CENTER FOR APPLIED RESEARCH
AND EDUCATIONAL IMPROVEMENT
UNIVERSITY OF MINNESOTA

AN EVALUATION OF THE MANUFACTURING ADVANCEMENT AND ASSESSMENT CENTER (MAAC) PROGRAM

FINAL REPORT
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Research, Development and Engagement to Improve Education

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Executive Summary

I. MAAC Program and Purpose

A. Briefly describe your TAACCCT project and purpose

In 2012, Hennepin Technical College (HTC) received a Trade Adjustment Assistance Community College and Career Training (TAACCCT) grant awarded by the U.S. Department of Labor (DOL) for the purpose of implementing the Manufacturing Assessment and Advancement Centers (MAAC) program. MAAC administered its services through the Customized Training Services (CTS) division at HTC. The program was designed to help students earn manufacturing credentials, become employed, receive wage increases and retain employment after completing an individualized program of study. The primary goal of the MAAC program was to create an accelerated learning path for students, and increase HTC's capacity to increase the number of participants who receive credentials, complete programs and retain employment. The MAAC model posited that outcomes will improve when participants complete credentials and continue their educational path. Access to instruction increases for participants with effective career counseling, the removal of barriers to access training, the availability and use of programs designed for their needs, strong organizational support, access to knowledge and instruction, and sufficient resources. HTC strived to influence the development of such systems through its collaboration with industry partners, advocacy and leadership.

II. Evaluation Design Summary

A. Goals and purpose

In 2013, HTC contracted with the University of Minnesota's Center for Applied Research and Educational Improvement (CAREI) to conduct an evaluation of the MAAC program. The evaluation activities focused on providing information on the program's implementation and outcomes to help guide decision making and program development during the grant period.

The purposes of the evaluation were to (1) document the organizational conditions and structures designed to implement the program at HTC, (2) formatively report program implementation to support the development and refinement of the MAAC program, and (3) provide summative information that shows the program's effectiveness with respect to increasing access to sought after industry credentials for participants, and increasing the number of participants who earn credentials, become employed, receive wage increases and/or retain employment after completing a program of study. This report updates information previously provided in the 2014 interim report and provides summative evaluation results.

B. Overall study design

CAREI's evaluators met regularly with MAAC and other HTC staff to obtain information on program activities and to collect data to answer the evaluation questions. Data collection activities included staff, faculty and participant interviews, administration of study surveys,

analysis of HTC student data and Department of Employment and Economic Development (DEED) data. In addition, MAAC reports were reviewed to help inform analyses.

A multiple methods quasi-experimental evaluation design was employed to provide formative and summative information to the program staff. The recommendations set forth in the U.S. Department of Labor Solicitation for Grant Applications (SGA/DFA PY 11-08) (p. 53) indicate that a quasi-experimental design was appropriate for the MAAC program based on the following: (1) the program planned to enroll a moderate to high number of participants; and (2) the program had a moderate to high number of TAA eligible participants (making random-assignment not viable); (3) the program anticipated certification after the first 18 months of the grant; and (4) the program had a recent valid cohort of students for the same programs of study who were not grant funded that could be compared with students who enrolled in grant-funded programs.

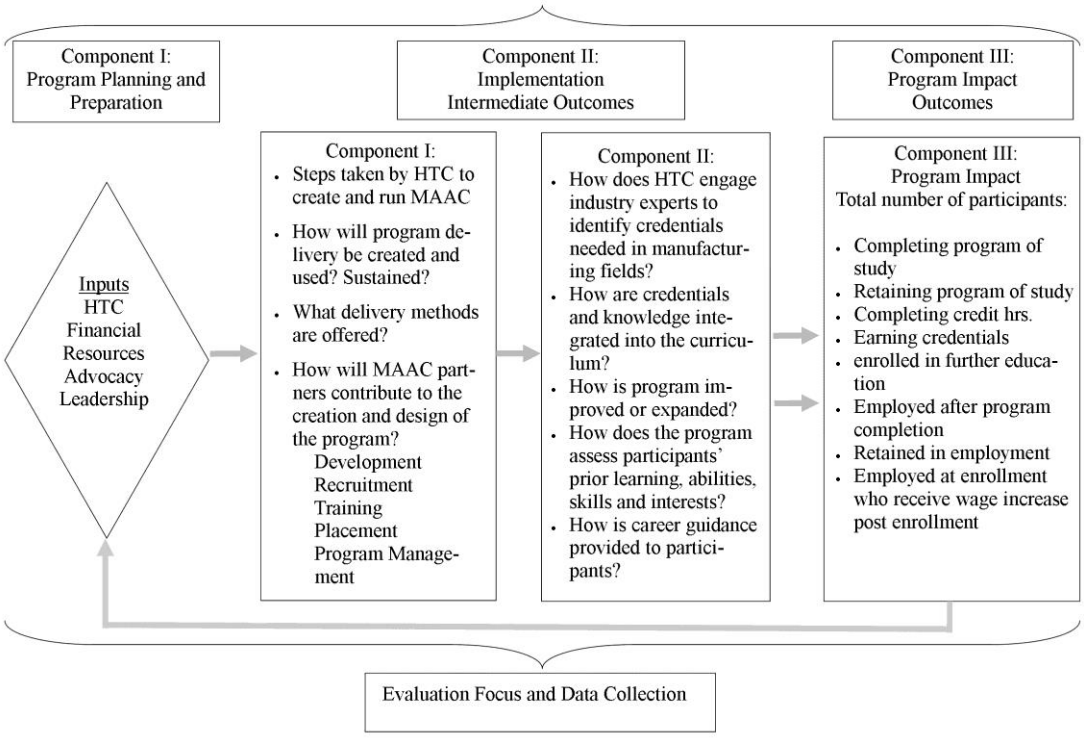
Research suggests that random assignment of students in educational settings is inappropriate when studying multiple settings as it increases the potential for diffusion of treatment, random assignment compliance, and ethical concerns over the possibility of denying some individuals access to the potential benefits of a program.[1] Thus, a quasi-experimental approach was suitable for MAAC to help ensure internal and external validity of treatment outcomes and to minimize problems associated with random assignment compliance and ethical concerns in educational settings. Propensity score matching was used to create a comparison group of students at HTC in manufacturing programs of study.

Given the complex and multifaceted nature of the MAAC program, the evaluation was guided by a logic model (Figure 1) that unpacked how the program sought to improve access to credentials and employment opportunities. This logic model identified the research questions to be addressed and desired outcomes, the strategies used to achieve the outcomes, and assumptions regarding how strategies and outcomes are related. Component I focused on program planning and organizational support for the work. Component II focused on implementation and intermediate outcomes of the program, and Component III addressed the MAAC program impact outcomes.

To answer the formative research questions, a multi-method approach was used that involved interviews, a student survey, and a review of MAAC program documents. Periodic briefings at specified points in data collection and analysis, as well as scheduled reports, allowed for timely and candid feedback.

[1] Ong-Dean, C., Hofstetter, C.H., & Strick, B.R. (2011). Challenges and dilemmas in implementing random assignment in educational research. *American Journal of Evaluation, 32 (1), 29-49.*

Figure 1. Evaluation Model for the MAAC Program



C. Program impact design.

To answer the program impact question*, "What is the impact of the MAAC program on participants' ability to earn credentials and obtain/retain employment?"* the evaluators tracked MAAC participants and compared their progress with those who completed manufacturing programs in the three years prior to MAAC. MAAC participants were defined as students enrolled in courses utilizing vLab resouces who also were enrolled in one of the manufacturing programs: ARET ENGC, FLPW, MACH, and WLDG.

Propensity score matching was utilized to construct a comparison group using the nearest neighbor procedure. MAAC participants in FY 2014 were matched with comparison students enrolled in FY 2011, MAAC participants in FY 2015 were matched with comparison students enrolled in FY 2012, and MAAC participants in FY 2016 were matched with comparison students enrolled in FY 2013. The matching variables were: Gender, race/ethnicity, age, HTC program, Pell grant eligibility, first generation status, and underrepresented status. Information regarding the equivalency of the matched groups is provided in Appendix G.

III. Implementation Findings

- **MAAC increased HTC's capacity to provide manufacturing students' with access to state-of-the-art software and training equipment.** MAAC opened three virtual labs (vLab) making virtual simulators available to students in locations in the Twin Cities metro area. The vLabs were equipped with welding simulators, CNC machines, 3D printers, and milling and lathe simulators. One community-based center provided students access to these resources in their own neighborhood. MAAC also purchased software used in automation robotics engineering and technology (ARET) courses.

- **MAAC increased HTC's capacity to provide flexible course delivery to students.** MAAC supported the development of online and hands-on courses, and students' attainment of certificates through 360º eTECH, a consortium of 10 MnSCU community and technical colleges. Overall, 26 online course modules were made available to students. Among these were courses designed to develop skills in critical thinking and teamwork on the job. The online curriculum led to two certificates in the ARET program including production and automation technologies. MAAC also helped facilitate the conversion of HTC campus only courses to online courses including Computers and Manufacturing (METS1000) and Blueprint Reading (MACH1056).

- **MAAC facilitated development of a national third party credential (PMMI).** HTC was selected as one of three national testing centers to administer the hands-on portion of the national Package and Machinery Manufacturers Institution (PMMI) examination for students in automated controls, packaging and robotics. MAAC provided resources to develop the national credential related to the automation and packaging career fields.

- **MAAC made progress towards its goal to provide credit for prior learning to manufacturing students, however more work is needed to finalize a process that works for all students.** Credit for prior learning in manufacturing fields typically need to be based, in part, on a demonstration of skills. HTC had planned to develop a comprehensive college-wide policy for awarding credit for prior learning for all students at the institution. It was expected that such a policy would encourage increased use by manufacturing students. To date, only a few incoming manufacturing students have needed or requested credit for prior learning.

IV. Participant Impacts & Outcomes

- The results of a survey and interviews indicate that the MAAC students were highly goal oriented, expecting to complete a degree or diploma at HTC and then expecting to enter the workforce, continue in their present positions, or receive a promotion. In addition, survey responses showed that students felt positively about MAAC-supported services and made frequent use of vLab resources such as desktop computers, CAM software, a CNC simulator, and tutoring assistance.

- The FY 2014 MAAC students significantly outperformed a comparison group of students both with respect to the percent of students earning an award (41% vs. 16%, respectively) and the average number of credentials earned (M = 1.02 and M = 0.29, respectively).

- Data show that MAAC students were successful with respect to completing credit hours (Outcome Measure #4), completing awards (Outcome Measures #2 and #5), and receiving a wage increase after graduation (Outcome Measure #9). A summary of the results of analyses carried out on Outcome Measures #1-#9 for the three MAAC cohorts is displayed in the table below.

Summary of Outcome Measures #1 - #9 for MAAC Cohorts

Outcome Measure	MAAC Cohort			
	FY 2014	FY 2015	FY 2016	Total
#1 Total Unique MAAC Students Served Who Were Enrolled in One of the Following Manufacturing Programs: ARET, ENGC, FLPW, MACH, WLDG	55	186	39	280
#2 Total Number of MAAC Students Completing an AAS Degree, Certificate, and/or Diploma	22 of 55	45 of 186	4 of 39	71 of 280
#3 Total Number of MAAC Students Still Retained in Their Program of Study	NA	a	a	a
#4 Total Number of MAAC Students Completing Credit Hours	55 of 55	182 of 186	36 of 39	273 of 280
#5 Aggregate Number of Awards Completed by MAAC Students	54	114	7	175
#6 Total Number of MAAC Students Enrolled in Further Education After Grant-Funded Program of Study Completion	NA	0 of 0	2 of 2	2 of 2
#7 Total Number of MAAC Students (Non-Incumbent Workers) Employed After Grant-Funded Program of Study Completion	0 of 3	1 of 18	NA	1 of 21
#8 Total Number of MAAC Students (Non-Incumbent Workers) Retained in Employment After Program of Study Completion	0 of 0	1 of 1	NA	1 of 1
#9 Total Number of MAAC Students (Incumbent Workers) Employed at Enrollment Who Received a Wage Increase Post-Enrollment	38 of 40	112 of 141	NA	150 of 181

[a]Outcome Measure #3 could not be determined because different proxy numbers were assigned to each cohort.

Introduction

Evaluators from the Center for Applied Research and Educational Improvement (CAREI) at the University of Minnesota collaborated with HTC staff to design procedures to gather data on how well the MAAC program's goals were met. The information provided in this report focuses on updates since the interim report was submitted in 2014, and summative information collected in 2015-16. Evaluation results regarding program design, planning, implementation, and program impact are provided in the sections below that assess the effectiveness of the work carried out in MAAC grant activities.

CAREI's Scope of Work

The evaluation focused on the ways that MAAC provided access to training for manufacturing students and the completion of credentials. The evaluation activities addressed in this final report are focused on three components listed below.

1. **Component I: Program Planning and Preparation**
   Document the current organizational conditions and structures designed to implement the program at HTC.

2. **Component II: Implementation and Intermediate Outcomes**
   Formatively report program implementation that supports the development and refinement of the MAAC program.

3. **Component III: Program Impact Outcomes**
   Provide summative information that shows the program's effectiveness for providing access to industry credentials for participants, and for increasing the number of participants who earn credentials, become employed, receive wage increases and/or retain employment after completing a program of study.

MAAC Program Background

In 2010, President Obama signed the Health Care and Education Reconciliation Act which included $2 billion over four years to fund the Trade Adjustment Assistance Community College and Career Training (TAACCCT) grant program. TAACCCT provides community colleges and other eligible institutions of higher education with funds to expand their capacities to develop two-year training programs for workers with the goal of helping them acquire the skills, degrees, and credentials needed for high-wage, high-skills employment. These grants are provided through the Department of Labor (DOL) in partnership with the Department of Education (DOE).

In 2012, HTC was awarded $2.8 million from the U.S. Department of Labor to address a demand in the Minneapolis-St. Paul metro area for an increase in highly-skilled manufacturing workers. At that time, it was estimated that 600,000 manufacturing jobs were unfilled in the U.S. with a

projected growth over the next five years of 2 to 3 million jobs.[2] At that time, HTC indicated that the physical capacity to train workers had declined in the Minneapolis-St. Paul metro area.[3]

In an effort to address some of these manufacturing workforce training needs, HTC launched the MAAC program in an effort to accelerate attainment of skills, increase knowledge, and advance TAA-eligible workers and other adults seeking credentials in manufacturing career fields. The goals of the program included credit for prior learning assessments, online learning opportunities, and access to hands-on simulation technology such as virtual welders, CNC machines, and 3D printing. The program posited that credential attainment increases with access to effective career counseling, the removal of barriers to access training, the availability and use of individually designed programs, strong organizational support, access to knowledge and instruction, and sufficient resources.

Methods

The methods used to collect data for this report include a review of program reports, individual interviews, a student survey, student level data collected from HTC and DEED. The sections below provide details regarding data analysis procedures.

Individual Interviews

Thirteen interviews were conducted for this final report. Members of the MAAC staff and other HTC staff, industry partners, and students shared their views on the program's impact on participants. A semi-structured interview guide was designed in collaboration with MAAC program staff and used to collect data on participant experiences and how, when, and why changes were made to the program. For all interviews, CAREI evaluators took notes and also made an audio recording. Each interview was transcribed into a database and the transcripts were used for the analyses.

Student Survey

An online survey was administered to manufacturing students in spring 2015 to gauge how well the program was meeting students' educational needs. The CAREI evaluators collaborated with MAAC staff to administer the survey. Students who were enrolled in manufacturing programs at the time were invited to complete the survey. A total of 261 students received an email invitation. Ninety-seven (n=97) surveys were completed representing a 37 percent response rate.

[2] Minnesota State Colleges and Universities, Hennepin Technical College Request for Proposal for Third Party Evaluator: Small Business Labs. (2011, October18). The trend towards U.S. manufacturing continues to accelerate. Retrieved from http://www.smallbizlabs.com/2011/10/the-trend-towards-us-manufacturing-continues-to-accelerate.html.

[3] Minnesota State Colleges and Universities, Hennepin Technical College Request for Proposal for Third Party Evaluator: MnSCU Workforce Assessments (2012 April 18). Industry Reports and Regional Data Supplements. Retrieved from http://www.mnscu.edu/business/workforceassessment/doc/Manufacturing_Twin_Cities_Final.pdf
(2012 May 20). US Manufacturing Reshoring, Investing but Still Faces Challenges. *The Green Economy.*

Document Review

The documents reviewed for this report included MAAC quarterly and annual reports submitted by the program to DOL. A periodic review of MAAC program documents provided insight into program activities and the extent to which goals were being met.

Student Data

Data from Hennepin Technical College

The Director of Institutional Research at HTC provided student data for the evaluation. A separate set of Excel files was provided for MAAC participants for each of the three fiscal years (FY 2014, FY 2015, and FY 2016). The files contained de-identified student-level data where each student was assigned a proxy ID. For each fiscal year, in addition to a file that contained descriptive data for MAAC participants, other files provided data on awards completed, credit hours by term, and course delivery.

To test for significant differences on outcome measures between MAAC participants and similar students not participating in MAAC, a comparison group was constructed from students enrolled in manufacturing-related programs at HTC during FY 2011 through FY 2013. These years were selected because the MAAC program began enrolling participants in FY 2014[4]. Propensity score matching was utilized to construct a comparison group using the nearest neighbor procedure. MAAC participants in FY 2014 were matched with comparison students enrolled in FY 2011, MAAC participants in FY 2015 were matched with comparison students enrolled in FY 2012, and MAAC participants in FY 2016 were matched with comparison students enrolled in FY 2013. HTC provided Excel files containing data for students enrolled at HTC during these fiscal years who were in one of the following manufacturing-related programs: ARET, ENGC, FLPW, MACH, and WLDG. The matching variables were: Gender, race/ethnicity, age, HTC program, Pell grant eligibility, first generation status, and underrepresented status. Information regarding the equivalency of the matched groups is provided in Appendix G.

Data from the Minnesota Department of Employment and Economic Development (DEED)

In order to provide student-level data from its database, DEED required approval from each MAAC participant. This approval was obtained by the MAAC Program Manager from all students participating in the MAAC program. A list of the participants' social security numbers and corresponding proxy IDs was given to the Business Intelligence Project Manager at DEED so that files could be generated based on matching social security numbers. An Excel file was prepared for each of three calendar years (2014, 2015, and 2016). Each file contained de-identified individual-level employment data from 2011 going forward. Each file included the following variables: Proxy ID (same as HTC data), program start date, wage year, wage quarter, wages, hours worked, NAICS code (North American Industry Classification System code), and NAICS description.

[4] For grant years 2012-2014 enrollment for MAAC did not meet expectations. Thus participant counts for MAAC did not begin until fall 2014.

Results

The results of analyses carried out on interviews, program documents, a survey, and student data are organized by the evaluation components and key questions in the sections below.

Evaluation Component I: Program Planning and Preparation

Organizational structures and methods for delivering MAAC services. This section of the report pertains to changes in the design and structure of the program between 2015 and 2016 and how the changes impacted program delivery.

Mid-course shifts to meet enrollment challenges. In 2014, we reported that a shift in the economy in 2010 impacted MAAC's efforts to recruit TAA-eligible employees seeking job training. MAAC staff expressed concern that many dislocated employees who were without jobs during the recession had accepted entry-level jobs because they needed an income. Consequently, the shift in the economy created a much smaller pool of participants seeking training opportunities. Early efforts to market and recruit TAA-eligible participants for the program did not produce expected enrollment.

The DOL grant also excluded recruitment of younger students. HTC staff were concerned that by not including high school students an opportunity was missed to help increase the number of potential employees in the field. Thus, to meet recruitment challenges and to maximize the benefits of MAAC for students, the program shifted its focus to provide flexible service delivery resources to all manufacturing students enrolled in the college. This allowed MAAC to serve more students by providing resources for the purchase of equipment and the development of course materials.

Updates on career guidance provided to participants. MAAC provided assistance to students through the EMERGE center and HTC campuses. For example, the College Lab Assistants (CLA) were on-site to help students with financial aid applications, computer simulators and software (CAD/CAM, Surfcam, Mastercam), and tutoring in areas such as blueprinting, coding, and machines. At the EMERGE site, the CLA also assisted students with finding employment opportunities and transportation.

In 2016 MAAC also provided resources to develop an introduction to manufacturing careers course in an effort to familiarize students this field of study. The school attempted to offer the class in the spring, however low enrollment prevented the class from being offered.

Evaluation Component II: Implementation and Intermediate Outcomes

Updates on the development and refinement of MAAC. CAREI's evaluators explored the extent to which MAAC made changes to organizational structures and processes to support program implementation.

Three vLabs provided access to state-of-the-art training, equipment, and software. In fall 2014, we reported that MAAC opened two on-campus vLabs at sites located in Brooklyn Park and Eden Prairie. These labs were equipped with 20 virtual reality welding computers purchased

with grant funds. The virtual welding simulators were used in the gas metal welding course (WLDG1135) which is a requirement of the GMAW Production Welder (MIG) certificate and welding diploma.

A third MAAC vLab was opened in 2015 at EMERGE, a community-based career and technology center in Minneapolis, MN. This new location allowed MAAC to provide training at an offsite location that gave students access to technology and training in their own neighborhood. According to one administrator, this access was very important for teaching production welding in a nontraditional pathway for students who were not in a position to enroll in a full semester of classes. Having access to training in close proximity to their home or work helped students who could not travel to HTC campuses.

The new lab also featured milling and lathe simulators used toward earning a computer numeric controller machine operational occupation certificate (CNC), a 3D printer, virtual welding simulators, and automated controls trainers. The instructors at the center held evening classes in the fundamentals of manufacturing, welding, and machining. The EMERGE site also provided access to virtual welding simulators and in-person welding trainers available for students to pursue the GMAW production welder certificate (MIG). It is expected that this equipment will continue to benefit manufacturing students beyond the completion of the current grant cycle.

The MAAC program also purchased software needed for the completion of automation robotics engineering and technology (ARET) courses as shown in the table below.

Table 1. Courses Supported by Automation Robotics Technology Software and Equipment

ARET courses	Software/equipment
ARET1140 Computer Integrated Manufacturing	Intelitek Mill and Lathe Simulators
ARET 1155 Automation Controls	Motor Controls Trainers by Lab-Volt
ARET 1175 Industrial Electricity and Electronics I	Electrical Kits by Kelvin and AC/DC Trainers by Amatrol
ARET 1190 Programmable Logic Controllers	PLC Trainers by Lab-Volt
ARET 2150 Engineering Design and Fabrication	PLC Control Logix Trainers by Lab-Volt
ARET 2300 Mechanical Components I Certificate Review	Intelitek Lab-View Trainers
ARET 2320 Industrial Electricity I Certificate Review	Intelitek Lab-View Trainers
ARET 1125 Packaging Machinery Systems	Intelitek LearnMate
ARET 1130 Maintenance Operations	Intelitek LearnMate
ARET 1165 Vision Systems for QA/SPC	Intelitek LearnMate
ARET 1170 Troubleshooting Packaging Machinery	Intelitek LearnMate
ARET 2300 and ARET 2320	Intelitek LearnMate

Flexible course delivery. MAAC resources made it possible for HTC to offer online and hands-on courses to students. For example, certificates were made available to students through 360º eTECH, a consortium of 10 MnSCU community and technical colleges. MAAC supported the development of 26 online career success modules. Students learned "soft skills" such as thinking critically, and working in teams on the job. The online curriculum offered through the

consortium lead to two certificates under the ARET program including production technologies and automation technologies.

MAAC also provided resources to support the development of courses that incorporated a national third party credential from the Package and Machinery Manufacturers Institute (PMMI) for students in automated controls, packaging and robotics. For example, the mechatronics advanced technical certificate and the mechatronics diploma both require a mechanical components certificate review course (ARET2300). In addition the industrial electricity certificate review course (ARET2320) was developed with resources provided by the MAAC program. The PMMI examination is now required as the final test in each of three courses and students receive a PMMI for each test they pass.

MAAC also helped facilitate the conversion of HTC campus-only courses to online courses including Computers and Manufacturing (METS1000) and Blueprint Reading (MACH1056). These online courses provided easy access to the curriculum and will continue to be offered at HTC beyond the TAAACT grant cycle. One MAAC staff member described the lasting benefit of MAAC on HTC. The staff member said, *"Access to more equipment means more students can be served more efficiently. Curriculum development and capital equipment are the most beneficial parts of the grant because it gives us stuff to teach with."*

Updates on assessment of participants' prior learning abilities, skills and interests. In 2014 we reported that HTC planned to develop a comprehensive college-wide policy for awarding credit for prior learning for all students at the institution. A few portfolio assessments were carried out on a very limited basis at HTC, and it was expected that the college-wide policy would encourage increased use. Since that time, only four incoming students have needed or requested credit for prior learning. One HTC staff stated that, "*Unfortunately, there were only four people who took advantage of it, and the grant was paying for the fees for the test out as well. Four people took advantage of it and three passed both exams to get credit for two courses."*

Evaluation Component III: Program Impact Outcomes

Provide summative information that shows the program's effectiveness in increasing the number of participants who earn credentials, become employed, receive wage increases and/or retain employment after completing a program of study. What is the impact of the MAAC program on participants' ability to earn credentials, and obtain/retain employment?

Benefits of HTC Manufacturing training from the perspective of students. In spring 2015 CAREI's evaluators administered an online survey to students enrolled in manufacturing programs at HTC (n=97). The evaluators also interviewed manufacturing students to learn more about their experiences at HTC. The following summary highlights the information provided by students. A copy of the survey, data, and interview instruments are attached in Appendix A at the end of this report.

Students who participated in the survey attended HTC with a goal of completing an associate degree (46.4%) or a diploma (27.8%). Most students planned to enter the workforce after completing their degree (55.7%), they expected to continue in their present jobs (20.6%), they

planned on receiving a promotion (11.3%), and they planned to continue their education at a four-year college (8.2%).

Table 2 shows the programs of study selected by manufacturing students. Most students were enrolled in machine tool technology (MACH) (59.8%), welding and metal fabrication (WELD) (16.5%), or automation robotics engineering technology (ARET) (13.4%). At the time of the survey administration, 92.8% of students indicated they did not hold a professional license.

Table 2. Program of Study Selected by Manufacturing Students as of 2015

Current program of study	Frequency	Percent
MACH (Machine Tool Technology)	58	59.8
WELD (Welding & Metal Fabrication)	16	16.5
ARET (Automation Robotics Engineering Technology)	13	13.4
FLPW (Fluid Power Engineering Technology	6	6.2
ENGC (Engineering CAD Technology)	2	2.1
Other	2	2.1

Table 3 shows student use of the variety of resources provided by MAAC in the vLabs. Fifty-three students used the desktop computers in a vLab to access online curriculum or other programs. Students also worked with CAM software (n=31), CNC simulators (n=26), virtual welders (n=16) or other trainers. Twenty-five students sought the assistance of a college lab assistant (CLA) for tutoring.

Table 3. Resources Used by Students in the Virtual Manufacturing Lab as of 2015

vLab Resources Used	Frequency
Desktop computers (e.g., D2L, online curriculum, Microsoft Word, etc.)	53
Computer Aided Manufacturing (CAM) software	31
CNC simulator	26
Tutoring provided by vLab assistant	25
Virtual welder	16
Automated Controls simulator (PLC)	13
Electricity trainers	13
3D printer	11
360 Career Success Modules	8

Students were satisfied with MAAC-supported services for tutoring, 360 career success modules, and career guidance. The majority of students (91.8%) indicated they would recommend HTC to other students seeking a credential in manufacturing. These results are consistent with students' interview responses regarding their experiences at HTC. When asked if they would recommend HTC for manufacturing, one student replied, *"Are you kidding me? You get to play with robots all day for a living. It's fun."*

Students also shared their thoughts about what they liked best about attending HTC. They said,

> *The wide range of things you can get your hands into. In PLCs, general maintenance. We have a whole lab of packaging machines. And the different interest areas you can go into. We have companies who are looking for basic maintenance or*

design or programming, PLC or troubleshooting. There are a multitude of things you can go into. Even basic wiring. You may need a couple of extra classes and certifications, but you have most of your knowledge already. (Student 1.)

For the most part it's pretty fast paced. I feel like I'm going to be able to apply a lot of what I'm learning right into the field. I will have to pick up a lot of new things. I feel that the examples here and working on real machines will help a lot. (Student 2.)

I think it covers the bases well. I think it is not specific on one certain thing. It is very broad and you are touching on a lot of different things. You are touching on PLCs, robotics, programming. It's not just super specific. Your job opportunities will be a lot bigger because you have experience on plenty of things.(Student 3.)

Program Outcomes

Results of Analyses on Program Outcomes for Students Receiving MAAC Services

MAAC participants were defined as students enrolled in courses utilizing vLab resources who also were enrolled in one of the manufacturing programs: ARET, ENGC, FLPW, MACH, and WLDG. Program outcomes are presented for each outcome measure specified by the DOL grant.

Outcome Measure #1: Total Unique Participants Served

The total unique number of participants served by MAAC between 2014 and 2016 is shown in Table 4. Prior to 2014, only a few students were eligible for the program due to shifts in the labor market and the availability of eligible TAACCCT employees seeking educational opportunities. As mentioned previously in this report, MAAC addressed these challenges by expanding its services to all students already enrolled in manufacturing programs.

Demographic information about MAAC participants for each fiscal year is provided in Appendix C. The academic programs of the MAAC participants for each fiscal year are presented in Appendix D. In each of the fiscal year cohorts, the typical MAAC participant was a part-time male student who was white, under represented, first generation, and enrolled in the Machine Tool Technology (MACH) program.

Table 4. Number of Students Receiving MAAC Services by Fiscal Year

Fiscal Year	Students Receiving MAAC Services*
2014	55
2015	186
2016	39

*Count includes students enrolled in courses utilizing vLab resources who also were enrolled in one of the following manufacturing programs: ARET, ENGC, FLPW, MACH, and WLDG.

Outcome Measure #2: Total Number of Participants Completing a TAACCCT-Funded Program of Study

Outcome measure #2 is defined as the number of unique MAAC participants having earned all of the credit hours needed for the award of a degree or certificate. At HTC, awards include AAS degrees, certificates, and diplomas. The number of MAAC participants earning an award is displayed in Table 5. The total number of MAAC participants earning an award in FY 2014, FY 2015, and FY 2016 was 22, 24, and 4. Because FY 2016 was a partial year for grant activities, the number of awards earned was considerably less than the other fiscal years.

Table 5. Number of MAAC Participants Completing an Award by Fiscal Year and Academic Program

Academic Program	Number of Unique Participants Completing an Award by Academic Program (AAS, Certificate, and/or Diploma)		
	FY 2014	FY 2015	FY 2016
ARET	4	5	2
ARET/FLPW	0	1	0
ARET/MACH	0	1	0
ENGC	0	1	2
FLPW	0	2	0
MACH	12	20	0
MACH/WLDG	1	1	0
WLDG	5	14	0
Total	**22**	**45**	**4**

Outcome Measure #3: Total Number of Participants Still Retained in Their Program of Study or Other TAACCCT-Funded Program

The report guidelines define Outcome Measure #3 as the number of unique participants enrolled who did not complete and are still enrolled in a grant-funded program of study. By design MAAC made it possible for students to complete credentials at any time during the course of their program of study. As a result, different proxy IDs were assigned to MAAC participants in each fiscal year cohort. Thus it was not possible to track students from one fiscal year to the next to determine the number who did not complete but were still retained.

Outcome Measure #4: Total Number of Participants Completing Credit Hours

The reporting guidelines define Outcome Measure #4 as the total number of students enrolled in the program that have completed any number of credit hours to date. The summary displayed in Table 6 presents the number of students receiving MAAC services who completed credit hours between fiscal years 2014 and 2016. Also presented is a frequency distribution of credit hours completed to date for each fiscal year. The summary does not include participants who were enrolled but earned 0 credits.

Table 6. Number of Students Receiving MAAC Services That Completed Any Number of Credit Hours to Date by Fiscal Year

Number of Credit Hours Completed to Date	Number of Unique Students Receiving MAAC Services That Completed Any Number of Credit Hours to Date					
	FY 2014		FY 2015		FY2016	
	n	%	n	%	n	%
1-19	3	5.5	81	44.5	19	52.8
20-29	5	9.1	20	11.0	6	16.7
30-39	7	12.7	26	14.3	2	5.6
40-49	10	18.2	8	4.4	3	8.3
50-59	12	21.8	15	8.2	3	8.3
60-69	2	3.6	18	9.9	1	2.8
70-79	6	10.9	6	3.3	0	0.0
80-89	3	5.5	7	3.8	2	5.6
90+	7	12.7	1	0.5	0	0.0
Participants Completing Credit Hours	**55 (of 55)**		**182 (of 186)**		**36 (of 39)**	
Mean Number of Credit Hours Completed	**57.80**		**31.79**		**26.67**	
Std. Dev.	**30.827**		**23.075**		**21.405**	

In fiscal year 2014, 55 of 55 MAAC participants (100%) completed credits with the mean equal to 57.80 credits. In fiscal year 2015, 182 of 186 participants (98%) completed credits with the mean equal to 31.79 credits. In fiscal year 2016, 36 of 39 participants (92%) completed credits with the mean equal to 26.67. The relatively lower means for FY 2015 and FY 2016 are due to the majority of participants in these cohorts completing 1 to 29 credits whereas the majority of the FY 2014 MAAC participants in the FY 2014 had completed 30 credits or more.

Outcome Measure #5: Aggregate Number of Degrees and Certificates Completed by Participants in Grant-Funded Programs of Study

The summary of aggregate number of degrees and certificates completed by MAAC students presented in Table 7 includes AAS degrees, certificates, and diplomas. The FY 2014, FY 2015, and FY 2016 cohorts earned 54, 114, and 7 awards, respectively. Fewer awards were completed by participants in the FY 2016 cohort compared to the other two cohorts because FY 2016 was a partial year whereas the FY 2014 and FY 2015 were complete years. Across FY cohorts, the largest number of awards were earned by participants in the MACH (n = 81) and WLDG (n = 46) programs and the least in the ENGC program (n = 7).

Table 7. Aggregate Number of AAS Degrees, Certificates, and Diplomas Completed by MAAC Participants by Fiscal Year and Program

Academic Program	Aggregate Number of AAS Degrees, Certificates, and Diplomas Completed			
	FY 2014	FY 2015	FY 2016	Total
ARET	9	17	3	29
ENGC	0	3	4	7
FLPW	0	12	0	12
MACH	30	51	0	81
WLDG	15	31	0	46
Total	**54**	**114**	**7**	**175**

A breakdown by type of award (AAS, Certificate, Diploma) is presented in Table 8. By far the majority of the 175 awards were certificates. One hundred five certificates were completed by MAAC participants across the three cohorts compared to 24 AAS degrees and 46 diplomas.

Table 8. Aggregate Number of Awards Completed by MAAC Participants by Fiscal Year and Type of Award

Type of Award	Aggregate Number of Awards Completed			
	FY 2014	FY 2015	FY 2016	Total
AAS	7	17	0	24
Certificate	34	67	4	105
Diploma	13	30	3	46
Total	**54**	**114**	**7**	**175**

Completed certificates are summarized by name in Table 9. The two certificates with the highest frequencies were CNC Operator (n = 26) and GMAW Production Welder (MIG) (n = 21).

Table 9. Aggregate Number of Certificates Completed by Fiscal Year and Name of Certificate

Name of Certificate	Aggregate Number of Certificates Completed			
	FY 2014	FY 2015	FY 2016	Total
Auto CAD Operator	0	1	1	2
CNC Operator	10	16	0	26
CNC Swiss Turning Center Technician	5	7	0	12
CNC Setup Technician	5	9	0	14
GMAW Production Welder (MIG)	6	15	0	21
GTAW Production Welder (TIG)	5	8	0	13
Industrial Maintenance Mechanic	0	3	0	3
National Certified Fluid Power Specialist	0	1	0	1
Pro ENGINEER Operator	0	1	1	2
Quality Assurance	1	1	0	2
SolidWorks Operator	0	1	2	3
Structural Iron and Repair	2	4	0	6
Total	**34**	**67**	**4**	**105**

Outcome Measure #6: Total Number of Participants Enrolled in Further Education After TAACCCT-funded Program of Study Completion

To determine the number of MAAC participants for outcome measure #6, we counted the number of MAAC participants in a cohort who were identified in the HTC data set as having completed one or more previously completed awards in one of the five programs included in this evaluation (ARET, ENGC, FLPW, MACH, and WLDG). Previously completed awards included AAS degrees, certificates, and diplomas. Because MAAC began enrolling participants in FY 2014, the FY 2014 cohort was not considered applicable for this outcome measure. The FY 2015 did not include any MAAC participants who had previously completed an award in ARET, ENGC, FLPW, MACH, or WLDG, and the FY 2016 included two participants. One of these FY 2016 participants had completed awards in the ARET program and the other had completed awards in the ENGC program. Thus, the total number of MAAC participants enrolled in further education after completing a grant-funded program of study was two.

Outcome Measure #7: Total Number of Participants Employed After TAACCCT-funded Program of Study Completion.

For Outcome Measure #7, the reporting guidelines specify that the number of participants should include non-incumbent workers only who completed a grant-funded program of study entering employment in the quarter after the quarter of program exit. For this report, we defined *entering employment* as the MAAC participant's proxy ID appearing in the file provided by DEED for the quarter after the quarter of program completion. This indicates that the student began employment with an employer located in Minnesota. MAAC students who were identified in the HTC data file as having graduated were included in the count of participants completing a program of study. The FY 2016 cohort was not included because the May 2016 graduation date for the three participants who had graduated was in the second quarter of the calendar year and the DEED data file only included the first and second quarters of 2016. Thus, it was not possible to determine whether or not the participants entered employment in the third quarter. The results for FY 2014 and FY 2015 are presented in Table 10. A total of three non-incumbent workers completed a program of study in FY 2014, and none of these individuals were employed in the quarter after program completion. A total of 18 non-incumbent workers completed a program of study in FY 2015 and 1 individual was employed in the quarter after program completion. The individual was employed in a non-manufacturing company.

Table 10. Worker Status of MAAC Participants Completing a Program of Study

FY 2014				
Worker Status in Quarter When Program of Study Was Completed	Worker Status in Quarter after Completing Program of Study			Total
	Employed - Manufacturing Company	Employed - Not a Manufacturing Company	Not Employed	
Incumbent	12	7	0	19
Non-incumbent	0	0	3	3
Total Number of MAAC Participants Completing a Program of Study in FY 2014				22

Table 10 (Cont.). Worker Status of MAAC Participants Completing a Program of Study

FY 2015				
Worker Status in Quarter When Program of Study Was Completed	Worker Status in Quarter after Completing Program of Study			Total
	Employed - Manufacturing Company	Employed - Not a Manufacturing Company	Not Employed	
Incumbent	12	13	0	25
Non-incumbent	0	1	17	18
Total Number of MAAC Participants Completing a Program of Study in FY 2015				43

Outcome Measure #8: Total Number of Participants Retained in Employment After Program of Study Completion

For Outcome Measure #8, the reporting guidelines specify that the number of participants reported should be non-incumbent workers only who entered employment in the quarter after the quarter of program exit who retained employment in the second and third quarters after program exit. None of the FY 2014 MAAC participants met the inclusion criteria for Outcome Measure #8. The one FY 2015 MAAC participants who met the inclusion criteria did retain employment in the second and third quarters after program exit.

Outcome Measure #9: Total Number of Those Participants Employed At Enrollment Who Received a Wage Increase Post-Enrollment

For Outcome Measure #9, the reporting guidelines specify that the number reported should be the total number of participants who are incumbent workers and who enrolled in a grant-funded program of study who received an increase in wages after enrollment. For purposes of this report, *increase in wages* was defined as an increase in hourly wage of any amount from quarter of program enrollment through the second quarter of 2016, when comparing hourly wage received in quarter of enrollment to hourly wages received in subsequent quarters. The results for FY 2014 and FY 2015 MAAC cohorts are summarized below.

- **FY 2014 MAAC Cohort Summary**: Forty of the 55 (73%) MAAC participants were employed at the time of enrollment in MAAC. Thirty eight of the 40 (95%) received a higher hourly wage after enrollment in MAAC. Two of the 40 (5%) could not be determined because, even though the DEED dataset indicated they had received wages in the quarter they began the MAAC program, hours worked was recorded as 0, making it impossible to determine whether or not there was a change in hourly wage.

- **FY 2015 MAAC Cohort Summary**: One-hundred-forty one of the 286 (49%) MAAC participants were employed at the time of enrollment in MAAC. One-hundred-twelve of the 141 (79%) received a higher hourly wage after enrollment in MAAC. Eleven of the 141 (8%) could not be determined because, even though the DEED dataset indicated they had received wages in the quarter they began the MAAC program, hours worked was recorded as 0, making it impossible to determine whether or not there was a change in hourly wage.

Results of Analyses of MAAC and Comparison Group Differences

Propensity score matching was used to create comparison groups to analyze differences between MAAC participants and non-participants. Two MAAC cohorts were included in the analysis, FY 2014 and FY 2015. The FY 2016 cohort was not included because the MAAC program ended before the fiscal year was completed, and an appropriate comparison group could not be formed for a partial fiscal year. For the FY 2014 and FY 2015 cohorts, students enrolled in manufacturing programs in previous fiscal years were selected for the comparison groups. The participants in the two MAAC cohorts were matched with comparable students who were enrolled at HTC three years previously. The fiscal year matches are shown below along with the number of matched pairs. Appendix G contains information on the matching variables and the equivalency of the MAAC and comparison groups.

MAAC Cohort Group	Comparison Group	n of Matched Pairs
FY 2014	FY 2011	51
FY 2015	FY 2012	169

Three outcome measures were analyzed to test for MAAC and comparison group differences. Outcome Measures, 2, 4, and 5. The following paragraphs present a description of each outcome measure, a description of the analysis, and a summary of the results.

Outcome Measure #2 and Analysis Description: Total number of participants completing a program of study. This measure represented the number of unique students who earned all the credit hours (formal award units needed) for the award of an AAS degree, a certificate, or a diploma. For the analysis, we calculated the proportion of individuals in the MAAC and comparison groups who earned an award and then tested the difference between the proportions using a two-sample *z*-test of proportions.

Outcome Measure #2 Results: The results of the analyses carried out on outcome measure #2 are displayed in Table 11. The FY 2014 MAAC cohort significantly outperformed the comparison group with 41% of MAAC students earning an award compared to 16% of comparison group students. The difference between the FY 2015 MAAC cohort (13%) and its comparison group (17%), however, was not significant.

Table 11. Outcome Measure #2 Results: Percent of MAAC and Comparison Group Members Earning an Award

Descriptive Measure	FY 2014		FY 2015	
	MAAC Cohort	Comparison Group	MAAC Cohort	Comparison Group
Total number of students	51	51	169	169
Number earning an award	21	8	22	28
Proportion earning an award	41%	16%	13%	17%
z-test result	2.854		0.929	
2-tailed *p*-value	.004*		.358	

*Statistically significant test result

Outcome Measure #4 and Analysis Description: Total number of participants completing credit hours. This measure represented the total number of students in each group that had completed any number of credit hours to date. For the analysis, we first counted the number of students in the MAAC cohorts and comparison groups who had earned any number of credit hours to date. We then divided this number by the total number of students in the group. The difference between proportions was tested for significance using a two-sample *z*-test of proportions.

Outcome Measure #4 Results: The results of the analyses carried out on outcome measure #4 are displayed in Table 12. The proportion of students earning credits was very high in all groups. All students in the FY 2014 MAAC cohort (100%) and 94% of students in the comparison group earned credits. Ninety-seven percent of the FY 2015 MAAC cohort and 98% of the comparison group earned credits. Neither statistical test was significant.

Table 12. Outcome Measure #4 Results: Percent of MAAC and Comparison Group Members Earning Any Number of Credits

Descriptive Measure	FY 2014		FY 2015	
	MAAC Cohort (FY 2014)	Comparison Group (FY 2011)	MAAC Cohort (FY 2015)	Comparison Group (FY 2012)
Total number of students	51	51	169	169
Number earning an award	51	48	164	166
Proportion earning an award	100%	94%	97%	98%
z-test result	1.758		0.716	
2-tailed *p*-value	.0784		.472	

Outcome Measure #5 and Analysis Description: This measure represented the aggregate number of degrees and certificates completed by students in each group. For HTC students, this measure represented the total number of AAS degrees, certificates, and diplomas completed by group members. For the analysis, we first counted each group's number of completed credentials and then divided the number of completed credentials by the total number of students in the group. This gave us the mean number of credentials completed by each group. The difference between the MAAC and comparison group means was tested for significance with a *t*-test for two independent samples.

Outcome Measure #5 Results: The results of the analyses carried out for outcome measure #5 are displayed in Table 13. The results were similar to those obtained for outcome measure #2. Namely, the FY 2014 MAAC cohort outperformed its comparison group by completing an average of 1.02 credentials compared to an average of .29 for the comparison group. The difference between the FY 2015 MAAC cohort (M = .38) and its comparison group (M = .25 was not significant.

Table 13. Outcome Measure #5 Results: Mean Number of Credentials Earned by MAAC Cohorts and Comparison Groups

Descriptive Measure	FY 2014		FY 2015	
	MAAC Cohort (FY 2014)	Comparison Group (FY 2011)	MAAC Cohort (FY 2015)	Comparison Group (FY 2012)
Total number of students	51	51	169	169
Aggregate number of credentials earned	52	15	64	42
Mean number of credentials earned	1.02	.29	.38	.25
Std. dev.	1.631	0.855	1.219	0.643
t-test result	2.813		1.227	
df	75.578		254.844	
2-tailed p-value	.006*		.221	

*Statistically significant test result

Summary of the Results

This section of the report summarizes the results of the evaluation study. The summary is organized by the three components and evaluation goals that guided the evaluation.

Component I: Program Planning and Preparation
Document the current organizational conditions and structures designed to implement the program at HTC.

- **MAAC experienced enrollment challenges in the first two years of the grant. In response, program planners expanded services to reach more manufacturing students.** A shift in the labor market, difficulties in communicating program benefits, and funding restrictions for recruitment presented challenges for enrollment. MAAC addressed these challenges by providing its flexible service delivery to all HTC manufacturing students. This mid-course shift allowed MAAC to serve more students needing access to equipment and course materials.

- **MAAC made progress towards its goal to provide credit for prior learning to manufacturing students, however more work is needed to finalize a process that works for all students.** Credit for prior learning in manufacturing fields typically need to be based, in part, on a demonstration of skills. HTC had planned to develop a comprehensive college-wide policy for awarding credit for prior learning for all students at the institution. It was expected that such a policy would encourage increased use by manufacturing students. To date, only a few incoming manufacturing students have needed or requested credit for prior learning.

Component II: Implementation and Intermediate Outcomes
Formatively report program implementation that supports the development and refinement of the MAAC program.

- **MAAC increased HTC's capacity to provide manufacturing students' with access to state-of-the-art software and training equipment.** MAAC opened three virtual labs (vLab) making virtual simulators available to students in these locations in the Twin Cities metro area. The vLabs were equipped with welding simulators, CNC machines, 3D printers, and milling and lathe simulators. One community-based center provided students' access to these resources in their own neighborhood. MAAC also purchased software used in automation robotics engineering and technology (ARET) courses.

- **MAAC increased HTC's capacity to provide flexible course delivery to students.** MAAC supported the development of online and hands-on courses, and students' attainment of certificates through 360^{o} eTECH, a consortium of 10 MnSCU community and technical colleges. Overall, 26 online course modules were made available to students. Among these were courses designed to develop skills in critical thinking, and teamwork on the job. The online curriculum led to two certificates in the ARET program including production and automation technologies. MAAC also helped facilitate the conversion of HTC campus-only

courses to online courses including Computers and Manufacturing (METS1000) and Blueprint Reading (MACH1056).

- **MAAC facilitated development of a national third party credential (PMMI).** HTC was selected as one of three national testing centers to administer the hands-on portion of the national Package and Machinery Manufacturers Institution (PMMI) examination for students in automated controls, packaging and robotics. MAAC provided resources to develop the national credential related to the automation and packaging career fields.

Component III: Program Impact Outcomes

Provide summative information that shows the program's effectiveness for providing access to industry credentials for participants, and for increasing the number of participants who earn credentials, become employed, receive wage increases and/or retain employment after completing a program of study.

- **The results of a survey and interviews indicate that the MAAC students were highly goal oriented, expecting to complete a degree or diploma at HTC and then expecting to enter the workforce, continue in their present positions, or receive a promotion.** In addition, survey responses showed that students felt positively about MAAC-supported services and made frequent use of vLab resources such as desktop computers, CAM software, a CNC simulator, and tutoring assistance

- **The FY 2014 MAAC students significantly outperformed the comparison group students both respect to the percent of students earning an award (41% vs. 16%, respectively) and the average number of credentials earned (M = 1.02 and M = 0.29, respectively.** The positive results regarding Outcomes #2 and 5 are supported by analyses of differences between students receiving MAAC services and similar students not receiving MAAC services, especially analyses conducted on FY 2014 MAAC cohort outcomes.

- **Data show that MAAC students were successful with respect to completing credit hours (Outcome Measure #4), completing awards (Outcome Measures #2 and #5), and receiving a wage increase after graduation (Outcome Measure #9).** A summary of the results of analyses carried out on Outcome Measures #1-#9 for the three MAAC cohorts is displayed in Table 14.

Table 14. Summary of Outcome Measures #1-#9 for MAAC Cohorts

Outcome Measure	MAAC Cohort			
	FY 2014	FY 2015	FY 2016	Total
#1 Total Unique MAAC Students Served Who Were Enrolled in One of the Following Manufacturing Programs: ARET, ENGC, FLPW, MACH, WLDG	55	186	39	280
#2 Total Number of MAAC Students Completing an AAS Degree, Certificate, and/or Diploma	22 of 55	45 of 186	4 of 39	71 of 280
#3 Total Number of MAAC Students Still Retained in Their Program of Study	NA	a	a	a
#4 Total Number of MAAC Students Completing Credit Hours	55 of 55	182 of 186	36 of 39	273 of 280
#5 Aggregate Number of Awards Completed by MAAC Students	54	114	7	175
#6 Total Number of MAAC Students Enrolled in Further Education After Grant-Funded Program of Study Completion	NA	0 of 0	2 of 2	2 of 2
#7 Total Number of MAAC Students (Non-Incumbent Workers) Employed After Grant-Funded Program of Study Completion	0 of 3	1 of 18	NA	1 of 21
#8 Total Number of MAAC Students (Non-Incumbent Workers) Retained in Employment After Program of Study Completion	0 of 0	1 of 1	NA	1 of 1
#9 Total Number of MAAC Students (Incumbent Workers) Employed at Enrollment Who Received a Wage Increase Post-Enrollment	38 of 40	112 of 141	NA	150 of 181

[a]Outcome Measure #3 could not be determined because different proxy numbers were assigned to each cohort. Thus, it was not possible to track students from one fiscal year to the next.

Conclusion

The primary goal of the Manufacturing Assessment and Advancement Centers (MAAC) was to create an accelerated learning path for students designed to increase HTC's capacity to provide attainment of skills, knowledge, and credentials to students seeking career advancement. Through MAAC, the college sought to enhance partnerships with TAA agencies, increase access to services through vLab centers, support the development of virtual simulation instruction and online courses, and award industry credentials.

The evaluation results presented in this report show that MAAC met its expectation of providing flexible services to students seeking access to manufacturing technology and virtual training, and credentials.

APPENDICES

A. Interview Guides

B. Student Survey Data

C. Manufacturing MAAC Student Survey

D. Demographic Characteristics of MAAC Program Participants by Fiscal Year

E. Academic Programs of MAAC Participants by Fiscal Year

F. Summary of Variables Used in Propensity Score Matching

Appendix A

MAAC Program
Industry Partner/Advisory Board Interview Guide
Spring 2015

Background

1. Can you briefly tell me about yourself?

   a. What is your title and position at _____?
   b. How long have you been in this position?
   c. What are your specific responsibilities?

MAAC Program Planning and Preparation

2. How have you been involved with planning/implementation of MAAC?
   a. What is your understanding of the goals of MAAC?

3. How is information about MAAC shared with you?
   a. Does the information tell you everything you want to know?
   b. Is the information timely?

MAAC Program Implementation

4. What resources are available at your company for employees who may need credentials to perform or advance in their jobs?

5. How can MAAC serve your current employees?

Recommendations

6. Based on your experiences, what recommendations do you have for making the MAAC program more effective?

   Probes:
   Recruitment and Enrollment
   On-site Training
   Student resources
   Credit for prior learning

Thank you for your participation.

MAAC Program
Staff and Faculty Interview Guide
Fall 2015

Background

1. Can you briefly tell me about yourself? [If first time interviewed.]
    a. What is your title and position at HTC?
    b. How long have you been in this position?
    c. What are your specific responsibilities?

MAAC Program Planning and Preparation

2. How have you been involved with MAAC over the past year?
    a. Has your involvement changed from previous years?
    b. How has the program evolved in the past year?

3. How is information about MAAC currently shared with faculty and staff?
    a. Does the information tell you everything you want to know?
    b. Is the information timely?

4. What training, if any, have you received through MAAC?
    a. Did you participate?
    b. What was the focus of training?
    c. Who provided the training?
    d. How effective was the training?

I. MAAC Program Implementation

5. From your perspective, in what ways has MAAC helped students with program completion? (*Probe on the following.)*
    a. Counseling
    b. HIRED
    c. EMERGE
    d. Employers
    e. Flexible curriculum delivery (online learning, blended learning, simulators and equipment in virtual labs)
    f. Skill advancement (technical skill credentialing, certificates, stackable awards)
    g. Transfer for articulation

6. What are the current recruiting processes for the program? How has that changed over time?

7. What progress has been made with developing credit for prior learning processes for manufacturing students?

    a. Have there been changes in how credit for prior learning is awarded to students?
        Probes:
        Credit by examination
        Test outs
        Assessment for machining, welding, automation
    b. How well is the credit for prior learning working so far?

How does the program ensure that students have the background and skill levels needed to earn credit?

8. What resources are available to students to help them complete an award in manufacturing?
    a. HIRED
    b. EMERGE
    c. Wrap around services
    d. Career counseling/advising
    e. Job search

7aa. Additional questions for faculty:

What MAAC equipment are you using in your courses?

How is the equipment used for……

Teaching and learning?

Student Assessments?

How satisfied are you with students' access to VLab resources?

Are the skills they develop transferable to the classroom and real world applications?

II. Lessons Learned and Sustainability

9. What are some changes so far at HTC that can be attributed to MAAC? What facilitated those changes?
    a. Note the value added of those changes.
    b. Were the changes viewed as easy or difficult to make?
    c. What components were program staff not able to implement and why?
    d. Note changes for students and what is attributed to them.

10. What supports do you think are absolutely necessary to take on this kind of work in the future?

11. What supports have been the most useful to you over the course of the MAAC grant? Why?

12. What else would you have liked to have to support your efforts?

13. What needs to happen at the college to sustain the changes made through the MAAC program beyond the grant.

14. What parts of MAAC are you most happy about engaging in?

III. Wrap Up

15. To what extent did the work facilitated through MAAC meet your expectations? To what extent were the program goals met?

16. Based on your experiences, what recommendations do you have for other institutions thinking of engaging in this type of work?

17. What supports are absolutely necessary to take on this kind of work?

18. In case we didn't ask a question you were hoping for, what additional information would you like to share with us regarding your experiences with the MAAC program?

Thank you for your participation.

MAAC Program
Student Interview Guide
Spring 2016

1. Background
    a. Please tell us about yourself?
        a. What is your current program of study at HTC?
        b. How long have you been a student at HTC?
        c. Are you a full time or part time student?
        d. Are you currently employed?
           Where?

2. How did you decide on your program of study?
        a. employer requested
        b. recruited
        c. decided on own

3. What are your educational goals?
        a. Courses, no degree
        b. Courses to maintain job
        c. Courses to advance job
        d. Transfer to another college
        e. Complete certificate
        f. Complete diploma
        g. Complete AA degree

4. What do you plan to do when you complete your current program at HTC?
        a. Enter the workforce
        b. Continue in current job
        c. Receive a promotion
        d. Enroll in a 4-year college

5. What has been your experience with using the virtual manufacturing labs?
        a. Are they accessible?
        b. Were lab assistants helpful?

6. What equipment have you used in the lab?
        a. 3D printer
        b. 360 Career Success Modules
        c. Automated controls simulator (e.g., PLC)
        d. Computer aided manufacturing (CAM) software
        e. CNC simulator
        f. Desktop computers to use programs (e.g., D2L, online curriculum, Word)
        g. Electricity trainers
        h. Tutoring provided by vLab assistant
        i. Virtual welder

6. How satisfied are you with your classes?
    a. Is the on campus location is convenient?
    b. Are the times offered convenient?
    c. Do the number of classes offered meet your needs?

7. To what extent have you received assistance from HTC to help you progress through your studies?
    a. Tutoring services
    b. 360 Careers Success Modules
    c. Career search guidance
    d. Credit for prior learning
    e. Financial assistance
    f. Other

8. What do you like best about your program?

9. What do you least like about your program?

10. What are your plans beyond attending classes at HTC?

11. Would you recommend attending HTC to a friend, family member, or colleague?

    Why?

12. Is there any information that we didn't cover regarding your education in manufacturing at HTC that you think is important to include?

These are all of the questions that we have at this time. Thank you for your participation.

Appendix B

MANUFACTURING MAAC STUDENT SURVEY
Spring 2015
n=97

Evaluators from the Center for Applied Research and Educational Improvement (CAREI), in collaboration with the Manufacturing Assessment and Advancement Centers (MAAC) program staff at Hennepin Technical College (HTC) gram staff administered online survey to manufacturing students in spring 2015. The results of survey responses are presented below. Students currently enrolled in manufacturing programs at HTC were invited to complete the survey on April 6, 2015. A reminder was mailed to students on April 14, 2015, followed by a second reminder on April 27, 2015. A total of 289 students were emailed a survey. Of those 289 surveys, 28 were returned as undeliverable. The remaining 261 are counted as the total number of students receiving a survey. Ninety-seven (97) surveys were completed representing a 37 percent response rate.

1. What is your current program of study (select one)?

	Frequency	Percent
MACH (Machine Tool Technology)	58	59.8
ARET (Automation Robotics Engineering Technology)	13	13.4
WELD (Welding & Metal Fabrication)	16	16.5
FLPW (Fluid Power Engineering Technology	6	6.2
ENGC (Engineering CAD Technology)	2	2.1
Other	2	2.1

2. Who was most influential in helping you decide on a program of study? (check all that apply)

	Frequency
Employer	19
Family member	37
Friends	31
High school counselor/teacher	6
HTC College counselor/teacher	10
HTC Student or graduate	6
HIRED Counselor	2
EMERGE Counselor	1
Other	22

3. What is your main goal for currently attending HTC? (check only one)

	Frequency	Percent
Courses only/no degree	5	5.2
Courses to maintain current job	1	1.0
Courses to advance in my job	6	6.2
Courses to transfer to another college	2	2.1
Complete certificate	6	6.2
Complete diploma	28	28.9
Complete associate degree	46	47.4
Other	3	3.1

Other: CNC, Get better job, Employment (2)

4. What do you plan to do when you complete your current program at HTC?

	Frequency	Percent
Enter the workforce	54	55.7
Continue in current job	20	20.6
Receive a promotion	11	11.3
Enroll in a 4-year college	8	8.2
Other	4	4.1

Other: Continue with degree (2), Continue in job, New career

5. Please indicate your level of agreement with each of the following statements regarding your experiences at HTC as part of the MAAC program.

	Strongly Agree	Agree	Disagree	Strongly Disagree	Not Applicable
a. The virtual manufacturing labs (vLab) are accessible at times that are convenient for me. n=77	62.3	26.0	0.0	0.0	6.5
b. On-campus classes are offered at a location convenient for me. n=76	52.6	34.2	6.6	5.3	1.3
c. On-campus classes are offered at times that are convenient for me. n=71	49.3	38.0	8.5	4.2	0.0
d. The content of online courses is relevant for my educational goals. n=75	38.7	37.3	4.0	6.7	13.3

e.	The number of online course options meets my scheduling needs. n=76	34.2	31.6	6.6	3.9	23.7
f.	I would recommend HTC to other students seeking a credential in manufacturing. n=85	60.0	31.8	2.4	2.4	3.5

6. Please indicate your level of satisfaction or dissatisfaction with the MAAC support services listed below.

		Very Satisfied	Somewhat Satisfied	Somewhat Dissatisfied	Very Dissatisfied	Not Applicable
a.	Tutoring n=91	42.9	20.9	0.0	2.2	34.1
b.	360 Careers Success Modules n=88	26.1	23.9	3.4	2.3	44.3
c.	Career Search Guidance n=87	33.3	17.2	6.9	3.4	39.1

7. Have you applied for credit for prior learning in your program of study?

	Frequency	Percent
Yes	14	15.9
No	74	84.1

a. At what stage is your application for credit for prior learning?

	Frequency	Percent
I have received credit	9	64.3
I was not able to receive credit	1	7.1
My credit for prior learning application is still in progress	4	28.6

b. Please indicate your level of satisfaction or dissatisfaction with the credit for prior learning process thus far?

	Frequency	Percent
Very satisfied	9	64.3
Somewhat satisfied	5	35.7
Somewhat dissatisfied	0	0.0
Very dissatisfied	0	0.0

8. Please indicate which resources you have used in the Virtual Manufacturing Lab. (Select all that apply)

	Frequency
3D printer	11
360 Career Success Modules	8
Automated Controls simulator (PLC, etc.)	13
Computer Aided Manufacturing (CAM) software	31
CNC simulator	26
Desktop computers (e.g., D2L, online curriculum, Microsoft Word, etc.)	53
Electricity trainers	13
Tutoring provided by vLab assistant	25
Virtual welder	16
None of the above	16
Other	3

Specify:

- Andrew has been a huge help. I don't think I would be where I am at with grades if it wasn't for his help!
- I haven't started with it yet.
- Inventor, CAD

9. What do you like best about your program? (briefly describe)

- 2nd year on hand CNC learning
- Achieving tight tolerances
- Easy to use
- Fast paced
- Flexibility, and knowledgeable instructors
- Getting done
- Going to class everyday
- Good teachers
- Hands on experience (12)
- How content is displayed through D2I
- How in depth we get. Very thorough courses. And of course, Bob Yund is a great teacher.
- I am able to make projects come to life
- I did like my programming
- I like handling machine tools
- I like my program because I have good teachers who are willing to help me at any time.
- I really enjoy creating anything!
- I really enjoy working with my hands and turning raw materials into parts.
- Instructors (5)
- Instructors have the answer you are looking for more often than not.

- It has content relevant to my current job and taught by instructors in the manufacturing fields
- Knowledgeable teachers who want to help
- Learn from ground up. Hands on learning. Knowledgeable instructors and assistants. Instructors and assistants are very helpful and encouraging
- Learning new things
- Learning something new
- Machine tools
- Making parts
- Milling
- Offered at a time convenient to me
- One on one tutoring at my level (speed) of learning. Andrew has an excellent understanding of the fluid power side and the math concepts. And is able to break it down step by step for me.
- Quality equipment, helpful instructors
- Robotic control
- Setup, program, and SufCAM
- Teachers and students are great, makes school much more fun
- That the instructors give real world like experience
- The ability to interact with other students and teachers
- The experience of my teachers
- The flexibility of time for classes in the shop (2)
- The online portion of learn mate was really helpful and helped me learn a lot easier
- The work seems really fun and also it helps me to improve my skills with all the machines
- Welding
- Work with machines
- Working with my hands. I love mechanical stuff!.

10. What part of the program could be improved to make it more effective for you?

- Five days of machine lab instead of four
- Better scheduling a night more in line with my day program
- Bob not having class every afternoon
- Create stuff with irons and steels
- Decision, and accuracy
- Enough equipment for the students
- Everything is good.
- Faculty availability (more lab assistants)
- Few more examples and explanations on how the content can relate to jog tasks
- Hours
- I can’t think of anything
- I wish I could contour the program to take the classes, work the projects, etc. that I want to learn without the teacher’s attitude!
- Instructors are awesome

- Just more personal motivation mostly. If I were to have that I'd be able to read the textbooks more often
- Learn more about file sharing using external server software/Vault, Windchill, etc.
- Longer hours
- Making more of a full use of the machines and how to use them effectively
- Materials/funding
- Math
- Milling
- More available material
- More available material to weld
- More basics
- More carbide tooling on first year side
- More instructors less students
- More lab assistants
- More lab time
- More lab time. However I believe next year we will be doing a lot of lab
- More lab work
- More machines
- More one on one time with instructors
- More shop hours in the evening
- More teachers in the shop for more one on one attention
- Much of the unguided content seems very vague
- No Saturday classes
- Nothing really, overall I think it was a good course and easy to follow with the content
- Offer certain classes more often than just once per year
- Online self-study. Games, things that assist learning alone.
- Only one semester of manual machining Two semesters is a waste of time and money
- Programming
- Removing some of the beginning projects because it takes too much time and it's not necessarily important
- Scheduling of classes during the week
- Setup and programming
- Sign out the equipment and booth
- Some of the worksheets ask for the student to watch a video and there doesn't seem to be access to any of these old videos
- Study how to use many controllers and SurfCAM, Master CAM and Gibbs
- Study notes online
- SurfCAM programming
- The program is perfect the way it is.
- The registration process. A lot of students end up where they shouldn't be because of a poor system. Thus, preventing the students who should be in them from registering.
- The size of the welding in areas, need new machines
- To off the morning classes at night
- Update coursework

10. Please select the types of assistance you have received from the college to help you reach your educational goal. (Choose all that apply.)

	Frequency
Financial aid assistance	48
Educational counseling/advising	29
Job placement	6
Tutoring	17
Customized training designed for your specific needs	13
Other	9

Other:

- Andrew in the MAC lab. Great guy. Great help!
- Andrew Marino
- Company expense
- General life advice from instructors and assistants
- Lab assistants do most of the on the floor help
- Trade adjustment assistance

Background Information

To put your answers in context, we would like to gather some background information from you. This information will be kept confidential and will only be reviewed by CAREI analysts.

11. What is the highest level of education you have completed?

	Frequency	Percent
High school diploma	54	65.9
GED Certificate	9	11.0
Associate Degree	12	14.6
Bachelor's Degree	5	6.1
Graduate Degree	2	2.4

12. Do you hold a professional license?

	Frequency	Percent
Yes	6	7.2
No	77	92.8

Specify:

- Certified teacher, medial generalist, fcc license, electronics, ham radio
- CNA certificate

- Electrical, boiler
- Nail technician
- SJCP

11. What is your HTC enrollment status right now?

	Frequency	Percent
Full-time (12 credits or more)	61	73.5
Part-time (fewer than 12 credits)	22	26.5

12. When do you attend classes?

	Frequency	Percent
All daytime classes	30	36.1
Mostly daytime classes	31	37.3
Half time evening classes	0	0
Mostly evening classes	11	13.3
All evening classes	11	13.3

13. Where do you currently attend classes? (check all that apply)

	Frequency
Eden Prairie	23
Brooklyn Center	63
EMERGE Site	1
Bloomington Site	0
Other	5

Specify: Brooklyn Park (4), Online class

14. What is your current employment status?

	Frequency	Percent
Full-time	43	51.8
Part-time	17	20.5
Not currently employed	23	27.7

15. What is your age in years?

	Frequency	Percent
n=66		
18-22	14	21.2
23-27	10	15.2
28-32	11	16.7
33-37	17	25.8
38-42	4	6.0
Over 42	10	15.2

16. What is your race/ethnicity? (Select all that apply.)

	Frequency
American Indian/Alaska Native	2
Asian	19
Black/African American	10
Hispanic/Latino	6
Native Hawaiian/Pacific Islander	2
White	52
Other	3

Thank you for completing the survey!

Appendix C

Demographic Characteristics of MAAC Program Participants by Fiscal Year

Demographic Characteristic	FY 2014 (n = 55)		FY 2015 (n = 186)		FY 2016 (n = 38)	
	n	***%***	***n***	***%***	***n***	***%***
Gender						
Female	1	1.8	11	5.9	2	5.3
Male	51	92.7	175	94.1	34	89.5
Not Specified	3	5.5	0	0.0	2	5.3
Race/Ethnicity						
American Indian/Alaskan Native	0	0.0	3	1.6	0	0.0
Asian	6	10.9	43	23.1	5	13.2
Black	8	14.5	24	12.9	6	15.8
Hispanic	2	3.6	6	3.2	2	5.3
White	34	61.8	100	53.8	24	60.5
Other (NRA, Multiple, Unknown, etc.)	2	3.6	10	5.4	1	2.6
Not specified	3	5.5	0	0.0	1	2.6
Under Represented						
Yes	42	76.4	154	82.8	26	68.4
First Generation						
No	20	36.4	59	31.7	12	31.6
Yes	32	58.2	117	62.9	23	60.5
Unknown	0	0.0	4	2.2	2	5.3
Not Specified	3	5.5	6	3.2	1	2.6
Pell Eligible						
Yes	28	50.9	108	58.1	19	50.0
Fulltime/Parttime Status						
Fulltime	17	30.9	18	9.7	5	13.2
Parttime	38	69.1	168	90.3	33	86.8
Age						
Less than 20 years	1	1.8	8	4.3	2	5.3
20-29 years	20	36.4	78	41.9	14	36.8
30-39 years	21	38.2	70	37.6	9	23.7
40-49 years	7	12.7	24	12.9	5	13.2
50-59 years	2	3.6	4	2.2	3	7.9
60+ years	1	1.8	2	1.2	4	10.5
Not specified	3	5.5	0	0.0	1	2.6

Appendix D

Academic Programs of MAAC Participants by Fiscal Year

Program	FY 2014		FY 2015		FY 2016	
	n	***%***	***n***	***%***	***n***	***%***
ARET - Automation Robotics Engineering Technology	7	12.7	18	9.7	4	10.5
ENGC - Engineering CAD Technology	2	3.6	17	9.1	9	23.7
FLPW – Fluid Power Engineering Technology	1	1.8	17	9.1	0	0.0
MACH - Machine Tool Technology	34	61.8	100	53.8	17	44.7
Welding and Metal Fabrication (WLDG)	11	20.0	34	18.3	8	21.1
Total	55	100.0	186	100.0	38	100.0

Appendix E

Summary of Variables Used in Propensity Score Matching

Variables used in the propensity score matching were gender, race/ethnicity, Pell eligibility, underrepresented status, first generation status, HTC program and age. Summary tables showing the equivalency of the MAAC and comparison groups are displayed in this appendix.

Table E-1. Gender of MAAC and Comparison Group Students

Gender	FY 2014		FY 2015	
	MAAC	Comparison	MAAC	Comparison
Female	1	1	10	10
Male	50	50	159	159
Total	51	51	169	169

Table E-2. Race/Ethnicity of MAAC and Comparison Group Students

Race/Ethnicity	FY 2014		FY 2015	
	MAAC	Comparison	MAAC	Comparison
American Indian/Alaskan Native	0	0	2	0
Asian	6	4	40	36
Black	8	8	29	25
Hispanic	2	3	3	4
Native Hawaiian/Pacific Islander	0	0	1	0
Two or More	1	1	3	7
Unknown	0	0	1	0
White	34	35	90	97
Total	51	51	169	169

Table E-3. Pell Eligibility of MAAC and Comparison Group Students

Pell Eligible	FY 2014		FY 2015	
	MAAC	Comparison	MAAC	Comparison
No	23	20	0	0
Yes	28	31	169	169
Total	51	51	169	169

Table E-4. Underrepresented Status of MAAC and Comparison Group Students

Underrepresented	FY 2014		FY 2015	
	MAAC	Comparison	MAAC	Comparison
No	10	8	0	0
Yes	41	43	169	169
Total	51	51	169	169

Table E-5. First Generation Status of MAAC and Comparison Group Students

First Generation	FY 2014		FY 2015	
	MAAC	Comparison	MAAC	Comparison
No	20	17	52	46
Yes	31	34	117	123
Total	51	51	169	169

Table E-6. HTC Program of MAAC and Comparison Group Students

HTC Program	FY 2014		FY 2015	
	MAAC	Comparison	MAAC	Comparison
ARET	7	7	18	19
ENGC	2	2	12	11
FLPW	0	0	8	5
MACH	31	29	93	97
WLDG	11	13	38	37
Total	51	51	169	169

Table E-7. Age of MAAC and Comparison Group Students

HTC Program	FY 2014		FY 2015	
	MAAC	Comparison	MAAC	Comparison
Minimum	17	17	18	18
Maximum	61	51	60	64
Mean	31.2	30.0	32.5	32.0
Std. Dev.	9.45	9.40	8.56	9.30
Number in Group	51	51	169	169