this core element.
[11] Evidence sited in the original grant narrative included: PLAs | The Council for Adult & Experiential Learning, Fueling the Race to Postsecondary Success, February 2010. Online and technology-enabled learning | Bowen, W. et al, ITHAKA S+R, *Interactive Learning Online at Public Universities: Evidence from Randomized Trials*, May 2012. Accelerated and contextualized remediation | Jenkins, D. et al, Columbia University Teachers College, *A Model For Accelerating Academic Success of Community College English Students*, September 2010.

Training Programs

GCMCA training programs primarily focused on welding and computer numerical control (CNC) - related manufacturing. These programs were developed or enhanced within two main divisions at CSTCC: (1) the Workforce Development Center (WDC), which specializes in short-term, customized workforce education and training programs; and (2) the Center for Innovative Technologies (CIT), which provides college-credit bearing associate degree and certificate programs. The map below highlights the training programs and training locations for GCMCA.

Figure 1: GCMCA Training Programs



Workforce Development Center

Throughout the course of the GCMCA initiative, CSTCC's Workforce Development Center (WDC) located in Evendale, OH provided four main offerings, focused on shorter-term manufacturing-related training:

MSSC Certification*

Manufacturing Skill Standards Council (MSSC) was a four week certification providing basic skills for an entry-level manufacturing job. **The last offering for the MSSC program was April/May 2015 due to lack of enrollment and competition from another local training provider who offered free training for the same program.*

Machine Operator I Certification

Machine Operator I (MO I) was a 6 ½ month evening program providing basic Computer Numerical Control (CNC) machine operating training including machine safety, measurement and blueprint reading, manual milling, and CNC programming.

Machine Operator II Certification

Machine Operator II (MO II) was a 5 ½ month evening program providing more advanced CNC programming and hands-on training, building off skills developed in the MO I Certification.

Apprenticeship Program (MO I + MO II)

The Apprenticeship Program was a year-long program combining MO I and MO II training with work-based learning. Participants worked at an employer location Monday – Thursday and attended class on Friday.

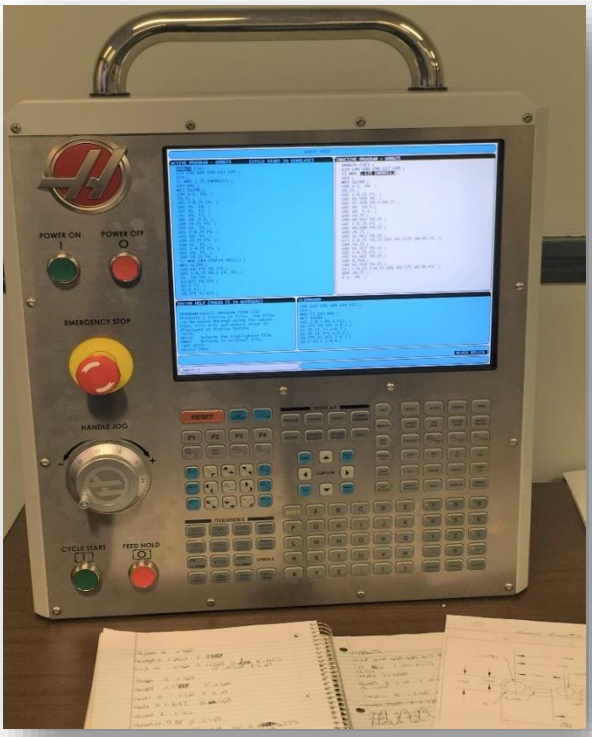
The Manufacturing Skill Standards Council (MSSC) Certification, Machine Operator I (MO I) Certification, Machine Operator II (MO II) Certification, and Apprenticeship program were developed as a result of industry needs within the region. MSSC, MO I, and MO II were conceived of during the grant application period. Then during program implementation, in collaboration with employers and Partners for a Competitive Workforce, the Apprenticeship program was developed, incorporating work-based learning into MO I and MO II.

WDC offerings were designed so that the MSSC stacked into MO I, and MO I stacked into the MO II. Designing stackable courses meant that concepts from MSSC carried into MO I, and concepts from MO I carried into MO II. If interested, participants could begin with MSSC and continue into MO I and then MO II gaining certifications and building on expertise gained in each previous program. However, individuals could also enter into training at any point (i.e. MO I or MO II) as long as they were qualified.

After completing training, students could also continue on to a certificate or degree program within CSTCC. Each certification counted as one transfer course into the Center for Innovative Technologies (CIT) CNC Certificate and Mechanical Engineering Technology (MET) Degree track.

MO I, MO II, and the Apprenticeship program included a mix of classroom-based and hands-on equipment training. To enhance classroom training, CNC programming courses incorporated CNC simulators. The simulator technology allowed students to enter and test CNC code exactly as they would when operating CNC equipment, such as a mill or lathe. This same technology is also used within the manufacturing courses offered by CSTCC's CIT division (see *Figure 2* below).

Figure 2: CNC Training Equipment



CNC simulator used in WDC (and CIT manufacturing) classrooms

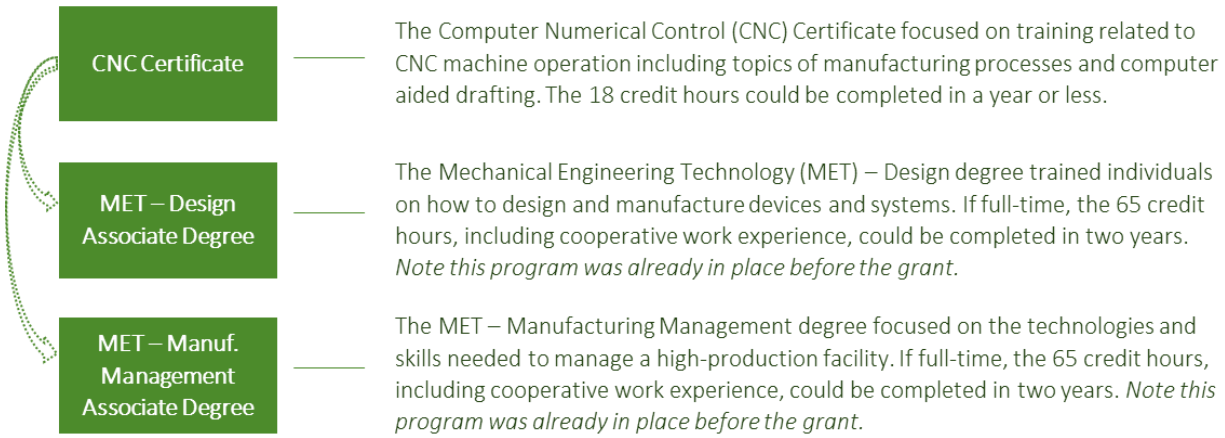
CNC lathe at WDC, with matching CNC control panel

Center for Innovative Technologies

The Center for Innovative Technologies (CIT) developed two main program offering tracks as a result of the GCMCA initiative – Manufacturing and Welding.

CIT Manufacturing

Through GCMCA, CSTCC restarted the CNC Certificate and enhanced the Mechanical Engineering Technology (MET) Design and Manufacturing Management Associate of Applied Science (AAS) Degrees:



The CNC Certificate was redesigned and restarted through the GCMCA initiative. The CNC Certificate was structured to offer training for individuals looking for a part-time education option in the manufacturing field and stacks into either of the MET Associates Degrees. Once on the MET degree track, students could transfer CSTCC college credits to the University of Cincinnati, Miami University, or Northern Kentucky University for continued studies.[12]

For individuals who have started CNC-related training and were looking to continue, the CIT manufacturing pathway also offered options for credits to transfer into the program. The CNC Certificate bridged training across CSTCC's academic (CIT) and workforce (WDC) divisions, as individuals who received MSSC, MO I, and/or MO II training from WDC could have credits transfer into this program. Additionally, courses within the CIT manufacturing track were pre-approved for students transferring from career training locations to CSTCC.[13]

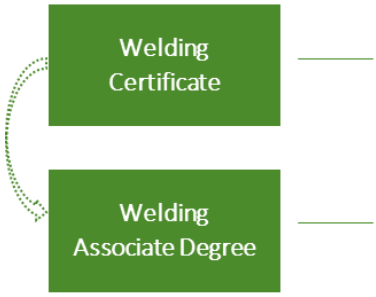
Similar to MO I and MO II in WDC, the CIT manufacturing track used CNC simulators to provide hands-on classroom learning experiences before students start programming on the CNC equipment.

[12] The Transfer Assurance Guide (TAG) system was developed by the State of Ohio to enhance transferability across Ohio's educational institutions. Approved TAG courses, such as those within the MET program at CSTCC, guarantee that the courses and their credits will transfer and apply toward a major at Ohio's public institutions of higher education.

[13] The Career-Technical Assurance Guide (CTAG) system was developed by the State of Ohio to increase transferability across career/technical training institutions and institutions of higher education, such as CSTCC. With CIT manufacturing, MET 111, 131, and 132 are CTAG approved.

CIT Welding

The GCMCA initiative allowed for the development of an entirely new Welding program at CSTCC's West Campus (at Harrison).[14]



The Welding Certificate program provided an introduction to welding through classroom and hands-on training around welding processes, metal fabrication, and metal testing. If full-time, the 30 credit hours could be completed in one year.

The Welding Associate Degree offered more advanced welding training with curriculum aligned with the American Welding Society's SENSE program (Level 2 Certification). Training included metal fabrication, visual inspection, and blueprint reading. If full-time, the 61 credit hours, including cooperative work experience, could be completed in two years.

CSTCC stakeholders reported that the Welding program was created because of an identified need by employers for additional qualified welders, and thus welding training, in the greater Cincinnati area. Employer engagement with the development of the Welding program has been sustained through the creation of a Welding advisory committee.

The program was designed so that individuals new to welding could be introduced to fundamental welding concepts and techniques through the Welding Certificate. This Certificate then stacked into the Welding Associate Degree, which allowed students to easily continue from one program to the next.

Additionally, students who entered the program already having taken Welding courses through local technical education organizations, such as Butler Tech, Great Oaks Career Campuses, and Warrant County Career Center, could receive credit for prior learning.[15]

Similar to the manufacturing programs, the CIT Welding track incorporated hybrid and technology-enabled learning into the classroom. With the goal of increasing student practice time and decreasing expendables used during student welding practice, CSTCC purchased a virtual welder.[16] Additionally, with the state-of-the-art welding equipment purchased through the grant, instructors had the ability to connect into a student's welding machine, through the USB drive, to view activity and understand where and how challenges arose during a student's equipment use.

Welding lessons learned and progress made through GCMCA have also supported the college's efforts with their Welding program developed under the Ohio TechNet (OTN) TAACCCT Round 4 grant, of which CSTCC is a consortium member.

[14] Toward the end of the grant, GCMCA Welding courses were also offered on the Main Campus (at Clifton). The Ohio TechNet (OTN) TAACCCT Round 4 grant, in which CSTCC is one of 11 consortium members, provided funding to develop an accelerated Welding program, which was located on Main Campus (Clifton). Interviewed CSTCC leadership noted that the college was able to join the consortium in part because GCMCA laid the foundation for Welding at the college.

[15] Agreements were in place between CSTCC and Butler Tech and Warren County Career Center. Credit for prior learning could also be provided on an individual-level basis.

[16] The Evaluation Team received mixed-feedback about the usefulness of the virtual welder. If another college is considering purchasing one, it is recommended that the college discuss the virtual welder concept with other similar Welding programs and with regional employers.

Student-Centered Learning

One of the most innovative components of the GCMCA initiative was the incorporation of contextualization and adaptive learning into the Welding curriculum. In a collaborative effort across faculty, instructors, and leadership in CIT, the Humanities & Sciences, and the Pathway to Employment Center (PTEC), CSTCC developed customized math and English training approaches for GCMCA Welding participants. The content created focused on two main approaches – adaptive learning and contextualization.

Adaptive Learning

Adaptive learning focused on supporting students who tested at the lowest levels of math and English proficiency. These individuals needed support and additional training to bring them up to the pre-college level course standards. Traditionally, students would be referred to an outside training program for remediation, test scores were low enough, before they could be admitted at CSTCC and take additional remediation coursework. Through the grant, CSTCC provided free Bootcamps for students who would have been referred to an outside training provider. These Bootcamps consisted of a half-to-full day of intensive training in math and English. Once admitted to the college, students needing foundational training were provided with free access to ALEKS, an online math training program, with supplemental tutoring as needed. Students could progress through the ALEKS training at their own pace, instead of taking a non-credit foundational course, for which the students would have needed to pay tuition.

Contextualization

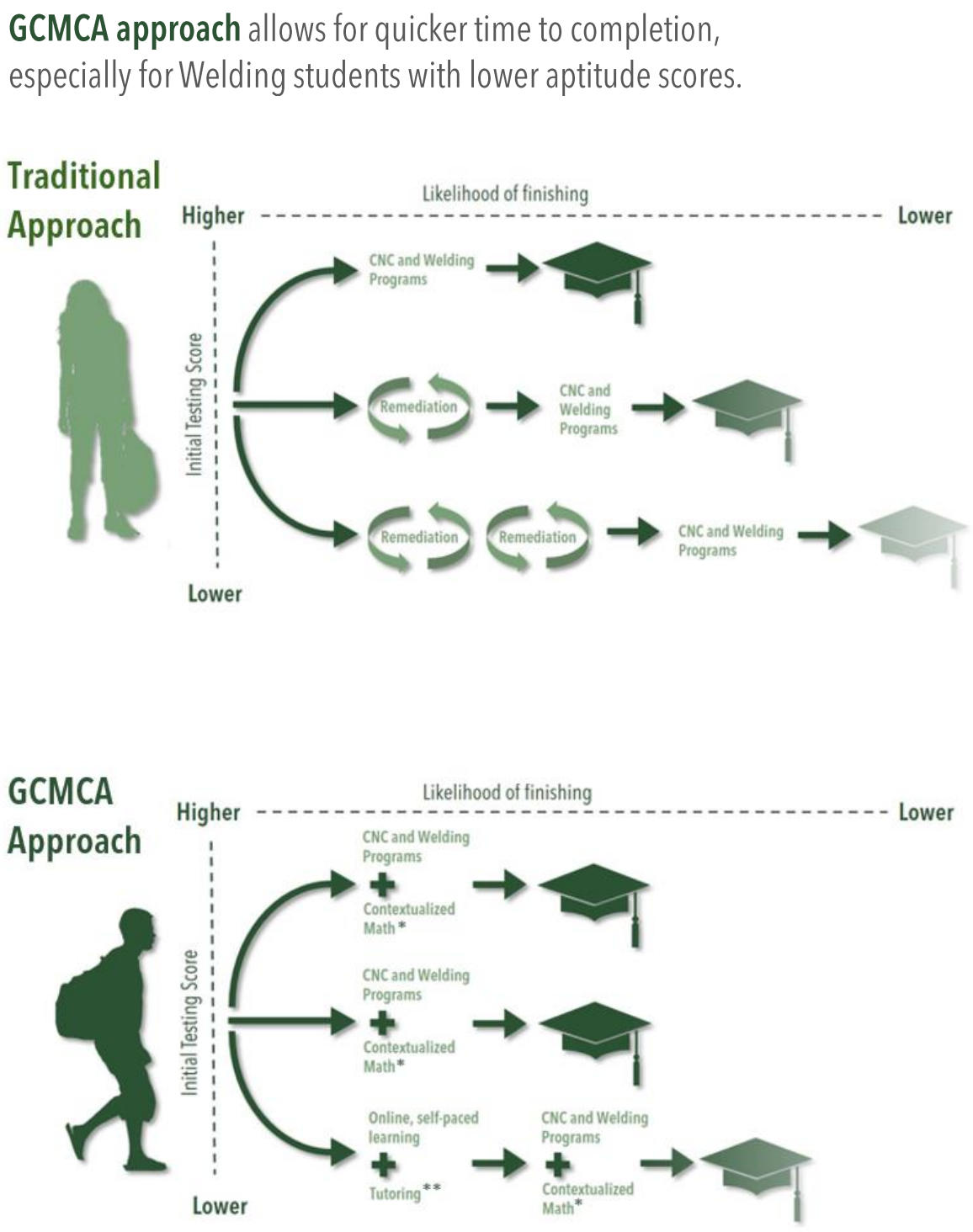
For students who passed the ALEKS training and/or tested into regular developmental education, CSTCC created two contextualized training approaches – one for English and one for math. Traditionally, students who test into the college's Academic Foundations courses would be required to take non-credit developmental coursework before enrolling into any courses that required math or English as a pre-requisite. Through the grant, students were able to enter into their training programs of study right away.

English. For students requiring developmental English, a contextualized English course was created. The course used a welding textbook with technical writing applications embedded in welding activities, assignments, and essays. Students would take this as an additional class in their schedule first semester. This course was offered to students at no cost and included additional English tutoring.

Math. Contextualized math was offered concurrently with the Welding blueprint reading course, taken during the first semester. Six welding-related math lab applications were incorporated into the regular course. They were delivered as labs during the classroom time, using math examples relevant to the students' welding coursework. All Welding students, independent of whether or not they needed additional math support, received the contextualized math labs. At the end of the semester, students who had tested into developmental math were required to take a technical math final exam before moving on with their math-related welding coursework.

The long-term goal of both the adaptive learning and contextualization content developed through GCMCA was that students could begin their programs of study sooner and therefore could be more likely to persist through and complete their chosen programs of study in a shorter timeframe.

Figure 3: Student-Centered Learning Approaches



*Contextualized math was added only to the Welding program ** Tutoring was primarily delivered to Welding students

Pathway To Employment Center

To support students throughout their grant experience, CSTCC built upon and enhanced the Pathway to Employment Center (PTEC), a student supportive services concept originally designed through CSTCC's TAACCCT Round 1 Health Professions Pathways (H2P) Consortium grant. PTEC provided support to GCMCA students as needed throughout their time with the college, including recruitment and enrollment, retention, completion, and employment services.

Recruitment & Enrollment

PTEC staff supported GCMCA program enrollment by attending job fairs and other recruiting events. They also connected with organizations that might benefit from or assist in marketing the GCMCA initiative.

Potential students interested in GCMCA programs could meet with PTEC staff at the beginning of their time at CSTCC for incoming assessments and career guidance. Continuing the assessments used for the H2P TAACCCT grant, PTEC staff provided ACT's Fit, Talent, and Performance WorkKeys assessments to assist a student in understanding which program(s) he or she may fit best with. Additionally, PTEC staff administered the National Career Readiness Certificate (NCRC) to, at minimum, all students receiving Workforce Innovation and Opportunity Act (WIOA) funding to better determine the individual's aptitude level and provide the student with appropriate academic support and program placement.

Additionally, due to the unique adaptive learning and contextualization approaches developed for the Welding program, Welding students received advising and enrollment services through PTEC, instead of through the Main Campus' advisors.

Retention

As GCMCA students began their programs, PTEC staff provided ongoing academic support and intrusive advising resources. All GCMCA students could work with PTEC staff to build and customize their educational experience through course guidance and planning sessions. Tutoring services were available to all GCMCA students, with a special focus on Welding students who required adaptive learning or contextualization. In-person tutoring was provided at the Main Campus and West Campus.

In addition to tutoring, PTEC staff were engaged in the development, delivery, and support of adaptive learning and contextualization GCMCA components, including, at times, teaching the contextualized math lab (added to the Tutor's original core job).

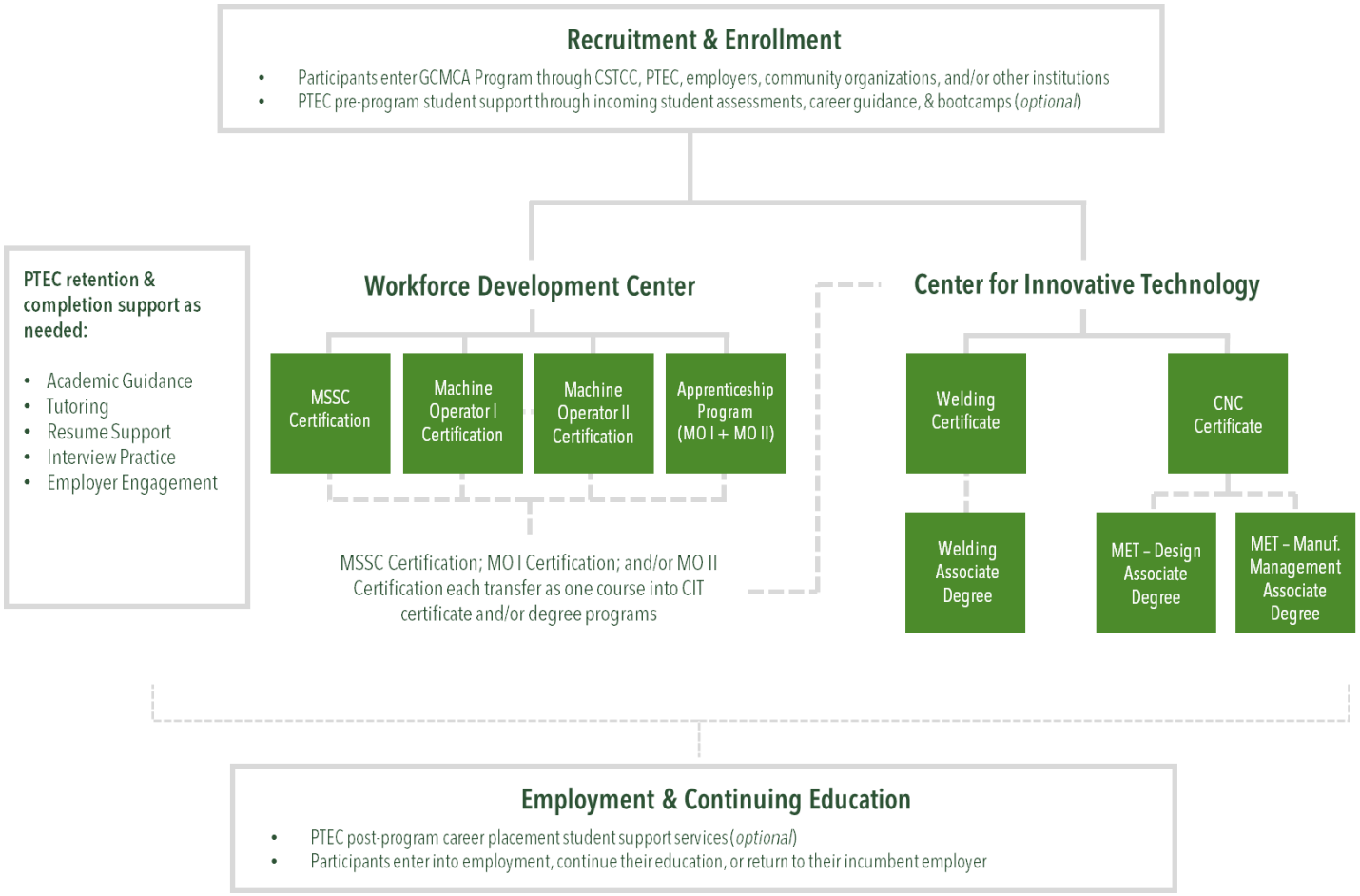
Completion

To support successful completion and job placement, PTEC staff worked with interested GCMCA students on resumes, cover letters, and interview preparation, among other forms of assistance. PTEC staff also reached out to employers and employer coordinating organizations within the community to assess their needs and career opportunities for students. By connecting with both students and employers, PTEC staff were able to better direct graduating GCMCA students to potential career opportunities and resources.

PARTICIPANT FLOW

Each of the GCMCA components – training programs, student-centered learning, and PTEC – come together to support students at CSTCC. The diagram below is a visual representation of a participant experience with the GCMCA initiative.[17]

Figure 4: Participant Flow

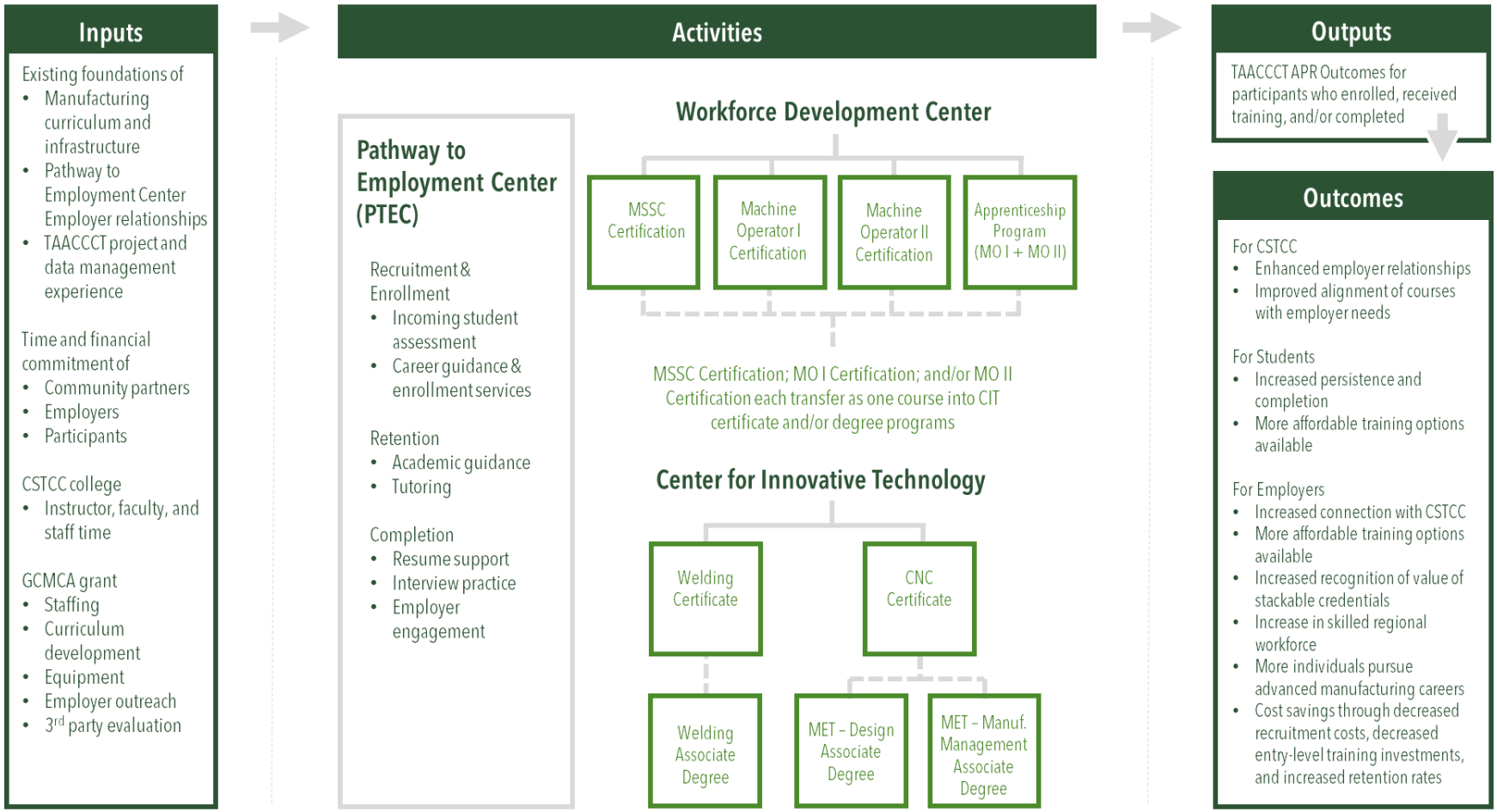


[17] Changes to the participant flow from the original grant design will be covered in the *Implementation Evaluation* section.

Logic Model

The logic model below highlights the vision for the GCMCA initiative. This vision includes the program pathways and flow of participants, which are components of the Activities section, but also the broader needs and anticipated effects of the grant, including: (1) inputs and resources needed for the grant; (2) activities and work undertaken during grant implementation; (3) direct results (Outputs) from the activities; and (4) anticipated changes for participants, partners, and CSTCC (Outcomes).

Figure 5: Logic Model



GCMCA
Program Evaluation

GCMCA Evaluation

CSTCC contracted with Thomas P. Miller & Associates, LLC (TPMA) to serve as an independent, third-party evaluator. The evaluation design included a mixed-methods approach:

Implementation Evaluation (Formative)

The formative Implementation Evaluation was conducted throughout the delivery of the GCMCA initiative. Through this evaluation, the Evaluation Team documented program progress, successes, challenges, and provided ongoing recommendations to GCMCA staff.

Implementation & Impact and Outcomes (Summative)

The formative Implementation Evaluation provided context for the Impact and Outcomes Evaluation by documenting the timing and nature of adjustments to program design. The Impact and Outcomes Evaluation used this to understand whether changes to the program might affect various participants, and then conducted descriptive and statistical analyses for GCMCA programs.

Final Evaluation Report

At the conclusion of the evaluation, and presented within this report, are the findings from the summative (cumulative) Implementation Evaluation and Impact and Outcomes Evaluation.

Implementation Evaluation

The Implementation Evaluation began January 2014 and continued through March 2017, to document program progress, monitor program outcomes, and provide recommendations for continuous improvement of program operations. The Implementation Evaluation focused on a series of research questions (see *Appendix A*) to explore the development of the GCMCA training programs and services provided by PTEC, employing principles of a utilization-focused framework.[18] This evaluation was primarily qualitative and used a general inductive thematic approach,[19] with influences of applied phenomenology,[20] to analyze the data including calls, interviews, and document reviews.

Impact and Outcomes Evaluation

The Impact and Outcomes Evaluation focused on three primary research questions around GCMCA participant persistence and completion (see *Appendix B*). To respond to these questions, TPMA included both a quasi-experimental design (QED) to determine impact for GCMCA Welding and MET programs, as well as an outcomes-focused design to provide a descriptive picture of student results for the GCMCA WDC programs. The QED approach used propensity score matching[21] and analyzed changes in persistence and completion for GCMCA participants, compared to similar individuals in similar programs of study, through chi-square (χ^2) tests, and logistic regression analyses.

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[18] Patton, M.Q. *Essentials of Utilization-focused Evaluation*. Thousand Oaks, CA. SAGE Publications, Inc., 2012.
[19] Thomas, D.R. (2006). *A general inductive approach for analyzing qualitative evaluation data*. American Journal of Evaluation, 27, 237-245.
[20] Guest, Greg, MacQueen, K.M., and Namey, E.E. *Applied Thematic Analysis*. Thousand Oaks, CA. SAGE Publications, Inc., 2011.
[21] Rosenbaum, P.R. and Rubin, D.B. (1983). The central role of the propensity score in observational studies for causal effects. *Biometrika. 70*, 41–55.; Rosenbaum, P.R. and Rubin, D.B. (1985). Constructing a control group using multivariate matched sampling methods that incorporate the propensity score. *The American Statistician. 39.* 33–38.

Implementation Evaluation

Design Summary

The Implementation Evaluation began January 2014 and continued through March 2017[22] to document program progress, to monitor program outputs, and to provide recommendations for continuous improvement of program operations. The Evaluation Team conducted a formative and summative evaluation, primarily focused on the development of the Greater Cincinnati Manufacturing Careers Accelerator (GCMCA) training programs and services provided by PTEC. Because GCMCA was an innovative, untested program design, the Implementation Evaluation was intended to be a key element in learning lessons along the way to enhance program implementation and results in real-time. Evaluation feedback was provided through analysis of the following primary themes:[23]

- Progress toward achieving certain program outcomes or milestones
- Program accelerators, barriers, and environmental factors
- How strategies or activities not successfully implemented could be adapted or modified to the realities of the circumstances surrounding the project
- Context for sustaining certain project activities

To gather information on the themes above, the Evaluation Team used a combination of conference calls and emails, phone and in-person individual and group interviews, and program document reviews:[24]

- Progress update calls and communication with the grant's Project Director and Data Manager/Data Analyst
- Quarterly implementation calls with leadership
- Site visit interviews with key stakeholders including leadership, GCMCA staff and instructors, CSTCC staff and instructors, participants, and partners
- GCMCA document reviews, including quarterly program reports, annual performance reports, program internal reports and score cards, and promotional and descriptive materials.

The Implementation Evaluation allowed the Evaluation Team, grant staff, and stakeholders to better understand the program's core activities and qualitatively evaluated how the operations of GCMCA functioned. This component of the evaluation placed the outcomes of the intervention into context with the implementation process and examined whether the program was implemented as designed. This allowed the Evaluation Team to uncover any potential threats to the validity of the Impact Evaluation[25] and helped program staff understand how the process might be modified to improve results.

[22] Grant implementation took place up to March 30, 2017. April 1, 2017 through September 30, 2017 was additional time for evaluation analysis and reporting.
[23] For a description of analysis methods and a full listing of Implementation Evaluation research questions and the relationship between the research questions, data sources, and methods see *Appendix A*.
[24] *Appendix A* contains descriptions of each Implementation Evaluation data source and limitations to the evaluation. Triangulating results from these varying sources was used as an attempt to address the limitation of partial and biased findings.
[25] See the *Informing the Impact Evaluation* section of *Appendix A*.

Findings Overview

Findings for the Implementation Evaluation were grouped by research question themes. Every implementation research question is within this section, and the questions align with the *Research Question* section in *Appendix A*. Overall themes within the Implementation Evaluation findings include:

Established Buy-In & Engagement

An important foundation for the GCMCA initiative was the support and engagement from college leadership and employer partners (highlighted in *Successes*). Leadership from across the college (e.g. CIT, WDC, Humanities & Sciences, and PTEC) were actively engaged in program start-up and implementation. Having buy-in and ongoing support from college leadership helped GCMCA maintain momentum and progress through initiative challenges.

Starting from a strong employer base, and continuing to grow employer connections, was key to receiving ongoing feedback. This allowed for innovations within the grant, including the creation of an Apprenticeship program.

Built Grant Structure

The GCMCA grant's operational structure also helped lay the groundwork for successful implementation. Knowledge sharing across CSTCC's several TAACCCT grants was facilitated by placing one director over all TAACCCT grants, and sharing staff across programs (e.g. PTEC). Also, GCMCA's focus on data quality was key for demonstrating the program's effects. To support quality data collection, tracking, and analysis, CSTCC hired internal staff (i.e. Data Manager, Data Analyst) and an external Data Specialist Consultant.

Progressed Through Start-Up Challenges

These key elements of buy-in and structure have supported GCMCA and CSTCC leadership, staff, faculty, and instructors in progressing through the phases of program start-up and implementation. Challenges experienced during implementation included (1) the amount of time needed for program start-up; (2) pivoting on roll-out strategies (e.g. Welding location); (3) identifying and training qualified staff, faculty, and instructors; (4) determining effective approaches for cross-division collaboration; (5) marketing and recruitment; and (6) shifting environmental factors (e.g. changes in local economy). (Highlighted in *Challenges*)

Enhanced College Capacity & Reach

As a result of the grant, CSTCC has been able to expand the college's reach and programmatic capacity in several key areas. The first Welding program at CSTCC was offered through GCMCA. This extended the reach of the college into the western area of Hamilton County, Ohio and helped fill a training gap in the community. After creating the GCMCA Welding program, the college was also able to leverage their experience with and exposure to Welding to add additional Welding trainings through a TAACCCT Round 4 consortium.

Strengthening and adding new machine-related trainings (e.g. MET, CNC, MO I, and MO II) has fostered increased collaboration between CIT and WDC and led to new opportunities for enhancing machine-related training (e.g. additive manufacturing).

Additionally, GCMCA has supported innovations in student-centered learning through adaptive learning, contextualization, and supportive student services (i.e. PTEC). Stakeholders have highlighted the value and benefit these innovations have provided to students, instructors, and the college as a whole and plan to continue developing innovative approaches to developmental education and student support beyond the grant.

Program Development

The content within this section of findings focuses on research questions related to developing the GCMCA initiative, including curriculum selection, program design, participant skill assessments, and available career guidance and support. Additional details are available in the *GCMCA* report section.

Research Questions

- How was the particular curriculum selected, used, and/or created?
- How were programs and program designs improved or expanded using grant funds? What delivery methods were offered? What was the program administrative structure? What support services and other services were offered?
- Was an in-depth assessment of participants' abilities, skills, and interests conducted to select participants into the grant program? What assessment tools and processes were used? Who conducted the assessment? How were the assessment results used? Were the assessment results useful in determining the appropriate program and course sequence for participants? Was career guidance provided, and if so, through what methods?
- What contributions did each of the partners (employers, workforce system, other training providers and educators, philanthropic organizations, and others as applicable) make in terms of: (1) program design and (2) curriculum development? Which contributions from partners were most critical to the success of the grant program?[26]

Training Programs

GCMCA training programs were administered through two divisions within CSTCC – the Workforce Development Center (WDC) and the Center for Innovative Technologies (CIT). WDC focuses on short-term trainings while CIT offers academic training options (certificates and associate degrees). Leadership and instructors from these two divisions, leadership and instructors from the Humanities & Sciences division, leadership and staff at PTEC, and leadership members within the college (e.g. Provost, Vice President of Academic Affairs, Vice President of Enrollment & Student Development) were engaged in the development of GCMCA.

GCMCA training took place in three program areas:

(1) WDC manufacturing-related programs, including Manufacturing Skill Standards Council (MSSC) Certification, Machine Operator I (MO I) Certification, Machine Operator II (MO II) Certification, and Apprenticeship program
(2) CIT Computer Numerical Control (CNC) Certificate and Mechanical Engineering Technology (MET) Degrees
(3) CIT Welding Certificate and Degree

The table below highlights program development for each GCMCA training program.

[26] This is part of a larger research question, which is also addressed in the Program Implementation section. The full research question includes: What contributions did each of the partners (employers, workforce system, other training providers and educators, philanthropic organizations, and others as applicable) make in terms of: (1) program design, (2) curriculum development, (3) recruitment, (4) training, (5) placement, (6) program management, (7) leveraging of resources, and (8) commitment to program sustainability? What factors contributed to partners' involvement or lack of involvement in the program? Which contributions from partners were most critical to the success of the grant program? Which contributions from partners had less of an impact?

Table 1: GCMCA Training Programs

Training Programs	Curriculum	Using Grant Funds	Delivery Methods
MSSC, MO I , MO II, & Apprenticeship	New program offerings were developed by WDC instructors as a result of identified industry needs and skills shortages within the region	Instructors, Curriculum Development, Equipment & Supplies, PTEC Supportive Services	Mix of classroom-based and hands-on equipment training. CNC trainers for virtual learning / practice
CNC Certificate & MET Degrees	CIT division re-tooled previous CNC Certificate curriculum and updated current MET Degree curriculum to incorporate more up-to-date technologies	Equipment & Supplies, PTEC Supportive Services	Mix of classroom-based and hands-on equipment training. CNC trainers for virtual learning / practice
Welding Certificate & Degree	New program offerings were developed by Welding instructors as a result of identified industry needs and skills shortages within the region	Instructors, Curriculum Development, Equipment & Supplies, PTEC Supportive Services	Mix of classroom-based and hands-on equipment training. Online safety courses and virtual welder. Extra tutoring support and Math and English contextualized courses

Interviews with leadership and instructors highlighted the use of technology-enabled learning, including CNC training simulators for the MO and CNC courses, which they reported allowed students to receive extra training time and experience before and during hands-on machine use. GCMCA instructors noted that this allowed students to practice on real and relevant equipment without using up limited material supplies, which are required on the machine operator CNC equipment.

> "The [CNC training] simulators are a huge help. You can verify [student understanding and skill] on a machine or on simulators. It literally does what a machine will do."– GCMCA Instructor

Interviewed leadership, staff, instructors, and partners all noted the importance of employer engagement in the program development process, including providing feedback on regional skills shortages and providing ongoing feedback around training quality and topic areas covered. For example, employers identified a need for blueprint reading in the Welding curriculum, and employers identified a need for a machine operator Apprenticeship program.

> "The way this worked was very industry driven. What is it that they [employers] need? Identifying that need, specifically what skills do they need for that person to be able to walk in the door and actually start work? That's how we created the program, and then tweaked the program because we reflect on 'is this right' when we have a graduate or a graduating cohort. And that has proved to be wonderful in terms of placement – it's a good placement because (1) they understand the work because they're doing the work they would be doing in the field [in the training program], and (2) they're well trained, so it's an awesome fit for the employer." – GCMCA Leadership

Supporting Student Success

To support students throughout their grant experience, CSTCC built upon and enhanced the Pathway to Employment Center (PTEC), a student supportive services concept originally designed through CSTCC's TAACCCT Round 1 grant. PTEC provided support to GCMCA students as needed throughout their time with the college. This support included recruitment and enrollment (e.g. job fairs, advising and enrollment for welding students), retention (e.g. tutoring, intrusive advising), and employment (e.g. resume review, interview preparation).

> "They're very helpful. [PTEC] will do whatever they can to help, and that's a big deal."
> – GCMCA Leadership

During the recruitment and enrollment phase, potential students interested in GCMCA programs could meet with PTEC staff for an assessment of their abilities, skills, and interests. Specific assessment tools used by PTEC and the college's Testing Center included:

- ACT's WorkKeys Fit, Talent, and Performance assessment to assist a student in understanding which program(s) he or she may fit best
- National Career Readiness Certificate (NCRC) to better determine the individual's aptitude level and provide the student with appropriate academic support and program placement
- COMPASS, and then Accuplacer, testing was used to assess an individual's aptitude in key academic areas such as math and reading (administered by CSTCC's Testing Center)

Use of assessments varied by individual. At minimum, all students receiving Workforce Innovation and Opportunity Act (WIOA) funding completed the NCRC, and the majority of students tested using COMPASS or Accuplacer. COMPASS/Accuplacer results were used to determine the level of additional preparatory courses a student needed before or during their GCMCA program of study. Additionally, the Welding program required students to pass a Schools Excelling through National Skills Education (SENSE) or similar safety exam at 100 percent before students were able to begin welding. A more detailed description around PTEC services, including information about PTEC's employment-related services, is available in *Pathway to Employment Center* and descriptive statistics around PTEC service trends is available in the *Impact and Outcomes Evaluation*.

> "We see really good success [at PTEC] when students come in and they have some of that initial career exploration and fit and talent. Those are really important. As opposed to the industrial model of [a student] coming in, what are you interested in, and we put you in that degree. PTEC allows for that."– GCMCA Leadership

When students' COMPASS or Accuplacer scores indicated that the individual needed additional educational training in core areas like math or English, GCMCA Welding students could pursue self-paced and contextualized learning options that would condense their time to starting their training program. For students who scored the in lowest COMPASS grouping, instead of taking non-credit foundational courses, these individuals could take adaptive learning through self-paced ALEKS math with in-person tutoring. After progressing, these students would join students whose scores placed them into academic courses.

Instead of taking remedial non-credit developmental courses before starting their program of study, Welding students could take contextualized math and English courses that were offered concurrently with their program of study. CSTCC and GCMCA leadership identified these approaches to adaptive learning and contextualization for students needing additional preparation for their program of study as innovations for the grant. Additional detail is available in *Student-Centered Learning*.

> "If someone tests in that level, [the adaptive learning component] overcomes a full semester and in some cases two full semesters or an entire year. So they do accelerated [learning] in ALEKS with tutoring support, then they go into the Math 120 which is embedded into [Welding's blueprint reading course]."– GCMCA Leadership

> "Success in retention is key to us. Really where we lost them is that first year, or even that first semester. Anything we can do to get them off to a pretty good start is helpful."– GCMCA Leadership

Program Implementation

The content within this section of findings focuses on research questions grouped around the common elements of program implementation. These findings discuss the overall grant rollout, successes, barriers, environmental factors, and program outputs.

Research Questions

- What program outputs have been generated to date? What barriers hindered output achievement? What factors unexpectedly improved output achievement? Why?
- What have been successes and obstacles to program performance?
- How satisfied are program partners, staff, and participants with the program? Why?
- What contributions did each of the partners (employers, workforce system, other training providers and educators, philanthropic organizations, and others as applicable) make in terms of: (1) program design, (2) curriculum development, (3) recruitment, (4) training, (5) placement, (6) program management, (7) leveraging of resources, and (8) commitment to program sustainability? What factors contributed to partners' involvement or lack of involvement in the program? Which contributions from partners were most critical to the success of the grant program? Which contributions from partners had less of an impact?

Program Progress

Throughout the grant, CSTCC made progress toward GCMCA training programs (green), student-centered learning components (gray), and PTEC support services (light green). Highlights of the GCMCA initiative with key milestones are included in the table on the following page.

Table 2: GCMCA Milestone Timeline

2013	Oct-Dec	• Humanities & Sciences begin work on contextualization courses for welding • Community outreach begins and continues throughout the grant • PTEC and GCMCA staff hiring begins
2014	Jan-Mar	• CNC Main Campus (Clifton) equipment bid package released • Collaboration with Gateway Community College for military crosswalk begins
	Apr-June	• MSSC and MO I trainings begin • Welding equipment bid package released • Adaptive learning tools purchased (ALEKS and MySkills Lab)
	July - Sept	• Welding certificate and degree and CNC certificate approved by CSTCC Academic Policies & Curriculum Committee (APCC) and Ohio Board of Regents • Decision made to move welding from Main Campus to West Campus (Harrison) • First Welding cohort begins • Full-time Welding instructor hired • COMPASS Bootcamp tutoring/support services begin • Tutoring services begin
	Oct-Dec	• Welding equipment installed at West Campus • CNC equipment received on Main Campus • Significant work on contextualized education takes place • Adaptive learning online tools launched to pilot group of welding students
2015	Jan-Mar	• MO II first offered • CNC Main Campus equipment incorporated into spring courses • Second Welding cohort begins • Contextualized Math and English courses first offered • Military crosswalk developed
	Apr-June	• CState CareerLink begins use
	July - Sept	• Adaptive learning review/analysis completed • Contextualized math course shifted to be co-taught with welding instructor and PTEC tutor • Contextualized English course taught at West Campus
	Oct-Dec	• Welding lab at West Campus is running at full capacity
2016	Jan-Mar	• Apprenticeship program first offered • Welding wait list created for Spring 2016 registration
	Apr-June	• *CSTCC transitions from COMPASS to Accuplacer*
	July - Sept	• GCMCA surpasses USDOL enrollment target (350 students) with 360 students enrolled
	Oct-Dec	• Subject matter expert for welding curriculum review secured
2017	Jan-Mar	• GCMCA grant implementation period ends, with total of 360 students enrolled • Subject matter expert for CNC curriculum review secured

Successes

Key successes in the GCMCA initiative include factors that have helped accelerate GCMCA toward a successful grant implementation and successes that have resulted from the grant.

Factors that accelerated GCMCA success included:

Engaged & Dedicated College Leadership

Commitment and buy-in from college leadership is foundational to supporting a successful grant. Key leadership from across the college were engaged in the development and implementation of GCMCA. During grant start-up, leadership from each implementation division (CIT, WDC, Humanities & Sciences, and PTEC); leaders from key supporting areas of the college (Institutional Research & Effectiveness and Grant Administration); and overarching leadership from college Vice Presidents (Academic Affairs and Enrollment and Student Development), Provost, and President participated in grant development. As the grant progressed, college leadership continued to be engaged in program strategy and coordination across divisions within the college. Having buy-in and ongoing support from leadership across the college helped GCMCA maintain momentum and address implementation challenges, and it is anticipated to support sustainability of GCMCA elements beyond the grant.

> "In this role, I have to understand the granularity in any of our programs including welding and manufacturing… I need to really understand each program: what are their needs, what are their resources, what are their bragging points – so I can represent that to the external community."
> – GCMCA Leadership

Strong Employer Base

Strong employer connections, especially for the WDC programs, were a foundational accelerator for the GMCMA initiative. Employer support and feedback has allowed for ongoing enhancements to short-term trainings and improvements to the Welding program. For example, Welding leadership and faculty identified receiving feedback from employers about the importance of adding blueprint reading to the curriculum, which was then incorporated.

One significant change based on employer engagement was the creation of an Apprenticeship program through WDC. The Apprenticeship program was created in collaboration with WDC, Partners for a Competitive Workforce (PCW) –a regional convener in the Ohio, Kentucky, and Indiana tri-state region focused on meeting employer demand by growing the skills of the current and future workforce– and local employers. The program combined MO I and MO II trainings, developed through GCMCA, with on-the-job training at an employer location.

> "The combination of class and hands-on [training] is what makes the Apprenticeship program unique."– Employer Partner

According to stakeholders, strong employer connections and collaboration contributed to the relevance of and need for the programs offered through GCMCA.

> "I worked at [a company] and they laid off over 100 people and even after that layoff… they still needed CNC operators. And even right now, if I get this [training] done, I could get called back to fill those open positions."– GCMCA Student

> "Every two or three days I was getting an email about job openings and of the 6-10 listings they had, there would probably be at least half of them for CNC operators."– GCMCA Student

> "One of the biggest struggles was the recruiting, retention, and training of machinists, because the talent pool was non-existent."– Employer Partner

Focus on Quality & Accessible Data

CSTCC's focus on quality data set a foundation for successful implementation and reporting. At the beginning of the grant, CSTCC hired a dedicated GCMCA Data Manager who worked in collaboration with the college's Institutional Research & Effectiveness division. The Data Manager was in charge of consistent data tracking and analysis, including participant intake and tracking, understanding and following USDOL data definitions, and regular reporting to USDOL and college leadership. GCMCA leadership and staff reported that the Data Manager's use of a data dashboard for college leadership helped keep key stakeholders engaged and informed about grant progress and helped keep GCMCA as a topic of conversation during leadership gatherings.

When CSTCC was awarded additional TAACCCT grants during Round 4, GCMCA leadership and staff reported that the Data Manager's knowledge was leveraged across grant programs to decrease start-up time and increase the transfer of institutional knowledge across TAACCCT initiatives. During a time of staffing transition for the Data Manager position, CSTCC hired a Data Specialist Consultant with TAACCCT data reporting experience to provide onboarding training and oversight to the new Data Analyst[27] to support a continued focus on high quality GCMCA data.

Knowledge Sharing Across TAACCCT Grants

In addition to leveraging knowledge of TAACCCT data tracking and reporting, as referenced in *Focus on Quality & Accessible Data*, CSTCC set in place added means for TAACCCT knowledge sharing. These included: (1) placing one director over all TAACCCT grants, (2) building on PTEC services from TAACCCT Round 1 by incorporating these into Round 3 and Round 4 initiatives, and (3) building on the GCMCA Welding program by pursuing an accelerated welding program for Round 4. By sharing staff and program concepts across TAACCCT grants, GCMCA leadership reporting being able to support institutional knowledge transfer, decrease time for initiative start-up, and leverage limited staffing resources.

[27] The Data Manager title changed to Data Analyst to reflect a shift in the data staff's reporting structure and job responsibilities.

Successes of GCMCA included:

New Welding Program

As a result of the grant, CSTCC, in collaboration with employer partners, was able to build a Welding program. This was created as the first Welding program at CSTCC. The GCMCA Welding program is located at the Harrison West Campus, which extends the reach of CSTCC, providing training to the western area of Hamilton County, Ohio. West Campus hosts ten welding booths, classroom space, and a virtual welder. Students in this program have the opportunity to learn new skills such as Metal Inert Gas (MIG), Tungsten Inert Gas (TIG), and Flux Cored Arc Welding. In addition to providing training at Harrison, the GCMCA Welding program has also been leveraged to support CSTCC's TAACCCT Round 4 grant, which offers accelerated welding at the Clifton Main Campus. College leadership noted that funding from the grant was key for starting up the Welding program. The grant funds allowed the college to start the program slowly and offset the costs of significant time and financial investment (e.g. equipment). This allowed smaller than sustainable enrollment numbers at the beginning of the grant period and provided CSTCC the time to work on getting the Welding program up to full capacity.

> "We didn't have Welding before. Therefore, the community didn't have this kind of advanced welding, and we have it now. We now have students who are graduating from the certificate or from the degree program.
>
> We will be sustaining this and that's a success, because there's a lot of building. You have to build the curriculum, you have to get the equipment installed and it has to be done right, the personnel, the approvals through the state, and the approvals through federal financial aid.
>
> All of those pieces would have been overwhelming. We wouldn't have arrived at where we are at without this grant. … We have initiated something here, filled a gap for the community that would have been very difficult to do without the grant." – GCMCA Leadership

Revived CNC Certificate Program & Capacity

The CNC Certificate was originally removed from CSTCC offerings due to low student enrollment, but was redesigned and restarted through the GCMCA initiative. Through the grant, CSTCC purchased state-of-the-art CNC equipment for use in the CNC Certificate and MET Degree programs. The CNC Certificate offered training in about half as much time as the MET Degree, allowing students to get back into the workforce quickly. College leadership identified the strong CNC enrollment numbers and the high-quality equipment purchased through the grant as key strengths of the new program. Before the grant, the MET program had limited equipment, often requiring students to rotate on machines. This decreased the amount of hands-on practice each student would receive. Leadership also noted that the new CNC equipment has helped market the program, as CSTCC has brought employers and interested stakeholders in for tours of the CNC program.

> "Other divisions are dropping 6-10% each semester in head count where as we have been able to counter that particularly in mechanical. [The CNC Certificate] has been able to grow or even just hold its own, which in these times is pretty good. I attribute [the growth] to that exposure to manufacturing [through the new equipment]. It has put us on the map as far as manufacturing goes."– GCMCA Leadership

Increased Collaboration between WDC & CIT

Another success of the GCMCA initiative was increased collaboration between WDC and CIT. Before the grant, college leadership noted that workforce development was separate from the rest of the college – both in location and focus areas. WDC primarily focused on the employer as the primary customer, creating customized short-term trainings, while the academic programs such as CIT primarily focused on the student.

Through the grant, CSTCC developed a pathway for students that connected shorter-term machine operator-related trainings at WDC (MO I, MO II, and MSSC) with longer-term machine operator-related trainings at CIT (CNC Certificate and MET Degrees). For students interested in moving from WDC to CIT, each WDC training counted as one transfer course within the CIT programs.[28] Students could also move from CIT to WDC, if interested in shorter training opportunities. Leadership noticed that collaborating to build these pathways for students has increased the level of communication across WDC and CIT and helped to strengthen each division's approach to training (employer- and student-focused). WDC leadership also noted that a structural change within WDC during the grant, including the addition of a Director position to serve a similar role as a Dean in other divisions, led to increased collaboration. The WDC Director attended all college Dean meetings and led coordination efforts with the Dean of CIT. College leadership anticipate future opportunities around WDC-CIT collaboration, especially around additive manufacturing (see *Beyond the Grant*).

> "While our primary customer is the corporate client, our secondary customer is the student. The idea of putting that student on a potential pathway was really important for anything that we were putting forth. That we have credit hours that can transfer from this program into a degree program under CIT is I think another really wonderful thing, so [WDC training] is not a terminal experience." – GCMCA Leadership (*WDC*)

> "Before they were doing their thing and we were doing our thing. We were academic and they were training. Those paths cannot cross. This grant really made us [come together and] establish pathways." – GCMCA Leadership (*CIT*)

[28] GCMCA leadership noted that it was more likely for an individual who completed WDC training to take time to work and then decide to return to school and pursue training through CIT than for that individual to continue into a CIT pathway after immediate completion of WDC training.

New Pathways in Developmental Education

Through the grant, CSTCC created new educational pathways through adaptive learning and contextualization that were not previously available. These approaches to developmental education allowed CSTCC to accelerate student entry into their program of study by offering self-paced math and by offering math and English courses that were contextualized to match training program content and taught concurrently with first semester program courses (see *Student-Centered Learning*). This grant helped conversations around remediation become a reality and provided a focused avenue in which the college could explore new developmental education options. After the grant, college leadership anticipate expanding the contextualized math courses to students in all technical programs (see *Beyond the Grant*).

> "Based on the contextualized math labs, [students] can truly see the importance and how crucial [math] is." – GCMCA Staff

> "The contextualization and acceleration pieces, those are best practices nationally, but any community college has to fund those opportunities to actually do them… Community colleges tend to be thinly resourced. [GCMCA] allows us, as an institution, to say it's not just that we know about this [best practice], but we actually have experience with it." – GCMCA Leadership

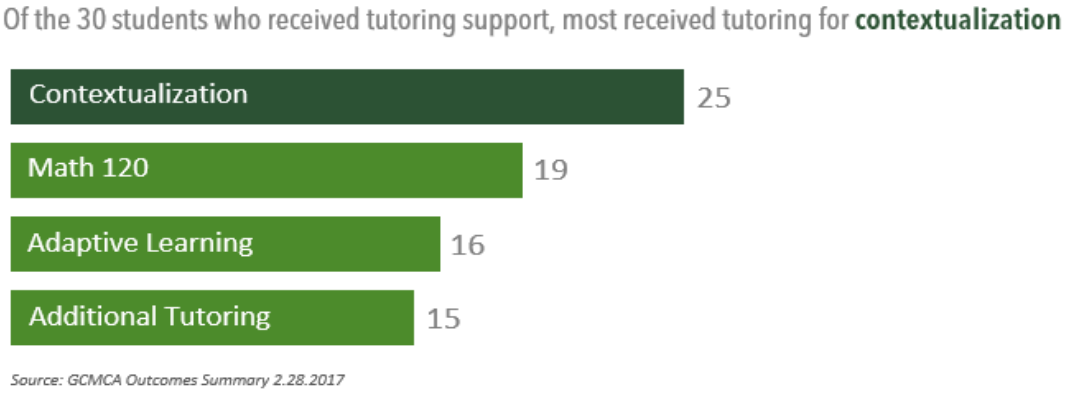
Supportive Services Customized to Training

The extent of program-specific supportive services provided by PTEC is a new approach to student support at CSTCC. Support from PTEC took a variety of forms throughout recruitment and enrollment, retention, and completion/employment phases of a student's CSTCC experience:

Advising	"The biggest [need] that I've seen that they [students] need from PTEC has been advising. The advising that they get from [PTEC] is amazing." – GCMCA Instructor
Coordination	"Having PTEC there, that helps us know what [student barriers or challenges] to watch out for." – CSTCC Staff
Tutoring	"If I have a student who contacts me: 'I'm struggling in this class, I think I'm going to fail.' I'm able to refer them to [the PTEC tutor] and she's able to bring them back on track and that's helped with the retention as well." – GCMCA Staff
Job Readiness	"If I could get them half-way through [training], [the PTEC Job Coach] could get them a job." – GCMCA Staff

Interviewed stakeholders in each GCMCA program highlighted various services offered by PTEC as valuable additions to their program, offering services that the instructors and staff were not in a position to provide due to lack of time and/or expertise. One such service was the array of tutoring offered to the Welding students. Support included (1) contextualization tutoring for students who were in the math labs or technical writing courses; (2) tutoring for students taking Math 120; (3) adaptive learning tutoring for students who needed support with their self-paced math or language arts pre-program studies; and (4) other services such as placement support, testing, and Math-121 tutoring. The chart below highlights student support in each of these areas:

Figure 6: PTEC Tutoring Services



Student Success Stories

A key result of a successful training initiative is the success of individuals who persist and complete their training. The following stories below highlight individual student successes as a result of GCMCA. More details around student data are available in *Program Outputs* and *Impact and Outcomes Evaluation*.

Mike*

Mike had been working at a Cincinnati machining company. Although he was doing deburring, assembly, and some minor machining – his goal was to run the larger machine tools as his vocation.

In early 2014, Mike enrolled and completed MO I and MO II trainings through GCMCA. GCMCA staff recently took a tour of the facility where Mike works and were able to speak with him, as well as his managers.

Mike has progressed through the ranks and is now considered the company's second-best machinist. When their lead machinist retires in about two years, this student is poised to be the new lead machinist in a 100+ person facility of this multi-national company.

"We enjoyed having him as a student and wish him all the best!" – GCMCA staff

Owego*

Originally from Ghana, "*I came to this great country about seven years ago*." Owego has become a US citizen and has been working toward reuniting with his wife and daughter who are currently living in Niger. Owego has also been working at a local company while pursuing MO I training through GCMCA.

"I would advise anyone who has responsibility and is trying to go to school and make more [of themselves], I would advise them to take CNC programming, because it takes only 6 months or one year and sometimes you make more [money] than someone who went to college for several years." – Owego

"Although it has not been easy for him, he does have a great attitude and has done well in his classes. I feel that he will continue to be successful in his studies and with his efforts to reunite his family." – GCMCA staff

**Names have been changed to protect student identity*

Challenges

Several factors that hindered or slowed GCMCA's progress are described below.

Initiative Start-up Time

As with any new initiative, launching GCMCA took time. Some start-up elements have already been referenced within the report, including hiring and training staff and instructors, launching Welding at a new location, and creating new approaches to developmental education. An additional element true for credit-bearing programming was the time needed for program/course approval and accreditation. First, internal college approval was needed, then approval from the state, and then approval for federal financial add. For CSTCC, leadership reported that the length of the approval processes delayed the college's marketing of the GCMCA programs and in turn led to smaller enrollment numbers early on, especially within the Welding program.

> "The approval process… that takes a period of time. Meanwhile, the clock starts ticking in terms of the grant and deliverables. So that was a challenge for this grant." – GCMCA Leadership

Cycle of New Program Start-up

Starting a new program often requires a variety of key factors to all fall into place at "the right" time, which can be a challenge. For example, the Welding program faced challenges with enrolling and retaining a full cohort of Welding students, especially toward the beginning of the program. Fewer students meant the college offered fewer Welding courses. Fewer courses meant that, at times, the course(s) students needed to graduate were not offered during semesters when students needed them. Fewer students and delays in students graduating led to a decreased opportunity for word-of-mouth advertising by Welding graduates and their employers, cycling back to the challenge of student enrollment.

> "[Welding] is a new program. It's still kinda getting on its feet, so I understood that there would be some hiccups." – GCMCA Student

Location & Space for Welding

CSTCC originally anticipated the Welding program to be housed at the Clifton Main Campus. After considering the financial investment of updating facilities to accommodate new equipment, college leadership chose to shift the Welding location to the Harrison West Campus. Leadership reported that this shift in campus location created barriers for students near Main Campus who were interested in training, because the students were less likely to travel to the West Campus for trainings. The location deliberation and shift also delayed the timeframe for starting the Welding program, as equipment finalization and set-up was delayed until the new location had been finalized.

While the location offered the benefit of extending CSTCC services to the western part of Hamilton County, as referenced in *Successes*, the West Campus offered less space, limiting the number of Welding booths available for the program from 12 to 10. GCMCA and Welding leadership also noted that the location off the Main Campus made access to resources available on the Main Campus, such as supportive student services, more challenging. To help address this, GCMCA staff, such as the PTEC Tutor, traveled to the West Campus to visit Welding students for in-person tutoring.

> "There were 10 initially from the first [Welding] cohort and then a lot of them dropped right at the very beginning because of the location, because it was out in Harrison." – GCMCA Leadership

Finding Welding Instructors

Hiring Welding instructors who were qualified to teach according to CSTCC education standards was an ongoing challenge for the program. Per college requirements, an instructor needed to be one educational level above the courses that he/she was teaching. For Welding, this meant that an individual who was teaching for the Welding Associate Degree would need to have a bachelor's degree. In the Welding industry, as with other skilled trades, bachelor's and other higher education degrees are less common. Additionally, when working in the industry, instructors and staff reported that a welder would often be able to make more money than what a community college like CSTCC could offer. Another challenge to finding qualified instructors reported by college staff and leadership was that individuals who were skilled welders might not make the best instructors due to limited skills in teaching and course planning.

> "Finding Welding instructors is our greatest challenge. They're supposed to have bachelor's degrees in Welding and that's just dang near impossible, that's not in their industry." – GCMCA Leadership

In spite of the challenges involved in finding qualified Welding instructors, students, leadership, and staff commented about the high quality of current instructors:

> "The [Welding] teachers are really laid back and know what they're doing, so that helps a lot." – GCMCA Student

> "So far, all the teachers I had, they all had worked out in the field of Welding. It's always cool to have that with the teacher." – GCMCA Student

> "The [Welding] instructors are very passionate…We've been very fortunate to work with instructors who are extremely passionate about Welding and wanting the best for their students." – CSTCC Staff

Figuring Out Cross-Division Collaboration

The vision for GCMCA included increasing collaboration across divisions in the college that had not worked together at this level of depth before. Humanities & Sciences and CIT partnered together to create contextualized courses for Welding. CIT and WDC partnered together to build a pathway within their machine operator programs. Ultimately, these collaborations led to successes in student-centered learning and machine operator-related training (see *Successes*), but did include "growing pains" during the process.

For example, innovations in course contextualization led to increased collaboration between Humanities & Sciences faculty, who brought math and English subject-matter knowledge and experience with curriculum development, and CIT Welding instructors, who brought Welding subject-matter knowledge. The collaboration between these two divisions resulted in the creation of contextualized math labs, which were imbedded into a blueprint reading Welding course, and a contextualized English course that was offered as a supplement to another Welding course (see *Student-Centered Learning*). Faculty and instructors reported that during the curriculum development and initial implementation, it took time to figure out how to best work with each other, as expertise and expectations were different across groups. The contextualization team used feedback from students and instructors in the contextualized Welding math labs to adjust how aspects of these labs were offered. For example, the role of teaching the math labs has shifted from the Humanities & Science instructors to the Welding instructors and PTEC staff.

Similarly, GCMCA's new approach to developmental education allowed students to enroll directly into their program of study and take contextualized math or English courses concurrently. This required increased collaboration between college admissions and advising staff, PTEC staff, and CIT. Grant staff noted that the new co-requisite math and English courses were sometimes challenging for college advising staff to navigate during the admissions process. As a result, the role of initial advising and course enrollment for Welding students was transitioned to PTEC staff during the grant.

Staffing Transitions

The process of hiring and training new individuals took time, and sometimes there was a gap between when one individual left and another was hired. This could slow progress of the GCMCA implementation and could also increase workloads for others on the grant or in the college who took on the positions' responsibilities. CSTCC experienced position transitions during grant implementation, including changes in the Welding Director, Data Manager, and Job Coach/Business Developer. For each position, CSTCC was able to find and train another qualified candidate (if they were looking to re-fill the role).

Needs of the Student Population

GCMCA staff, instructors, and students reported that most students had competing responsibilities (e.g. work, family). They reported that many students were also working while in a GCMCA program and were therefore attending CIT programs part-time. Staff and instructors noticed that a full-time cohort model approach, which was originally envisioned for Welding Degree/Certificates, CNC Certificate, and MET Degrees, was especially challenging to implement with part-time students. Therefore, grant staff noted that part-time students would join different student cohorts, based on the semester class (or classes) they were taking.

Another challenge related to the GCMCA student population included varying levels of skill or technical aptitude. For example, GCMCA instructors noticed that students in their classes could vary widely on

understanding technical concepts and applying these in a hands-on setting. This meant that the instructors would need to spend additional simulation/class time training students who were not as far along as others. Conversely, interviewed students in these courses reported that they wanted more hands-on training with physical machines rather than classroom or simulator practice time.

> "I like the machines – the lathe, the mill. … [I would like] more hands on, more of the machines. We barely had a month between the lathe and the mill and then we have a month in here [the classroom]. But [the classroom] is hands on because we have the simulators ." – GCMCA Student

Additionally, other characteristics like time management and motivation were identified by GCMCA staff as barriers to successful persistence and completion for GCMCA students.

> "Time management, procrastination, lack of motivation. First you have to think about the population in which we serve – we serve at-risk, we serve hard-to-serve. They get a great idea 'I'm going to school' but they're in [transitional housing] and they know they need a job, and then they forget about school. But there's a way you can do both." – GCMCA Staff

Program Marketing & Enrollment

Marketing for GCMCA has been an ongoing effort for the college. GCMCA stakeholders reported a diverse approach to marketing, including networking with personal business contacts, attending career fairs, and outreach to community organizations. The college also hired Pearson, an education service provider, to coordinate marketing support for the college (not through grant funding).[29] However, transitioning marketing efforts into college enrollments was challenging (as mentioned in previous challenges and in *Environmental Factors* discussing the MSSC). Even in programs with higher volumes of enrollment, like WDC's short-term trainings, interviewed GCMCA stakeholders identified challenges with current enrollment levels. For MO I and II, for example, staff and instructors reported that increasing the visibility of the trainings might lead to an increase in MO training participants. This could allow them to run concurrent MO courses, customized to different student aptitude and skill-levels, instead of one MO course with a wider range of student skill-levels.

[29] This partnership was dissolved in early 2017.

Environmental Factors

In addition to accelerators and barriers, there were also several external factors with the environment surrounding GCMCA, which positively and negatively affected the initiative's implementation.

State of the Economy

GCMCA leadership and staff reported that shifts in the US economy negatively affected GCMCA grant progress. As the US economy improved and more jobs became available, leadership reported that fewer individuals enrolled in community colleges, including CSTCC. When individuals did enroll at CSTCC, leadership noticed an increasing interest in shorter-term trainings (i.e. WDC trainings and certificates) instead of degree programs. Leadership and staff also reported that there were fewer TAA-eligible individuals in CSTCC's service area during grant implementation than during grant application submission, which led to challenges identifying TAA-eligible participants for GCMCA. Additionally, for individuals with previous experience and skills – such as TAA-eligible individuals and Veterans – college leadership noted that they could more readily find jobs as the economy improved.

> "The economy changed on us. It was like the river started flowing the other direction in the middle of this [initiative]. That's become a challenge for recruiting those [TAA and Veteran] folks, because if you're a Veteran or you're a trade-impacted worker, you have skills. Starting somewhere around 2012-2013, if you have those skills you can get a job.
>
> That's why there's an inverse relationship between the economy and community college enrollment. Community college enrollment goes down, because folks need a job and they can get a job right now. I think that made it challenging on those goals."– GCMCA Leadership

> "Community colleges are suffering right now from [low] enrollment. It's an issue we're dealing with. Even the college itself has been in decline."– GCMCA Leadership

Regional Employer Convener

GCMCA leadership and employers recognized the positive affects created by Partners for Competitive Workforce (PCW). As referenced in *Successes*, PCW is a regional convener in the Ohio, Kentucky, and Indiana tri-state region focused on meeting employer demand by growing the skills of the current and future workforce. PCW works with a variety of education partners, including CSTCC, to help build talent pipelines in key industry areas, including manufacturing. Part of PCW's efforts included identifying manufacturing-related training needs from regional employers, from which feedback for machine operator trainings (MO I and MO II) were created.

In collaboration with Richards Industries, a regional employer, PCW conducted a return on investment study of GCMCA's MO I training. This study was based on 10 Richards Industries' incumbent workers who completed MO I training in 2013. PCW used the Manufacturing Institute's return on investment calculator and included in its calculations key costs related to machine operator positions, such as costs of an open position, costs of recruiting and hiring, and costs of on-the-job training. PCW's study found that the

return on investment for Richards Industries to train 10 individuals through CSTCC's MO I was 875%.[30] Relationships and studies such as these provide opportunities for the college to continue growing, enhancing, and marketing the GCMCA initiative.

State-level Progress with PLAs

GCMCA leadership and staff identified that the timing of Prior Learning Assessment (PLA) guidelines at the state level negatively affected the creation and implementation of GCMCA PLAs.[31] Leadership recognized the importance of aligning CSTCC's PLAs with the state's PLA policies/guidelines and then aligning GCMCA PLAs with those of the college. At the beginning of the grant, GCMCA stakeholders anticipated that the state would be providing guidance on PLAs. Therefore, the college waited to hear about the state's approach before adjusting or creating new PLA policies. The delays in state-level PLA guidance contributed to the GCMCA PLA effort stalling during the grant period. However, through the grant GCMCA staff did develop a PLA Reference Guide and a military crosswalk that was adapted from Gateway Community College, a TAACCCT Round 2 grant recipient.

MSSC Offerings in the Community

After creating and launching the MSSC program, WDC leadership and staff found that the Community Action Agency had received funding to offer MSSC training for free. Ultimately, leadership decided that offering the MSSC program at WDC was unnecessary (as training in the area already existed) and not sustainable (as enrollment for the program was considerably low). WDC staff commented that if they had known about the other MSSC training earlier, they would have spent time and energy on developing other training programs.

> "We had run some cohorts and it seemed to be going well, and then all of a sudden there was no interest. Part of that, I think, is because at the same time the United Way funded the Community Action Agency to offer the MSSC for free. But then we found out they were having trouble filling their cohorts… It just lost its momentum."– GCMCA Leadership

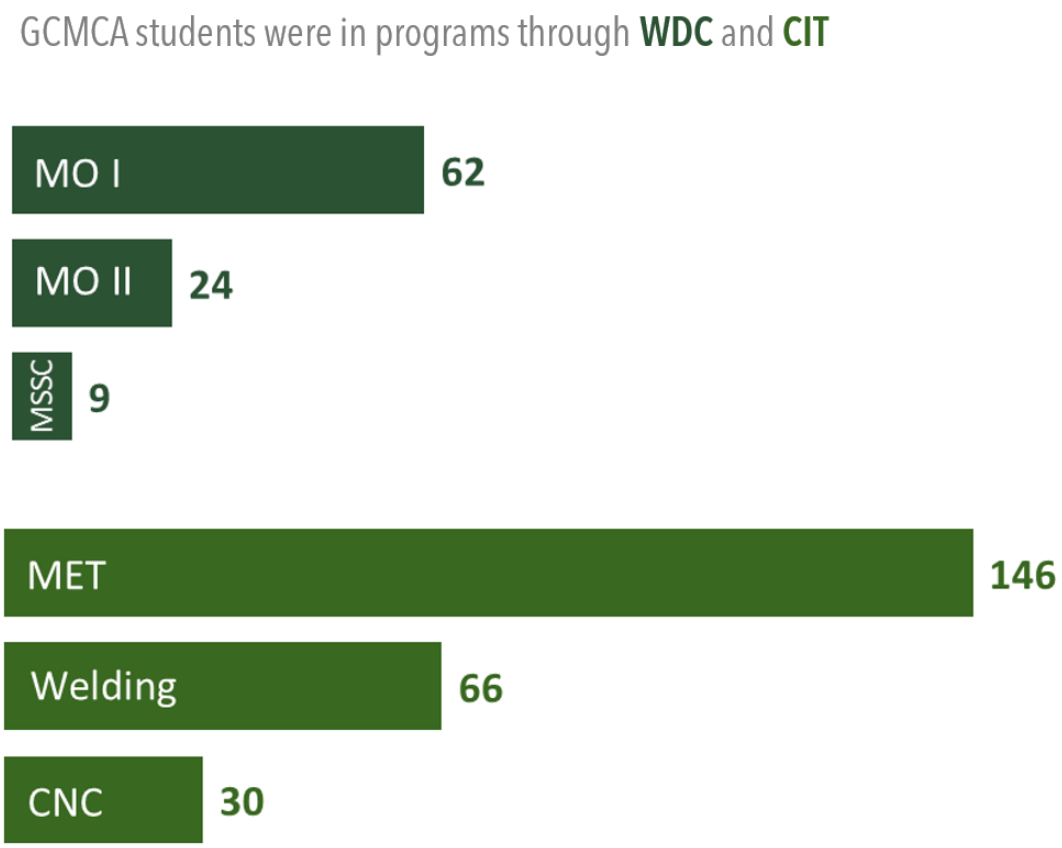
[30] Partners for Competitive Workforce. *Case Study: Manufacturing Institute's Return on Investment Calculator with Richards Industries*. 2013. http://www.competitiveworkforce.com/Richards-Industries-Case-Study.html (Accessed 6.2.17).

[31] Note that CSTCC uses the term "advanced standing" instead of "PLA." However, in this section the term PLA will be used to refer to state, college, and GCMCA approaches and policies for assessing prior learning and/or experiences.

Program Outputs

Throughout the course of the grant, CSTCC served a total of 360 students, which exceeded the college's initial goal of 350 students served by the grant.[32] Exceeding enrollment goals for GCMCA is especially impressive given the changing economy and trend toward employment over further education (see *Environmental Factors*). Students who received training through GCMCA included students who were in GCMCA programs, as well as students who took a course that was created through the GCMCA initiative.

Figure 7: GCMCA Program Participants

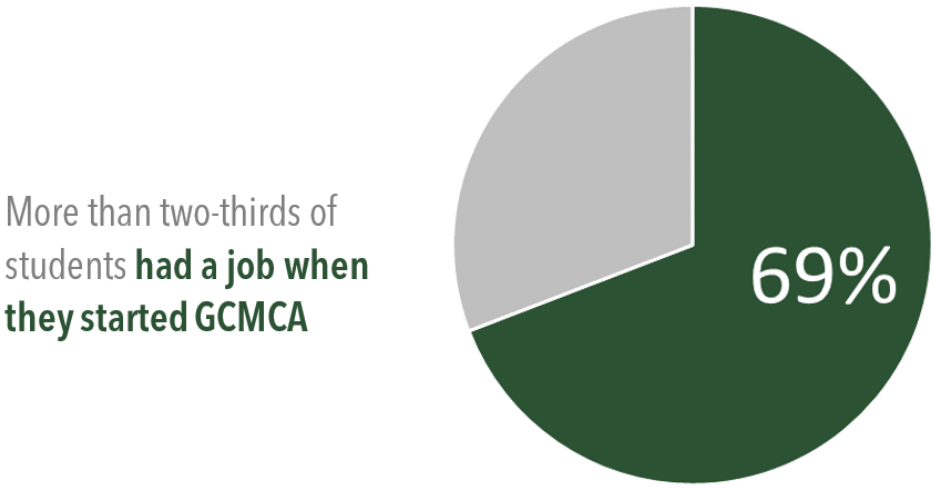


For the 360 GCMCA students: 95 students (26%) participated in programs through WDC, 242 (67%) participated in programs through CIT, and 23 students (6%) took a grant funded course but did not join a GCMCA program of study. This means there were a total of 337 students who were in "grant-funded programs of study" (i.e. GCMCA programs offered through WDC and CIT highlighted in the above figure).

[32] All data for this section was collected by GCMCA staff and provided to the Evaluation Team. This data is up-to-date as of March 31, 2017.

Of the 360 students who were served by GCMCA, almost 70% could be considered an incumbent worker. The classification "incumbent worker" means that the individual was already employed before entering training at CSTCC.[33]

Figure 8: GCMCA Incumbent Workers

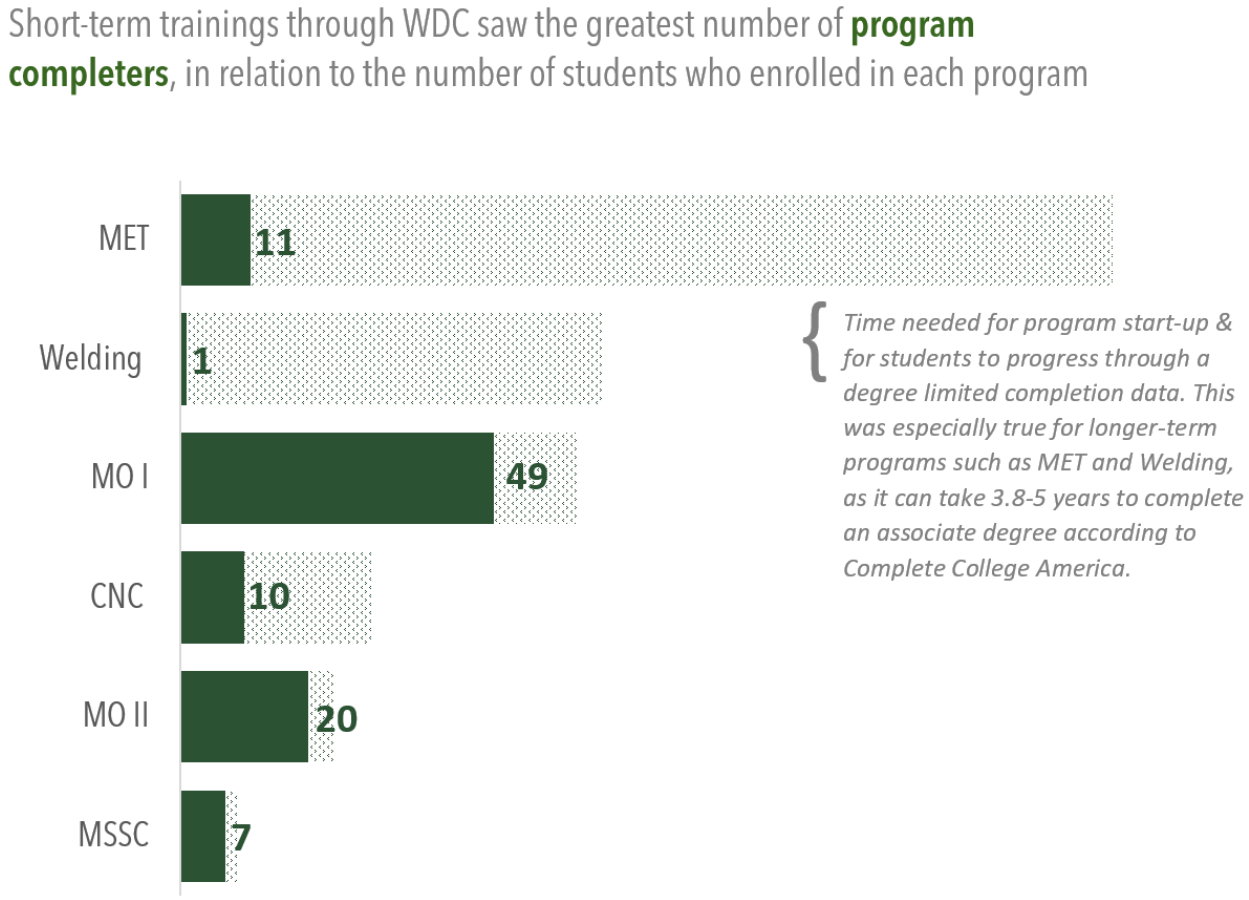


One challenge highlighted earlier in the report was the recruitment of GCMCA target populations, such as TAA-eligible individuals and Veterans (see *Environmental Factors*). In total, GCMCA served zero TAA-eligible individuals and 20 Veterans.

Of the 337 students who were in a grant-funded program of study, 114 (34%) completed their program of study, with many GCMCA students still progressing through their programs as of March 31, 2017. GCMCA student completion progress was affected by various challenges, such as the amount of time that it took to start-up a new initiative. This led to students enrolling later in the grant period. Furthermore, the unique needs of the student population, such as competing priorities with work and family life, led students to pursue part-time rather than full-time education. For additional details around these and other factors that hindered or slowed GCMCA progress, see *Challenges*.

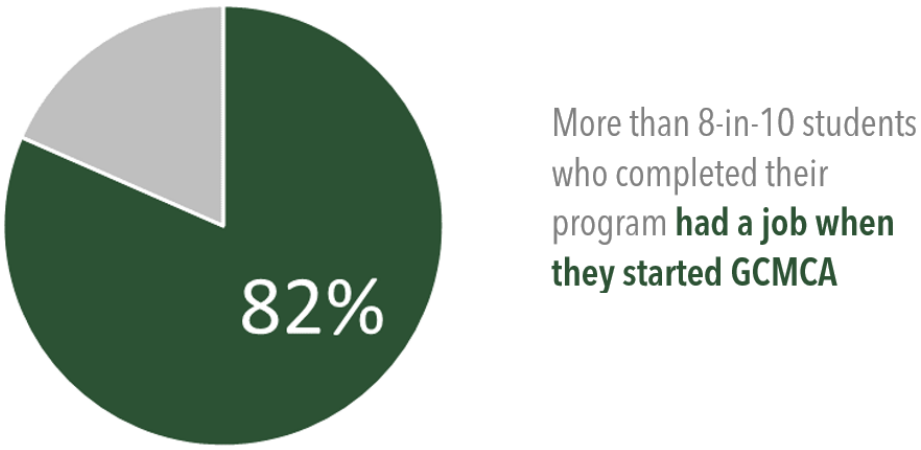
[33] It is important to note that the individual does not need to be employed in his/her field of training. For example, if one person worked part-time at a grocery store and another person worked full-time as a machine operator, both individuals would be considered incumbent workers. For more information about USDOL's TAACCCT outputs and data tracking definitions see the TAACCCT website: https://doleta.gov/taaccct/

Figure 9: GCMCA Program Completers



For those who completed a GCMCA program, over 80% were incumbent workers (i.e. had a job when they first started GCMCA training).

Figure 10: GCMCA Incumbent Program Completers



The number of incumbent workers is especially important to consider when examining GCMCA's TAACCCT Required Performance Outcomes, which are the data points that USDOL required all TAACCCT grantees to report on.[34] For example, grant measures that examined the number of individuals employed after completing their program and examined the number of individuals retained in employment after completing their program could not include incumbent workers. Additionally, educational trends noticed by college leadership around greater student interest in short-term credentials instead of degrees are likely reflected in the lower than anticipated number of individuals who pursued further education after completing their program (see *Environmental Factors*).

> "We see a lot of folks completing the certificate, but they're not continuing on to the degree program. When the economy gets good, they get that certificate and that's all they need. In some instances they don't even need that, they need the basic training and then someone will hire them. Again that's a challenge in terms of getting to that piece [of TAACCCT data tracking]."– GCMCA Leadership

The figure on the following page examines GCMCA's progress toward the TAACCCT Required Performance Outcomes. These data points, collected by each TAACCCT grantee, help track an initiative's progress around several core areas. For GCMCA, these included:

(1) **Participants.** The number of students who were enrolled in a GCMCA program of study or had taken a course that was created by GCMCA.

(2) **Completers.** The number of students who finished a GCMCA program of study.

(3) **Retained in GCMCA.** The number of students who were still in a GCMCA program or study.

(4) **Completed Credit Hours.** The number of students who enrolled and completed any number of credit hours.

(5) **Earned Credentials.** The number of students who earned credentials through GCMCA.

(6) **In Further Education.** The number of students who completed a GCMCA program of study and then entered into a different program of study to continue their education.

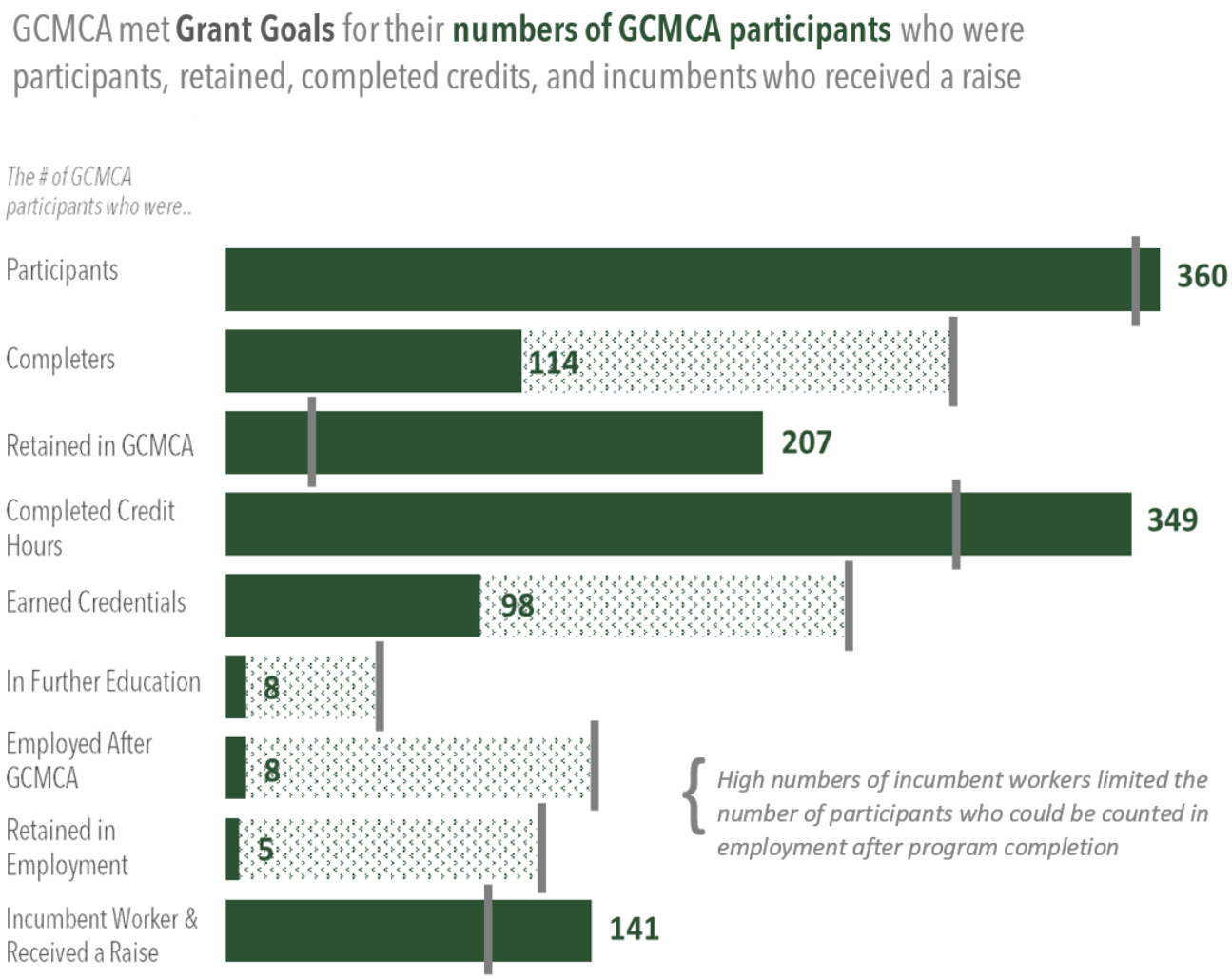
(7) **Employed After GCMCA.** The number of non-incumbent students who completed a GCMCA program of study and then became employed.

(8) **Retained in Employment.** The number of non-incumbent students who completed a GCMCA program of study, became employed, and have stayed employed for at least two quarters.

(9) **Incumbent Worker & Received a Raise.** The number of incumbent workers who received an increase in pay during or after completing GCMCA training.

[34] Note that USDOL used the term "outcomes" for their required data. Data required by USDOL were considered "outputs" within this report.

Figure 11: GCMCA TAACCCT Required Outcomes



Data provided within this section included aggregate data for all individuals who were considered GCMCA participants. Not all GCMCA participants signed consent forms to allow the Evaluation Team to use their individual-level data for the Impact and Outcomes Evaluation. Therefore, figures in this Program Outputs section will be different from figures in the Impact and Outcomes Evaluation.

This data is up-to-date as of March 31, 2017. CSTCC will continue tracking GCMCA students until the college submits their close-out report to USDOL, by December 31, 2017. Therefore, it is possible that CSTCC will have more updated student data included in their close-out report.

Beyond the Grant

The following research question addressed considerations for GCMCA after grant funding had ended. These findings centered around sustainable changes and opportunities for increased capacity created as a result of the grant.

Research Question

- How can the program expand or enhance institutional capacity? What are the most promising programmatic components to use institution–wide? Why?

Sustainability & Institutional Capacity Building

Sustainability of the GCMCA initiative included a variety of strategies focused on leveraging GCMCA for additional resources, building upon GCMCA innovations, and building financial sustainability for GCMCA innovations.

Leveraging GCMCA for additional resources & partnerships included:

Welding Expansion through TAACCCT Round 4

As a result of creating a Welding program through GCMCA, the college was able to leverage their experience with and exposure to Welding to join a TAACCCT Round 4 consortium. A component of the Round 4 consortium grant to the Ohio Technical Skills Innovation Network (Ohio TechNet)[35] included Welding and allowed CSTCC to further enhance the college's Welding program. Welding offered through GCMCA was a full Welding program (certificate and degree with federal financial aid) located at the Harrison West Campus. College leadership reported that having that program in place provided them with the confidence to apply for additional resources to expand Welding at CSTCC. Round 4 funding has allowed CSTCC to create an accelerated Welding training that was embedded and aligned with the GCMCA Welding degree and was located at the Clifton Main Campus.

> "Welding here [at Main Campus] wouldn't be here [without GCMCA]. I don't know that we would have had the courage to go into a TechNet [consortium] if we didn't have GCMCA…If we would have jumped in there without any Welding, we wouldn't have known what we were doing." – GCMCA Leadership

> "Now we have the two-year degree and certificate on a more academic schedule. As well as now the ability to do accelerated training, which is more geared towards workforce. I see those as complementing and how we're leveraging [GCMCA] to create this. We are full-service to the community in this sector and we were [close to] zero-service before" – GCMCA Leadership

[35] Ohio TechNet: http://ohiotechnet.org/about-us/

Additive Manufacturing

Leadership from across the college highlighted GCMCA as an important capacity builder for CSTCC, especially in the area of additive manufacturing. For example, CSTCC has been able to purchase 3D printing equipment (i.e. additive manufacturing equipment) through a combination of the GCMCA grant and other grants. College leadership reported being able to leverage GCMCA when applying for funding such as a Regionally Aligned Priorities in Delivering Skills (RAPIDS) grant and a Lightweight Innovations for Tomorrow (LIFT) grant – both of which support work in additive manufacturing.

Additionally, CSTCC leveraged GCMCA staff capacity and expertise to create a new employer-driven technical advisory committee for WDC. The technical advisory committee reviewed the MO I and MO II curricula to explore how CSTCC could build on the GCMCA initiative. Feedback from the committee highlighted the need for additive manufacturing. Leadership reported that WDC and CIT are now working to develop two new courses in additive manufacturing to fill this gap in training.

Leveraging GCMCA for State Funding

CSTCC leveraged the GCMCA grant when applying for several state funds, including the RAPIDS grant described earlier for additive manufacturing and a grant for material testing equipment. In their applications to the state, college leadership cited that CSTCC had received federal funding and that state resources could be used to enhance the college's impact and reach. College leadership anticipate receiving the equipment for material testing in Summer 2017. They also plan to continue leveraging GCMCA in future resource requests even after TAACCCT funding ends.

> "It helped us leverage other grants. We had a RAPIDS Grant that we got from the state which helped us go into an additive manufacturing area. And we also leveraged it to get some equipment for material testing for our main 134 testing lab from the state… to complement the equipment we got from [GCMCA]." – GCMCA Leadership

Stronger Partnership Opportunities

College leadership recognized that training capacity that resulted from GCMCA – directly through the grant and indirectly through leveraged resources – provided the college with opportunities to be stronger and more comprehensive partners for their community. For example, General Electric (GE) in Cincinnati was interested in additive and other forms of advanced manufacturing. GE has partnered with the University of Cincinnati (UC) and CSTCC to strengthen research and training in advanced manufacturing fields. College leadership felt more confident approaching GE to be a training partner because CSTCC had enhanced their manufacturing trainings (i.e. CNC and MET) and added Welding.

> "GE is providing the innovation piece, and UC is providing the research piece. But they're going to need technicians who are able to do this work, and this is the Cincinnati State piece. This is an example of where you need to have [Welding and CNC] in place so these other pieces come into place, so when we approach stakeholders and big players in the industry sector, it's not piecemeal for them.
>
> It allows us to be comprehensive partners for big players in the industry that have lots of different technical needs from a community college." – GCMCA Leadership

Building upon GCMCA innovations included:

Contextualized Math

Contextualizing math for GCMCA Welding students opened up the opportunity to build contextualization into additional program pathways within the college. For programs where students did not need to be on an algebra-based pathway to be successful, such as business or healthcare, CSTCC created additional math contextualization pathways. Beginning Fall 2017, CSTCC offered four pathways for contextualized math:

- Technical Math (created by the GCMCA initiative)
- Quantitative Reasoning Statistics
- Health Math
- Algebra-based Math (the only pathway available before GCMCA)

Contextualized courses for these pathways took the non-credit developmental math and turned it into a 100-level credit-bearing course. These courses were then contextualized for a range of programs (e.g. Technical Math could cover both Welding and CNC/MET), using examples and techniques that were applicable to their target programs. Instead of stopping students and having them take remedial coursework before starting their programs, students across the college can now enter into their training pathways sooner. This allowed the courses to follow the GCMCA model and act as both an accelerator and a contextualization for relevant content.

> "How does that move us forward as a college, to overcoming barriers in other degree pathways? There's a couple things we're doing. One is we have changed our math…We have created more contextualized math courses and those were rolled out this past fall [2017], so just this past semester.
>
> It really overcomes a lot of barriers. It's more engaging because now those courses are more tuned into what you're actually doing. Even the kinds of examples, the kinds of problems that they do, are connected somewhat with where they're going. " – GCMCA Leadership

> "Contextualization has really opened my eyes because I think every program, especially in a community college, should warrant math contextualization. I'm very excited about the future of contextualization." – GCMCA Staff

> "I can tell you that it would have been a much harder conversation – to make [contextualized math] happen and make it work without this experience that we've had through this grant. So I would say that that's a success and that's a way that we're leveraging that success." – GCMCA Leadership

Meta-Majors

The concept of a meta-major continues the intent of the GCMCA initiative in re-tooling developmental education. As adaptive learning and contextualization helped students enter into their program of study sooner, so too would meta-majors. The meta-major concept involves re-purposing the time that a student needs to spend taking pre-requisite or remedial coursework. When students begin at CSTCC and are not yet ready for their program of study, they could enter a meta-major. While students take their developmental coursework, they could also take gateway courses for their program and engage in career exploration (e.g. exploring the difference between civil engineering and mechanical engineering in the engineering meta-major). Each meta-major would have a faculty chair who could provide guidance and advice as student progress with their coursework. College leadership anticipate that students in meta-majors will feel more engaged and move into and through their degree programs quicker than students in a more traditional developmental track. CSTCC is working to develop meta-majors within the college, and college leadership anticipate that meta-majors will be in place for Fall 2018.

> "When students aren't college ready, we say, 'Well, you've got to do remediation.' Meta-majors help to overcome that. It takes that wide-open landscape of the developmental year and says, 'Ok, just because you are not quite college ready for say IT, we can still say that you're in the business meta-major. You're ramping up. You've got a chair that goes with that, so you have a faculty member, and you have an opportunity to do a little more career exploration." – GCMCA Leadership

WDC-to-Academic Pathways

Collaboration efforts that began with the GCMCA pathways for WDC and CIT are being continued beyond the grant. The college has begun creating pathways between WDC and other academic programs within CSTCC. Examples of these pathways include already existing WDC programs in chemical operator and child development, as well as the development of the Welding short-term pathway through TAACCCT Round 4. A key consideration with translating WDC programs into academic credit hours includes balancing the need for considerable hands-on lab time for student learning with the significant number of lab hours required to equal a credit hour – 15 classroom hours translate to one credit hour compared to 45 lab hours for one credit hour.

> "What we try to do is [identify] – this is the need. We need to design [the training] to meet the need. Now how can we maximize that for credit hours?" – GCMCA Leadership

In addition to the pathways themselves, the new structure for WDC, which includes a Director position to collaborate with the Deans of the academic divisions (as well as other duties) will continue to remain in place. College leadership anticipate that this structure will continue to support and enhance collaboration beyond the grant.

Building financial sustainability for GCMCA innovations included:

Workforce-Focused Fund

CSTCC's President, leadership, and staff recognized that short-term training offered by the college, especially through WDC, would face challenges around sustainability after the grant ended.

> "When [the new CSTCC President] took the reins, one of the things that she recognized was that anything that we're doing that's short-term and customized, she saw that the expense is high. And compounded with that, you have an issue where it is not eligible for Pell Grants or Stafford Loans because you're not in an associate degree." – GCMCA Leadership

In an effort to sustain short-term training opportunities at CSTCC, the President established a workforce-focused fund through CSTCC's Office of Development. This fund could be used to support short-term trainings like MO I and MO II. As of the completion of the grant extension period, CSTCC's President and leadership were continuing to work on securing financial donations for the fund.

Incorporating Programs into Division Budgets

In preparing for the end of grant funding, CSTCC leadership reported working within each grant-funded program to build that program into the division's budget. For example, the Welding program will be added into CIT's budget, including instructor and adjunct pay, benefits, supplies, and travel. Some resources used by Welding, such as technicians for the equipment, have always been a component of the CIT budget. However, most of the Welding costs will be a new budget addition for CIT with some Welding expenses being absorbed by the TAACCCT Round 4 grant until March 21, 2018. College leadership anticipate having ongoing conversations around program sustainability, such as the minimum number of students needed and the best approaches to preparing for more expensive material and equipment needs in the future.

Capital Fund for PTEC Location

Every two years CSTCC can ask for capital funds from the State of Ohio. Most recently, CSTCC received several million dollars in capital funds, which college leadership reported will go toward creating the physical space and architecture for PTEC-like services.[36] At present, the college does not have a central location to provide a suite of student services, as PTEC was housed in an off-campus location. College leadership reported seeing success through all the different rounds of TAACCCT when students received initial career exploration services from PTEC staff (e.g. ACT's WorkKeys Fit, Talent, and Performance assessment). The goal of the capital fund is to create a space where these career exploration and other student services could be provided. It is important to note that capital funds will only be used for the physical location. Staffing for student support will likely be an on-going conversation.

> "We decided that we need to create the physical space and architecture so that our front door allows for PTEC-type services to all students. That's what we're doing and we're committed to that." – GCMCA Leadership

[36] Capital funds form the State of Ohio cannot be used to build a new building. The physical space that will be created for student services will be within an existing building on CSTCC's Main Campus.

Impact and Outcomes Evaluation

Design Summary

To best answer the research questions for the Impact and Outcomes Evaluation, the Evaluation Team included both a quasi-experimental design (QED) to determine impact for two specific GCMCA programs, as well as an outcomes-focused design to provide a descriptive picture of student results for the WDC GCMCA programs.[37] Given that participants could choose to enter a particular program, a pure experimental design through randomization was not possible. Thus, the Evaluation Team focused on the next most rigorous option: a QED for the impact portion of the study. The causal parameter of interest was the effect of this program on the treatment group (GCMCA grant participants, also referred to as the GCMCA group). Propensity score matching[38] was used for the QED. The goal was to create a matched sample of students in the GCMCA group and comparison group who were similar based on covariates such as demographics (e.g. age, race), relevant placement scores, and other variables determined important. This reduced potential bias in comparing outcomes that would otherwise be created from natural differences in the two groups.

Research Questions

The research questions for the Impact and Outcomes Evaluation were:

(1) How do persistence and completion rates of students participating in GCMCA's Welding Associate Degree program compare to those who are going through the Aviation Mechanics Airframe (AVAC) and Aviation Mechanics Powerplant (AVPC) programs at CSTCC?
(2) How do persistence and completion rates of students participating in GCMCA's Mechanical Engineering Technology (MET) Manufacturing and Design programs compare to students in the MET Manufacturing and Design programs before grant funding occurred?
(3) What are the completion rates of students participating in WDC GCMCA grant programs? These include MSSC, MO I, MO II, and Apprenticeships.

Each research question was answered through a separate study. Study 1 corresponded to Research Question 1. Study 2 corresponded to Research Question 2. Study 3 corresponded to Research Question 3.

Data Sources

Data used for the analyses came from existing administrative data available through CSTCC's Student Information System or collected through CSTCC's data intake form.

The GCMCA group in the first study was participants going into the Welding Associate Degree program. There was no delimitation in the data between the Welding Certificate and Welding Associate of Applied

[37] The four WDC GCMCA programs are for short-term certifications, which are more difficult to assess through a QED, as an appropriate comparison group was not available.
[38] Rosenbaum, P.R. and Rubin, D.B. (1983). The central role of the propensity score in observational studies for causal effects. *Biometrika. 70*, 41–55.; Rosenbaum, P.R. and Rubin, D.B. (1985). Constructing a control group using multivariate matched sampling methods that incorporate the propensity score. *The American Statistician. 39.* 33–38.

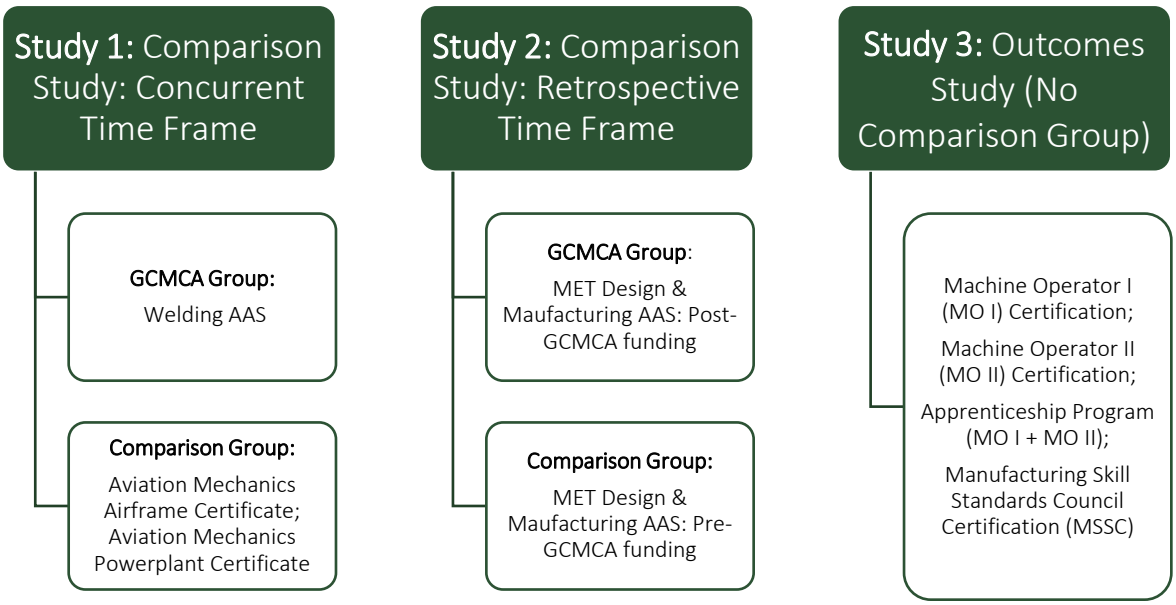
Science (AAS) Degree program, so some students pursuing only a Welding Certificate might have been included in the GCMCA Welding group. [39] The comparison group in the first study was participants in two comparable programs: Aviation Mechanics Airframe (AVAC) and Aviation Mechanics Powerplant (AVPC). These students were enrolled at approximately the same time (i.e. concurrently) with those students in the GCMCA Welding group. The two programs selected for the comparison group had similar credit hour requirements to the Welding program, and students were required to take Math 121, a critical gateway course.

The GCMCA group in the second study was participants enrolled in the Mechanical Engineering Technology (MET) Associate Degree program *after* the grant program was implemented.[40] In contrast, the comparison group included students enrolled in the MET program *before* the GCMCA initiative was implemented. A retrospective comparison group design was used to explore outcomes of CSTCC's MET students prior to grant program changes compared to CSTCC MET students who have taken at least one grant-funded course.

Students taking short-term credentials from the Workforce Development Center were included in the third study, which was descriptive only and had no comparison group.

For more information about the data sources and collection procedures, please reference *Appendix B*.

Figure 12: Designs for Studies 1-3



[39] During implementation, GCMCA leadership and staff recognized that students registered as Welding AAS might have registered for the degree but planned to pursue the Welding certificate. This could have resulted from differences in financial aid incentives available to degree-seeking students. The Evaluation Team discussed with GCMCA leadership and staff options for how to best separate Welding AAS and certificate student data. Ultimately, it was agreed to keep the Welding students as one category instead of separating them out by group due to complexities in determining who was part of each group. Keeping students as one group also helped preserve the sample size. If the Welding group was split into smaller groups, a comparison design might not have been feasible.

[40] The primary differences between the two MET groups is that the GCMCA group had access to PTEC's supportive services and new technology for instruction and learning (and subsequent curriculum adjustments to align with the new technology).

Analysis

Outcomes Measured

The analyses focused on understanding two main outcomes: the impact of the GCMCA initiative on participants' persistence and completion. Persistence was measured a number of ways.

(1) Persist to completion (defined by an end date when they earned a degree/certificate)
(2) Consecutive persistence (no end date but continue to be enrolled)
(3) Persist during traditional school year (no summer enrollment)
(4) Enroll-leave-enroll and persist (i.e. stop out)
(5) Not persisting (i.e. drop out)

These five persistence outcomes were mutually exclusive. This means that students who were categorized in one persistence group were not part of another group. For example, students who were coded as having consecutive persistence were not categorized as persisting during the traditional school year. Please reference *Appendix B* for more information about these outcomes.

Statistical Analysis

Research Questions #1 & #2

Based on sample sizes, the Evaluation Team used a 1:1 propensity score match. This means that one student in the GCMCA group was matched to one student in the comparison group. Individuals were matched using a set of variables – matching variables – that were determined to be important using a comparison of descriptive results, as well as statistical and visual analyses. Matching allowed the Evaluation Team to identify the best sub-grouping of comparison group individuals to use for the statistical analyses.

After each individual in the GCMCA group was matched to a unique individual in the comparison group, the Evaluation Team analyzed the two groups to ensure they were similar enough that matches were efficiently made. The Evaluation Team then conducted chi-square (χ^2) tests, as well as logistic regression analyses. Chi-square tests are useful exploratory analyses for examining if there is a significant relationship between group membership (i.e. GCMCA or comparison group) and the five persistence outcomes. Logistic regression is useful for determining the extent of these relationships when controlling for background variables (e.g. race, COMPASS placement scores). Effect sizes (ϕ, odds ratios) were also computed, which helped substantiate any statistically significant results. Effect sizes are useful for understanding if the statistically significant results are practically relevant. They also serve as an additional safeguard to fallacious *p*-values insofar as they are indifferent to significances that may result from sample size.

Research Question #3

For the third study, the Evaluation Team focused on frequencies and percentages, as these provide useful information about student outcomes for the short-term programs. Descriptive data was separated by categories (i.e. disaggregated) as appropriate, including disaggregations by race, age, and educational attainment level at intake. These results allowed for further understanding of the types of individuals who participated in GCMCA. Though the focus of Study 3 was on descriptive findings, frequencies and percentages were also calculated for Studies 1 and 2 to provide context for the statistical results.

For all of these research questions, data from participants in the GCMCA-impacted programs was analyzed to look at patterns in PTEC usage by students from different majors. Additionally, information from students in both the GCMCA-impacted programs, as well as those in comparison programs, if applicable, was analyzed to investigate within-group differences.

Please reference *Appendix B* for in-depth information on the analyses procedures.

Findings Overview

The GCMCA Impact and Outcomes Evaluation examined descriptive results for individuals participating in the GCMCA programs and analyzed statistical trends for persistence and completion for GCMCA participants when compared to a similar grouping of non-grant individuals. Highlights from the analysis, which will be explored in greater detail in the sections that follow, include:

Welding

The majority of individuals in the GCMCA Welding group were male, white, and 30 years old or younger. When examining across other GCMCA groups, Welding participants had the lowest COMPASS scores for English/Language Arts and Math (i.e. the majority received a score of less than 60), and the lowest levels of incoming educational attainment for CIT programs. The majority of individuals in Welding were not employed at intake, and older individuals were more likely to drop out of the program than younger participants.

MET & CNC

Like the Welding students, the majority of those in the MET Degree and CNC Certificate programs were also white and male. MET students tended to be younger than those pursuing the shorter-term CNC Certificate, and the majority of MET students were not employed at intake, compared to CNC where the majority were employed. When comparing GCMCA MET students to individuals who were in MET before the grant, students in the comparison group were more likely to persist to completion and more likely to stop persisting (i.e. drop out), while GCMCA MET students were more likely to consecutively persist from semester to semester and persist throughout the traditional academic year.

WDC Trainings

WDC's GCMCA trainings included MO I, MO II, Apprenticeship, and MSSC. Individuals in these training programs had a greater range of ages and increased diversity in race, in comparison to GCMCA CIT programs. WDC's trainings also had the highest rates of persist to completion (78%), likely supported by the shorter-term nature of WDC's certifications. MO I, MO II, and Apprenticeship showed similar trends of extremely high rates of an individual being employed at intake, a broader spread of educational attainment backgrounds, and the majority of participants being white. MSSC training participants had noticeably different characteristics, where the majority of individuals were black, 51 years or older, not employed at intake, and had lower educational attainment.

PTEC Supportive Services

Across all GCMCA programs, trends in PTEC service use tended to align with the population's needs and program progress. For example, key innovations around contextualization took place within the Welding program, which included the addition of PTEC tutoring and other support services. However, the Welding program has yet to have completers. Conversely, most individuals entering WDC training were already employed and persisted through their shorter-term trainings. PTEC data trends show that Welding participants had higher rates for use of PTEC services in recruitment & enrollment and retention categories, while WDC participants used PTEC completion services more.

Study 1 | Welding Associate Degree

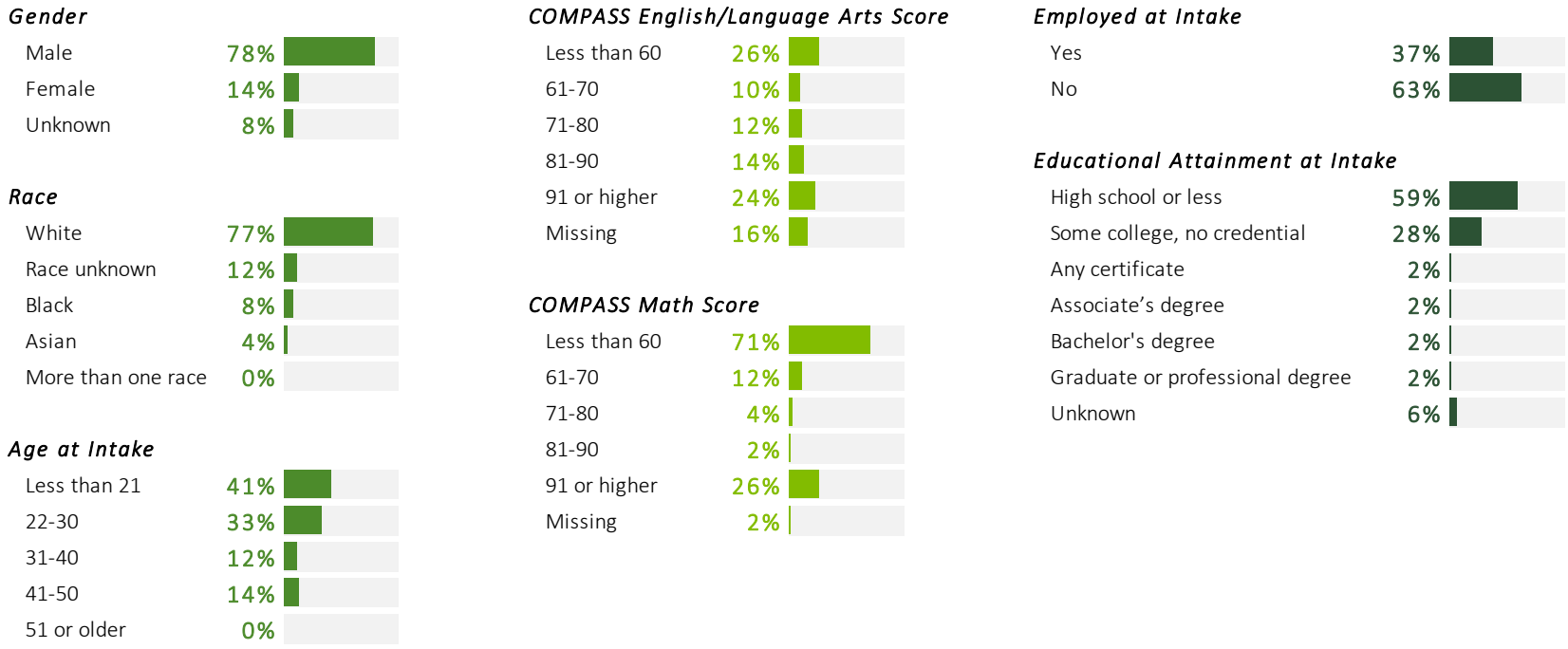
Descriptive Results for GCMCA Welding Group

For the following results, there was a total of 51 individuals in the GCMCA Welding group. For more detailed descriptive data, see *Appendix C*.

Background Characteristics

The majority of individuals in the GCMCA Welding group were male (78%), white (77%), and 30 years old or younger (74%). Additionally, the majority of individuals received the lowest Math COMPASS score rating category of less than 60 (71%), were not employed at intake (63%), and had high school attainment or less (59%). Background characteristics for the comparison group show similar demographic trends, see *Appendix C*.

Figure 13: Background Characteristics for GCMCA Welding Group

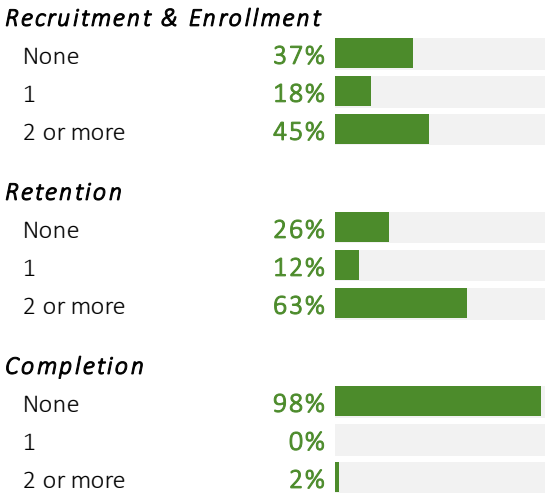


PTEC Services Used

PTEC services were available to the GCMCA Welding group, helping support students through phases of recruitment and enrollment (e.g. job fairs, advising and enrollment for Welding students), retention (e.g. tutoring, intrusive advising), and employment (e.g. resume review, interview preparation). For more detail around PTEC and the supportive services offered, see the previous report sections on *GCMCA* and *Implementation Evaluation*.

Almost half of GCMCA Welding group students (45%) used PTEC services related to recruitment and enrollment two or more times. Examples of these services include financial aid assistance and WorkKeys assessments. Almost two-thirds of students (63%) utilized PTEC services related to retention two or more times. Examples of these services include tutoring and adaptive learning. This heavy service use aligns with the implementation of PTEC, with several services (e.g. contextualized math) being offered only to Welding students. Conversely, few students (2%) took advantage of PTEC services related to completion. Examples of these include resume writing and career advising. This trend in PTEC service use mirrors data in the following section around persistence and completion. More specifically, no Welding students have yet completed the program, though many are continuing to persist in their education. The lack of Welding completers may be due in part to added time needed to start-up the Welding program (see *Cycle of New Program Start-up*). Additionally, it can take between 3.8 and 5 years[41] to complete an associate degree and GCMCA existed for about 3.5 years[42] through TAACCCT funding.

Figure 14: PTEC Services Used by GCMCA Welding Group



Descriptive Results for Welding and Comparison Groups

Persistence and Completion

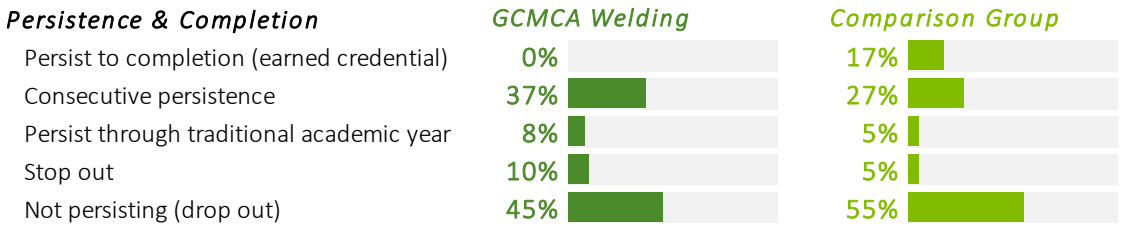
Persistence and completion includes data for 51 individuals in the GCMCA Welding group and 59 individuals in the comparison group. Overall, few students persisted to completion (i.e. earning a credential). No students in the GCMCA Welding group persisted to completion, and only 10 students (17%) in the comparison group persisted to completion. Of those in the comparison group who completed, six earned certificates, and five completed associate degrees.[43] About a third of students overall (32%) were persisting consecutively, with more students from the GCMCA Welding group (37%) persisting from one semester to the next than students from the comparison group (27%).

[41] Complete College America (2011). *Time is the Enemy: The surprising truth about why today's college students aren't graduating … and what needs to change.* Washington DC: Complete College America. Retrieved from http://www.completecollege.org/docs/Time_Is_the_Enemy_Summary.pdf

[42] The GCMCA grant began October 2013 with program start-up and implemented the initiative through March 2017.

[43] This might be due to a matter of timing, since there was a delayed start to the implementation of the Welding program, please refer to the *Cycle of New Program Start-up* in the Implementation Evaluation findings.

Figure 15: Persistence & Completion Trends



Statistical Results

The figure below summarizes the findings from the statistical analyses.

Figure 16: Summary of Findings for Different Types of Persistence[44]

Persist to completion (earned credential)	•Students from the comparison group were more likely to persist to completion.*
Consecutive persistence	•N/A
Persistence through traditional academic year	•N/A
Stop out	•N/A
Not persising (drop out)	•Older students were more likely to drop out than younger students, when controlling for background variables.

**The results of the chi-square analysis may be confounded, due to GCMCA not yet having Welding completers. Also, without completers, a logistic regression analysis could not be completed. The Evaluation Team recommends revisiting this analysis after Welding participants have completed the program.*

Impact of the GCMCA Program

Results of the chi-square (χ^2) test reveal that group membership (i.e. if the individual was in the GCMCA group or the comparison group) has a statistically significant association with persistence to completion (χ^2=7.52, df=1, p<0.05), as shown below. This finding is unsurprising, given that no students in the Welding group had completed any credentials at the time of the analysis.[45] Further, all of the effect sizes (ϕ) that accompany the analysis were negligible or small (0.05 to 0.27)[46]. This could indicate that the

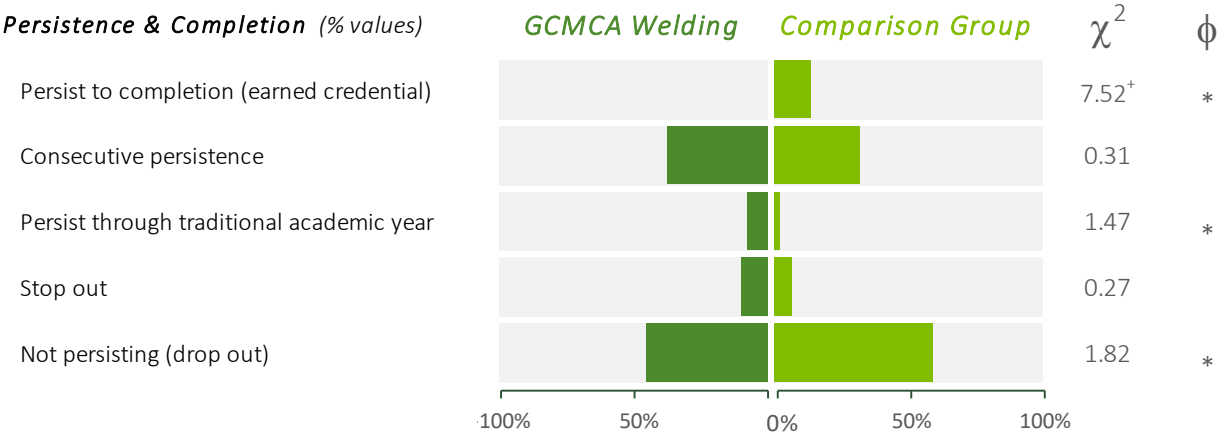
[44] The findings are slightly different for some of the persistence variables (e.g., persist to completion) than others (drop out). If the results from the logistic regression are significant, then there is a note stating "when controlling for background variables." if the results from the chi-square test are the only ones that are significant, then that phrase is left it out.

[45] Because there were no Welding completers, the assumptions of the chi-square test are not met. Additionally, because there was only one student in the comparison group who persisted through the traditional academic year, the assumptions of the chi-square test are not met for the test with that persistence variable. These statistical results should be taken with caution, but the observed results show that there is a clear effect even if the assumption is not met.

[46] Effect sizes range from small (0.10), to medium (0.30) and large (0.50), see Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed) . Hillsdale. NJ: Lawrence Earlbaum Associates, 2.

GCMCA initiative did not have a substantial effect on these particular measures in this context, but could also be due to confounding factors, such as the delayed startup. Since the GCMCA Welding program was not fully functioning for a period of time, it would be expected that there might not be any completers, as noted in the *Cycle of New Program Start-up* section in the Implementation Evaluation. For more information, please reference Table C4 in *Appendix C*.

Figure 17: Welding Persistence & Completion Cross Tabulation Results (n=102)



+Chi-square is statistically significant at p<.05

Effect sizes are small=.10 (*), meduim=.30 (**), or large=.50 (***)

The results of the chi-square analysis may be confounded, due to no GCMCA Welding students who completed

Other Important Factors in Completion and Persistence

Age was an important factor in students' likelihood to drop out of their program, more so than other characteristics such as group membership, COMPASS scores, etc. When controlling for the other variables in the model, age was a statistically significant predictor in the likelihood to drop out of the program. For every one year increase in age, the odds to drop out of the program (versus staying in the program) increased by a factor of 1.08 (or 8%) when controlling for the other variables (COMPASS Math and ELA, Gender, Race). Please reference Table C5 in *Appendix C*.

Study 2 | Mechanical Engineering Technology

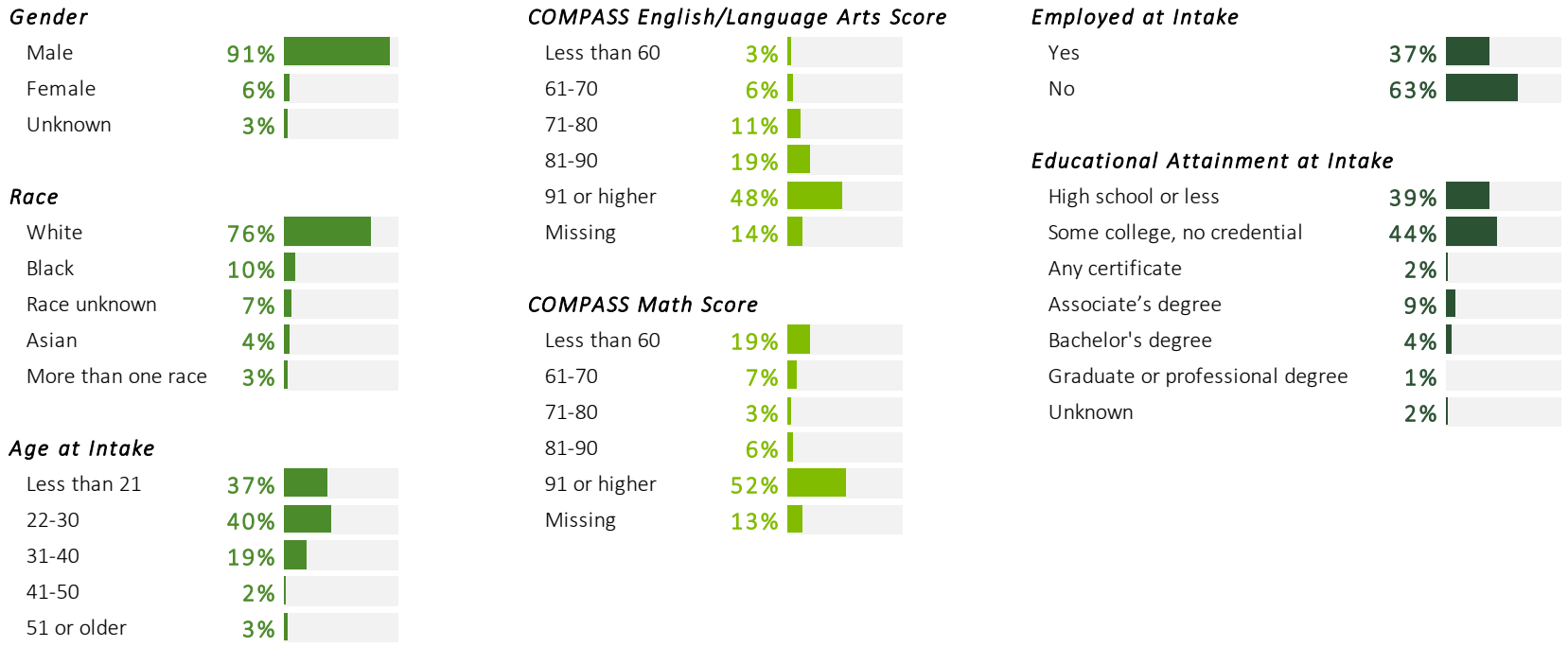
Descriptive Results for GCMCA MET Group

For the following data, there was a total of 122 individuals in the GCMCA MET group. For more detailed descriptive data, see *Appendix C*.

Background Characteristics

Similar to GCMCA Welding participants, the majority of GCMCA MET participants were male (91%), white (76%), and 30 years old or younger (77%). On average, MET individuals scored relatively high on COMPASS intake testing, with the majority of those who took the placement tests scoring above a 91.[47] Almost two-thirds (63%) of individuals were not employed at intake, and just under half (44%) of MET students had some college but no credential as their highest level of education. Background characteristics for the comparison group show similar demographic trends, see *Appendix C*.

Figure 18: Background Characteristics for GCMCA MET Group

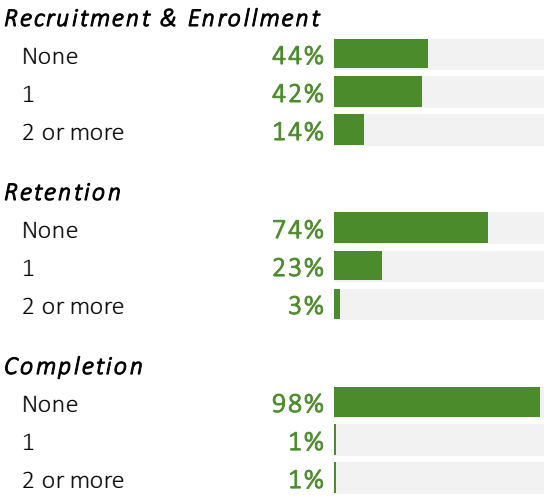


[47] The maximum score for ELA COMPASS tests is 99.

PTEC Services Used

Over half of those in the GCMCA MET group (56%) used PTEC services related to recruitment and enrollment at least once. Examples of these services include financial aid assistance and WorkKeys assessments. About a quarter of these students (26%) utilized PTEC services related to retention. Examples of these services include tutoring and adaptive learning. Similar to GCMCA Welding individuals, almost no students (2%) took advantage of PTEC services related to completion. Examples of these include resume writing and career advising.

Figure 19: PTEC Services Used by GCMCA MET Group

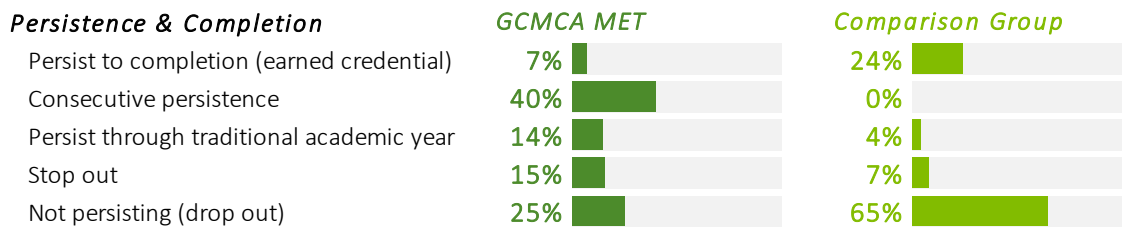


Descriptive Results for MET GCMCA and Comparison Groups

Persistence and Completion

Persistence and completion includes data for 122 individuals in the GCMCA MET group and 193 individuals in the MET comparison group. Similar to the Welding data, few students persisted to completion (i.e. earned a credential) in the GCCMA MET group (8 individuals, 7%). Examining the MET comparison group, 46 students (24%) in the comparison group persisted to completion. However, because of the retrospective study design, the comparison group had more time to complete their degrees (and drop out) than the GCMCA MET group. From the data, students from the MET comparison group had six more terms (2 years) to complete than the students in the GCMCA MET group. Of those in both groups who completed, six (2%) earned certificates, and 53 (17%) completed associate degrees.[48] About a third of students (32%) were persisting consecutively, with more students from the GCMCA MET group (37%) persisting from one semester to the next than those in the comparison group (27%). These findings from the GCMCA MET group were similar to that of the GCMCA Welding students, who appear to be trending in toward completion (i.e. they were persisting consecutively), but did not complete. Because there was a delay in the start of the program (see *Cycle of New Program Start-up*), there might not have been enough time to observe these students to completion. Also, since the average time to complete an associate degree is 3.8-5 years,[49] based on full-time/part-time status, students did not have enough time to complete their degree before grant funding finished, (see *Program Progress* for program timeline).

Figure 20: MET Persistence & Completion Trends



[48] Five students completed both a certificate and associate's degree, so this is why the unduplicated count for completion is 54 in the table.
[49] Complete College America (2011). *Time is the Enemy: The surprising truth about why today's college students aren't graduating ... and what needs to change.* Washington DC: Complete College America. Retrieved from http://www.completecollege.org/docs/Time_Is_the_Enemy_Summary.pdf

Statistical Results

The figure below summarizes the findings from the statistical analyses.

Figure 21. Summary of Findings for Different Types of Persistence [50]

Persist to completion (earned credential)	•Students in the comparison group were more likely to persist to completion than the GCMCA group, when controlling for background variables.
Consecutive persistence	•Students in the GCMCA group were more likely to consecutively persist than the comparison group.*
Persistence through traditional academic year	•Students from the GCMCA group were more likely to persist through the academic year.
Stop out	•N/A
Not persising (drop out)	•Students in the comparison group were more likely to not persist than the GCMCA group, when controlling for background variables.

**The results of the chi-square analysis may be confounded, due to no students from the MET Comparison group consecutively persisting. Also, without students in this group, a logistic regression analysis could not be completed.*

Impact of the GCMCA Program

Results of the chi-square (χ^2) tests reveal that group membership had a statistically significant association with four of the five types of persistence, as shown below. These include persistence to completion (χ^2=16.15, df=1, p<0.05); consecutive persistence (χ^2=54.40, df=1, p<0.05)[51]; persistence through the traditional school year (χ^2=4.69, df=1, p<0.05), and not persisting (drop out) (χ^2=68.93, df=1, p<0.05). Furthermore, the effect sizes (ϕ) that accompany consecutive persistence (0.50) and not persisting are large (0.58). The effect sizes were not as large for persist to completion (0.26); persistence through traditional academic year (0.15), and stopping out (0.09).[52] Group membership (i.e. if the individual was in the GCMCA MET group or the comparison group) was also an important factor in students' likelihood to persist, more so than other characteristics such as age, race, and COMPASS scores. When controlling for the other variables in the model, group membership was a statistically significant predictor in:

- The likelihood to persist to completion. If the student was part of the GCMCA MET group, the odds to persist to completion in the program (versus not completing) decreased by a factor of 0.18 (or 82%) when controlling for the other variables (COMPASS Math and ELA, Age, Gender, Race).

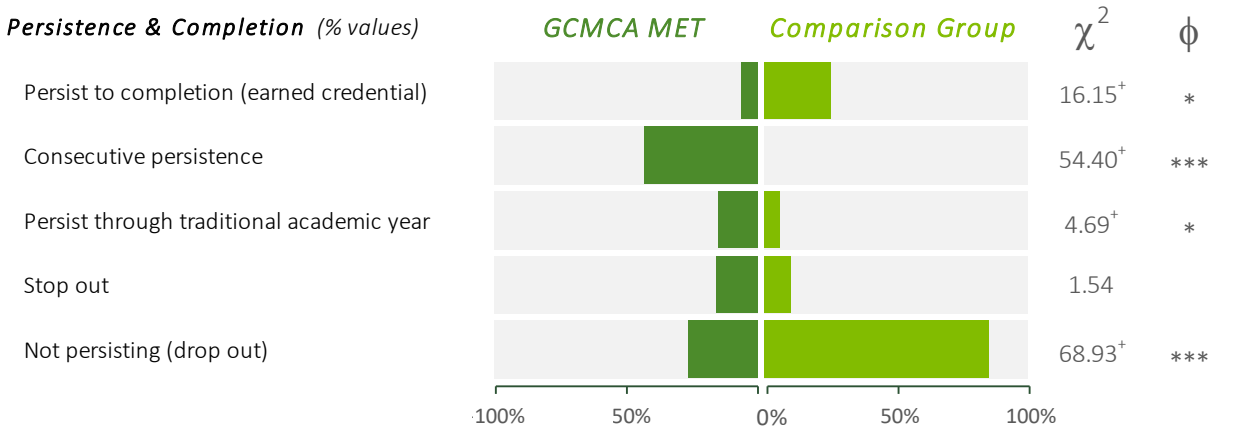
[50] The findings are slightly different for some of the persistence variables (e.g., persist to completion) than others (drop out). If the results from the logistic regression are significant, then there is a note stating "when controlling for background variables." if the results from the chi-square test are the only ones that are significant, then that phrase is left it out.

[51] Because there were no students in the MET Comparison group who persisted consecutively, the assumptions of the chi-square test are not met. These statistical results should be taken with caution, but the observed results show that there is a clear effect even if the assumption is not met.

[52] Effect sizes range from small (0.10), to medium (0.30) and large (0.50), see Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed) . Hillsdale. NJ: Lawrence Earlbaum Associates, 2.

- The likelihood to persist through the traditional school year. If the student was part of the GCMCA MET group, the odds to persist through the school year (versus dropping out) in the program increased by a factor of 3.35 (or 235%) when controlling for the other variables (COMPASS Math and ELA, Age, Race).
- The likelihood to drop out of the program. If the student was part of the GCMCA MET group, the odds to drop out of the program (versus staying in the program) decreased by a factor of 0.06 (or 94%) when controlling for the other variables (COMPASS Math and ELA, Age, Gender, Race).

Figure 22: GCMCA MET Persistence & Completion Cross Tabulation Results (n=244)



+Chi-square is statistically significant at p<.05

Effect sizes are small=.10 (*), meduim=.30 (**), or large=.50 (***)

The results of the chi-square analysis may be confounded, due to no comparison group students who were consecutive persisters

This could indicate that the GCMCA initiative had a substantial positive effect on consecutive persistence (vs. stopping out) in this context. For more information, please reference Tables C9-C12 in *Appendix C*. There were no other background variables that made a substantial impact in the persistence and completion outcomes.

As a reminder, students in the MET comparison group had more time to complete their degrees (and drop out) than those in the GCMCA MET group, since students in the comparison group were enrolled in the METD or METM programs before GCMCA funding. It generally took about seven (7) terms for the MET comparison group to complete, while for those who did complete in the GCMCA MET group, it took two (2). However, the finding that it only took two (2) terms to finish is not typical, and these students might have transferred from another institution or had some other reason for completing so quickly. It appeared that students were trending in toward completion (i.e. they were persisting consecutively), but did not complete. Because there was a delay in the start of the program, there might not have been enough time to observe these students to completion. Since the average time to complete an associate degree is 3.8-5 years,[53] depending on full-time/part-time status, then it seemed logical that students did not have enough time to complete their degree, (see *Program Progress* for a program timeline). These timelines might have had (or were perceived to have) an effect on completion.

[53] Complete College America (2011). *Time is the Enemy: The surprising truth about why today's college students aren't graduating ... and what needs to change.* Washington DC: Complete College America. Retrieved from http://www.completecollege.org/docs/Time_Is_the_Enemy_Summary.pdf

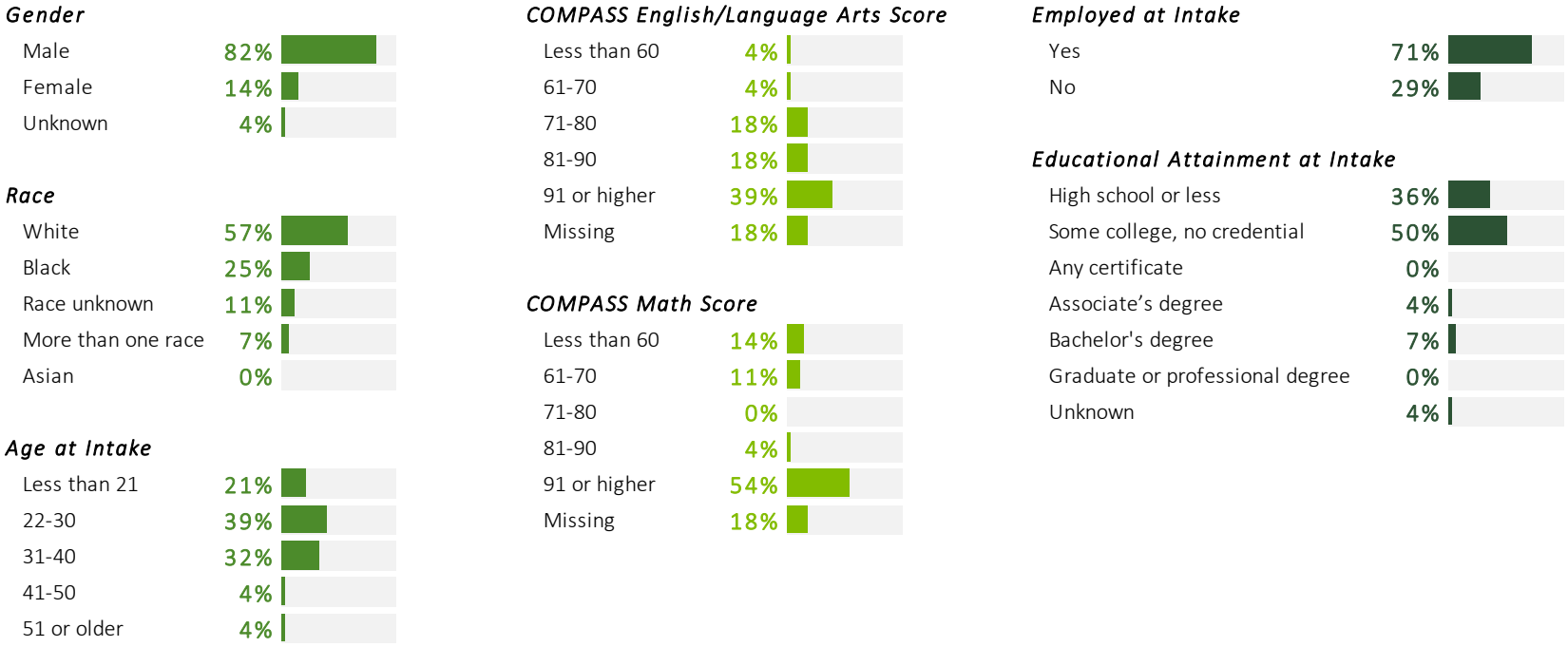
CNC Students

The main group of interest is the MET (METM, METD) students who are progressing toward their associate degrees, with the option of earning a CNC certificate. However, a number of students enrolled exclusively in the CNC program. These students were different in that they were not progressing toward their MET degree but were not enrolled in the short-term credentialing offered by the WDC manufacturing-related programs. Since individuals pursuing their CNC certificate do not fit in any particular study, their results are reported here within the MET program context in order to provide an understanding of this group of students. Of the 28 CNC individuals described in this analysis, seven of them were also pursuing an MET degree and were included in data within Study 2.

Background Characteristics

Similar to students in MET, students in the CNC program were primarily male (82%) and white (57%). The age at intake for CNC was higher than for MET, with the majority of students ranging from 22 to 40 years old (71%). COMPASS intake score patterns mirror those of the MET group, with the almost forty percent of individuals scoring in the top categories for English/Language Arts, and over half (54%) scoring in the top categories for Math. They also mirrored incoming education levels, with the majority having some college but no credential or below (86%). Different from MET, the majority of CNC participants were employed at intake (71%).

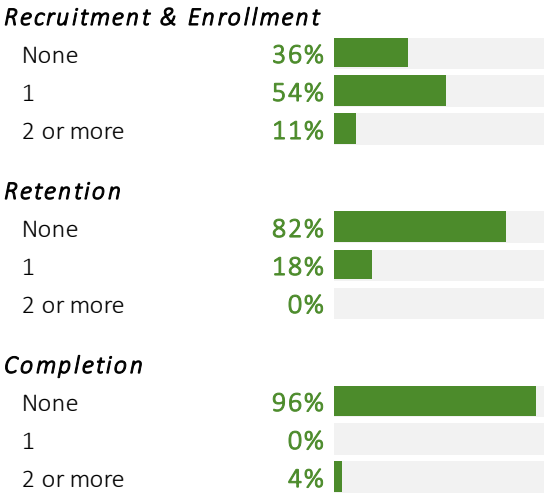
Figure 23: Background Characteristics for GCMCA CNC Group



PTEC Services Used

Almost two-thirds of CNC students (64%)[54] used PTEC services related to recruitment and enrollment at least once. Examples of these services include financial aid assistance and WorkKeys assessments. Fewer CNC students (18%) utilized PTEC services related to retention. Examples of these services include tutoring and adaptive learning. Similar to Welding and MET GCMCA students, few students (4%) took advantage of PTEC services related to completion. Examples of these include resume writing and career advising.

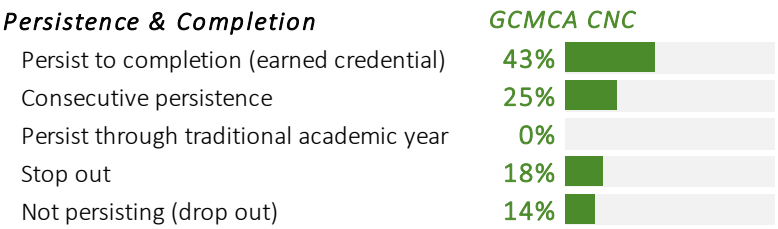
Figure 24: PTEC Services Used by GCMCA CNC Students



Persistence and Completion

Less than half of CNC students (43%) completed their CNC Certificate, though a quarter of students (25%) were consecutively persisting in the program and enrolling in courses each semester. Combined with the completion information, 68% of students were consecutively persisting or completed their CNC Certificates.

Figure 25: CNC Persistence & Completion Trends



[54] Number described in the text does not perfectly match Figure 24 because values were rounded to the ones place for the figure.

Study 3 | WDC Certifications

Overall, 87 individuals participated in GCMCA training through WDC. Of these, the majority (n=55, 63%) participated in Machine Operator I (MO I), followed by 12 (14%) in Apprenticeship, 11 (13%) in Machine Operator II (MO II), and 9 (10%) in MSSC.

Background Characteristics

The GCMCA WDC participants were more diverse than the GCMCA participants in the previous two studies (i.e., Welding and MET). Around half of participants were male (48%)[55] and white (53%). Age ranges for individuals in WDC trainings were slightly older, with the majority of participants falling in the 22 to 50 age range (83%). A noticeable exception to the participant trends was in the MSSC participant group, where the majority of individuals were black (67%) and 51 years or older (56%).

Figure 26: WDC GCMCA Participants

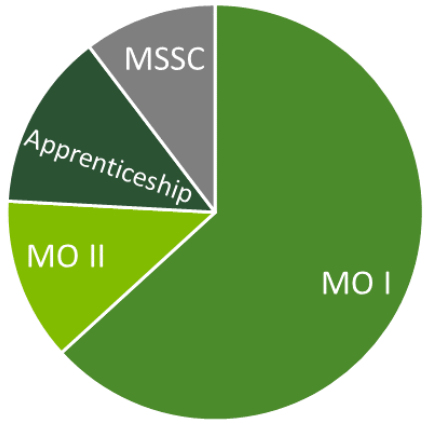


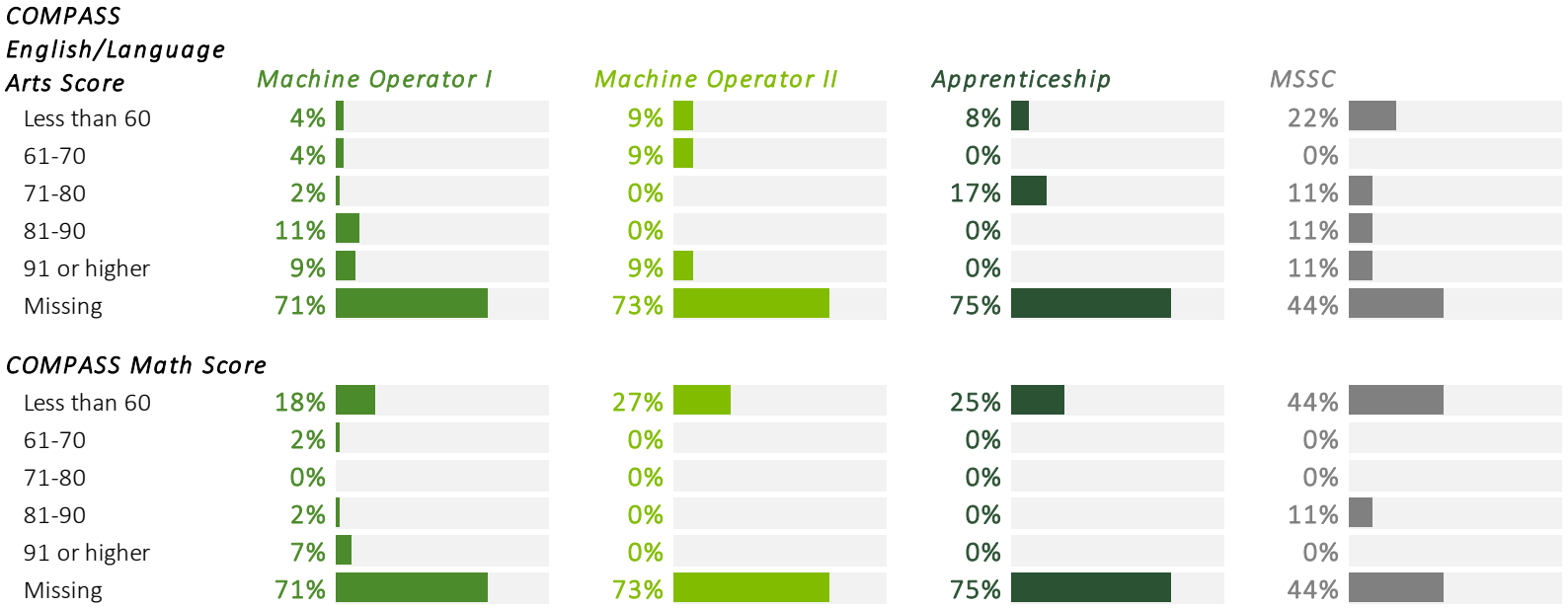
Figure 27: WDC GCMCA Demographics

	Machine Operator I	Machine Operator II	Apprenticeship	MSSC
Gender				
Male	38%	36%	92%	67%
Female	6%	0%	8%	0%
Unknown	56%	64%	0%	33%
Race				
White	55%	55%	54%	22%
Black	29%	18%	15%	67%
Asian	2%	0%	15%	0%
Race unknown	9%	27%	8%	0%
More than one race	4%	0%	0%	11%
Age at Intake				
Less than 21	4%	9%	0%	0%
22-30	31%	46%	50%	22%
31-40	24%	18%	33%	0%
41-50	31%	27%	8%	22%
51 or older	11%	0%	8%	56%

[55] As shown in the table, a sizeable amount of participants (47%) did not report their gender, so there might have been more males or females.

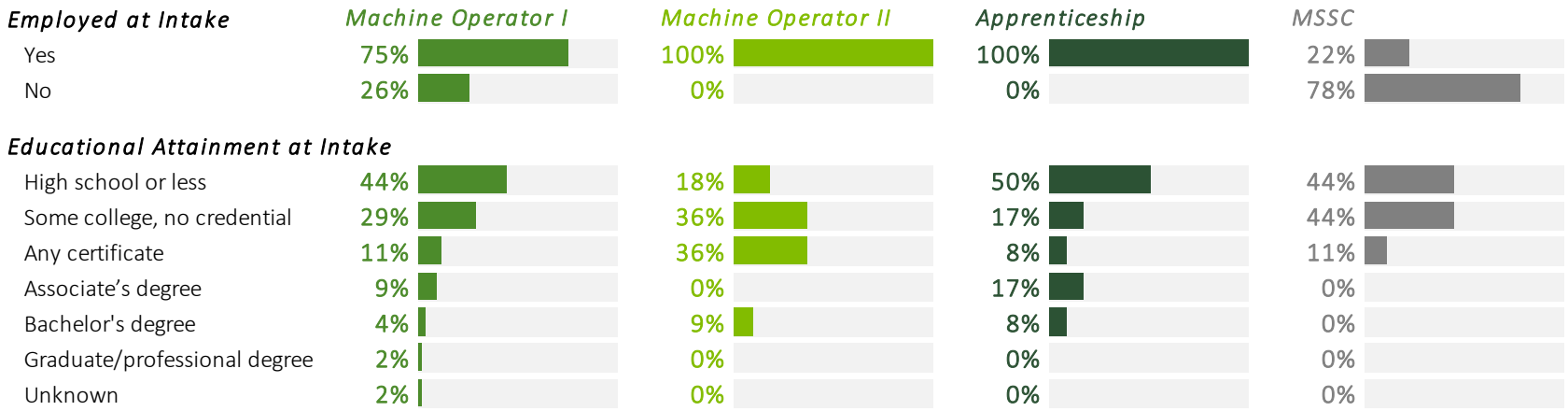
Due to differing program entry requirements, over two-thirds (69%) of the WDC students did not take any kind of placement test, as COMPASS testing is not required for WDC short-term trainings.

Figure 28: WDC GCMCA COMPASS Scores



About two-thirds of WDC individuals (66%) were employed at intake. When MSSC is excluded, this number increases to over 80%. Similar to demographic trends, individuals in the MSSC group show differing trends for employment (majority not employed at intake). Education at intake varied across groups, with the majority of participants having some college, but no credential or below. However, 36% of those enrolled in MO II had a certificate of some kind, which differed from the other groups; MO II participants were also least likely to have high school or less. While half of the Apprenticeship participants had high school or less (similar to MSSC and MO I participants), about one-third of participants had some credential above high school.

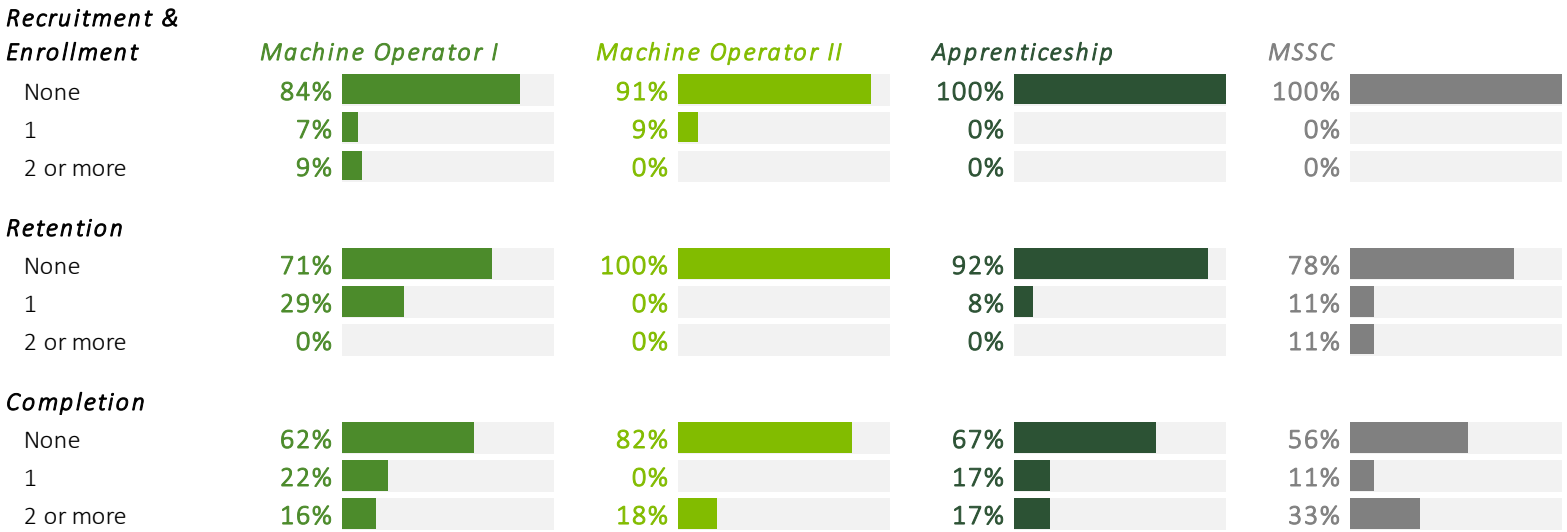
Figure 29: WDC GCMCA at Intake



PTEC Services Used

The majority of GCMCA students did not take advantage of PTEC services (64% - 88%). Since the majority of students in these short-term programs were incumbent workers who were returning their jobs and not seeking longer-term degrees, this may have contributed to low use of services. By training program, MO I and MSSC students used PTEC services overall more often than other programs. Those who were using PTEC services most commonly used those related to completion, such as resume writing. Notably, MO I and MSSC were the only two WDC training programs with a portion of participants who were not employed at intake; as such, these participants may have been more interested in career readiness and placement-type services.

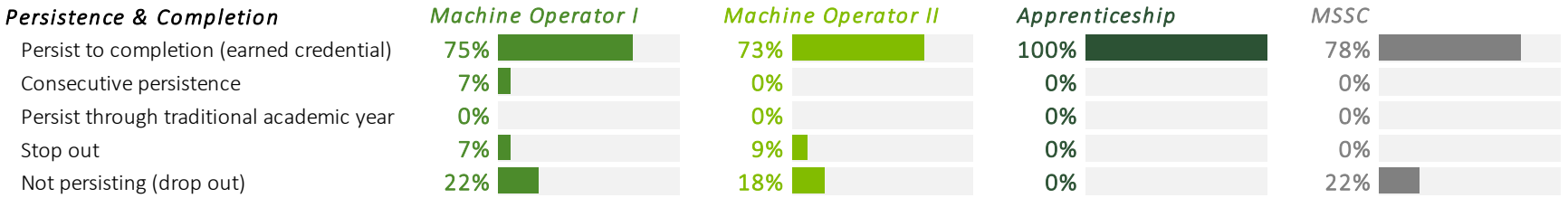
Figure 30: WDC GCMCA PTEC Service Use



Persistence and Completion

Over three-quarters (78%) of all WDC students persisted to completion (i.e. they earned their credential). By major, all students in the apprenticeship program (MO I + MO II) earned their credentials, while approximately three-quarters of students in the other programs earned their relevant credentials.

Figure 31: WDC GCMCA Persistence & Completion



Conclusion

Lasting Effects of the Grant

As a result of the grant, CSTCC has been able to expand the college's reach and programmatic capacity. Qualitative evidence suggests that these effects of GCMCA are likely to continue through the end of the grant and beyond, including:

Welding	The first Welding program at CSTCC was offered through GCMCA. This extended the reach of the college into the western area of Hamilton County, Ohio and helped fill a training gap for the community. This Round 4 funding has allowed CSTCC to create an accelerated Welding training that was embedded and aligned with the GCMCA Welding degree and located at the Clifton Main Campus.
Machining	Strengthening and adding new machine-related trainings (e.g. MET, CNC, MO II) has increased training opportunities across Hamilton County and fostered increased collaboration between CIT and WDC. This has led to new opportunities for enhancing machine-related training, especially in the area of additive manufacturing, including leveraging GCMCA when applying for funding.
Student-Centered Innovations	GCMCA has supported innovations in student-centered learning through adaptive learning and contextualization, and in supportive student services (i.e. PTEC). Contextualizing math for GCMCA Welding students opened up the opportunity to build contextualization into additional program pathways within the college, explore opportunities for college meta-majors, and work to establish a physical presence for PTEC-like student support services. Additionally, collaboration efforts that began with the GCMCA pathways for WDC and CIT have led to the creation of pathways between WDC short-term trainings and other academic programs within CSTCC.

Recommendations for Further Research

It is beyond the scope of this evaluation to make value judgments about whether the degree of tangible and intangible success obtained as a result of GCMCA was sufficient to warrant the amount of public investment made. However, early findings from this report show promise. Students report finding aspects of the GCMCA program useful. Furthermore, these students have been persisting in their programs. However, due to increased start-up time needed for the program (a challenge faced by other TAACCCT grantees, and reported in *Cycle of New Program Start-up*), there has not been enough time to follow all of the students impacted by GCMCA funding through their college career to completion (and ultimately the workforce). Though students in the short-term training programs offered by the WDC were completing at adequate rates, those in the longer-term programs (i.e. associate degrees) did not complete at satisfactory rates, and in some cases no students completed (i.e. GCMCA Welding). However, GCMCA

students were persisting in their programs. Since it can take between 3.8 and 5 years[56] to complete an associate degree, more time would be valuable when determining a program's impact. Future research could follow these GCMCA students to determine how, and the extent to which, programming impacted students' likelihood of completion and their progression through the workforce.

Future research could also examine if some of these delays in establishing new programs could be mitigated. If this is a common challenge for TAACCCT grantees (and other USDOL grantees), perhaps there are ways to share best practices through future implementation evaluations that explicitly look for accelerators or barriers to timely program start-up across a number of different institutions, including CSTCC. These could be used to identify the accelerators and mitigate the barriers that might occur.

Finally, future research could follow CSTCC leadership, staff ,and faculty, who were impacted by the grant, during their sustainability efforts. The findings from this could help provide an understanding of the progress of these sustainability and institutional capacity efforts. This knowledge could be used to inform policies for future grant-funded programs.

[56] Complete College America (2011). *Time is the Enemy: The surprising truth about why today's college students aren't graduating ... and what needs to change.* Washington DC: Complete College America. Retrieved from http://www.completecollege.org/docs/Time_Is_the_Enemy_Summary.pdf

APPENDICES

Appendix A: Implementation Evaluation Methods

The Implementation Evaluation began January 2014 and continued through March 2017[57] to document program progress, to monitor program outcomes, and to provide recommendations for continuous improvement of program operations. During the evaluation, the Evaluation Team employed principles of a utilization-focused framework.[58] The substantiated assumptions[59] of utilization-focused evaluation are: (1) intended users are more likely to utilize evaluation findings if they understand and value the evaluation's processes; (2) intended users are more likely to understand and value the evaluation's process if they are engaged in evaluation decisions; (3) engaged intended users both enhance the credibility of evaluation findings and possess greater capacity for utilizing findings to improve the program; and (4) capacity for utilizing findings relies heavily on a collaborative, functional relationship between evaluators and intended users.

Additionally, the formative component of the Implementation Evaluation offered real-time feedback as the Greater Cincinnati Manufacturing Careers Accelerator (GCMCA) program rolled out, through regular phone calls, quarterly summary reports, and a report following the interim evaluation site visit. This provided the Evaluation Team the opportunity to identify and share early evidence of strengths and areas for growth throughout the development of the program, as opposed to offering information only retrospectively.

Research Questions

Table A1 summarizes the research questions[60] examined through the Implementation Evaluation, including ties to data sources and analysis methods. Further details on data sources and collection plans, analysis methods, and potential limitations of the Implementation Evaluation are detailed in subsequent sections.

Table A1: Implementation Evaluation Research Questions

Research Questions	Data Sources	Analysis Methods
1. How was the particular curriculum selected, used, and/or created?	• Quarterly Implementation Calls • Site Visit Interviews • Program Documents	• Document and synthesize themes from leadership, grant staff and instructors, and CSTCC staff and instructors
2. How were programs and program designs improved or expanded using grant funds? What delivery methods were offered? What was the program administrative structure? What support services and other services were offered?	• Progress Updates • Quarterly Implementation Calls • Site Visit Interviews • Program Documents	• Document and synthesize themes from leadership, grant staff and instructors, and CSTCC staff and instructors

[57] Grant implementation took place up to March 30, 2017. April 1, 2017 through September 30, 2017 was additional time for evaluation analysis and reporting.

[58] Patton, M.Q. *Essentials of Utilization-focused Evaluation*. Thousand Oaks, CA. SAGE Publications, Inc., 2012.

[59] Brandon, P., N. Smith, C. Trenholm, and B. Devaney. (2010) *The Critical Importance of Stakeholder Relations in a National, Experimental Abstinence Education Evaluation.* American Journal of Evaluation, 31(4). 517–531.
Patton, M.Q. *Essentials of Utilization-focused Evaluation*. Thousand Oaks, CA. SAGE Publications, Inc., 2012.
Taut, S. (2008) *What Have We Learned about Stakeholder Involvement in Program Evaluation?* Studies in Education Evaluation. 34.

[60] Research Questions 1-4 were required by USDOL. Research Questions 5-9 were added by the Evaluation Team.

RESEARCH QUESTIONS	DATA SOURCES	ANALYSIS METHODS
		• Review program descriptions/ details documents
3. Was an in-depth assessment of participants' abilities, skills, and interests conducted to select participants into the grant program? What assessment tools and processes were used? Who conducted the assessment? How were the assessment results used? Were the assessment results useful in determining the appropriate program and course sequence for participants? Was career guidance provided, and if so, through what methods?	• Progress Updates • Quarterly Implementation Calls • Site Visit Interviews	• Document and synthesize themes from grant staff and instructors, CSTCC staff and instructors, and participants
4. What contributions did each of the partners (employers, workforce system, other training providers and educators, philanthropic organizations, and others as applicable) make in terms of: (1) program design, (2) curriculum development, (3) recruitment, (4) training, (5) placement, (6) program management, (7) leveraging of resources, and (8) commitment to program sustainability? What factors contributed to partners' involvement or lack of involvement in the program? Which contributions from partners were most critical to the success of the grant program? Which contributions from partners had less of an impact?	• Quarterly Implementation Calls • Site Visit Interviews	• Document and synthesize themes and details from leadership, grant staff, grant instructors, and partners
5. What program outputs have been generated to date? What barriers hindered output achievement? What factors unexpectedly improved output achievement? Why?	• Progress Updates • Quarterly Implementation Calls • Site Visit Interviews • Program Documents	• Review and discuss GCMCA Score Card and data trends with leadership and grant staff • Document and synthesize themes from leadership and grant staff • Review all USDOL and GCMCA internal program reports
6. How satisfied are program partners, staff, and participants with the program? Why?	• Quarterly Implementation Calls • Site Visit Interviews	• Document and synthesize themes from grant staff and instructors, participants, and partners
7. What have been successes and obstacles to program performance?	• Quarterly Implementation Calls • Site Visit Interviews • Program Documents	• Document and synthesize themes and details from leadership, grant staff and instructors, CSTCC staff and instructors, and participants • Review all USDOL, GCMCA Score Card, and GCMCA internal program reports
8. How can program processes, tools, and/or systems be modified to improve performance?	• Quarterly Implementation Calls • Site Visit Interviews	• Document and synthesize themes from leadership, grant staff and instructors, CSTCC staff and instructors, participants, and partners
9. How can the program expand or enhance institutional capacity? What are the most promising programmatic components to use institution–wide? Why?	• Quarterly Implementation Calls • Site Visit Interviews	• Document and synthesize themes from leadership, grant staff, and grant instructors

Data Sources & Collection

Data for the Implementation Evaluation was collected from the following data sources:[61]

- Progress update calls and communication
- Quarterly implementation calls with leadership
- Site visit interviews with key stakeholders
- Program document reviews

Progress Updates

Progress updates with the grant's Project Director and Data Manager/Data Analyst primarily served to support administrative and data-related functions. Regular correspondence through calls and emails assisted the Evaluation Team with evaluation-related scheduling, IRB document submissions (initial approval and updates), and updates on data sharing and access. Data calls were also scheduled to discuss impact analysis methodology and to review the most recent GCMCA Score Cards for trends in enrollment, persistence, and completion data. The Evaluation Team maintained ongoing communication with the grant's Project Director and Data Manager/Data Analyst through the life of the grant.[62]

Quarterly Implementation Calls

The primary function of these calls was they allowed GCMCA leadership to provide the Evaluation Team with timely information regarding GCMCA processes, progress, obstacles, and successes. These findings were elaborated upon during site visit interviews, but calls provided leadership with an opportunity to recall events and challenges more frequently than the site visits. Following each call, the Evaluation Team provided the grant's Project Director with a written quarterly summary based on the call. This summary was distributed to call attendees and others at CSTCC as needed, and feedback was provided to the Evaluation Team to ensure an accurate understanding of grant progress was being captured. These notes are stored on Thomas P. Miller & Associates' servers and provided a timeline of relevant occurrences used as a reference point for site visit interviews and reporting.

Quarterly calls with GCMCA leadership took place throughout the grant implementation period. When USDOL granted GCMCA a six-month grant implementation extension, the Evaluation Team expanded qualitative data collection to include calls during the extension period (October 1, 2016 – March 31, 2017) and expanded feedback on data collected to include calls in the evaluation reporting period (beginning April 1, 2017). Face-to-face meetings substituted for the implementation update calls when the Evaluation Team conducted evaluation site visits.

[61] The project launch meeting, a data source identified in the Evaluation Plan submitted to USDOL, took place at the start of the grant period. Since GCMCA was still very early on in development, the project launch meeting served to better clarify understandings of the evaluation for CSTCC staff and to better identify approaches the Evaluation Team could use to provide real-time feedback and information to CSTCC, rather than answer research questions.

[62] This includes the grant implementation period through March 31, 2017 (CSTCC was awarded an extension by USDOL) and through the evaluation reporting period (April 1, 2017 – September 30, 2017).

Site Visit Interviews

The Evaluation Team conducted two in-person site visits, one midway through the grant (May 2015) and one at the end of the extension period.[63] The interim site visit focused on progress, successes, and challenges with GCMCA implementation. The final site visit, in March 2017, focused on themes and issues that had emerged throughout the three years of implementation as well as program sustainability and lessons learned.

During the site visits, the Evaluation Team conducted individual and small group interviews using customized interview facilitation guides developed for each visit. Interviews were semi-structured with a majority being open-ended questions and probing, coupled with conversational inquiry. In line with the principles of applied thematic research, this interview approach allowed interviewees to speak about experiences in their own words, free of the constraints imposed by fixed-response questions. Inductive probing allowed the Evaluation Team to clarify statements, meanings, and feelings associated with experiences. This promoted evaluator accuracy in capturing detailed observational notes and evaluator learning from participant's word-choice and descriptions.[64]

The Evaluation Team received tours of and conducted interviews at the CSTCC Main Campus (in Clifton), the CSTCC West Campus (in Harrison), and the Workforce Development Center (in Evendale). The evaluators also conducted phone interviews when participants were unable to meet in-person. Stakeholder groups interviewed during the site visits are outlined in *Table A2*.

Table A2: Implementation Evaluation Stakeholders

Stakeholder	Description	Totals
Leadership	The Evaluation Team conducted semi-structured 45-60 minute group and individual interviews with CSTCC and GCMCA leadership including the Provost and former Dean of Humanities & Sciences,[65] the Vice President of Academic Affairs,[66] the Vice President of Enrollment & Student Development, the Vice President of the Workforce Development Center, the Dean of the Center for Innovative Technologies, the Senior Director of Institutional Research & Effectiveness, the Director of Grant Administration, and the Director of the Pathway to Employment Center.[67] These interviews focused on program activities and integration, collaboration, resources, lessons learned, and sustainability.	> 5 group/ individual interviews
Grant Staff	Semi-structured 30-60 minute group interviews were held with the grant's Pathway to Employment Center (PTEC) staff, the grant's data staff within the division of Institutional Research & Effectiveness,[68] the WDC Assistant Business Manager, and	≥ 5 group/ individual interviews

[63] When USDOL granted CSTCC a six-month grant implementation extension, the Evaluation Team shifted the final site visit from the end of Program Year 3 (September 2016) to the end of the extension period (March 2017). This shift allowed the Evaluation Team to better capture grant progress made during the extension as well as during the second half of the original grant implementation period.
[64] Guest, Greg, MacQueen, K.M., and Namey, E.E. *Applied Thematic Analysis*. Thousand Oaks, CA. SAGE Publications, Inc., 2011.
[65] The Dean of Humanities & Sciences transitioned into the role of interim and then permanent Provost of CSTCC during the course of the grant.
[66] The Vice President of Academic Affairs transitioned into the role of interim and then permanent President of CSTCC during the course of the grant.
[67] The Director of the Pathway to Employment Center has been the grant's Project Director for the majority of grant implementation.
[68] The first grant Data Manager was housed in the division of Institutional Research & Effectiveness. When re-hiring for the position, CSTCC changed the title to Data Analyst and housed the staff member within the Pathway to Employment Center.

STAKEHOLDER	DESCRIPTION	TOTALS
	the grant's data specialist consultant.[69] These interviews focused on understanding grant implementation, challenges, successes, and lessons learned.	
Grant Faculty & Instructors	Semi-structured 20-45 minute individual and group interviews were held with grant faculty and instructors in the divisions of Center for Innovative Technologies (CIT) and the Workforce Development Center (WDC). These interviews focused on progress, challenges, successes, and recommendations for strengthening program development.	> 5 group/ individual interviews
CSTCC Staff & Faculty	Semi-structured group interviews were held for 45-60 minutes with college staff/faculty, including individuals from Humanities & Sciences. The primary purpose was to better understand successes, challenges, and implementation of the adaptive learning and contextualization components of GCMCA.	< 5 group interviews
Participants	The Evaluation Team held semi-structured 20-30 minute group interviews with grant participants. During the first site visit, the Evaluation Team conducted a mixed group interview, interviewing students across Welding, Mechanical Engineering Technology (MET), and WDC, to gauge the broader student experience. During the final site visit, the Evaluation Team conducted separate group interviews with Machine Operator WDC students and CIT Welding students, to better focus on each program's provision of services and educational training to students. Discussions focused on the individual's goals, program experience, and overall program feedback.	< 5 group interviews
Employers & Partners[70]	Semi-structured 30-60 minute group interviews were held with regional employers. During the first site visit, the Evaluation Team conducted a mixed group interview, interviewing employers engaged or interested in CIT and WDC programs. During the final site visit, the Evaluation Team focused on employers and a regional workforce coalition organization primarily engaged in the WDC shorter-term trainings. Discussions focused on program engagement, anticipated impacts to the business/organization, and overall satisfaction.	< 5 group/ individual interviews

To increase consistency of the interviews, the Project Lead was present for both site visits and participated in phone interviews, progress updates, implementation calls, program document reviews, and report writing. This consistency helped build and preserve institutional knowledge across site visits. In addition, at least two Evaluation Team members were present for each site visit; this allowed one member of the Evaluation Team to focus on facilitation and a second member to take detailed notes. These site visit methods are consistent with recommendations made by qualitative researchers.[71]

[69] The grant's Data Specialist Consultant was a contracted position to bring in an individual with TAACCCT-specific data collection and tracking experience.

[70] Individual and small-group interviews with employer participants were conducted, rather than distributing a Grant Partner Evaluation Form as proposed in the original evaluation methodology. The interview format was anticipated to provide greater depth of insight into how and why employers, especially newly engaged employers, chose to engage with CSTCC and the GCMCA initiative.

[71] Kidd, P.S. & Parshall, M.B. (2000). *Getting the focus and the group: enhancing analytical rigor in focus group research*. Qualitative Health Research, 10(3), 293-308.

Program Document Reviews

The Evaluation Team reviewed program documents received from CSTCC, including:

- Quarterly Narrative Progress Reports (QNPRs) created by CSTCC to USDOL
- Annual Performance Report (APR) Table 1s created by CSTCC to USDOL
- GCMCA Score Cards created quarterly by CSTCC to track USDOL required outcomes
- GCMCA internal reports (e.g. Adaptive Learning & Contextualization Outcomes Report, Bootcamp Report)
- GCMCA promotional and descriptive materials (e.g. brochures, program descriptions)

These documents provided additional context and information to evaluate program implementation. Context from these documents informed questions for the quarterly implementation calls and site visits and informed content within the evaluation reports.

Analysis Methods

A general inductive thematic approach,[72] with influences of applied phenomenology,[73] was used to analyze the qualitative data generated from the interviews. This approach was selected because of its usefulness in drawing clear links between research questions or objectives and data collection results, and because it provided a theoretical foundation for subjective meaning to be interpreted and extrapolated from discourse.[74] The analytical framework used for the analysis included a time-dependent gradient (before the program and changes occurring in each year of program implementation) and a program-dependent gradient (analyzing the program components).

Units of analysis included the programs, leadership, grant staff, grant instructors, CSTCC staff/instructors, participants, and program partners.

Emerging themes were then developed according to the analytical frame and through a review of (1) progress update call notes and emails, (2) notes taken during quarterly implementation calls; (3) quarterly summaries resulting from the implementation calls; (4) detailed notes taken during the site visits; (5) GCMCA documents; and (6) the Evaluation Team's extensive experience with technical training programs and the body of evaluation knowledge built through their work. Guidance about what was important came from the grant narrative, research questions, and calls that had occurred throughout the grant period. Following this initial theme development, additional Evaluation Team members reviewed the results, adding contextual details and examples. These themes were divided into the following categories:

- *Interim Progress* – Documentable steps that had been taken to advance or achieve grant outcomes, deliverables, milestones, and/or goals**;**
- *Accelerators/Strengths of Progress* – Factors that had enhanced grant progress and improved the ability of grant staff to carry out grant initiatives, focused on internal factors (program design, modification, implementation, and application);
- *Barriers/Challenges to Progress* – Persistent difficulties grant staff had faced in accomplishing grant initiatives;

[72] Thomas, D.R. (2006). *A general inductive approach for analyzing qualitative evaluation data*. American Journal of Evaluation, 27, 237-245.
[73] Guest, Greg, MacQueen, K.M., and Namey, E.E. *Applied Thematic Analysis*. Thousand Oaks, CA. SAGE Publications, Inc., 2011.
[74] Ibid.

- *Environmental Factors* – External factors beyond the control of those implementing the program;
- *Recommendations* – Opportunities the Evaluation Team identified for improving progress toward grant outcomes (in Interim Report and quarterly summaries, where applicable); and
- *Sustainability* – Components of the program that will continue once funding ends.

The results were again compared to the analytic frame and the anticipated reporting elements. The final step in the analysis was to send the summarized results to the grant's Project Director and CSTCC/GCMCA leadership for clarification and additional contextual details.

To strengthen the accuracy and credibility of implementation study findings, the Evaluation Team relied on triangulation and collaborative inquiry. By comparing findings based on different data sources and using approaches that incorporated both evidence and negative evidence, the Evaluation Team created a robust and dynamic depiction of implementation.[75] By presenting findings to GCMCA stakeholders for elaboration, corroboration, and modification, the Evaluation Team confirmed and updated analyses. Additionally, by sharing findings with intended users as they emerged, the Evaluation Team built a collaborative relationship with stakeholders that encouraged higher quality first-person data and increased the likelihood the evaluation could produce timely, user-relevant findings.[76]

Reporting

Data were interpreted, analyzed, and included in (1) quarterly implementation summaries completed throughout the grant implementation period; (2) the Interim Report (covering October 1, 2013 – May 31, 2015) and (3) this Final Report, finalized by September 30, 2017. The Interim and Final reports contain the results of the analysis, recommendations for program enhancements (Interim only), and lessons learned. An in-depth review of these reports was conducted by the grant's Project Director, leadership, and grant staff for member checking, factual verification, and elaboration on findings and recommendations. Subsequently, the reports were submitted to the USDOL by CSTCC.

Limitations

Limitations for the Implementation Evaluation included the following main elements:

Partial and Biased Findings – Qualitative and perceptual research methods offer good insights, but are, by nature, partial and biased. To attempt to address this limitation, the Evaluation Team took advantage of an opportunity embedded in mixed-methods evaluation, the triangulation of data. Triangulating results from multiple sources, such as comparing findings among stakeholder interviews and with documents reviewed, creates more credible evaluation results and is considered critical to the validity and reliability of findings. Findings that have been corroborated through triangulation tend to be sufficiently robust and credible.[77]

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[75] Brewer, J. and A. Hunter. *Foundations of Multimethod Research: Synthesizing Styles*. Thousand Oaks, CA: Sage, 2006.

[76] Cousins, J.B. and Earl, L. M. (1992) *The Case for Participatory Evaluation*. Educational Evaluation and Policy Analysis, 14(4), 397-418.
Cousins, J.B. and Whitmore, E. (1998) *Framing participatory evaluation*. New Directors for Evaluation, 80. 5-23.
Greene, J. G. (1998) *Stakeholder participation and utilization in program evaluation*. Evaluation Review, 12. 91-116.
Reineke, R. A. (1991). Stakeholder involvement in evaluation: Suggestions for practice. American Journal of Evaluation, 12, 39-44.
Sturges, K.M. (2013). *Building consensus in (not so) hostile territory: Applying anthropology to strategic planning*. Practicing Anthropology, 35, 1: 35-39.

[77] Denzin, N.K. *The research act: A theoretical introduction to sociological methods* (2nd edition). New York, NY. McGraw-Hill. 1978.

SELECTION BIAS – To address the threat of non-response and non-consent, and to improve the likelihood that sufficient data could be collected to draw valid conclusions, the Evaluation Team relied on sampling coordinated by program staff. This approach introduced selection bias into the findings. Participants and employers more interested in providing feedback or more involved in the program may have chosen to participate in interviews at a higher rate than less-interested or less-engaged participants and employers, and program staff responsible for coordinating interviews may have selected only those cases where they anticipated favorable responses to interview questions. Neutral and critical feedback from participants and employers, however, supported the notion that these participants were chosen primarily for their willingness to participate in the evaluation rather than the likelihood that they would cast the program in a favorable light.

RESPONDENT ORDER EFFECT – For the final site visit, the Evaluation Team conducted a group interview for all participants within the chosen Machine Operator class. During the group interview, participants more interested in sharing their opinions of the program may have spoken up at a greater rate than other students. This may have created a pecking order bias by participants self-selecting their response order (i.e. certain participants go first and others go last). Receiving a range of feedback from participants, from positive to critical, supports the notion and that a spectrum of student experiences was captured, however, it is possible that bias related to the participant response ordering was introduced into the evaluation.

RESEARCHER EXTRAPOLATION – Analysis conducted with an interpretive analytical framework, influenced by phenomenology, suffers from the threat that researcher extrapolation and interpretation may go too far beyond what is present in, and supported by, data.[78] Indeed, the recommendations provided in this report are based on a combination of what was learned and supported by data and the experiences and findings of the evaluators' previous experience designing, implementing, and evaluating various workforce development programs.

HUMAN ERROR – The Evaluation Team relied on grant staff to collect and track much of the quantitative data used within the Implementation Evaluation (i.e. participant tracking). Human error and competing priorities could lead to imperfect and delayed data entry and tracking, which impacts the validity of the analysis. To mitigate this as much as possible, GCMCA leadership had staff member(s) dedicated to data collection, verification, and reporting. GCMCA's data team also regularly reported and discussed the TAACCCT required outcomes with both CSTCC leadership and the Evaluation Team via the GCMCA Score Card. Regular data reviews and discussions may have decreased data errors, as multiple individuals had the opportunity to review and comment about GCMCA progress and data trends. Additionally, CSTCC brought in a Data Specialist Consultant for the grant, after the first grant Data Manager left. The Data Specialist Consultant had experience with TAACCCT data reporting and was used to review and verify previous reporting numbers and train the new Data Analyst on necessary data collection and reporting approaches. This dedication to

Harry, B., Sturges, K.M., & Klinger, J.K. (2005). *Mapping the process: An exemplar of process and challenge in grounded theory analysis*. Educational Researcher, 34, 2: 3-13.
Patton, M.Q. (2001). *Evaluation, Knowledge Management, Best Practices, and High Quality Lessons Learned*. American Journal of Evaluation. 22(3). 329-336
Patton, M.Q. *Qualitative Research & Evaluation Methods* (4th edition). Thousand Oaks, CA. SAGE Publications, Inc.,. 2015.
[78] Guest, Greg, MacQueen, K.M., and Namey, E.E. *Applied Thematic Analysis*. Thousand Oaks, CA. SAGE Publications, Inc., 2011.

maintaining high-quality data tracking and reporting through staffing data-specific positions was a strength of the program's implementation and has led to decreased human error within the data.[79] However, there may still be data imperfections with the outputs tracking.

Informing the Impact and Outcomes Evaluation

The implementation findings provided context for the Impact and Outcomes Evaluation by documenting the timing and nature of adjustments to program design. The Evaluation Team used this documentation and real-time program understanding to better adjust the Impact Evaluation design. A Revised Evaluation Plan memo documenting the rationale of the design adjustments was sent to the Urban Institute, the TAACCCT evaluation point of contact, on June 23, 2017.[80]

Original Approach

Within the Outcomes/Impact Analysis section in the Final Evaluation Plan submitted in May of 2014, the Evaluation Team identified the following research questions to guide the outcomes/impact analysis in rigorously evaluating participant outcomes/impacts:

(1) How do retention and completion rates of students participating in GCMCA's Welding Associate's Degree program compare to those who are going through similar programs at CSTCC?
(2) How do retention and completion rates of students participating in GCMCA's Welding Certificate program compare to those who are going through similar programs at CSTCC?
(3) How do program outcomes (nine required) compare to GCMCA estimations of program outcomes?

Research Questions #1 and #2

To answer the research questions on academic achievement and employment success, the Evaluation Team was to receive data on GCMCA program participants (GCMCA's Welding Certificate and Welding Associate's Degree students) and non-grant participants (students in programs such as Aviation Mechanics Airframe, Avionics, Aviation Mechanics Powerplant, and Automotive Service Management).

Methodology

Given the program's focus on particular students who cannot be randomly assigned, the Evaluation Team originally planned to conduct a comparison group study of the Welding program where Welding Associate Degree and Welding Certificate participants were to be analyzed as two separate GCMCA groups. This was intended to be a quasi-experimental analysis, assessing the impacts of training completion upon the grant participants. The causal parameter of interest was the effect of this program on the grant participants. Propensity score matching[81] was chosen for the quasi-experimental analysis method. The goal was to create a matched sample of students in the GCMCA and comparison groups who were similar based on covariates such as demographics (e.g. age, race, education), program participation (e.g. Welding Associate Degree), career interests, relevant placement scores, and other variables determined as important. This would reduce the potential bias in comparing outcomes that would

[79] The data specialist consultant, after reviewing previous data tracking and reporting, identified a handful of reporting errors that CSTCC was able to revise by submitting updated APRs and updated information to the Evaluation Team.
[80] The content within this *Informing the Impact Evaluation* report section mirrors the content included in the Revised Evaluation Plan memo.
[81] Rosenbaum, P.R. and Rubin, D.B. (1983). The central role of the propensity score in observational studies for causal effects. *Biometrika. 70*, 41–55.; Rosenbaum, P.R. and Rubin, D.B. (1985). Constructing a control group using multivariate matched sampling methods that incorporate the propensity score. *The American Statistician. 39.* 33–38.

otherwise be created from natural differences in the two groups of students. To determine the importance of matching variables, TPMA determined to run the correlation between the variables and outcome variables. After propensity score matching, TPMA planned to analyze the groups to determine comparability between the matched comparison and GCMCA groups.

Source and Size of GCMCA and Comparison Groups

Within the analysis, the Evaluation Team had originally envisioned that there would be two GCMCA groups – Welding Associate Degree and Welding Certificate. Students in both of these groups were to enter their welding program of choice at CSTCC through the institution's Pathways to Employment Center (PTEC).[82] In the PTEC model, participants would come through the PTEC center for inquiry and enrollment services. Students could take a career exploration assessment, earn a National Career Readiness Certificate, and/or work with the recruiter/advisor to go through the application/enrollment process (e.g. admissions, financial aid assistance, enrollment, program choice). After coming through PTEC, all students entering CSTCC were originally required to take a COMPASS placement test to determine their math and English placement levels.[83] The first GCMCA group were participants going into the Welding Associate Degree program – a two-year, 65 credit hour program. Estimates for Welding Associate Degree GCMCA program students included: 10 in Fall 2014, 20 in Fall 2015, and 20 in Fall 2016. The second GCMCA group were participants in the Welding Certificate – a 31 credit hour program. Estimates for Welding Certificate students included: 5 in Fall 2014, 10 in Fall 2015, and 15 in Fall 2016.

The Evaluation Team envisioned that the comparison group matched to the Welding Associate Degree program would be formed from three Center for Innovative Technologies (CIT) programs – Aviation Mechanics Airframe (AVAC), Avionics (AVONC), and Aviation Mechanics Powerplant (AVPC) – and one Business Technologies Division (BTD) program – Automotive Service Management. The programs contained similar credit hour requirements and include technical learning components similar to those that were utilized by the Welding Associate Degree. Specifically, the Welding Associate Degree required 65 credit hours, the Automotive Service Management required 71 credit hours, and the Aviation Maintenance Certificates required 58, 67, or 71, depending on the chosen program. This comparison group (comprised of Automotive Service Management and Aviation Mechanics Certificates (AVAC, AVONC, and AVPC) students) would include students who began in Fall 2013, Fall 2014, and Fall 2015 – with indicator variables being used to designate cohort start time.

The comparison group matched to the Welding Certificate program was originally formed by students within the Business Technologies Division (BTD). Specifically, the Welding Certificate comparison group included students within the Automotive Services Technician Certificate because of the similar credit hour match (Automotive Services Technician Certificate required 27 credit hours) within the technology field. The Welding Certificate comparison group would be comprised of students who began in Fall 2013, Fall 2014, Fall 2015, and Fall 2016.

Outcomes for Comparison and Analysis

TPMA planned to conduct a quasi-experimental impact analysis focusing on two primary outcomes for GCMCA welding participants – persistence and completion. Persistence was defined as continuous enrollment from term to term (e.g. Fall 2013 – Spring 2014). Completion was defined as DOL indicates -

[82] Note that not all grant participants entered through PTEC as students could also enter through the college's main enrollment services group.
[83] Note that the college switched from COMPASS to Accuplacer during the implementation period. Not all students were required to take Accuplacer testing.

completing all the credit hours for the credential. Using persistence and completion as dependent variables, a regression analysis was planned for Welding Associate Degree students and Welding Certificate students. Concerning regression equations and modeling, the Evaluation Team planned to wait until Program Year 4 to determine the precise model, allowing TPMA to engage in model fitting (and evaluate covariate differences between GCMCA and controls) to determine what covariates need to be included, best regression fit, sample size restrictions, etc.

Research Question 3

Each quarter, the Evaluation Team planned to verify program outcome calculations by reviewing data provided by GCMCA staff and independently calculating program outcome totals. This was to be an independent calculation and validation of the USDOL required reporting measures and to also serve as a "reality check" for the impact analysis grant participant group size (i.e. GCMCA group) estimates.

Rationale for Revised Approach

During the evaluation period, the Evaluation Team decided to refine the evaluation approach and research questions. This decision was made after communicating with GCMCA staff and after careful consideration of the grant programs' progress and assessing the data available for analysis. The following includes a rationale for why the change in approach.

Research Questions #1 and #2

Selecting Grant Programs

Because of changing enrollment patterns, the Evaluation Team identified that the original design for GCMCA and comparison groups was not feasible. These enrollment patterns included (1) difficulty separating students in Welding Certificate and Welding Associate Degree programs, and (2) increased enrollment in short-term training programs. Initially, there were two GCMCA subgroups—those in the Welding Associate Degree program and those in the Welding Certificate program. During GCMCA implementation, the Evaluation Team learned that no students enrolled in the Welding Certificate program because financial aid was not available at the time, so some students in the Welding Associate Degree program enrolled in that program for financial aid, but planned to graduate with a Welding Certificate. Thus, all students in the study were categorized as Welding students, not Welding Certificate or Welding Associate's Degree.

Additionally, GCMCA funds went to the Mechanical Engineering Technology (MET) Manufacturing and Design Degree programs, which were already in place before this grant. Through GCMCA, these students had access to PTEC services, as well as improved technology in the classroom. The addition of this funding created a unique context to compare how programs might benefit before and after funding. Additionally, a sizeable number of students enrolled in this program before and after funding, so there was enough statistical power to perform more advanced statistical analysis.[84]

Finally, a substantial number of students enrolled in short-term training rather than longer academic programs. This number was much greater than originally anticipated, and the completion results for these students could provide important information for GCMCA staff. However, since the training was so

[84] Some of the shorter-term training programs had sizeable enrollment numbers. However, since they had shorter timeframes, the Evaluation Team could not study them over time.

short, the best way to look at these results was descriptively and not through statistical inference (see revised Research Question #3 in the section that follows).

Because of these changes, the Evaluation Team still used the Welding Associate Degree participants as the GCMCA Welding group, but could not separately examine students enrolled in the Welding Certificate program, since there were no students in the data identified as enrolling in the Welding Certificate program. Instead of the Welding Certificate group, the Evaluation Team compared outcomes for the Mechanical Engineering Technology (MET) group, to understand how GCMCA resources might have helped improve outcomes for the program. These two GCMCA groups were selected because reasonable comparison groups were identified, which allowed the Evaluation Team to still examine outcomes for GCMCA and comparison groups. Furthermore, these groups had enough participants that adequate statistical power could be achieved. As a result, the Evaluation Team still conducted the advanced analyses as originally planned, but examining slightly different GCMCA and comparison groups. Finally, the Evaluation Team descriptively examined results for students enrolled in short-term training programs.

Selecting a Comparison Group

After receiving the first round of data on grant participants and students from possible comparison groups, the Evaluation Team proceeded to narrow this focus on programs that were suitable matches to those in the Welding Associate Degree program. The Evaluation Team examined the similarities and differences between students pursuing a Welding Associate Degree and students enrolled in three other majors that were considered possible comparison groups (i.e., Aviation Mechanics Airframe, Avionics, Aviation Mechanics Powerplant, and Automotive Service Management). The goal was to find a comparison group that was a better match to the Welding Associate Degree group in terms of credit hours, content, and inclusion of the gateway course, Math 121.

Refocusing the Outcomes

During the course of grant implementation, the Evaluation Team also learned that GCMCA participants were not completing certification (certificates and degrees) as quickly as program staff had originally intended, due to forces outside of their control (e.g., family and work engagements for the students). For example, there were fewer completers in the Welding Associate Degree than anticipated by Project Year 4, so original persistence and completion analyses were not feasible. Also, not all students were continuously enrolled from one semester to the next, though they did persist and eventually complete. Thus, there were not enough completions to meaningfully compare groups, and persistence patterns were completely linear.

Research Question #3

When the evaluation plan was first written, CSTCC was compiling data from across a variety of data sources for USDOL-required reporting. During grant implementation, CSTCC implemented a central data system called CState CareerLink, which allowed the college to more easily pull data for the TAACCCT outcomes. The Evaluation Team discussed Research Question #3 and the verification of TAACCCT outcomes with CSTCC in light of this new data system. Collectively, the decision was made that the Evaluation Team would focus on additional data collection approaches, like employer interviews (which were not originally a part of the evaluation design) and the possibilities of exploring different analysis approaches rather than confirming CSTCC data reporting. As a result, Research Question #3 shifted to reflect a descriptive analysis of the short-term training grant participants. Because these trainings were

not as long as some of the other programs (e.g., Welding Associate's Degree), it was logical to focus on completion rather than persistence.

Revised Approach

For the above reasons, the Evaluation Team altered the evaluation design. This study used a comparison design for two of the research questions, but refocused on multiple GCMCA programs (instead of just Welding), as well as on multiple measures of persistence as the main outcomes of interest. Additionally, the Evaluation Team included the outcomes for additional GCMCA-impacted programs that benefitted from the TAACCCT R3 funding. This revised approach is described in detail in *Appendix B: Impact and Outcomes Evaluation Methods*.

Appendix B: Impact and Outcomes Evaluation Methods

This study used a quasi-experimental design (QED) for Research Questions #1 and #2. For these questions, the QEDs focused on students from two GCMCA programs and their counterparts. Research Questions #1 and #2 also included multiple measures of persistence as the main outcomes of interest.

For Research Question #3, the Evaluation Team examined the outcomes for WDC GCMCA-impacted programs that benefitted from the TAACCCT R3 funding. These programs focused on short-term credentials and include:

- Machine Operator I (MO I) Certification
- Machine Operator II (MO II) Certification
- Apprenticeship Program (MO I + MO II)
- Manufacturing Skill Standards Council (MSSC) Certification

Research Questions

Table B1 summarizes the three research questions examined through the Impact and Outcomes Evaluation, including the relevant data sources and analysis methods used to answer these research questions. Further details on data sources and collection plans, analysis methods, and potential limitations of the Impact and Outcomes Evaluation are described in subsequent sections.

Table B1: Impact and Outcomes Evaluation Research Questions

Research Questions	Data Sources	Research Design	Analysis Approaches
1. How do persistence and completion rates of students participating in GCMCA's Welding Associate Degree program compare to those who are going through the Aviation Mechanics Airframe (AVAC), and Aviation Mechanics Powerplant (AVPC) programs at CSTCC?	• Administrative data from Colleague Student Information System; CState CareerLink Service Record; GCMCA Intake Form	• Quasi-experimental	• Descriptive analysis • Propensity score matching • χ^2 tests • Logistic regression
2. How do persistence and completion rates of students participating in GCMCA's Mechanical Engineering Technology (MET) Manufacturing and Design programs compare to students in the MET Manufacturing and Design programs before grant funding occurred?	• Administrative data from Colleague Student Information System; CState CareerLink Service Record; GCMCA Intake Form	• Quasi-experimental	• Descriptive analysis • Propensity score matching • χ^2 tests • Logistic regression
3. What are the completion rates of students participating in WDC GCMCA grant programs? These include MSSC, MO I, MO II, and Apprenticeships.	• Administrative data from Colleague Student Information System; CState CareerLink Service Record; GCMCA Intake Form	• Outcomes	• Descriptive analysis

Data Sources & Collection

Data used for the analyses came from existing administrative data available through CSTCC's Student Information System (Colleague, CState CareeerLink Service Record) or collected through CSTCC's data intake form.

45 of the 360 students (12.5%) in the GCMCA program did not sign a consent form to participate in the study. Of these 45 students, 22 (48.9%) completed their intake form during the Fall 2015 term. 10 of these 22 students (45.5%) were enrolled in the MOI program.

There were 12 students who were enrolled in both the GCMCA programs and relevant comparison programs.[85] After examining the coursework, dates of enrollment, and majors, 9 students were removed from the dataset to mitigate any crossover effects. Most of this student data was relevant for Study 2, (see below), where MET students were compared before and after GCMCA funding. The students who were removed were enrolled in the MET program before GCMCA funding and continued to be enrolled after funding. Because the Evaluation Team could not determine if these students were technically part of the GCMCA MET or comparison group, they were taken out.

GCMCA and Comparison Groups (Research Questions #1 and #2)

To answer Research Question #1, the first study (Study 1) compared participants in the Welding Associate Degree program to two other groups who were taking courses at the same time as the Welding Associate Degree students, so this study included a concurrent timeframe. To answer Research Question #2, the second study (Study 2) compared participants in the MET program before and after GCMCA funding, so this study included a retrospective timeframe.

After examining student enrollment in the programs, researching the curricula for different programs, and thoughtful deliberation, the Evaluation Team chose the following groups for the comparison design:

Study 1: Concurrent Timeframe: The Evaluation Team explored possible comparison groups for the Welding Associate Degree program using more technically-focused programs offered at CSTCC with similar credit hour requirements as the Welding Associate Degree program, and who also took a critical gateway course, Math 121 (Technical Algebra and Geometry with Statistics).[86] After examining the similarities and differences among the programs, the Evaluation Team decided to use two Center for Innovative Technologies (CIT) programs – Aviation Mechanics Airframe (AVAC) and Aviation Mechanics Powerplant (AVPC). These two programs have similar credit hour requirements to the Welding program, and students are required to take Math 121.

Study 2: Retrospective Timeframe: This study compared two groups of students enrolled in the MET program. This comparison group design included students enrolled in the MET program *before* the

[85] Before the final comparison groups were determined, CSTCC was asked to pull comparison group data for five different groups (outside of the MET group for Study 2): Aviation Mechanics Airframe, Avionics, Aviation Mechanics Powerplant, Automotive Service Technician Certificate and Automotive Service Management. Only two of these groups were chosen for the first study where the participant group was welding students (Aviation Mechanics Airframe and Aviation Mechanics Powerplant). The comparison majors chosen had taken a similar number of courses with similar types of coursework. Furthermore, they took the gateway course of Math 121.

[86] Programs explored for the Welding Associate's Degree program included: three Center for Innovative Technologies (CIT) programs – Aviation Mechanics Airframe (AVAC), Avionics (AVONC) and Aviation Mechanics Powerplant (AVPC) – and one Business Technologies Division (BTD) program – Automotive Service Management.

GCMCA initiative was implemented and *after* the GCMCA initiative was implemented.[87] A retrospective comparison group design allowed for exploration into CSTCC's MET students prior to grant program changes, with CSTCC MET students who have taken at least one grant-funded course.

Students in the MET program can earn a CNC certificate in addition to their associate degree. 28 students enrolled in the CNC certificate program exclusively without intending to enroll in the MET program. These students enrolled after GCMCA funding was put into place, so the students were technically part of the GCMCA group. Since the students were not enrolled in the same program as MET students, their outcomes were examined descriptively.

GCMCA WDC Group Only (Research Question #3)

For this outcomes-focused study, data from students enrolled in the short-term credential programs was used. These programs were offered through the Workforce Development Center (WDC). These include MSSC, MO I, MO II, and Apprenticeships (MOI and MO II were a proxy for the Apprenticeship program).

Analysis Methods

Measurements

Outcomes

Because the majority of GCMCA participants have not completed their certification, the main outcomes for this study centered around different facets of persistence, rather than completion. Indeed, persistence is an area of major focus for stakeholders in higher education,[88] and student enrollment patterns are quite variable. Scholars argue that studies should include a number of indicators to accurately measure student progress.[89] This is especially true in two-year institutions, which have more non-traditional students who might face unique challenges. To address this and to help inform the GCMCA initiative, the Evaluation Team measured the outcome of persistence a number of ways:

(1) Persist to completion (defined by an end date when they earned a degree/certificate)
(2) Consecutive persistence (no end date but continue to be enrolled)
(3) Persist during traditional school year (no summer enrollment)
(4) Enroll-leave-enroll and persist (i.e. stop out)
(5) Not persisting (i.e. drop out)

These five different persistence categories were mutually exclusive for the study. This means that students who were categorized in one persistence group were not part of another group. For example, students who were coded as persisting consecutively were not categorized as persisting during the traditional school year.

[87] The primary differences between the two MET groups is that the GCMCA group had access to PTEC's supportive services and new technology for instruction and learning (and subsequent curriculum adjustments to align with the new technology).
[88] Tinto, V. (2006). Research and practice of student retention: What next? *Journal of College Student Retention, 8*(1), 1-19.
[89] Hagedorn, L. S. (2005). How to define retention: A new look at an old problem. In A. Seidman (Ed.), *College student retention* (pp. 89-105). Westport: Praeger Publishers.

COVARIATES

Covariates are variables that are not related to the primary quasi-experimental manipulation but may have an effect on the outcome measure. These can include sex, age, race and any other demographic or academic data elements that may be included in the dataset and were measured at baseline. The following table shows the covariates included in the statistical analysis. Because several of the variables were only included for the GCMCA group,[90] the number of variables for the QED studies (Studies 1 and 2) was limited.

Table B2: Coding of Covariates

Variable	Categories and Coding	Range
Female	Female=1; Male=0 Unknown=Missing	0 .0 - 1.0
White	White=1; All other races=0 Unknown=Missing	0.0 – 1.0
Age at Intake	N/A	17.3 – 68.7
COMPASS English/Language Arts (ELA)	COMPASS Writing • Accuplacer Sentence Skills • ACT English[a] • COMPASS Writing COMPASS Reading • Accuplacer Reading • ACT Reading • COMPASS Reading COMPASS English [a] • COMPASS English	25.5 – 99.0
COMPASS Math	COMPASS Math Domain 1 • Accuplacer Arithmetic • ACT Math (to a certain cut score) • COMPASS Math Domain 1 • COMPASS Pre-Algebra COMPASS Math Domain 2 • Accuplacer Elementary Algebra • ACT Math (to a certain cut score) • COMPASS Math Domain 2 • COMPASS Algebra COMPASS Math Domain 3 • COMPASS Math Domain 3 • COMPASS College Algebra COMPASS Advanced Math • COMPASS Geometry • COMPASS Trigonometry	20.0 - 376.00[b]

Note. If more than one test score is recorded, the mean was used (Max was not available as an option in the software program). This was relevant for 35 students (GCMCA group) and 40+ students (comparison group).
[a] The crosswalk did not include COMPASS English but did have conversions between ACT English scores and COMPASS Writing scores. Since all of these scores were going to be combined into a composite measure, we did not see any issues with using this conversion between ACT English and COMPASS Writing Scores.
[b] Range includes weighted scores. As shown in the frequency tables in the body of the report, not many students scored as high as the maximum. The median for COMPASS Math (weighted) was 70.00; the median for COMPASS ELA (not weighted) is 87.5.

[90] These include ethnicity, employed at intake and highest education level at time of intake.

A crosswalk[91] was used that had conversions between ACT and Accuplacer scores to COMPASS scores. This was chosen over other types of documents (such as cut score sheets from CSTCC or Ohio Board of Regents) because the Evaluation Team wanted to keep the scores continuous. The other crosswalks only had cut-off scores, rather than discrete conversions between the scores, which would have limited how the scores were translated. Keeping these scores as continuous, rather than categorical or ordinal, increased the precision of the results.

Before collapsing the scores into two composite variables of ELA COMPASS Scores and Math COMPASS Scores, they were weighted to account for those who took more advanced placement tests (e.g. Trigonometry). Scores from Math Domain 1 (Pre-Algebra) were weighted with a "1." Scores from Math Domain 2 (Algebra) were weighted with a "2." Scores from Math Domain 3 (College Algebra) were weighted with a "3." Scores from Trigonometry and Geometry placement tests were weighted with a "4." Scores from COMPASS Reading, Writing, and English tests were not weighted because none of the courses were more advanced than another; they were simply different. As the last step, the mean score from each Reading, Writing, and English test that students took was combined into a variable called COMPASS ELA. The mean score from each math placement test that students took was combined into a variable called COMPASS Math.

Statistical Analysis

Research Questions #1 & #2

The first two research questions focused on persistence and completion for grant participants in the Welding Associate Degree program and for the Mechanical Engineering Technology (MET) Manufacturing and Design program. Propensity score matching with chi-square (χ^2) tests and logistic regression analyses were used to answer these questions. Descriptive analyses were used to answer the third research question. R[92] was used for all statistical analyses.

Propensity Score Matching

There were two groups for propensity score matching: a GCMCA group (those participating in the program) and a comparison group (those not participating in the program). Through propensity score matching, comparison groups were structured to identify matches who appear to be comparable to participants in terms of observable covariates. The fundamental goal of these types of matching methods is to estimate the change in treatment effect between treated and comparison groups in which the distribution of covariates in the comparison group is as similar as possible to the distribution in the treated group.

Based on sample sizes, the Evaluation Team used a 1:1 propensity score match. To determine the importance of matching variables, the Evaluation Team compared the descriptive results for both the GCMCA and comparison groups to determine how similar they were. After this step, further statistical and visual analyses were performed to substantiate these conclusions and to determine the extent to which they could be matched. After the propensity score matching was completed, the Evaluation Team

[91] Ellis, S.F. (n.d.). *Correlation between Various Placement Instruments for Reading Language/Writing, Mathematics, Elementary Algebra.* Retrieved from https://wvde.state.wv.us/abe/documents/CorrelationBetweenVariousPlacementInstruments.pdf

[92] R Core Team (2017). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. Retrieved from http://www.R-project.org/.

analyzed the groups to determine comparability between the matched comparison and GCMCA groups. For both Studies 1 and 2, the groups were similar enough that matches were efficiently made.

The program used for propensity score matching required that datasets be complete with no missing data. As a result, imputation was used.[93] The decision to impute data should be considered carefully, as there are many implications of this process. After comparing groups on their relevant characteristics, the Evaluation Team performed tests of missing completely at random (MCAR) versus not missing at random (NMAR). MCAR is preferred, since NMAR could indicate systematic reasons as to why certain students had missing data. The Evaluation Team also conducted sensitivity tests to compare the results for imputed vs. not imputed data to see if the results would change substantially. There were no major changes in terms of statistical significance or standard errors. The evidence from these tests suggests that imputation could be performed.

Chi-Square Tests

Two-by-two chi-square tests (χ^2) were performed to compare the frequency of the different persistence variables between the GCMCA and comparison group and to test if group membership and the various persistence variables were related (i.e. not independent). Chi-square tests were useful exploratory analyses to examine if there was a significant relationship between group membership (i.e. GCMCA or comparison group) and the five persistence outcomes. Effect sizes (ϕ) were also computed, which helped substantiate any statistically significant results. Effect sizes were useful for understanding if the statistically significant results were practically relevant. They also served as an additional safeguard to fallacious *p*-values insofar as they are indifferent to significances that may result from sample size.

Logistic Regression Analysis

Logistic regression analyses were performed to analyze whether significant differences in the likelihood for different types of persistence occur by group membership (i.e. GCMCA vs. comparison), gender, race, ELA COMPASS scores, and Math COMPASS scores, when all the other independent variables are controlled. Logistic regression permits the researcher to predict a discrete binary outcome from a set of variables that may be discrete, dichotomous, continuous.[94] Effect sizes (odds ratios) were also computed, which helped substantiate any statistically significant results.

The Evaluation Team engaged in model fitting through sensitivity tests to determine what covariates should be included in the model, best model fit, sample size restrictions, etc. These were also done to ensure that substantial multicollinearity or other issues common in regression analyses did not occur. Preliminary analyses also investigated whether possible interactions should be included. As might be expected, most of these did not substantially improve model fit due to the typical low power interaction effects. These exploratory tests were also used to check if the addition/deletion of variables might improve model fit, if some of the variables had had high standard errors. Pseudo R^2s (Cox & Snell R^2) were also computed, which helped inform decisions about model fit.

[93] The comparison group in Study 2 also had a large amount of missing data in COMPASS ELA and Math scores. About a third of students did not have placement scores recorded. Grant staff were not entirely sure why this occurred.
[94] Tabachnik, B.G., & Fidell, L.S. (2013). *Using Multivariate Statistics* (6th ed.). Boston, MA: Pearson.

The general model for the study was:

$$\text{Logit}(P) = \beta 0 + \beta_1(\text{Female}_i) + \beta_{2j}(\text{White}_i) + \beta_{3j}(\text{Age}_i) + \beta_{4j}(\text{COMPASSELA}_i) + \beta_{5j}(\text{COMPASSMath}_i)$$

where:

- Logit(P) is the log odds (i.e., logit) of P, which is the probability of persistence (as defined above through one of the five different persistence outcomes), and given the values of the constant and covariates in the model.
- $\beta 0$ is the constant (i.e., intercept) in the model
- $\beta_1(\text{Female}_i)$, $\beta_2(\text{White}_i)$, $\beta_3(\text{Age}_i)$, $\beta_4(\text{COMPASSELA}_i)$ and $\beta_5(\text{COMPASSMath}_i)$ are the covariates in the model[95]

Research Question #3

For Research Question #3, the Evaluation Team focused on frequencies and percentages, as these would provide useful information about student outcomes for these short-term programs. Descriptive data was disaggregated as appropriate, including disaggregations by race, age, etc. These results allowed for further examination of persistence for different groups. Though the focus of Study 3 was on descriptive findings, frequencies and percentages were also calculated for the groups in Studies 1 and 2 to provide context for the statistical results.

These different analyses and matching procedures were conducted by the TPMA Evaluation Team and verified independently by our Statistical Advisor at the Indiana Statistical Consulting Center.

Limitations

Limitations for the Impact and Outcome Evaluation included the following:

Claims of Causality – Though QEDs are rigorous, they still have limitations. Because the Evaluation Team could not isolate all of the effects of the grant program through the QED, we *cannot make claims* that the GCMCA program *alone* contributed to the persistence outcomes.[96] Though we have attempted to mitigate effects of other variables, such as academic achievement (measured through COMPASS placement scores), these alone might not explain why the GCMCA and comparison groups performed differently.

Omitted Variable Bias – Related to claims of causality, not all variables that might have accounted for variance in the model could be included due to availability of the data. These variables might have helped explain the outcomes. One such variable was a measurement for time. The Evaluation Team did have access to a variety of time-dependent variables, such as the terms in which students were enrolled. However, this information was used to create the persistence variables. Thus, including a

[95] For one of the logistic regression analyses in Study 2 (persist through traditional school year), female was not used because it distorted the results.

[96] Gertler, P.J., Martinez, S. Premand, P., Rawlings, L.B. & Vermeersch,, C.M.J. (2011). *Impact Evaluation in Practice.* Washington DC: The International Bank for Reconstruction and Development/The World Bank.

time variable in the model would have resulted in multicollinearity, since these time variables would be highly correlated with the various persistence variables. However, having some sort of time variable might have helped explain some of the effects in Study 2, especially since this was a retrospective study. As the results have shown, students in the comparison group had more time to complete their credentials (or decide to drop out), whereas students in the GCMCA group had a shorter amount of time to complete (or drop out).

Selection Bias – Selection bias is common in any form of design that does not involve random sampling or random assignment. Selection bias in the self-selection process would distort inferences to the larger population.[97] Any time an evaluator does not randomly assign individuals, one runs the risk of systematic differences between groups due to selection bias. This is a limitation of our design that we acknowledge. Thus, the Evaluation Team can only make inferences from this sample to the larger population of people that would have similar demographics, experiences, skills, and motivations to the participants in this study. Some of these differences include program participants who have already participated in another training program, or have more perseverance and determination to find meaningful work (and thus are willing to engage in self-paced adaptive learning – a curriculum component available within the Welding program). In addition, TPMA recognizes that challenges with the implementation timeframe or data collection processes may indeed limit the sample sizes.

Additionally, these findings and interpretations can only be applied to those in the GCMCA group who signed consent forms. Though 87.5% of the GCMCA group signed these forms, there might have been systematic differences between the two groups. As noted earlier, almost half of the students (48.9%) who did not participate in the study signed their intake forms during the Fall 2015 term, and 45.5% of these students were enrolled in the MO1 program.

Selection of Statistical Models – Each model comes with its own limitations, and it must be explicitly understood that any statistical model chosen is an approximation of reality. The Evaluation Team strongly encourages exercising caution when drawing conclusions from the results of statistical analyses. Precise limitations may vary by study, design, and method, but general advice for interpreting statistical results is that the results should only be seen as evidence toward the existence of a particular phenomenon, and should not be concluded to be factual. Rather, these findings should be seen as probabilistic under the modeling assumptions. Moreover, the quality of the evidence supporting statistical hypotheses mirrors that that of the design, data collection, data caliber, and data analysis. Finally, omitted variables may also inadvertently contribute to limited statistical results. For example, failing to account for items such as participant age may potentially allow characteristics correlated with age to appear statistically significant when in fact they are not. This is known as omitted variable bias (described above). As such, the Evaluation Team took care in planning, clarity, communication, diligence, and care for data collection in order to maximize the internal validity of the study. Furthermore, sensitivity tests in the model development process were used so that we could find the best probable model, given the data that we had.

Sample Size/Statistical Power – As noted earlier in the report, implementation progress was somewhat slow for some of the GCMCA-impacted programs such as Welding, (see *Initiative Start-Up*

[97] Ibid

Time). As a result, enrollment (and completion numbers) was not as high as might be projected. Because the Welding program had lower sample sizes (and no completers), the statistical power for the tests was compromised. This occurred in Study 1 for the persistence to completion outcome. Because no welding students in this study completed their credentials, then the logistic regression analyses could not be performed.

DATA AVAILABILITY – The Evaluation Team relied on program staff for primary and/or secondary data collection. While the data used for the analyses came from existing administrative data available through CSTCC's Student Information System (Colleague, CState CareeerLink Service Record), or collected through CSTCC's data intake form, some inconsistencies in data tracking between various systems was observed. For example, in the Colleague system there was no Start Term field reported for programs of study. Instead, the values lined up with the first date of students' start at CSTCC, which indicates that there is no way to determine when each student declared their major. As a result, the Evaluation Team could not accurately calculate how long the student spent in their program of study, if the student changed majors.

APPENDIX C: DESCRIPTIVE & STATISTICAL RESULTS

STUDY 1 | WELDING ASSOCIATE DEGREE

DESCRIPTIVE RESULTS

BACKGROUND CHARACTERISTICS

Table C1: Student Characteristics by Group Membership (N=110)

	Total Count		GCMCA Welding Group		Comparison Group	
	N	%	N	%	N	%
Total Enrollment	110	-	51	-	59	-
Gender						
Male	91	82.7	40	78.4	51	86.4
Female	12	10.9	7	13.7	5	8.5
Unknown	7	3.6	4	7.8	3	5.1
Race						
American Indian/Alaskan Native	0	0.0	0	0.0	0	0.0
Asian	3	2.7	2	3.9	1	1.7
Black	20	18.2	4	7.8	16	27.1
White	77	70.0	39	76.5	38	64.4
More than one race	0	0.0	0	0.0	0	0.0
Race unknown	10	9.1	6	11.8	4	6.8
Age at Intake						
Less than 21	35	31.8	21	41.2	14	23.7
22-30	47	42.7	17	33.3	30	50.8
31-40	15	13.6	6	11.8	9	15.3
41-50	9	8.2	7	13.7	2	3.4
51 or older	4	3.6	0	0.0	4	6.8
COMPASS English/Language Arts Score						
Less than 60	31	28.2	13	25.5	18	30.5
61-70	10	9.1	5	9.8	5	8.5
71-80	12	10.9	6	11.8	6	10.2
81-90	15	13.6	7	13.7	8	13.6
91 or higher	33	30.0	12	23.5	21	35.6
Missing	9	8.2	8	15.7	1	1.7
COMPASS Math Score [a]						
Less than 60	62	56.4	36	70.6	26	44.1
61-70	11	10.0	6	11.8	5	8.5
71-80	3	2.7	2	3.9	1	1.7
81-90	5	4.5	1	2.0	4	6.8
91 or higher	20	18.2	13	25.5	7	11.9
Missing	9	8.2	1	2.0	8	13.6

[a] COMPASS Math scores were weighted, but this did not affect the distribution of scores by a substantial amount.

PTEC Services Used

Table C2: PTEC Services Used: Welding Group Only (N=51)

	GCMCA Welding Group	
	N	%
Total Enrollment	51	-
PTEC Services Used-Recruitment & Enrollment		
None	19	37.3
1	9	17.6
2 or more	23	45.1
PTEC Services Used-Retention		
None	13	25.5
1	6	11.8
2 or more	32	62.7
PTEC Services-Completion		
None	50	98.0
1	0	0.0
2 or more	1	2.0

Note. Frequency of PTEC services were grouped into three categories. These were reported descriptively and not used in any of the statistical analyses. PTEC services include Recruitment/Enrollment, Retention and Completion. Recruitment/Enrollment services include: (a) applicant discussion; (b) class visit outreach; (c) financial aid assistance; (d) NCRC WorkKeys assessments, and (e) prior learning assessments. Retention services include: (a) academic advising; (b) academic foundations-math; (c) adaptive learning, and (d) tutoring. Completion services include: (a) career advising; (b) mock interview; (c) professionalism, and (d) resume writing.

Persistence and Completion

Table C3: Persistence and Completion by Group Membership (N=110)

	Total Count		GCMCA Welding Group		Comparison Group	
	N	%	N	%	N	%
Total Enrollment	110	-	51	-	59	-
Persistence/Completion						
Persist to completion (Earned credential)	10	9.1	0	0.0	10	16.9
Consecutive persistence	35	31.8	19	37.3	16	27.1
Persistence through traditional academic year	7	6.4	4	7.8	3	5.1
Stop out	8	7.3	5	9.8	3	5.1
Not persisting (drop out)	49	45.5	22	45.1	27	45.8

STATISTICAL RESULTS

Table C4: Cross Tabulations of Group Membership and Types of Persistence (N=102)

	Group Membership		χ^2	ϕ (Effect Size)
	GCMCA Welding	Comparison		
Persistence to completion				
Yes	0 (0.0%) [a]	7 (13.7%)	7.52*	0.27
No	51 (100.0%)	44 (86.3%)		
Consecutive persistence				
Yes	19 (37.3%)	14 (31.8%)	0.31	0.06
No	32 (62.7%)	30 (68.2%)		
Persistence through traditional academic year				
Yes	4 (7.8%)	1 (2.3%) [b]	1.47	0.12
No	47 (92.2%)	43 (97.7%)		
Stop out				
Yes	5 (9.8%)	3 (6.8%)	0.27	0.05
No	46 (90.2%)	41 (93.2%)		
Not persisting (drop out)				
Yes	23 (45.1%)	26 (59.1%)	1.82	0.14
No	28 (54.9%)	18 (40.9%)		

Note. Students who graduated are only included in the persistence to completion variable, not the other persistence variables. Effect size: Small=0.10; Medium=0.30; Large=0.50[98]

*p<.05

[a] Because there were no Welding completers, the assumptions of the chi-square test are not met.

[b] Because there was only one student in the comparison group who persisted through the traditional academic year, the assumptions of the chi-square test are not met.

Table C5: Summary of Logistic Regression Analysis for Variables Predicting Not Persisting (Dropping Out), Controlling for Selected Variables (N=102)

Predictor	*B*	*SE B*	*Odds Ratio*
1. Group Membership [a]	-0.85	0.48	0.48
2. Female [b]	-0.22	0.78	0.85
3. White [c]	-1.07	0.66	0.32
4. Age at Intake	0.08	0.03	1.08*
5. ELA COMPASS Test	-0.01	0.01	1.01
6. Math COMPASS Test	-0.01	0.01	0.99
Constant	0.11	1.10	0.46
χ^2	33.50*		
Difference in degrees of freedom	6		
Cox & Snell R^2	0.32		

Note. Odds ratio represents change per each unit of increase in the independent variable.

a Group Membership: 1=GCMCA, 0= Comparison; b Female: 1=Female; Male=0; c White: 1=White, 0= All other races.

*p<.05.

[98] Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed) . Hillsdale. NJ: Lawrence Earlbaum Associates, 2.

STUDY 2 | MECHANICAL ENGINEERING TECHNOLOGY

DESCRIPTIVE RESULTS

BACKGROUND CHARACTERISTICS

Table C6: Student Characteristics by Group Membership (N=315)

	Total Count		GCMCA MET Group		Comparison Group	
	N	%	N	%	N	%
Total Enrollment	315	-	122	-	193	-
Gender						
Male	281	89.2	111	91.0	170	88.1
Female	21	6.7	7	5.7	14	7.3
Unknown	13	4.1	4	3.3	9	4.7
Race						
American Indian/ Alaskan Native	2	0.6	0	0.0	2	1.0
Asian	8	2.5	5	4.1	3	1.6
Black	50	15.9	12	9.8	38	19.7
White	224	71.1	93	76.2	131	67.9
More than one race	4	1.3	4	3.3	0	0.0
Race unknown	27	8.6	8	6.6	19	9.8
Age at Intake						
Less than 21	126	40.0	45	36.9	81	42.0
22-30	124	39.4	49	40.2	75	38.9
31-40	46	14.6	23	18.9	23	11.9
41-50	10	3.2	2	1.6	8	4.1
51 or older	9	2.9	3	2.5	6	3.1
COMPASS English/Language Arts Score						
Less than 60	8	2.5	4	3.3	4	2.1
61-70	9	2.9	7	5.7	2	1.0
71-80	18	5.7	13	10.7	5	2.6
81-90	39	12.4	23	18.9	16	8.3
91 or higher	83	26.3	58	47.5	25	13.0
Missing	158	50.2	17	13.9	141	73.1
COMPASS Math Score [a]						
Less than 60	41	13.0	23	18.9	18	9.3
61-70	13	4.1	9	7.4	4	2.1
71-80	9	2.9	4	3.3	5	2.6
81-90	10	3.2	7	5.7	3	1.6
91 or higher	85	27.0	63	51.6	22	11.4
Missing	157	49.8	16	13.1	141	73.1

Note. 7 students had CNC majors as well, so they were included in Study 3.

[a] COMPASS Math scores were weighted, but this did not affect the distribution of scores by a substantial amount.

PTEC Services Used

Table C7: PTEC Services Used (N=122)

	GCMCA MET Group	
	N	%
Total Enrollment	122	-
PTEC Services Used-Recruitment & Enrollment		
None	54	44.3
1	51	41.8
2 or more	17	13.9
PTEC Services Used-Retention		
None	90	73.8
1	28	23.0
2 or more	4	3.3
PTEC Services-Completion		
None	120	98.4
1	1	0.8
2 or more	1	0.8

Note. Frequency of PTEC services were grouped into three categories. These were reported descriptively and not used in any of the statistical analyses. PTEC services include Recruitment/Enrollment, Retention and Completion. Recruitment/Enrollment services include: (a) applicant discussion; (b) class visit outreach; (c) financial aid assistance; (d) NCRC Work Keys assessments, and (e) prior learning assessments. Retention services include: (a) academic advising; (b) academic foundations-math; (c) adaptive learning, and (d) tutoring. Completion services include: (a) career advising; (b) mock interview; (c) professionalism, and (d) resume writing.

Persistence and Completion

Table C8: Persistence and Completion by Group Membership (N=315)

	Total Count		GCMCA MET Group		Comparison Group	
	N	%	N	%	N	%
Total Enrollment	315	-	122	-	193	-
Persistence/Completion						
Persist to completion (Earned credential)	54	17.1	8	6.6	46	23.8
Consecutive persistence	49	15.6	49	40.2	0	0.0
Persistence through traditional academic year	25	7.9	17	13.9	8	4.1
Stop out	32	10.2	18	14.8	14	7.3
Not persisting (drop out)	155	49.2	30	24.6	125	64.8

STATISTICAL RESULTS

Table C9: Cross Tabulations of Group Membership and Types of Persistence (N=244)

	Group Membership		χ^2	ϕ (Effect Size)
	GCMCA MET	Comparison		
Persistence to completion				
Yes	8 (6.6%)	31 (25.4%)	16.15*	0.26
No	114 (93.4%)	91 (74.6%)		
Consecutive persistence				
Yes	49 (43.0%)	0 (0.0%) [a]	54.40*	0.50
No	65 (57.0%)	91 (100.0%)		
Persistence through traditional academic year				
Yes	17 (14.9%)	5 (5.5%)	4.69*	0.15
No	97 (85.1%)	86 (94.5%)		
Stop out				
Yes	18 (15.8%)	9 (9.9%)	1.54	0.09
No	96 (84.2%)	84 (90.1%)		
Not persisting (drop out)				
Yes	30 (26.3%)	77 (84.6%)	68.93*	0.58
No	84 (73.7%)	14 (15.4%)		

Note. Students who graduated are only included in the persistence to completion variable, not the other persistence variables. Effect size: Small=0.10; Medium=0.30; Large=0.50[99]

*p<.05

[a] Because there were no students in the MET Comparison group who were consecutively persisting, the assumptions of the chi-square test are not met.

Table C10: Summary of Logistic Regression Analysis for Variables Predicting Persistence to Completion, Controlling for Selected Variables (N=244)

Predictor	*B*	*SE B*	*Odds Ratio*
1. Group Membership [a]	-1.73	0.45	0.18*
2. Female [b]	-0.88	1.18	0.42
3. White [c]	0.31	0.48	1.37
4. Age at Intake	0.03	0.02	1.03
5. ELA COMPASS Test	0.02	0.02	1.02
6. Math COMPASS Test	0.01	0.00	1.00
Constant	-3.96	1.88	0.02
χ^2	111.01*		
Difference in degrees of freedom	6		
Cox & Snell R^2	0.38		

Note. Odds ratio represents change per each unit of increase in the independent variable

a Group Membership: 1=GCMCA, 0= Comparison; b Female: 1=Female; Male=0; c White: 1=White, 0= All other races.

*p<.05.

[99] Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed) . Hillsdale. NJ: Lawrence Earlbaum Associates, 2.

Table C11: Summary of Logistic Regression Analysis for Variables Predicting Persistence Through Traditional School Year, Controlling for Selected Variables (N=244)

Predictor	*B*	*SE B*	*Odds Ratio*
1. Group Membership [a]	1.21	0.54	3.35*
2. White [b]	0.01	0.55	1.01
3. Age at Intake	-0.05	0.04	0.95
4. ELA COMPASS Test	-0.01	0.02	1.00
5. Math COMPASS Test	-0.01	0.00	1.00
Constant	-1.01	1.83	0.37
χ^2	33.41*		
Difference in degrees of freedom	5		
Cox & Snell R^2	0.15		

Note. Female removed from model because it distorted the estimates. Odds ratio represents change per each unit of increase in the independent variable
a Group Membership: 1=GCMCA, 0= Comparison; b White: 1=White, 0= All other races.
*p<.05.

Table C12: Summary of Logistic Regression Analysis for Variables Predicting Not Persisting (Dropping Out) Controlling for Selected Variables (N=244)

Predictor	*B*	*SE B*	*Odds Ratio*
1. Group Membership [a]	-2.85	0.38	0.06*
2. Female [b]	-0.62	0.82	0.54
3. White [c]	-0.06	0.41	0.94
4. Age at Intake	0.03	0.02	1.03
5. ELA Compass Test	0.02	0.02	1.02
6. Math Compass Test	-0.01	0.00	1.00
Constant	-0.56	1.44	0.57
χ^2	153.8		
Difference in degrees of freedom	6		
Cox & Snell R^2	0.44		

Note. Odds ratio represents change per each unit of increase in the independent variable.
a Group Membership: 1=GCMCA, 0= Comparison; b Female: 1=Female; Male=0; c White: 1=White, 0= All other races.
*p<.05.

CNC Students

Background Characteristics

Table C13: CNC Student Characteristics (N=28)

	CNC	
	N	%
Total Enrollment	28	-
Gender		
Male	23	82.1
Female	4	14.3
Unknown	1	3.6
Race		
Asian	0	0.0
Black	7	25.0
White	16	57.1
More Than one race	2	7.1
Race unknown	3	10.7
Ethnicity		
Hispanic	1	3.6
Not Hispanic	27	96.4
Age at Intake		
Less than 21	6	21.4
22-30	11	39.3
31-40	9	32.1
41-50	1	3.6
51 or older	1	3.6
Employed at Intake		
Yes	20	71.4
No	8	28.6
Educational Attainment at Intake		
High School or Less	10	35.7
Some College, No Credential	14	50.0
Any Certificate	0	0.0
Associate's Degree	1	3.6
Bachelor's Degree	2	7.2
Graduate or Professional Degree	0	0.0
Unknown	1	3.6
COMPASS English/Language Arts Score		
Less than 60	1	3.6
61-70	1	3.6
71-80	5	17.9
81-90	5	17.9
91 or higher	11	39.3
Missing	5	17.9
COMPASS Math Score [a]		
Less than 60	4	14.3
61-70	3	10.7
71-80	0	0.0
81-90	1	3.6
91 or higher	15	53.6
Missing	5	17.9

Note. 7 students had MET majors as well, so they were included in Study 2.

[a] COMPASS Math scores were weighted, but this did not affect the distribution of scores by a substantial amount.

PTEC Services Used

Table C14: PTEC Services Used for CNC Students (N=28)

	CNC	
	N	%
Total Enrollment	28	-
PTEC Services Used-Recruitment & Enrollment		
None	10	35.7
1	15	53.6
2 or more	3	10.7
PTEC Services Used-Retention		
None	23	82.1
1	5	17.9
2 or more	0	0.0
PTEC Services-Completion		
None	27	96.4
1	0	0.0
2 or more	1	3.6

Persistence and Completion

Table C15: Persistence and Completion for CNC Students (N=28)

	CNC	
	N	%
Total Enrollment	28	-
Persistence/Completion		
Persist to completion (Earned credential)	12	42.9
Consecutive persistence	7	25.0
Persistence through traditional academic year	0	0.0
Stop out	5	17.9
Not persisting (drop out)	4	14.3

Study 3 | WDC Certifications

Descriptive Results

Background Characteristics

Table C16: Student Characteristics by Training Program (N=87)

	Training Programs									
	All Programs		MO I		MO II		MO I + MO II		MSSC	
	N	%	N	%	N	%	N	%	N	%
Total Enrollment	87	-	55	-	11	-	12	-	9	-
Gender										
Male	42	48.3	21	38.2	4	36.4	11	91.7	6	66.7
Female	4	4.6	3	5.5	0	0.0	1	8.3	0	0.0
Unknown	41	47.1	31	56.4	7	63.6	0	0.0	3	33.3
Race										
American Indian/Alaskan Native	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Asian	3	3.4	1	1.8	0	0.0	2	15.4	0	0.0
Black	26	29.9	16	28.6	2	18.2	2	15.4	6	66.7
White	46	52.9	31	55.4	6	54.5	7	53.8	2	22.2
More Than one race	3	3.4	2	3.6	0	0.0	0	0.0	1	11.1
Race unknown	9	10.3	5	8.9	3	27.3	1	7.7	0	0.0
Ethnicity										
Hispanic	2	2.3	1	1.8	0	0.0	1	7.7	0	0.0
Not Hispanic	85	97.7	54	98.2	11	100.0	11	92.3	9	100.0
Age at Intake										
Less than 21	3	3.4	2	3.6	1	9.1	0	0.0	0	0.0
22-30	30	34.5	17	30.9	5	45.5	6	50.0	2	22.2
31-40	19	21.8	13	23.6	2	18.2	4	33.3	0	0.0
41-50	23	26.4	17	30.9	3	27.3	1	8.3	2	22.2
51 or older	12	13.8	6	10.9	0	0.0	1	8.3	5	55.6
Employed at Intake										
Yes	66	75.9	41	74.5	11	100.0	12	100.0	2	22.2
No	21	24.1	14	25.5	0	0.0	0	0.0	7	77.8
Educational Attainment at Intake										
High school or less	36	41.4	24	43.6	2	18.2	6	50.0	4	44.4
Some college, no credential	26	29.9	16	29.1	4	36.4	2	16.7	4	44.4
Any certificate	12	13.8	6	10.9	4	36.4	1	8.3	1	11.1
Associate's degree	7	8.0	5	9.1	0	0.0	2	16.7	0	0.0
Bachelor's degree	4	4.6	2	3.6	1	9.1	1	8.3	0	0.0
Graduate or professional degree	1	1.1	1	1.8	0	0.0	0	0.0	0	0.0
Unknown	1	1.1	1	1.8	0	0.0	0	0.0	0	0.0
COMPASS English/Language Arts Score										
Less than 60	6	6.9	2	3.6	1	9.1	1	8.3	2	22.2
61-70	3	3.5	2	3.6	1	9.1	0	0.0	0	0.0
71-80	4	4.6	1	1.8	0	0.0	2	16.7	1	11.1
81-90	7	8.0	6	10.9	0	0.0	0	0.0	1	11.1

91 or higher	7	8.0	5	9.1	1	9.1	0	0.0	1	11.1
Missing	60	69.0	39	70.9	8	72.7	9	75.0	4	44.4
COMPASS Math Score [a]										
Less than 60	20	74.1	10	18.2	3	27.3	3	25.0	4	44.4
61-70	1	3.7	1	1.8	0	0.0	0	0.0	0	0.0
71-80	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
81-90	2	7.4	1	1.8	0	0.0	0	0.0	1	11.1
91 or higher	4	14.8	4	7.3	0	0.0	0	0.0	0	0.0
Missing	60	69.0	39	70.9	8	72.7	9	75.0	4	44.4

[a] COMPASS Math scores were weighted, but this did not affect the distribution of scores by a substantial amount.

PTEC Services Used

Table C17: PTEC Services Used by Training Program (N=87)

	Training Program									
	All Programs		MO I		MO II		MO I + MO II		MSSC	
	N	%	N	%	N	%	N	%	N	%
Total Enrollment	87	-	55	-	11	-	12	-	9	-
PTEC Services Used-Recruitment & Enrollment										
None	77	88.5	46	83.6	10	90.9	12	100.0	9	100.0
1	5	5.7	4	7.3	1	9.1	0	0.0	0	0.0
2 or more	5	5.7	5	9.1	0	0.0	0	0.0	0	0.0
PTEC Services Used-Retention										
None	68	78.2	39	70.9	11	100.0	11	91.7	7	77.8
1	18	20.7	16	29.1	0	0.0	1	8.3	1	11.1
2 or more	1	1.1	0	0.0	0	0.0	0	0.0	1	11.1
PTEC Services-Completion										
None	56	64.4	34	61.8	9	81.8	8	66.6	5	55.6
1	15	17.2	12	21.8	0	0.0	2	16.7	1	11.1
2 or more	16	18.4	9	16.4	2	18.2	2	16.7	3	33.3

Note. Frequency of PTEC services were grouped into three categories. These were reported descriptively and not used in any of the statistical analyses. PTEC services include Recruitment/Enrollment, Retention and Completion. Recruitment/Enrollment services include: (a) applicant discussion; (b) class visit outreach; (c) financial aid assistance; (d) NCRC Work Keys assessments, and (e) prior learning assessments. Retention services include: (a) academic advising; (b) academic foundations-math; (c) adaptive learning, and (d) tutoring. Completion services include: (a) career advising; (b) mock interview; (c) professionalism, and (d) resume writing.

Persistence and Completion

Table C18: Persistence and Completion by Training Program (N=87)

	Training Program									
	All Programs		MO I		MO II		MO I + MO II		MSSC	
	N	%	N	%	N	%	N	%	N	%
Total Enrollment	87	-	55	-	11	-	12	-	9	-
Persistence/Completion										
Persist to completion (Earned credential)	68	78.2	41	74.5	8	72.7	12	100.0	7	77.8
Consecutive persistence	1	1.1	1	7.1	0	0.0	0	0.0	0	0.0
Persistence through traditional academic year	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Stop out	2	2.3	1	7.1	1	9.1	0	0.0	0	0.0
Not persisting (Drop out)	16	18.3	12	21.8	2	18.2	0	0.0	2	22.2