Prepared for
Fox Valley Technical College

Final Report

Evaluation of the AMP *PLUS* Program

Prepared by
Public Policy Associates, Incorporated

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Public Policy Associates, Incorporated is a public policy research, development, and evaluation firm headquartered in Lansing, Michigan. We serve clients in the public, private, and nonprofit sectors at the national, state, and local levels by conducting research, analysis, and evaluation that supports informed strategic decision-making.

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Executive Summary

The Program

The Advanced Manufacturing Pathways (AMP) *PLUS* program was funded through a Trade Adjustment Assistance Community College and Career Training (TAACCCT) grant from the U.S. Department of Labor Employment and Training Administration (DOL/ETA). The program aimed to meet the education and career-training needs of workers eligible for training under the Trade Adjustment Assistance (TAA) Act for Workers Program, as well as for veterans and other adults.

Three key program strategies were at the core of the innovations introduced through the TAACCCT grant:

Table 1: AMP *PLUS* Program Strategies

Strategy 1: Accelerate Student Progress
a. Create and incorporate mobile math learning applications (apps) into advanced manufacturing courses.
b. Implement flexible scheduling to engage and retain students.
c. Create shorter, industry-recognized career pathways.
d. Implement a robotic welding course.
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Strategy 2: Enhance Student Assessment
a. Evaluate students for mechanical aptitude.
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a. Increase capacity to provide veteran support.
b. Add a career navigation component to provide academic and career coaching, college transition services, and referral services.

The AMP *PLUS* program components were intended to increase student retention and completion, accelerate the time to attainment of industry-recognized credentials, and return to or gain employment at family-supporting wages. FVTC drew lessons from

the Integrated Basic Education and Skills Training (I-BEST) program,[1] developed by the Washington State Board for Community and Technical Colleges in collaboration with 34 Washington community and technical colleges, for insights about integrating the teaching of basic skills with technical content. FVTC's strong emphasis on retention services was consistent with findings from research conducted by the Community College of Denver, which showed that students who received comprehensive counseling and academic support services had lower withdrawal and higher retention rates compared to the overall campus rates for those factors.[2]

AMP *PLUS* focused on three technical areas deemed relevant to fill the need for skill enhancement that were also responsive to the industry needs in the region:

- Automation/Electronics
- Machine Tool
- Metal Fabrication/Welding

Evaluation Design Summary

The evaluation of the AMP *PLUS* grant was focused on both process and outcomes, and had three key goals:

1. To assess the degree to which the AMP *PLUS* program increases student retention and completion.
2. To assess the degree to which the AMP *PLUS* program accelerates time to attainment of industry-recognized credentials.
3. To understand the various factors that mediate the outcomes achieved by program participants.

The evaluation used quantitative and qualitative data to achieve these research goals. Data-collection methods for the implementation study included employer phone

[1] John Wachen, et al., *Contextualized College Transition Strategies for Adult Basic Skills Students: Learning from Washington State's IBEST Program Model* (New York, NY: Community College Research Center, Teachers College, Columbia University, December 2012), 2.

[2] Thomas R. Bailey and Mariana Alfonso, *Paths to Persistence: An Analysis of Research on Program Effectiveness at Community Colleges* (New York, NY: Community College Research Center, Teachers College, Columbia University, January 2005), 16.

interviews, review of administrative documents and extant data, multiple site visits to conduct interviews and roundtables with key stakeholders—such as project faculty and staff, and surveys of students. A quasi-experimental design (QED) was used to assess the degree that the program components had on student outcomes. A series of regression models was generated for each hypothesis. Two participant cohorts were created: one consisted of individuals whose enrollment commenced after grant-funded activities began. The second included those whose enrollment in the program areas for which grant funds were obtained occurred prior to the onset of grant-funded activities and continued into the grant-funded period. A comparison cohort was developed consisting of individuals who enrolled in and completed their programs of study in the semesters that were completed prior to the onset of grant-funded activities. Research questions that informed both the implementation and outcomes studies are included in the body of the report.

Key Findings – Implementation

Employer advisory committee members played key roles in development of curriculum and credentials

- AMP *PLUS* leadership, faculty, and staff were at a great advantage at the start of the grant because advisory committees for each of the selected programs had been in place for many years.
- Program faculty enjoyed strong relationships with the employer representatives who, in turn, offered a considerable amount of advice on improvement to equipment and curriculum that could better prepare students for employment in their respective firms.
- Employer interests often coincided with those of the college and students in the AMP *PLUS* programs. This reinforced the efforts made by Fox Valley Technical College (FVTC) faculty and staff to improve student retention and completion.

Students found web-based learning objects to be helpful

- Mobile apps embedded in the course management systems used in math courses were widely used by students who also found them to be very helpful.
- Providing iPads to advanced manufacturing faculty illustrated how mobile devices could be used to support and reinforce learning of concepts in the lab.

Prior learning assessments were conducted but few opportunities for credits due to military experience were identified

- FVTC administered prior learning assessments to all students who were veterans to determine if their experiences in the military matched course requirements in their program of study.
- The competencies required in advanced manufacturing did not match up well with veterans' military experiences and as a result very few veterans were awarded academic credit for their experience in the military, though their satisfaction with the assistance they received was high.

AMP *PLUS* added significantly to the GAMMA+ repository of web-based learning objects with mobile apps

- The number of mobile apps for math and advanced manufacturing produced by AMP *PLUS* faculty and staff exceeded the number targeted.
- Mobile apps were used widely by students in mathematics courses.
- Math students found the mobile apps to be very useful in helping them to learn and reinforce their learning of math concepts and problem-solving procedures.

Response to scheduling flexibility was positive, and enrollment in Machine Tool summer sessions was high

- As part of the AMP *PLUS* grant, FVTC created new summer sessions for students in the Machine Tool program.
- Enrollment in these sessions was high, providing opportunity for students to complete a lot of coursework within a schedule that was more accommodating to their needs. This was especially helpful since many of the Machine Tool students are only able to attend FVTC on a part-time basis.

Stackable credentials did not deter students from continuing with their program of study

FVTC staff believed that credentials served as milestones to students as they continued on their paths to a technical diploma or associates degree. Advanced manufacturing employers in the region strongly encouraged students and new employees to continue with their programs of study, believing that both students and employers would benefit.

FVTC expanded its focus on student retention and completion with AMP *PLUS*

- FVTC engaged AMP *PLUS* manufacturing faculty in conversations to better understand the factors that result in students leaving college without completing their programs of study, leading to adoption of a computerized attendance/early warning tracking system.
- FVTC conducted a study of graduation and retention trends to obtain a better understanding of characteristics that were common to non-completers and draw attention to those students that were more likely to be at risk of dropping out.
- Attention provided to AMP *PLUS* students by the Career Navigator and Veterans Specialist contributed to application of early intervention advising practices.

Key Findings – Outcomes

FVTC exceeded all performance goals and participant outcomes projected for AMP *PLUS*

Many of the performance goals were exceeded by considerable margins. For example:

- A total of 675 unique participants were served, which is approximately 175% of the total number projected.
- A total of 265 participants completed a grant-funded program of study, which is 122% of the number projected.
- A total of 601 students were still retained in their program of study from one academic year to the next, which was 217% of the number projected.
- The number of credentials earned by students (404) was 200% of the number projected.
- A total of 272 students continued to pursue further education after they completed a program of study—a rate that was 145% of the number projected.

Hypotheses regarding student outcomes could not be confirmed

The outcomes analysis was conducted using a quasi-experimental design involving two participant groups and a comparison group. A regression analysis was conducted to assess the degree to which AMP *PLUS* program innovations contributed to differences in student outcomes. None of the hypotheses could be confirmed.

Conclusions

Employer engagement in program development and implementation greatly contributes to successful outcomes for students, employers, and the college. FVTC developed rich and trusting relationships with employers by listening to their needs and developing programs that responded to those needs.

Student retention and completion requires and deserves a college-wide focus that involves all faculty and staff that have an opportunity to encounter students. Students at FVTC take advantage of support offered from a variety of sources and reported satisfaction with the services provided.

"The support I have received from Fox Valley Technical College has been a valuable part of my life."

"I would not be where I am without the support I received."

Grant implementation is likely to be improved if those to be involved in implementation are also involved in the grant application process.

It is critical to incorporate a marketing plan directed at students, faculty, and staff when adopting new tools and technology, such as learning objects/apps, to ensure broad and thorough understanding of its possibilities.

Introduction

This final report provides findings of the evaluation of the Advanced Manufacturing Pathways (AMP) *PLUS* program within Fox Valley Technical College (FVTC). AMP *PLUS* was funded through a grant from U.S. Department of Labor Employment and Training Administration's (DOL/ETA's) Trade Adjustment Assistance Community College and Career Training (TAACCCT) initiative. It aimed to meet the education and career-training needs of workers who are eligible for training under the Trade Adjustment Assistance (TAA) Act for Workers Program and other adults.

The program components incorporated into the AMP *PLUS* program design were intended to increase student retention and completion and accelerate the time to attainment of industry-recognized credentials. Changes initiated by this program were anticipated to help speed the return of laid-off workers to employment in jobs with family-supporting wages. The Logic Model, shown in Appendix A, provides an overview of the components, activities, and outputs of AMP *PLUS* as well as a description of the short- and long-term outcomes anticipated to result.

The Intervention

AMP *PLUS* was designed by FVTC in response to several factors. Northeast Wisconsin's Fox Valley had been significantly impacted by foreign trade, resulting in the loss of many jobs over the past few years. As of May 2012, over 2,900 workers had been awarded TAA certification in the counties in the FVTC service district. Over several years prior to the grant award, the manufacturing environment had also changed. During that time it had become much less possible to obtain a job earning family-supporting wages with a high school diploma—or less—and little or no experience. Rapid changes in manufacturing technology and an increase in the skills required for employment in advanced-manufacturing occupations required college-level education and training. Employers had also begun to require that these skills be documented with credentials or degrees granted by community colleges or other institutions of higher education.

The need for community and technical colleges to increase student retention and completion had also risen in priority. Retaining community college students in a program of study had always been difficult, even under the best of conditions. Low retention and completion rates were a major source of concern for community college

administrators and policy-makers nationwide. For adult students, such as TAA-eligible workers, work and family needs and the demands of an academic environment provided additional challenges and distractions, which often made retention and completion even more difficult.

The design of AMP *PLUS* took other factors into consideration as well. According to a national evaluation report for the DOL/ETA in 2010, most TAA-affected workers possessed a high-school diploma or GED, had been out of school for over two decades, and required remedial education before taking technical college courses. Most were married with family responsibilities, had financial concerns, and were largely unfamiliar with the various systems in place (unemployment, workforce, education, and employer) to help them return to employment in jobs with family-supporting wages.

Critical Interventions

To address the need for TAA-eligible and other workers to expeditiously retool and obtain family-supporting jobs, AMP *PLUS* focused on three program areas deemed relevant to address worker needs for skill enhancement and respond to industry demand. According to regional employers, several hundred new positions had been anticipated to be created during the grant-funded period (2012-2015) in these areas:

- Automation/Electronics
- Machine Tool
- Metal Fabrication/Welding

AMP *PLUS* incorporated several strategies for easing the transition to college work for TAA-eligible workers, veterans, and other students. These strategies were intended to increase retention and completion and accelerate the time to attainment of industry-recognized credentials.

Among the program elements intended to aid in student retention and completion were two new positions that were funded by the grant: a Career Navigator and a Veterans Specialist. FVTC made use, on a trial basis, of the Bennett Mechanical Comprehension Test (BMCT) to evaluate its suitability to assess students' mechanical aptitude and ultimately help predict success in advanced manufacturing coursework and employment. FVTC planned to use grant funds to develop hundreds of online learning objects (apps) that could be accessed by way of mobile devices to provide students with

just-in-time review of key concepts needed for their math and advanced manufacturing courses—and potentially use on the job as well.

AMP *PLUS* called for staff to engage employers in a process in which they would contribute to curriculum development and identification of career pathways in each program area. Together they planned to identify industry-recognized credentials to help program participants secure entry-level employment. They also planned to identify and create stackable and latticed credentials to enable program participants to progress along the pathways to jobs paying family-supporting wages. AMP *PLUS* was designed to build on data collected through an employer survey, completed in 2012, that informed the choices made in the AMP *PLUS* program design and that were included in the Technical Plan that was submitted with FVTC's TAACCCT Round Two application.

Many of the elements of the AMP *PLUS* program were included to enhance student retention and completion. Examples of said elements were Career Navigator and Veterans Specialist positions; use of the BMCT; flexible course scheduling; and mobile apps/web-based learning objects. Many of these innovations were not implemented exactly as planned or according to the timelines projected. Nonetheless, FVTC persisted in seeking out, assessing, and acting on new information to enhance its efforts in support of student retention and completion. FVTC engaged its manufacturing faculty in conversations to better understand the factors that result in students leaving college without completing their programs of study. Through these conversations and other data, faculty and staff became more aware that student dropouts were often preceded by poor or erratic attendance, leading to adoption of the MyAttendance program—a computerized system that would flag attendance problems early and alert faculty and staff that perhaps some sort of support or assistance was needed. In addition, AMP *PLUS* faculty were assigned iPads to make it easier for them to be able to review real-time data from the MyAttendance program. FVTC also conducted a study of graduation and retention trends to obtain a better understanding of characteristics that were common to non-completers and draw attention to those students that were more likely to be at risk of dropping out.

Targeted Population

At the outset, FVTC conducted significant outreach, working with local workforce boards, to recruit TAA Act-eligible workers that had been adversely affected by global trade, as well as veterans. Programs were also available to all other community college students. Program participants included all students that were enrolled in courses and or received services that were supported with grant funds.

Program Performance Goals

Table 2: AMP *PLUS* Performance and Outcomes Measures

Outcome Measure	# Targeted
1. Total unique participants served	383
2. Total number of participants completing a TAACCCT-funded program (including certificates and degrees)	217
3. Total number of participants retained in their program of study or other TAACCT-funded program	277
4. Total number of participants completing credit hours	306
5. Total number of participants earning credentials	198
6. Total number of participants enrolled in further education after TAACCCT-funded program of study completion	187
7. Total number of participants employed after TAACCCT-funded program of study completion	210
8. Total number of participants retained in employment after TAACCCT-funded program of study completion	197
9. Total number of those participants employed at enrollment who received a wage increase post-enrollment	77

Evaluation Purpose

Public Policy Associates, Inc.'s (PPA's) evaluation of the AMP *PLUS* program was focused on both implementation and outcomes; that is, it examined the outcomes that were achieved by individual participants, and the degree to which program components contributed to the outcomes. For the evaluation, the focus was on three overarching questions:

1. To what extent did the innovations of the AMP *PLUS* program increase student retention and completion?
2. To what extent did the innovations of the AMP *PLUS* program accelerate time to attainment of industry-recognized credentials?
3. To what extent did any factors mediate the outcomes achieved by program participants?

The evaluation included quantitative and qualitative methods. The activities included site visits to conduct key stakeholder interviews, faculty roundtables, and observations; administrative document review; student surveys; and a participant outcome analysis, utilizing a quasi-experimental approach. Appendix A explains the methodology used. A brief overview of methods is outlined below.

Methodology

Implementation Study

The implementation assessment focused on whether the combination of system improvements and changes to student services started smoothly, progressed effectively, and achieved the desired improvements in student retention and completion. The evaluation paid particular attention to the (a) design, (b) development, and (c) implementation efforts associated with the initiative and AMP *PLUS* goals and the degree to which the AMP *PLUS* program increased the capacity of FVTC to:

- Enhance supports to veterans.
- Increase accessibility to and expand learning technologies.
- Increase scheduling flexibility.
- Provide stackable credentials and industry-recognized career pathways.
- Enhance wraparound student support services.

To carry out the implementation study, the evaluation team focused specifically on the following variables to address the research questions.

- Fidelity to plan
- Improved access to and delivery of learning enhancements
- Satisfaction with learning enhancements
- Role and effectiveness of the partnerships in developing and implementing the program
- Opportunity and ability to sustain the enhancements in the college post-grant
- Increases in capacity of FVTC to carry out learning enhancements and support services

Outcomes Study

A quasi-experimental design (QED) was used to assess the impact of the program. A series of regression models were generated for each hypothesis. The model estimated

the effect size of participation in the program as well as specific program components on selected outcomes. Dependent variables for the analysis consisted of those representing education outcomes (continuing student status, attainment of terminal degree, credit hours completed) and employment outcomes. Separate regressions were run to estimate the influence of the project on each outcome. The key independent variable for the analysis was participation in the AMP *PLUS* project. Control variables included a number of demographic variables that were expected to correlate with outcomes, as well as work status at enrollment and term of admittance into the program of study, and programs of study indicators (Welding, Machine Tool; Automation/Electronics represents the baseline category)

Two participant groups were created for the evaluation analysis. Each group included those identified as grant participants who had enrolled in one of the grant-funded programs of study—Welding, Automation/Electronics, or Machine Tool in spring, summer, or fall 2013 semesters; or spring, summer, or fall 2014 semesters.

- Participant Group 1 was a full-intervention group comprised of those whose admit term into their advanced manufacturing program of study was on or after January 1, 2013, and before January 1, 2015.
- Participant Group 2 was a partial-intervention group comprised of those whose admit term into their advanced manufacturing program of study was before January 1, 2013, but who continued to be enrolled in the program of study after that date at any semester in 2013 or 2014.

A comparison group of a similar size was created comprised of students who had enrolled in the same courses of study as those funded by the TAACCCT grant in semesters prior to the launch of the grant-funded innovations (2010, 2011, or 2012), and who graduated or left the college prior to January 1, 2013.

Fidelity

This chapter focuses on the degree to which elements of the Advanced Manufacturing Pathways (AMP) *PLUS* program were implemented and according to the timeline originally planned. The following research question is relevant to this discussion:

IRQ 2. Are program activities implemented with fidelity to the plan?

a. What are the challenges to doing so?

The main strategies of AMP *PLUS* were implemented as planned, though the timeline lagged for some

Table 3 provides a visual display of the main program elements and their completion status as of September 30, 2015, the close of the period of time in which grant funds were able to be used for grant-funded program activity. Delays were generally caused by factors that had not been anticipated by those that wrote and submitted the formal grant application to the U.S. Department of Labor. When possible, Fox Valley Technical College (FVTC) and AMP *PLUS* faculty and staff made accommodations to implement the strategies in other ways. Discussion of implementation and non-completion follows.

Table 3: Progress on Program Implementation

Activity	Completed as Planned	Completed on Delayed Timeline	Not Completed
Strategy 1: Accelerate Student Progress			
1.1 Create contextualized, technology-embedded mobile applications for advanced manufacturing courses		X	
1.1.1 Mobile app development		X	
1.1.2 Faculty training	X		
1.1.3 Incorporation by faculty		X	
1.1.4 Utilization by students		X	
1.1.5 Student utilization tracking			X

Table 3: Progress on Program Implementation

Activity	Completed as Planned	Completed on Delayed Timeline	Not Completed
1.2 Create flexible scheduling	X		
1.3 Create shorter industry-recognized pathways	X		
1.4 Implement robotic welding course	X		
1.5 Expand technology-enabled learning		X	
Strategy 2: Enhance Student Assessment			
2.1 Evaluate students for mechanical aptitude			X
2.2 Enhance assessment of veterans' military experience	X		
Strategy 3: Enhance Wraparound Student Support Services			
3.1 Address veterans' supports	X		
3.2 Add career navigation		X	

Strategy 1: Accelerate Student Progress

1.1 Create contextualized, technology-embedded mobile applications for Advanced Manufacturing courses

1.1.1 Mobile app development: Creating, completing, and publishing the learning objects (apps) that could be accessed by mobile, internet-connected devices took longer than originally targeted. Staff believed that the expectations were not realistic. In addition, app development required extensive faculty participation to identify the topic areas that would be the focus of individual apps and to write the text that would comprise the lesson to be provided in the app. Changes in the laws governing public sector collective bargaining caused a large number of faculty to retire from the Wisconsin Technical College System and/or withhold their support for and participation in the project. In spite of the delays and obstacles to be overcome, FVTC's GAMMA+ team charged with app development exceeded the number targeted in the grant application by the close of the grant.

1.1.2 Faculty training: FVTC provided training to faculty on app development in two ways. First, faculty participated in group training conducted by GAMMA+ staff. However, staff found that to be less effective than in conducting training one-on-one to

faculty that desired to learn how to develop apps for their courses. This individualized training proved to be very effective and group training was discontinued.

As apps were developed, faculty also received training on how to incorporate them into their classes. Utilization in math courses increased when the lead math faculty member took the initiative to place all of the math apps on the online platform to make it easier for the entire math faculty to have these tools readily at hand.

1.1.3 Faculty incorporation of apps into courses: Faculty in the advanced manufacturing courses chose to wait until all of the apps pertaining to the courses they taught were available to be included in course materials or uploaded to the college's online course management system. As of September 2015, none of the faculty of the advanced manufacturing courses had incorporated apps into their courses, though that began to change in 2016. FVTC issued iPads to advanced manufacturing faculty so that they would be able to demonstrate during course presentations how the apps could easily be accessed to help students to solve some of the problems they might encounter.

The apps for the various math classes were the first to be completed as a group and these were among the first to be available to all students that took those courses. Math students began to have access to mobile apps in their courses in 2014. Students in advanced manufacturing courses, however, encountered a barrier to the use of mobile apps in that mobile devices were not allowed in the manufacturing labs—the location where they would be most useful.

1.1.4 Student utilization of apps: Because of the delay in faculty utilization of mobile apps in advanced manufacturing courses, there was little utilization of these apps by students in those courses. However, math apps were utilized in math courses after the lead math faculty member uploaded the apps into course management software for the benefit of all faculty and to encourage student use. Math students reported in surveys (fielded in their math courses), a high degree of utilization of apps; nearly 6 of 10 reported using all eight of the apps mentioned in the survey. Students reported finding the apps helpful and the use of each app ranged from a low of 59% (trigonometry, polynomials) to a high of 83% (equations).

1.1.5 Tracking of student utilization of mobile apps: It was not feasible to track student utilization of mobile apps. The GAMMA+ team was able to identify the Internet Protocol (IP) address from which a user logged on to the GAMMA+ website to view an app. However, there was only one IP address for the entire Appleton campus, so students logging on from the main campus all showed the same IP address. Toward the end of the grant period, apps for the advanced manufacturing courses were

published, and faculty planned to upload the apps relevant for their course to the online course management system. In the future, using this system, it will be possible for faculty to monitor math utilization by their students.

1.2 Create flexible scheduling

The summer Machine Tool section and the new Welding section were created as planned to allow students to attend classes at times that were more convenient for them. Doing so enabled students to have access to welding bays and labs at times when they would normally not have been available. Expanding the number of sections made it easier for adult students to make appropriate plans and manage their progress toward program completion and employment more effectively.

1.3 Create shorter industry-recognized pathways

FVTC redesigned the AMP *PLUS* advanced manufacturing programs by grouping courses together to create credentials that could be stacked and latticed to achieve an established industry-driven, competency-based associate's degree or two-year technical diploma. Welding's established one-year technical diploma was able to be stacked to the next level of the metal fabrication program. The credentials were redesigned and implemented on schedule.

1.4 Implement robotic welding course

The robotic welding course was added and implemented as planned in response to the employers' desire for workers to be trained with this specific skill set.

1.5 Expand technology-enabled learning

Advanced manufacturing faculty decided not to incorporate the mobile apps developed for their use until the full complement of apps was completed. Consequently, use of the technology-enabled learning tools was delayed until near the end of the grant-funded period.

Strategy 2: Enhance Student Assessment

2.1 Evaluate students for mechanical aptitude

Inclusion of the Bennett Mechanical Comprehension Test (BMCT) in the AMP *PLUS* program was for the purpose of assessing the degree to which the test might be useful as an advising tool and a predictor of student success in an advanced manufacturing program of study. The BMCT was initially implemented as planned with students that expressed interest in two of the three advanced manufacturing programs included in the grant. Faculty in the third program—Automation/Electronics—did not believe the BMCT was relevant for the needs of their students and never used it. The BMCT is a

timed test, which one counselor thought could lead to misinterpretation of student performance on the test. Use of the BMCT was discontinued after only two semesters because faculty and staff did not see a correlation between student scores on the BMCT and performance in the program. FVTC did not conduct a structured review to explore how and for what, if at all, the BMCT might be useful to advanced manufacturing faculty and students.

2.2 Enhance assessment of veterans' military experience

FVTC hired a Veterans Specialist, as planned and on schedule, to spearhead the college's efforts to more effectively understand and apply the American Council on Education's system and the Joint Service Transcript's system of credit for military experience. The Veterans Specialist created and made available an online training module to all staff with similar responsibilities in the Wisconsin Technical College System.

Strategy 3: Enhance Wraparound Student Support Services

3.1 Address veteran's supports

The Veterans Specialist also helped to focus services provided by the college on addressing the unique needs of veteran students, working with staff from various departments and the Center for Student Life to aid veterans as they adjust to college life. Through the AMP *PLUS* grant, the veterans Specialist was able to gain deeper insights about the challenges that veterans face when they exit the military and how these challenges can affect their progress and success in their programs of study.

3.2 Add career navigation

FVTC hired a person to work as a Career Navigator with current and prospective AMP *PLUS* students. Over time, the role performed by that person evolved and, as that person reported, broadened from career navigation to include the wide range of counseling services developed by FVTC to support student retention. The original plan for providing a focus on career navigation for students was never officially replaced. However, that role is often performed by a program's faculty who are much closer to knowing about opportunities in their respective fields and understanding current and anticipated employer needs.

Pathways

One of the core elements desired by the U.S. Department of Labor (USDOL) in its Trade Adjustment Assistance Community College and Career Training (TAACCCT) projects is the creation of credentials that could be stacked and latticed to improve the employment outcomes of Trade Adjustment Assistance-eligible and other students.[3] USDOL also strongly encouraged applicants to work closely with employers and industry associations to develop credentials that are widely recognized and accepted.[4] This chapter focuses on the role that employers played in the development and implementation of the Advanced Manufacturing Pathway (AMP) *PLUS* advanced manufacturing programs and the creation of stackable credentials and how that connected with Fox Valley Technical College's (FVTC's) strategic plan. Also discussed are the flexible learning options provided to AMP *PLUS* and other FVTC students, the perceived value of stackable credentials and flexible learning options, and employer perceptions of student readiness as a result of participation in the AMP *PLUS* programs.

The following research questions are relevant to this discussion:

IRQ 1. What roles did partners play in the development and implementation of the program?

IRQ 3. How were the choices made in designing AMP PLUS?

IRQ 6. How were flexible learning options perceived to contribute to improved enrollments, course completion?

IRQ 8. How did the availability of stackable and latticed credentials contribute to the achievement of program outcomes?

IRQ 16. To what extent are employers satisfied with the employment readiness of students in enhanced programs?

[3] U.S. Department of Labor Employment and Training Administration, "Notice of Availability of Funds and Solicitation for Grant Applications for Trade Adjustment Assistance Community College and Career Training Grants Program," https://www.doleta.gov/grants/pdf/taaccct_sga_dfa_py_11_08.pdf.

[4] Ibid.

Employer involvement was pivotal in developing and implementing AMP *PLUS*

Technical colleges in Wisconsin are required by law to have active advisory committees for each technical program that they offer. This was a great advantage to FVTC in that program advisory committees for each of the programs included in the AMP *PLUS* grant had been in place and working with program faculty for many years. Faculty were able to develop long-standing relationships with the employers that participated in the advisory committees and used their representatives as sounding boards on many issues.

With respect to AMP *PLUS*, advisory committee members offered suggestions on equipment to be purchased to bring the student experience more in line with what businesses in the industry were doing. They conferred with program faculty members on the grouping of courses to create stackable credentials. Some expressed concern that students would overlook the value of the diploma or associate's degree, thinking instead that earning one or two certificates might be enough to provide them with a solid foundation for long-term employment and advancement. In reaction, they worked with both faculty and students to impress upon them the long-term value of completing the program of study.

Employer members of advisory committees also played a significant role in encouraging students and parents to consider studying advanced manufacturing as a career pathway. Their efforts also helped to ensure that the businesses they represented had a pipeline of skilled employees to draw from to replace retiring workers and to support expansion efforts. A number of employers indicated that they made presentations to classes of high school and middle school students and led groups of students and parents on tours of their respective facilities so that they could see and experience the type of work that is done in an advanced manufacturing environment. Some employers also participated in summer programs that provided teachers with firsthand knowledge and experience of advanced manufacturing that they could incorporate into their lesson plans.

AMP *PLUS* design focused on improving student retention and completion

The USDOL's goals for TAACCCT grantees, to improve student retention and completion and reduce the time to credential attainment fit well with FVTC's own strategic plan. AMP *PLUS* programs were all focused on strengthening course completion rates, supporting student persistence to complete credentials, and improving graduation rates—measures highlighted in FVTC's 2013-2016 Strategic Plan.[5] To that end, planned features included enhanced career guidance, counseling and other supports, contextualized coursework, flexible scheduling, technology enhancements to the teaching-learning process, and closer attention given to students' at-risk behaviors.

"The grant program is very compatible with how we are organized as a college. We are not reinventing wheels."

The college had already begun an intensive focus on improving student retention and completion, motivated in part by mandates from Wisconsin's state government, prior to receiving the TAACCCT grant. AMP *PLUS* plans were developed by FVTC faculty and staff to coordinate with and complement elements of FVTC's Strategic Plan. Employer advisory committees for the advanced manufacturing programs were consulted on bundling courses to create credentials that could be achieved in the interim prior to a terminal diploma or associate's degree. Some aspects of the AMP *PLUS* plan were developed without the involvement of those who would be responsible for implementing them—a situation that contributed to delays or hindrances in their implementation.

FVTC employed flexible learning options to support retention and completion

Students that enrolled in Machine Tool courses essentially were enrolling for time in the Machine Tool labs. All Machine Tool courses are competency-based, meaning that once students achieve the requisite competencies for a course, they can begin to work on the next, regardless of the point in the term. For Machine Tool courses, the standard FVTC semester is divided into two eight week terms. Faculty meet with students every eight weeks to review their progress, discuss problems they may be having, and advise them on what courses to take next.

[5] Fox Valley Technical College, *FVTC 2013-2016 Strategic Plan Measures*.

Students were free to choose how they use their time in the Machine Tool labs—working on two or more courses concurrently or working on one course from start to finish and then moving on to the next. Instructors in the Machine Tool program are experienced in all aspects of the entire Machine Tool program and work with all students, regardless of what the student is working on. For many students, the most significant barrier to completion was the amount of time that they could spend in the labs developing the competencies needed to complete courses. The AMP *PLUS* grant funds provided FVTC an opportunity to offer classes at times they could not previously offer them. With AMP *PLUS*, FVTC began to offer a summer session for the Machine Tool program making faculty and labs available for six hours a night, two nights a week. Students who enrolled in the summer session were enabled to speed up time to program completion.

FVTC also created a new Welding section and a robotics welding course that allowed students to attend classes at more convenient times and expanded the college's capacity to train more workers. In doing so, students were given access to the welding bays and labs at times when they were not previously available.

FVTC intended that incorporating the mobile learning objects, or apps, into the math and AMP *PLUS* advanced manufacturing courses would provide another option for student learning reinforcement, review, and retention. FVTC's interest in expanding access to learning objects was prompted by evidence that suggested that online and/or blended learning can support high levels of cognitive engagement in meeting learning objectives.[6] The completion and publication of the apps designed for use in the advanced manufacturing classes was delayed. Apps developed for use with the advanced manufacturing courses were just beginning to be utilized by faculty and students by the time the grant-funded period ended. Apps were used only in the college's math courses during the last year of the grant period and students enrolled in those courses found them to be very helpful.

Employers agreed that FVTC students are well prepared with skills needed to succeed in the workforce

Employers that participated in a telephone interview generally agreed that FVTC does a good job preparing students with the technical skills to succeed in the workforce. Some indicated that the training that students receive did not always sufficiently equip them

[6] Fox Valley Technical College, *Technical Proposal in support of a grant application to the U.S. Department of Labor for TAACCCT Round Two grant funds*.

with all of the knowledge and skills immediately required of them on the job. Often, after they are hired, employees need additional training, especially company-specific on-the-job training before they can fully adjust to their role in the company. Employers were quick to point out, however, that this was due to a reality in the industry and that the students could not be expected to be proficient on the wide and varied range of machines and equipment that employers in the region use.

Employers also commented on the soft skills that students possess when they complete programs at the college. Some employers noted the natural variability across individuals' soft skills. They further stated that the college could not be held completely responsible for a student's soft skills shortcomings, though they believed that the work-like atmosphere of some of the programs of study should aid students to gain experience in applying soft skills.

Stackable credentials were well received by students, faculty, and staff

"They come out with the knowledge and ability…we can turn a graduate from the school loose in the shop and know that they're going to be able to move forward and catch on to what we have to do and how we do it."

A credential attests to the qualification or competence that a student has demonstrated through work performed in a course or program of study. USDOL encouraged recipients of TAACCCT grants to group, by affinity, courses in a program of study that would result in a student earning a credential when all courses in that group were completed. Doing this would provide shorter-term options for TAA-eligible workers to obtain training leading to higher-paying employment than they would be able to obtain without that attestation of qualification. Credentials could help to document competence with skill sets that could position the student or employee for higher-skill, higher-paying employment.

In support of this idea, FVTC worked with advisory committees from each of its Basic Machine Tool, Automation, and Electronics programs to group together courses that defined specific skill sets, and they created seven new certificates recognized by area employers. AMP *PLUS* staff reported that students reacted positively to creation of the certificates in their programs of study. When the first certificates were awarded in the grant-funded period, students that did not receive certificates wanted to know why they did not receive one. They were satisfied when they learned that it was because they had not yet completed all of the work and would be awarded a certificate when they did. As this understanding increased, some students realized that very early in the

grant-funded program, they had earned credentials but had been unaware of it. Further, marketing of the credentials to students was a necessary step that was recognized belatedly, and was eventually pursued with some success according to AMP *PLUS* staff.

Faculty and staff responded enthusiastically to the idea of credentials too. They recognized that not every student could afford the money or time to stay in college for one or two years or more to earn a diploma or an associate's degree, and regretted when a student "jobbed out" without being able to demonstrate competencies apparent in their coursework. An industry-recognized credential gave the student something that attested to competence with specific skill sets and enabled them to qualify for higher-paying jobs in that field. Moreover, they could continue to work toward additional credentials and marketability to employers. AMP *PLUS* staff also believed that earning credentials helped to motivate students to continue on with their program of study. A credential was visible evidence of progress made.

Variation in program implementation did not have an adverse effect on program performance, as FVTC exceeded all program outcomes

Factors contributing to variation in the time and manner in which AMP *PLUS* was implemented did not adversely affect program performance. FVTC enjoyed very high enrollments during the grant-funded period in the three advanced manufacturing programs, and dedicated and committed faculty and staff contributed to high student achievement. Table 4 compares AMP *PLUS*'s actual performance with that which was targeted in the grant application.

Table 4: Year End Report – Year 3
Reported as of September 30, 2015
(AMP+ certificates counted as "Program of Study"

B. Cumulative Participant Outcomes (All Grant Participants)	Target	Year 1 + Year 2 + Year 3
1. Unique Participants Served/Enrolled	383	675
2. Total Number of Participants Who Have Completed a Grant-Funded Program of Study	217	265
2a. Total Number of Grant-Funded Program of Study Completers Who Are Incumbent Workers		191
3. Total Number Still Retained in Their Programs of Study (or Other Grant-Funded Programs)	277	601
4. Total Number Retained in Other Education Program(s)		84

Table 4: Year End Report – Year 3
Reported as of September 30, 2015
(AMP+ certificates counted as "Program of Study"

B. Cumulative Participant Outcomes (All Grant Participants)	Target	Year 1 + Year 2 + Year 3
5. Total Number of Credit Hours Completed (aggregate across all enrollees)		12,524
5a. Total Number of Students Completing Credit Hours	306	854
6. Total Number of Earned Credentials (aggregate across all enrollees)		453
6a. Total Number of Students Earning Certificates – Less Than One Year (aggregate across all enrollees)	198	336
6b. Total Number of Students Earning Certificates – More Than One Year (aggregate across all enrollees)		30
6c. Total Number of Students Earning Degrees (aggregate across all enrollees)		38
7. Total Number Pursuing Further Education After Program of Study Completion	187	272
8. Total Number of Employed After Program of Study Completion	210	28
9. Total Number Retained in Employment After Program of Study Completion	197	16
10. Total Number of Those Employed at Enrollment Who Received a Wage Increase Post-Enrollment	77	156

Employers supported use of the stackable credentials but continued to encourage students to complete their entire programs of study

Initially, members of the Machine Tool Advisory Committee expressed some reservation about the idea of creating stackable credentials in that program. Their concern was that upon being awarded a credential, a student would try to obtain a job and drop out of their program. For many of these employers, students provided them with the most value when they completed the programs of study because they had more and higher skills and were better prepared to successfully perform in positions involving more responsibility.

Employers were pleased when they discovered that students who earned a credential typically continued on with their programs of study. They also saw that the credentials may have actually motivated the students to continue and perhaps work harder toward their education and employment goals. Many employers that were interviewed for this study stated that they encouraged students, and even their incumbent workers, to continue learning and complete the degrees appropriate for their fields and jobs.

Support Services

One of the overarching goals of the U.S. Department of Labor (USDOL), as described in the Solicitation for Grant Applications (SGA), for this round of grants was to increase attainment of certifications, certificates, diplomas, and other industry-recognized credentials to better prepare Trade Adjustment Assistance (TAA)-eligible workers and other adults for high-wage, high-skill employment or re-employment in growth industry sectors.[7] For many students, especially those who have been out of school for a number of years—such as TAA-eligible and dislocated workers and veterans, staying in school and completing a program of study may present significant challenges. The need for remediation of math and reading skills may be a formidable hurdle, especially in advanced manufacturing settings dominated by computer numerical controlled equipment. Many students, regardless of age or work experience, may deal with financial and personal challenges that could set back or discourage even the most motivated students. Further, awareness of support services and how to access them can be an additional challenge, especially for those without recent experience navigating through educational institutions.

This chapter explores how Fox Valley Technical College (FVTC) leveraged funds from the Advanced Manufacturing Pathways (AMP) *PLUS* grant to broaden and intensify the supports and resources to increase student retention and completion. The following research questions are relevant to this discussion:

"…we'll encourage them [to get a 2-year degree or more training]…We still expect them to go through the course studies at one of the technical schools. Not just for what they learn, but it shows us their commitment to the trade."

IRQ 9. In what ways did assessments contribute to retention and completion rates?

IRQ 11. To what extent has the career navigation contributed to improved retention and completion?

IRQ 12. To what extent are the Veterans Specialist services (VSS) utilized?

a. To what extent do VSS contribute to increased retention and reduced time to completion?

[7] Ibid.

b. Has credit for prior learning increased with the introduction of VSS?

IRQ 13. To what extent are stakeholders satisfied with wraparound services?

a. What can be done to improve the quality of the student support services?

b. What is the level of student satisfaction with student support services?

IRQ 15. To what extent do career guidance components contribute to course completion by all students?

The contribution of assessments to retention and completion is inconclusive

Two assessment features were included as program elements in AMP *PLUS*. One was a tool—the Bennett Mechanical Comprehension Test (BMCT)—that was intended to be evaluated for its appropriateness in assessing aptitude for advanced manufacturing coursework and employment. The second was a process—an assessment of prior learning obtained through military service for granting academic credit. For different reasons, neither was implemented as completely as planned and so they were not able to provide evidence of whether or how they might have influenced student retention and completion.

The BMCT was deemed not a good indicator of manufacturing aptitude

During the third semester of the grant, administration of the BMCT to Machine Tool and Welding students was discontinued after staff determined that there was little correlation between a student's BMCT score and performance in their program of study. Faculty from Automation/Electronics had never used the BMCT with their students as they did not believe that it was a good fit with what students would be learning and asked to do in employment. Consequently there is not a complete data set available to inform a response.

Prior learning credits for military service proved difficult to provide in a technical college

Assessment to determine if any military experience might qualify for academic credit did increase with the addition of a Veterans Specialist to the FVTC staff. However, only nine of the veterans enrolled in AMP *PLUS* received academic credit for the military experience. With these small numbers, it was not feasible to assess the contribution that credits earned as a result of prior learning assessments made to retention and completion.

The explanation provided by FVTC staff was that the specific competency requirements included in technical courses did not match up well with even similar military experiences. General education courses, which are not a major portion of technical college programs, are a bit easier to match up with military experiences.

In spite of the fact that few veterans received credit for prior military learning, most were very appreciative of the support and services provided to them by FVTC and several commented that they believed that FVTC staff had done all they could to help them obtain credit for prior learning in the military.

Role of Career Navigation expanded to focus on improving student retention and completion

The Career Navigator position was included in FVTC's Trade Adjustment Assistance Community College and Career Training (TAACCCT) grant application to simplify career, college, and systems navigation for students as a means to increase student retention.[8] This was to be accomplished by providing academic and career coaching, college transition services, and referral services to each AMP *PLUS* participant. FVTC reported that 368 participants in grant-funded programs received services provided by the person hired as the Career Navigator. Approximately 75% of this group of students met with the Career Navigator one time, with another 12% meeting with the Career Navigator on two occasions. The remaining group of students met more frequently, with a few meeting with the Career Navigator as many as five times and a few others a bit more frequently than that. It is quite possible, though, that students met with other members of the counseling and advising staff as needed.

The Career Navigator carried out many tasks that were described as her responsibility in the grant application. Nonetheless, she did not consider herself a career navigator and indicated that her role focused more on student success and retention, though it did include elements of career development. She stated that her focus included advocating for students and becoming more of a social service referral source than she expected at the beginning of the grant-funded period. In that way, her work contributed to the enhanced and expanded retention services implemented by FVTC during the grant-funded period. Slightly more than half of her time each week focused on working specifically with students enrolled in grant-funded programs, while the remainder focused on working with the student population at large.

[8] FVTC, *Technical Proposal*, 15

Most AMP *PLUS* students that responded to a survey conducted in the first year of the grant-funded period did not recognize the term "career navigator" or the name of the person in that role. However, in a subsequent survey in spring 2016, 61% of the general population of students at FVTC (N = 632) indicated that they received a little, some, or a lot of support from counseling and advising services staff. Consequently, the outcomes analysis looked at the effect of the two key counseling additions—Career Navigator and Veterans Specialist—upon retention and completion outcomes. As described in the next chapter, an effect could not be confirmed by the analysis.

The Veterans Specialist role expanded to focus more on retention and completion

The Veterans Specialist explained that her role evolved throughout the grant-funded period. Through her work she came to understand that many veterans needed and wanted strong "connector points" to help them feel as if they belonged to something larger than themselves, as they often did when they served in the military. She also indicated that many services were available to veterans at FVTC, but were not always easy to find. Complicating matters is the fact that not all veterans identify themselves as veterans when providing personal information during registration and enrollment. Nonetheless, during the grant-funded period the Veterans Specialist served a total of 260 unique students that included 68 student participants in the grant-funded program. Much of her work also involved meeting with veterans to talk through issues and helping them to address various needs. Prior learning assessments were likely conducted by another member of the counseling services staff.

Services provided by the Veterans Specialist integrated well with FVTC's enhanced and expanded focus on student retention. In working specifically with students that were veterans, the visibility of the Veterans Specialist increased and she was able to develop relationships with students and faculty to increase utilization of the counseling and other services available to them. In addition, instructors became much more familiar with her and increasingly gave her early alerts on students that might need some additional attention. Overall, veteran students met with the Veterans Specialist an average of 1.63 times each. It is likely that some of these meetings resulted in referrals to others at the college that could provide services that were more specialized to the student's needs, though that data is not available.

Support services were provided to students by many entities within the college

Key stakeholder interviews revealed that faculty guidance and support is very extensive and considered important to retention and success. However, the level, frequency, or nature of support provided by faculty is not documented by FVTC.

FVTC faculty and staff did not simply wait for students to come to them with problems or needs. They recognized that students do not react to their need for help in the same way: some seek assistance and others do not—for any of a variety of reasons. To help ensure that students that needed help received it, FVTC introduced 2015 a student attendance tracking mechanism to make it easier to identify students who missed several consecutive classes. Missing classes, especially when combined with low performance, is often a sign that there are problems to be addressed. Faculty also kept close watch on student performance and progress and when passing the course became a concern, they regularly informed staff in Counseling and Advising services who then reached out to the student.

Utilization of support services was assessed by way of a survey administered to students enrolled in math courses during spring and fall 2015 and spring 2016 semesters. The survey was uploaded to the course management system used in these courses and students were given time in class to complete the survey. A total of 1,208 unique responses were collected in this manner, of which approximately 5% were from AMP *PLUS* students. Efforts to obtain online survey responses from only AMP *PLUS* students via e-mailed invitations resulted in very low response rates, leading to a decision to survey math students as a reasonable proxy to obtain information about how and to what degree support services were utilized by students.

Ninety percent of students that responded to a survey of math students (N=1,208), that included AMP *PLUS* participants and other FVTC students, reported receiving assistance from at least one source of support.

- Program faculty were the most frequent source of support for students, with nearly half of the students reporting some or a lot of support from this sector in the past year.
- The most common sources of support for students were program faculty, financial services, and counseling and advising services; more than half of respondents said they had received support from these sources.
- Less than half of students had obtained support from general education faculty, The Teaching and Learning Center (TLC), or Educational Support Services.

- More than one-quarter of students had received assistance from FVTC's Employment Connections, and about one in ten had received veterans services.
- Students that reported that they spent extra time on their classes were also more likely to utilize more supportive services.

Table 5: Number of Support Services Used by Students (n=1,208)

Number of Distinct Sources of Support Services Used	Number of Students	Percentage of Students
None	115	9.5
One	168	13.9
Two	184	15.2
Three	164	13.6
Four	158	13.1
Five	146	12.1
Six	117	9.7
Seven	117	9.7
Eight	39	3.2

Table 6: Amount of Support Received From Each of the Following Sources at FVTC in the Past Year (N=1,208)

Source of Support Service Including Advising	Percentage				Percentage (Some or A Lot)
	None	A little	Some	A lot	
Program faculty	30.3	18.2	28.5	21.2	49.7
Financial services	44.0	17.3	22.8	14.0	36.8
Counseling and advising services	37.6	25.6	25.2	10.3	35.5
General education faculty	54.1	16.6	17.3	9.9	27.2
The Teaching and Learning Center (TLC)	57.4	15.0	15.7	10.4	26.1
Educational support services	55.4	17.0	17.4	8.4	25.8
Employment Connections (formerly Student Employment Services	70.5	12.3	11.1	4.1	15.2
Veterans services	86.4	2..0	3.7	5.5	9.2

Student satisfaction with support services was very high. Many responded very enthusiastically when asked to offer comments about the support that they received from the various sources at FVTC. A sample of the deep appreciation that students have for FVTC and for the assistance they received is shown below.

"Fox Valley staff has always been very accommodating when helping me solve problems that pop up over the semester."

"I am very grateful that I am a part of this school."

"I would not be where I am without the support I have received."

"The labs, the faculty, the tutors, and fellow students are very willing to help. I tell everyone about the help offered for success."

"The support I have received from Fox Valley Technical College has been a valuable part of my life."

"This is one of the best investments and decisions I've made so far in my life."

Flexibility and Learning Tools

The commitment that Fox Valley Technical College (FVTC) faculty and staff brought to the process of improving student retention and completion did not stop with enhancing support services. In keeping with Trade Adjustment Assistance Community College and Career Training (TAACCCT) goals, FVTC focused on ways to strengthen the teaching–learning process through creating flexibility in scheduling and attendance, strengthening competency-base course assessments, and developing learning aids that could be accessed from any internet-connected device.

This chapter highlights the influence of and student satisfaction with the flexible course options and mobile learning applications (apps). The following research questions are relevant to this discussion:

IRQ 4. What was the process for incorporating contextualized mobile apps into the advanced manufacturing courses?

- ***c. What was the experience in training faculty to use these?***
- ***d. How easy was it for faculty to integrate these into their courses?***

IRQ 7. In what ways did utilization of mobile apps contribute to increased retention and attainment of credentials and completed credit hours?

IRQ 10. What is the perceived contribution of technology-enhanced learning components to increased retention and time to completion for students?

- ***a. To what extent are the mobile apps utilized?***
- ***b. What are the barriers to their use?***
- ***c. How satisfied are students with the technology-enhanced course aspects?***
- ***d. In what ways do they improve the student experience?***

FVTC is poised to incorporate mobile apps into advanced manufacturing courses

FVTC envisioned that access to these learning objects could be improved if they were available to anyone with a smart phone or other internet-connected device. FVTC exceeded the number of mobile apps planned, though not within the initial timeline projected. The apps for the math courses were completed, as a body of objects, early

enough in the grant-funded period to be able to get a strong indication of the degree to which they were used and found useful by math students. That data is provided later in this report.

By the end of the grant-funded period, mobile app development had reached 103% of the program's goal overall. There was some variation in the distribution of apps by subject area compared to what was originally planned; more Welding and math apps, but slightly fewer Machine Tool and critical core skills apps, were developed than planned. Table 7 shows the distribution of apps by subject area. In those subject areas where app production was lower than targeted, faculty determined that the number of apps was sufficient and appropriate for the curriculum.

Table 7: Grant-Funded Mobile App Production

Subject Area	Goal	Completed
Welding	105	113
Machine Tool	150	110
Automation/Electronics	85	84
Critical core skills	100	86
Math	150	216
Total	590	609

The timeline for completing apps was delayed for several reasons, with math apps being completed, as a body of work, first. Factors contributing to delays in app production were noted in the Fidelity chapter.

Math faculty were the first to integrate apps into their courses with many uploading them into the syllabi and course management software that they and students use in the courses. Many of the faculty in the advanced manufacturing programs chose to wait until all of the apps for those courses were completed before incorporating them into their courses.

FVTC provided advanced manufacturing faculty with iPads to make it easier for them to demonstrate the use of apps to students. During the final year of the grant-funded period, FVTC made a decision to encourage more widespread faculty use of a commercially available course management system. This would allow faculty to more easily upload the mobile apps into the lessons for their courses. It would also make it possible to track utilization of mobile apps by individual student—something that had been very difficult to do previously.

Because the entire portfolio of mobile apps for advanced manufacturing courses had not been completed until approximately the close of the grant-funded period—and that no student-level usage data could be tracked—there was not sufficient data available to assess the degree of utilization of mobile apps by course and credential completers.

Mobile app use by math students increased over time

Math students' use of mobile apps increased between spring semester 2015 and spring semester 2016, as is shown below in Table 8. A lower percentage of students did not use apps at all in spring 2016 as compared to spring 2015 and a higher percentage used apps in all content areas in 2016 than in 2015. Increased usage could have been due to greater need on the part of students, greater awareness of the apps as learning aids, and/or increased demonstration and promotion of the apps on the part of faculty.

Table 8: Number of Unique Apps Used, Spring 2015 Compared to Spring 2016

	Spring 2015 (n = 642)		Spring 2016 (n = 408)	
Number of Unique Apps Used, of the Eight Apps Mentioned in the Survey	**Number of Students**	**Percentage of Students**	**Number of Students**	**Percentage of Students**
No apps used	86	13.4	46	11.3
One	16	2.5	5	1.2
Two	21	3.3	3	0.7
Three	32	5.0	11	2.7
Four	72	11.2	13	3.2
Five	72	11.2	16	3.9
Six	58	9.0	20	4.9
Seven	56	8.7	52	12.7
Eight	229	35.7	242	59.3

Mobile app use and extra time spent on classes

Students that reported that they spent extra time on classes were also much more likely to utilize mobile apps.

Perception and lack of awareness were the primary barriers to utilization of mobile apps

There are no real barriers to use of mobile apps, though mobile phone use is not permitted in most classrooms. Nonetheless, apps are accessible using any device that is connected to the internet and they are accessible from any location. Indeed, the GAMMA+ website that is the repository of the apps created for Advanced Manufacturing Pathways (AMP) *PLUS*, as well as many other learning objects, draws visitors from all over the world.

Lack of awareness of the existence of the apps was a problem for a time. However, FVTC posted posters and flyers in every classroom and throughout the college's facilities to make information about the apps visible to students. Math faculty were the first to incorporate apps into their courses and they mentioned the apps prominently in their course materials and even provided links to them directly in some cases.

In a previous survey of all AMP *PLUS* students in 2014, a number of reasons were given why students had not utilized apps. While some students indicated that they did not need additional help in understanding the concepts, others explained that they either were not aware that the apps existed for their use or misunderstood that they did not need a smart phone and could access apps from any device that was connected to the internet. FVTC had already begun an outreach program to make students aware of the mobile apps and how they could be used, but intensified those efforts upon receipt of this information.

Math students find mobile apps to be helpful to their learning

Math students that utilized access to the mobile apps found them to be helpful to their efforts to learn the concepts involved. Apps pertaining to equations received the highest number of "somewhat" or "very helpful" responses by students that used them. These apps also were used by a higher percentage of students. Apps that received responses of "somewhat" or "very helpful" from a lower percentage of students that used them typically were in content areas that fewer students had used, such as those found in higher-level math courses.

Non-users can include those students that did not have a need for the help, students that had not yet taken courses that focused on those categories of topics, or students unaware of the apps.

Table 9: Perceived Helpfulness of Apps (n=1,208)

Category	Percentage Non-Users*	Percentage Somewhat or Very Helpful**	Average Rating of Helpfulness ***
Equations	16.5	76.8	3.5
Exponents, whole, and signed numbers	18.8	72.7	3.4
Fractions, mixed numbers, decimals, and percentages	17.7	74.6	3.5
Measurement	30.5	62.0	3.5
Other topics	22.3	67.1	3.3
Geometry	36.8	51.9	3.3
Polynomials	40.5	47.2	3.2
Trigonometry	41.1	47.2	3.2

* Nonresponse or said that they have not used the app.

** Among users, percentage who found it somewhat or very helpful.

*** Scale where 1 = not at all helpful and 4 = very helpful.

Participant Outcomes

This chapter focuses on how the Advanced Manufacturing Pathways (AMP) *PLUS* program impacted student educational and employment outcomes. The following research question is relevant to this discussion:

ORQ 1. Are students in the enhanced programs of study more likely to have improved enrollment status as compared to other students?

ORQ 2. Are students in the enhanced programs of study more likely to earn associate's degrees as compared to students in the comparison group?

ORQ 3. To what extent do students in the enhanced programs have more positive employment outcomes than other students?

ORQ 4. To what degree to do students who receive wraparound services experience more positive outcomes (be retained; earn associate's degree; earn a greater number of credits; be employed) as compared to students who received fewer or no wraparound services?

Participant Outcome Objectives

As one of a number of grants in the U.S. Department of Labor Employment and Training Administration's Trade Adjustment Assistance Community College and Career Training (TAACCCT) Round Two portfolio, the overarching objectives of AMP *PLUS* were to increase student retention and completion and accelerate time to attainment of industry-recognized credentials. The evaluation's focus included analysis of participant outcomes to see if achievement of those objectives could be confirmed as well as to understand the various factors that mediate the outcomes achieved by program participants.

Evaluation Approach

A quasi-experimental design (QED) was used to assess the impact of the program on educational outcomes (continuing student status, attainment of a terminal degree, and number of credit hours completed) and employment outcomes. A series of regression models were used for each of the four proposed hypotheses. The model estimated the

effect size of participation in the program as well as specific program components on selected outcomes.

Characteristics

Both participant groups and the comparison group were similar in age, racial makeup, receipt of Trade Adjustment Assistance (TAA) funds, veteran status, and use of veteran benefits. The comparison group had a higher proportion of students who were full-time status and received a Pell grant than either of the participant groups. More students in the participant groups were employed at enrollment than the comparison group. See the full table of descriptive statistics in Appendix B.

Both participant groups had very few Welding students compared to the comparison group, but far more Machine Tool students. Participant group 1 had somewhat more Automation/Electronics students than the other two groups.

	Participant Group 1	Participant Group 2	Comparison Group
	N = 371	N = 221	N = 566
Welding Machine Tool Automation/Electronics	27 (7%) 112 (30%) 232 (63%)	2 (1%) 103 (47%) 116 (52%)	161 (28%) 101 (18%) 304 (54%)

Findings

While one of the evaluation concerns was to assess the degree to which the AMP *PLUS* program accelerates time to attainment of industry-recognized credentials, the larger number of students in the participant groups that were part-time status made comparing time to completion between the participant group students and the comparison group students a dubious exercise, as there was no standard or consistency in the number of courses or credit hours that part-time students took.

The results of the hypotheses testing are shown below. These provided the framework for and focused the analysis on the effect of the AMP *PLUS* program factors on the targeted outcomes.[9]

Confirmatory 1a: Students in participant group 1 and students in participant group 2 are more likely to be retained/maintain continuous enrollment in the community college, relative to the comparison group of students.

- ***Result:*** Not confirmed.

Neither participant group 1 nor participant group 2 saw an improvement in continuous enrollment over the comparison group.

Confirmatory 2a: Students in participant group 1 and students in participant group 2 are more likely to earn terminal degrees in Welding (technical diploma), Automation/Electronics (associate's degree), or Machine Tool (technical diploma) relative to the comparison group students.

- ***Result:*** Not confirmed.

Participant group 1 did not see an increase in terminal degrees earned over the comparison group. However, participant group 2 did see an increase in terminal degrees earned relative to the comparison group. The odds of earning a degree in participant group 2 were a little over two times greater than the comparison group ($OR = \exp^{0.79} = 2.20$).

Exploratory 2b: Students in participant group 1 and students in participant group 2 are more likely to earn a greater number of credits, relative to the comparison group students.

- ***Result:*** Not confirmed.

Participant group 1 did not see an increase in the number of credit earned over the comparison group. Participant group 2 did see an increase in credits earned relative to the comparison group. Students in participant group 2 earned, on average, 15 more credits than students in the comparison group.

[9] Previously proposed exploratory hypotheses were dropped from the analysis in order to better manage three groups.

Confirmatory 3a: Students in participant group 1 who graduate and students in participant group 2 who graduate are more likely to enter employment upon course/program completion [two quarters post-exit or post-graduation] than the students in the comparison group.

- ***Result:*** Not confirmed.

Participant group 1 did not see an improvement in employment rates over the comparison group. However, participant group 2 did see an improvement in employment rates relative to the comparison group. The odds of becoming employed in participant group 2 were almost two times greater than the comparison group ($OR = \exp^{0.66} = 1.93$).

Overall, the results for participant group 1 did not differ from those of the comparison group. However, the results for participant group 2 were better than the comparison group in many regards. Since participant group 2 was a mixture of both the traditional programs seen in the comparison group and the AMP *PLUS* program seen in participant group 1 (where length of exposure to the program was uncontrolled for), this result is difficult to explain. There may be something about that particular student cohort that, independent of the teaching techniques and other factors included in the regression model, would explain the results

Table 10: Effect of Participation on Selected Outcomes

	Model 1	Model 2	Model 3	Model 4
Outcome Variable	**Continuous Enrollment**	**Earned Terminal Degree**	**Number of Credits**	**Employment (Graduates Only)**
	Logit	**Logit**	**OLS**	**Logit**
Participant Group 1	.43	-.12	-1.32	-.44
	(.30)	(.30)	(2.92)	(.52)
Participant Group 2	.35	.79**	15.4**	.66*
	(.23)	(.19)	(2.0)	(.33)
Age	.01	-.02*	-.23**	.01
	(.01)	(.01)	(.06)	(.01)
Nonwhite	-.49	-.38	-3.0	-.37
	(.27)	(.23)	(1.9)	(.44)
Disability	-.20	-.28	1.9	-.05
	(.31)	(.28)	(2.2)	(.45)
Full-time	.18	.74**	10.2**	.94**
	(.17)	(.15)	(1.4)	(.26)
TAA funded	.53	.68*	10.4**	.33
	(.30)	(.28)	(2.6)	(.45)
Vet benefits	.27	.24	-1.3	.57
	(.52)	(.60)	(3.9)	(.76)
Pell	-.06	.03	2.6*	-.79**
	(.16)	(.14)	(1.3)	(.25)
Veteran	.29	.04	7.0	-.89
	(.53)	(.60)	(4.2)	(.80)
Employed at enroll	-.10	-.06	1.5	.33
	(.16)	(.15)	(1.3)	(.25)
Machine Tool	-.14	.39*	4.6**	.29
	(.18)	(.16)	(1.4)	(.31)
Welding	.44*	1.42**	-4.2*	1.1**
	(.22)	(.19)	(1.7)	(.30)
Year admitted	.08	-.19*	-4.1**	-.11
	(.09)	(.09)	(1.0)	(.16)
Constant	-2.86	1.26	67.9	.00
	(1.05)	(.99)	(11.3)	(1.76)
N	1,158	1,158	1,158	376
(Pseudo) R squared	.03	.12	.27	.11
F statistic			29.6	
Prob.>F			.00	
χ^2	39.6	150.0		48.7
Prob>χ^2	.00	.00		.00

Notes: * p<.05, two-tailed; **p<.01, two tailed. Robust standard errors in parentheses.

Exploratory: Students who received wraparound services (assessment, coach/counsel, career guidance) [metric: number of career navigator and veterans specialist service

contacts over course of grant] are more likely to have positive outcomes (as noted above) as compared to students who received few or no wraparound services.

- ***Result:*** Not confirmed.

Overall, wraparound services did not improve outcomes for students. Veterans specialist services showed no impact on any outcomes. Students who used career navigator services earned, on average, almost two credits less than students who did not use wraparound services. See Appendix B for full regression model outcomes.

Factors Influencing the Participant Outcomes

Students in the Welding program had the best outcomes across the board. The Welding program was set up to be a more compact program with students earning credentials, graduating, and entering the workforce faster. This is reflected in the outcomes where Welding students earned significantly less credit hours, but were more likely to graduate and become employed than the other two manufacturing program groups. However, it should also be noted that the Welding program had the smallest number of AMP *PLUS* students enrolled, and these results may be an artifact of the smaller numbers.

Students in the Machine Tool program were more likely to graduate and earn more credits compared to Automation/Electronics students.

Younger students were more likely to graduate and earn more credits. Full-time students were more likely to graduate, earn more credits, and become employed. TAA funds aided students with graduation and credits earned. Students with Pell grants were more likely to have a higher number of credits earned.

Lessons

The lessons and implications regarding key areas of program implementation and the impacts to date are summarized below, along with recommendations where appropriate.

Fidelity

- Some features initially planned in the grant, such as the Bennett Mechanical Comprehension Test (BMCT), were not fully implemented and the loss of the feature was not fully vetted. Other features evolved and the Fox Valley Technical College (FVTC) team used data to identify next steps. Strategic priorities weighed in the decisions, and knowledge gleaned from other initiatives at the college was integrated to good advantage.
  - Fidelity to the program design is more likely to be improved, as is the timeliness of implementation, if those responsible for implementation are involved in developing the grant application.

Pathways

- The stackable credentials created at the outset of the Advanced Manufacturing Pathways (AMP) *PLUS* program were a key accomplishment of the program. Students were reported to appreciate the additional milestone of progress; employer concerns that they would lead to students leaving for employment prematurely were not realized.
- AMP *PLUS* staff believe that students were motivated to continue with their studies as they accumulated credentials as building blocks toward a technical diploma or degree.
  - Continued use of the current structure for credentials is likely to meet the needs of students and employers.
  - The creation of stackable credentials is very consistent with FVTC's competency-based requirements for course completion. Stackable credentials also help to focus student awareness on the organization and hierarchy of skills they learn in their programs of study.

- Marketing of the credentials to students is a necessary step to increase student awareness, understanding, and motivation.

- The fact that employers encourage their new hires and current employees to continue to learn new skills, and document them with credentials, suggests the importance of the programming in meeting employers' needs.
- Employers are an important partner in providing input into the skills needed that credentials represent.
  - FVTC staff highly value and continue to put energy into the relationships with manufacturing employers in the region.
- While FVTC was very successful in exceeding its enrollment targets for the AMP *PLUS* grant, the number of female students enrolled was vastly below the percentage of women employed in manufacturing nationwide.
  - FVTC staff and employers are encouraged to assess barriers and facilitators to enrolling more women into the manufacturing program, and consider establishing a goal to dramatically increase female enrollment.

Support Services

- Concerns raised by counseling staff should be taken into consideration when selecting assessments. These include:
  - Assessments to explore a student's aptitude for a particular program of study should be just one of many factors used in counseling students for study, jobs, and careers.
  - Timed interest and aptitude assessments might limit their usefulness as career exploration and aptitude tools.
- The contribution of assessments to retention and completion is inconclusive.
  - Two key assessments were featured in the FVTC grant. One was the Bennett Mechanical Comprehension Test, which was intended to assess aptitude for advanced manufacturing coursework and employment. The second was an assessment process to identify prior learning obtained through military service that would qualify for academic credit. However, neither was implemented as completely as planned and accordingly did not provide any specific evidence of whether or how they might have influenced student retention and completion.

- FVTC added to and enhanced their commitment to increase student retention and completion.
  - The two Trade Adjustment Assistance Community College and Career Training (TAACCCT) grant-funded staff roles—Career Navigator and Veterans Specialist—notably evolved from their original intention, and yet in some ways were carried out with fidelity to the model. Some of the changes were likely unavoidable, for instance where it was simply not feasible to align prior learning credits with types of courses at FVTC.
  - However, both positions added resources to FVTC's college-wide efforts to improve student retention and completion. These complemented the support services provided formally and informally by various sources.
- Survey results suggested that students obtained support from a wide range of sources at FVTC, and typically received support from multiple sources.
  - Faculty guidance and support is quite extensive and widely considered important to retention and success. However, there is no documentation of the level, frequency, or nature of support provided by faculty.
- The TAACCCT grant has indirectly contributed to FVTC's capacity to examine the complicated issue of retention, and to identify potential means to improve retention. A retention study provided data to help FVTC staff and faculty target likely problem areas.
  - The attendance monitoring procedures recently instituted by FVTC and supported by communication pathways between and across support staff and faculty have the potential to identify students that might need supports of one type or another before the need becomes a crisis.
  - Results from the surveys of math students showed that students that spent extra time in classes also were more likely to utilize a greater volume of supportive services. Similarly, math students that spent extra time on classes were more likely to utilize a larger number of mobile apps. Whether these are indicators of dedicated, hard-working students or indicators of students needing additional help and perhaps being at risk is something that may be worthy of closer attention.

Flexibility and Learning Tools

- Expanded offerings for Machine Tool and Welding appeared to have filled a strong need for flexibility among students.
- Though instituted prior to AMP *PLUS*, competency-based assessments and ability to use advanced manufacturing labs throughout the day provided students with the flexibility to schedule and complete courses at their own pace.
- Although the pace of development of learning applications (apps) was not as planned, ultimately the AMP *PLUS* team created and published over 600 learning apps, and did so in each of the planned subject areas: Welding; Machine Tool; Automation/Electronics; critical core skills; and math.
- Several important lessons were learned about the dissemination of learning apps. Among these were the need to make them readily accessible to both faculty and students and to demonstrate use of the apps in context as appropriate and needed.
  - Faculty are more likely to include mobile apps in their courses if those apps are readily available, i.e., if they are already embedded into the online course management system.
  - It is critical to incorporate a marketing plan for the adoption of new tools such as mobile learning apps. Specific and meaningful messages are needed in order to engage faculty—to bring into the course syllabus, as well as to engage students, so they may fully utilize them both in and out of labs and classes.
  - Designing the learning objects so that they could be accessed by any mobile device was an idea ahead of its time. Many students reported not having mobile internet-connected phones, mistakenly believing this was the only means of accessing the apps. Students were often not allowed to use mobile devices in classrooms and labs; many workplaces do not allow their use, either.
  - Students are more likely to make use of mobile apps if those apps are embedded in course materials and the online course management system, and are demonstrated by faculty.
- Learning apps were accessed by a large proportion of students enrolled in basic math class. Students rated them highly in terms of their helpfulness. Students who used the apps found them useful.

Appendix A: Logic Model

Table A-1: AMP *PLUS* Logic Model

Inputs	Activities	Outputs	Short-Term Outcomes	Long-Term Outcomes
AMP *PLUS* design I-BEST / RISE Career Navigator ACE/Prior Learning Assessment Tool/JST Bennett Mechanical Comprehension Test Wrap-around student support mechanisms WISC-Online learning technologies Relations with FVWDB and employers Technology-enabled learning Prior experience with learning objects Math contextualized courses Partnership Self-Assessment Tool	Create technology-embedded mobile apps for math classes Improve scheduling flexibility and capacity Create new industry-recognized pathways New course sections offered at times convenient for work/family (Summer Evening Machine Tool) Test students for mechanical aptitude Enhance flexible learning options thru technology-enabled courses Train veteran's specialist in ACE/PLA and other protocols Launch Career Navigator Partners complete Partnership Self-Assessment Tool	Mobile apps are disseminated Faculty integrate mobile apps into courses High-skilled robotic welding course delivered 300 students tested for mechanical aptitude 300 students served by Career Navigator 150 veteran-students served; 3 system-wide training events offered 150 learning apps and flash card sets created Students enroll in courses with new technology enhancements	Prior learning credit and ACCUPLACER assessments improve student persistence and retention rate Support services increase student retention Increased number of stackable/latticed credentials earned Accelerated time to student credential attainment Prior learning assessments increase in consistency and systematic application Veterans receive increased credit for Prior Learning Assessments Support services staff will use prior learning credit assessment information to counsel and support students	Increased student retention in program of study Increased student completion Shorter time to program, certification, and degree completion Articulation and transferability to further education Increased employment and retention Increased wage increments post-enrollment

Assumptions:

- Increased capacity in-house to serve veterans
- Partner/stakeholder engagement and leveraging of expertise
- New curriculum and learning apps accelerate learning and support student success
- Strengthening the relationship between the workforce development system and the college
- Working with other TAACCCT grantees

Appendix B: Methodology

Research Questions

The research questions that drove the evaluation are listed below.

Table B-1: Research Questions

Implementation Questions
1. What roles did partners play in the development and implementation of the program? a. Which partner contributions are the most critical to the success of the grant program? b. How engaged were the partners and what factors affected their degree of engagement? c. What can be done to improve the quality of partner engagement?
2. Are program activities implemented with fidelity to the plan? a. What are the challenges to doing so? b. Where variation occurred; did it help or hinder program implementation or achievement or program outcomes?
3. How were the choices made in designing AMP *PLUS*? a. What factors were considered? b. How were curricula selected and enhanced? c. How were the pathways designed?
4. What was the process for incorporating contextualized mobile apps into the advanced manufacturing courses? a. Was this fully implemented as planned? b. Was this implemented according to the planned timeline? c. What was the experience in training faculty to use these? d. How easy was it for faculty to integrate these into their courses?
5. How were mobile apps designed? a. What were the results of the third-party ratings?
6. How were flexible learning options perceived to contribute to improved enrollments, course completion?
7. In what ways did utilization of mobile apps contribute to increased retention and attainment of credentials and completed credit hours?
8. How did the availability of stackable and latticed credentials contribute to the achievement of program outcomes?
9. In what ways did assessments contribute to retention and completion rates?
10. What is the perceived contribution of technology-enhanced learning components to increased retention and time to completion for students? a. To what extent are the mobile apps utilized? b. What are the barriers to their use? c. How satisfied are students with the technology-enhanced course aspects? d. In what ways do they improve the student experience?
11. To what extent has the career navigation contributed to improved retention and completion?

Table B-1: Research Questions

12. To what extent are the veterans specialist services (VSS) utilized? a. To what extent do VSS contribute to increased retention and reduced time to completion? b. Has credit for prior learning increased with the introduction of VSS?
13. To what extent are stakeholders satisfied with wraparound services? a. What can be done to improve the quality of the student support services? b. What is the level of student satisfaction with student support services?
14. How are wraparound services perceived to contribute to retention? a. How does this vary across TAA grantees, veterans, female students, and members of minority groups?
15. To what extent do career guidance components contribute to course completion by all students?
16. To what extent are employers satisfied with the employment readiness of students in enhanced programs? a. To what extent are students and alumni satisfied with the preparation for employment they received with technology-enhanced learning components?
Outcome Questions
1. Are students in the enhanced programs of study more likely to have improved enrollment status (retained, transfer; not dropped) as compared to other students?
2. Are students in the enhanced programs of study more likely to earn associate's degrees as compared to students in the comparison group?
3. To what extent do students in the enhanced programs have more positive employment outcomes than other students?
4. To what degree to do students who receive wraparound services experience more positive outcomes (be retained; transfer to pursue further education; earn an associate's degree; earn a greater number of credits; be employed) as compared to students who received fewer or no wraparound services?

As noted in the body of the report, some research questions could not be fully answered. It was necessary to adjust the evaluation design in order to accommodate availability of administrative and program data. The design adjustments were accomplished by the evaluation team in collaboration with the Fox Valley Technical College (FVTC) staff and the national evaluation coordinator. As the grant as a whole sought to effectively move students through training for careers, the evaluation examined continuous enrollment, earned terminal degrees, number of credits earned, and employment. Specific instances of deviation from the original evaluation design are discussed as relevant below.

Implementation Study

Units of Analysis

The units of analysis for the capacity-enhancement goals were the groups of stakeholders involved in planning and/or implementing the project. This included FVTC faculty, support service staff, grant leadership, employers, and the advisory board members.

The implementation study began in April 2013 and the first site visit was conducted in May 2013. Data collection—which included additional site visits, observations of meetings, and reviews of administrative records—continued throughout the grant period. The evaluation continued past the end of grant activities, through June 2016, to allow time for maturation of outcome data and to produce the final report.

Methods

The implementation study was informed by qualitative and quantitative data from the following sources:

- *Primary data sources:*
  - Student participants – student online survey
  - Program leadership, faculty, and staff – interviews during site visits and by telephone
  - Employers – employer advisory committee meeting and telephone interviews
  - Other key stakeholders
- *Secondary data sources:*
  - Program documentation
  - Administrative data

Site Visits (Observations, Fidelity Assessment, and Interviews)

Table B-2: Site Visit and Interview Schedule

Site Visit Timing	Duration/Mode	Subject of Visit
May 2013	One day on site	Project launch activities and the evaluation
December 2013	Phone interviews conducted in lieu of two days on site aborted due to weather	Program implementation, availability of services, collaborations, mobile application (app) development, early lessons

Table B-2: Site Visit and Interview Schedule		
Site Visit Timing	**Duration/Mode**	**Subject of Visit**
July 2014	Phone interviews conducted in lieu of two days on site aborted due to stormy weather	Assessments, support services, mobile apps
November 2014	Two days on site	Program implementation, availability of services, collaborations, mobile app development, early lessons
February and March 2015	Phone interviews	Employers/advisory board members
April 2015	Two days on site	Credentials, support services, mobile apps

To assess the degree to which the program was implemented as planned, a fidelity scale was developed and incorporated into the data-collection activities. The fidelity scale identified core components of the program as implemented. As the program was implemented and understanding of the core components increased, the scoring rubric was more broadly defined. Through discussions with FVTC staff, the evaluation team determined whether some program elements were more important than others and those items were then given greater weight in the analysis.

Student Surveys

The survey of students was intended to collect select control variables in the outcome regression models. However, it was not feasible to survey only Advanced Manufacturing Pathways (AMP) *PLUS* students. Instead, students in all math courses were targeted in several semesters (spring 2015, fall 2015, and spring 2016) to respond to the survey. The instrument was embedded into course materials, facilitated by faculty, and data collected online. About 5% of the respondents to the math survey were *PLUS* students. Past research shows there is a correlation between the elements listed below and desired student outcomes, and these elements were included in the survey:

- Access to the internet
- Technical (computer) proficiency
- Math confidence
- Motivation, for which study habits are a proxy

Attitude toward mathematics, attitude toward computer use, and academic motivation were each measured with a series of Likert-type items. Subjects were asked to what extent they disagreed or agreed with a series of items, including "Attending class is a priority for me" and "I find myself putting in extra time for my math classes." The AMP *PLUS* program design assumed a sufficient amount of access to technology and a sufficient proficiency with and comfort in utilization.

Results related to internet access, computer proficiency, math confidence, and motivation are shown in Appendix C. The survey also dealt with usage and satisfaction with both mobile apps and support service, the results of which are described in the body of this report.

A prior effort to obtain online survey responses from only AMP *PLUS* students via e-mailed invitations resulted in very low response rates, leading to a decision to survey math students as a reasonable proxy to obtain information about how and to what degree support services were utilized by students, and feedback on learning apps.

Outcomes Study

Unit of Analysis

The unit of analysis for the outcomes study was the participant.

Methods

To understand outcomes, we used a quasi-experimental design (QED) to assess the impact of the program. A series of regression models were used for each hypothesis. The model estimated the effect size of participation in the program as well as specific program components on selected outcomes.

Dependent variables for the analysis consisted of those representing education outcomes (continuing student status, attainment of terminal degree, and number of credit hours completed) and employment outcomes. Separate regressions were run to estimate the influence of the project on each outcome.

The key independent variable for the analysis was participation in the AMP *PLUS* project. Additionally, use of the career navigator and veteran services were assessed in a separate exploratory analysis.

- For the research questions:
  - Participant Group 1 – Used a binary scale to compare members in the participant group who were *fully* exposed to the AMP *PLUS* program to the comparison group
  - Participant Group 2 – Used a binary scale to compare members in the participant group who were *partially* exposed to the AMP *PLUS* program to the comparison group
- For the exploratory question:
  - # Career Navigator – Used an interval scale of the number of contacts made with a career navigator
  - # Veteran Services – Used an interval scale of the number of contacts made with a veteran service specialist

Control variables included a number of demographic variables that were expected to correlate with outcomes. Additionally, the different manufacturing programs available were assessed. The Automation/Electronics program was used as the basis for comparison in the regression models:

- Age – Used an interval scale; data are as of August 1 in their academic start year
- Ethnicity/Race – Used a binary scale comparing white to nonwhite
- Disability – Used a binary scale where no disability was compared to any type of disability report (this included Disability-Primary not Identify; Psychological Disability; Other Health Impaired; Specific Learning Disability; Deaf; Autism Spectrum Disorder; and Traumatic Brain Injury)
- Full-time student status – Used a binary scale comparing full-time to part-time status
- Trade Adjustment Assistance (TAA) funded – Used a binary scale to compare TAA funding to no funding
- Veteran benefits – Used a binary scale to compare receipt of veteran benefits to no benefits
- Pell grant – Used a binary scale to compare receipt of Pell grant to no grant
- Veteran Self-Reported Status – Used a binary scale where "yes, veteran" (including Active Duty/Campaign Badge Vet; and Veteran (VA Ineligible)) was compared to "not a veteran" (including Not indicated; blank value; No Military Service; Not a Veteran; Inactive Reserve)

- Employed at enroll – Used a binary scale to compare employed at time of enrollment (including Employed, full-time; Employed, part-time; and Underemployed) to no employment (including Dislocated worker; Unemployed; Seeking employment; Not in labor market; and Refused to provide)
- Year admitted – Used an interval scale with ranges from 4 (2004) to 14 (2014)
- Machine Tool – Used a binary scale to compare enrollment in the Machine Tool program to enrollment in the Automation/Electronics program
- Welding – Used a binary scale to compare enrollment in the Welding program to enrollment in the Automation/Electronics program

Participant Evaluation Group

FVTC defined program participants as those who enrolled in one of the grant-funded programs of study—Welding, Automation/Electronics, or Machine Tool—during the spring, summer, or fall 2013 semesters; spring, summer, or fall 2014 semesters; and spring and summer 2015. Early in 2013, the programs had been reconfigured to offer a series of industry-recognized interim credentials. Of the 675 students served by the grant, 592 cases were available and included in the descriptive analysis and the outcomes analysis. For the analyses, cases were constrained to those with grant inclusion dates between January 2013 and June 2015. This allowed for maximizing the potential impact of the grant along with a cutoff date that permitted time for outcomes to mature prior to reporting..

Two participant groups were created for the evaluation analysis. Both groups included those identified by FVTC as grant participants, who were included spring, summer, or fall 2013 semesters; and spring, summer, or fall 2014 semesters. It does not include those who started in 2015, as there was insufficient time for follow up data for these cases. This presumes that all students enrolled in the grant-funded programs during the timeframe of interest began working toward an FVTC credential.

- Participant Group 1. This is a *full* intervention group comprised of those whose admit term into their advanced manufacturing program of study was on or after January 1, 2013, and before January 1, 2015. (n= 371)
- Participant Group 2. This is a *partial* intervention group comprised of those whose admit term into their advanced manufacturing program of study was before January 1, 2013, but who continued to be enrolled in the program of study after that date at any semester in 2013 or 2014. (n=221)

Comparison Group

A comparison group was created comprised of students who had enrolled in the same courses of study as those funded by the Trade Adjustment Assistance Community College and Career Training (TAACCCT) grant in semesters prior to the launch of the grant-funded innovations, and who graduated or left the college prior to when the grant was enacted (n = 566). The duration of time that student performance and outcomes were tracked was the same as that for the participant group; i.e., 24 months.

Eligibility for comparison group included:

- Students who had enrolled in a Machine Tool, Welding, or Automation/Electronics program of study prior to the launch of the grant-funded innovations:
  - Spring, summer, or fall 2010 semesters; or
  - Spring, summer, or fall 2011 semesters; or
  - Spring, summer, or fall 2012 semesters
- Students who graduated from or left the program prior to January 1, 2013
- Students who were not be in the participant group

Hypotheses for Outcomes Analysis

While one of the evaluation concerns was to assess the degree to which the AMP *PLUS* program accelerates time to attainment of industry-recognized credentials, the larger number of students in the participant groups that were part-time status made comparing time to completion between the participant group students and the comparison group students a dubious exercise, as there was no standard or consistency in the number of courses or credit hours that part-time students took.

The hypotheses, listed below, provide the framework for and focused the analysis on the effect that the AMP *PLUS* program factors had, if any, on the targeted outcomes.[10]

Confirmatory 1a: Students in participant group 1 and students in participant group 2 are more likely to be retained/maintain continuous enrollment in the community college, relative to the comparison group of students.

[10] Previously proposed exploratory hypotheses were dropped from the analysis in order to better manage three groups.

Confirmatory 2a: Students in participant group 1 and students in participant group 2 are more likely to earn terminal degrees in Welding (technical diploma), Automation/Electronics (associate's degree), or Machine Tool (technical diploma) relative to the comparison group students.

Exploratory 2b: Students in participant group 1 and students in participant group 2 are more likely to earn a greater number of credits, relative to the comparison group students.

Confirmatory 3a: Students in participant group 1 who graduate and students in participant group 2 who graduate are more likely to enter employment upon course/program completion [two quarters post-exit or post-graduation] than the students in the comparison group.

Other Exploratory: Students who received wraparound services (assessment, coach/counsel, career guidance) [metric: number of career navigator and veteran specialist service contacts over course of grant] are more likely to have positive outcomes (as noted above) as compared to students who received few or no wraparound services.

Analysis

SPSS was used to run the descriptive statistics, and Stata was used to run the regression models.

The regression model specification was as follows:

$$\text{Outcome(NAME)}_I = \alpha + \beta 1\ \text{ParticipationGroup1}_i + \beta 2\ \text{ParticipationGroup2}_i + \beta 3\ \text{Age}_i + \beta 4\ \text{Nonwhite} + \beta 4\ \text{Disability}_i + \beta 5\ \text{Full-time}_i + \beta 6\ \text{TAA funded}_i + \beta 7\ \text{Vet benefits}_i + \beta 8\ \text{Pell}_i + \beta 9\ \text{Veteran}_i + \beta 10\ \text{Employed at enroll}_i + \beta 11\ \text{Year admitted}_i + \beta 12\ \text{Machine Tool}_i + \beta 13\ \text{Welding}_i + \varepsilon_i$$

Regression equations were estimated for each of the hypothesized outcomes using ordinary least squares for continuous outcomes (credit hours completed) and using logit for binary outcomes (employment, continuing status in training, attainment of terminal degree). For the ordinary least squares regressions, the coefficient estimated for the participation variable represents the causal effect of the project on the relevant outcome. For the logit models, the estimated coefficient predicted the influence of the

project on the probability of the relevant outcome (e.g., the influence of project participation on the probability of becoming employed).

The regression model specification for the exploratory hypothesis was:

$$\text{Outcome(NAME)}_I = \alpha + \beta 1\ \text{Career Navigator}_i + \beta 2\ \text{Vet Services}_i + \beta 3\ \text{Age}_i + \beta 4\ \text{Nonwhite} + \beta 4\ \text{Disability}_i + \beta 5\ \text{Full-time}_i + \beta 6\ \text{TAA funded}_i + \beta 7\ \text{Vet benefits}_i + \beta 8\ \text{Pell}_i + \beta 9\ \text{Veteran}_i + \beta 10\ \text{Employed at enroll}_i + \beta 11\ \text{Year admitted}_i + \beta 12\ \text{Machine Tool}_i + \beta 13\ \text{Welding}_i + \varepsilon_i$$

Results

Descriptives

Both participant groups and the comparison group were similar in age, racial makeup, receipt of TAA funds, veteran status, and use of veteran benefits. The comparison group had a higher proportion of students who were full-time status and received a Pell grant than either of the participant groups. More students in the participant groups were employed at enrollment than in the comparison group.

Both participant groups had very few Welding students compared to the comparison group, but far more Machine Tool students. Participant group 1 had somewhat more Automation/Electronics students than the other two groups.

	Participant Group 1	Participant Group 2	Comparison Group
	N = 371	N = 221	N = 566
Mean Age	27.4	27.3	26.8
White	295 (80%)	184 (83%)	462 (82%)
Non-White	42 (11%)	21 (10%)	68 (12%)
Unknown Race	34 (9%)	16 (7%)	36 (6%)
Full-time status	119 (32%)	71 (32%)	295 (52%)
TAA funded	339 (91%)	211 (95%)	521 (92%)

	Participant Group 1	Participant Group 2	Comparison Group
	N = 371	N = 221	N = 566
Veteran benefits	44 (12%)	19 (9%)	44 (8%)
Pell grant recipient	140 (38%)	85 (39%)	289 (51%)
Veteran (self-reported)	38 (10%)	20 (9%)	42 (7%)
Employed at enrollment	237 (64%)	148 (67%)	301 (53%)
Year of admittance			
Before 2010	0 (0%)	15 (7%)	0 (0%)
2010	0 (0%)	25 (11%)	236 (42%)
2011	0 (0%)	63 (29%)	180 (32%)
2012	0 (0%)	118 (53%)	150 (27%)
2013	175 (47%)	0 (0%)	0 (0%)
2014	196 (53%)	0 (0%)	0 (0%)
Welding	27 (7%)	2 (1%)	161 (28%)
Machine Tool	112 (30%)	103 (47%)	101 (18%)
Automation/Electronics	232 (63%)	116 (52%)	304 (54%)

Regression

The results of the regression analysis are presented in Tables B-3 through B-8. The regression models were estimated with robust standard errors as a Breusch-Pagan/Cook-Weisberg test for heteroskedasticity rejected the null hypothesis of constant variance. A statistically significant coefficient for either group 1 or group 2 represents a statistically significant difference for the relevant group relative to the baseline category, the comparison group. The pseudo-R^2 is used as a measure of predictive power in the logit models. While it is not the same as a linear R^2 value, the McFadden's R^2 used in Stata is a close approximation of many of its characteristics.

All four models were statistically significant ($p<0.0001$) and had small to moderate effect sizes (pseudo R^2 range from 0.03 to 0.12 and R^2 of 0.27). This means the models are well-fitted, but have some difficulty predicting the outcomes based on the common

student characteristics available. This is not all that surprising since it is very difficult to predict human behavior, and an R^2 value less than 0.50 would not be unreasonable.

AMP *PLUS* Participation

The first set of outcomes interpretation focuses on the hypotheses made concerning the AMP *PLUS* program and only consider the coefficients for Participant Group 1:

- Model 1 employs a logit model to estimate the impact of participation on the probability of continuous enrollment as the outcome variable is binary. Participation in group 1 has a positive impact relative to the comparison group, but the coefficient is not statistically significant at conventional levels. The results do not support Confirmatory Hypothesis 1a.

- Model 2 explores the effect of participation on the probability of receiving a terminal degree (in any program, not just manufacturing) with a logit model. According to the model, there is a negative, statistically non-significant coefficient for the impact of membership in group 1 on graduation. There is no evidence to support Confirmatory Hypothesis 2a.

- Model 3 estimates the impact of participation on number of credits using an ordinary least squares (OLS) model. The coefficients for each of the group variables in the linear model represent the average effect of membership in the relevant group on the outcome variable relative to the comparison group (the baseline group). The average effect of membership in group 1 relative to the comparison group is approximately negative 1.3 credits, holding other control variables constant. This coefficient is not statistically significant. There is no support for Exploratory Hypothesis 2b.

- Model 4, limited to people who graduated, explored the impact of participation on the probability of employment following the program, again using a logit model. There is a negative and statistically non-significant coefficient for the influence of membership in group 1 on employment among graduates. The results do not support confirmatory Hypothesis 3a.

The confusing aspect here is that in Models 2–4, membership in participant group 2 showed a positive, statistically significant impact over the comparison group. Since participant group 2 was a mixture of both the traditional programs seen in the comparison group and the AMP *PLUS* program seen in participant group 1—meaning these students fit in neither the comparison group nor participant group 1—this result is difficult to explain. There may be something about that particular student cohort,

independent of the teaching techniques and other factors included in the regression model, which would explain the results. We believe there may be additional factors not accounted for in the regression model that are causing spurious results (e.g., length of time these students were enrolled in standard manufacturing education before exposure to the AMP *PLUS* model was uncontrolled for).

Other Factors Influencing the Participant Outcomes

While the models did not show evidence for the hypotheses made regarding the AMP *PLUS* program, there are still interesting conclusions that can be drawn from the models' other coefficients that were significant. In particular, the type of manufacturing program showed some interesting results:

- In Model 1, students in the Welding program had positive, statistically significantly impact on continuing enrollment compared to Automation/Electronics. Students in the Machine Tool program had a negative, non-significant impact.

- In Model 2, being a Welding student had a large positive, statistically significant impact on earning a terminal degree compared to Automation/Electronics students. Being a Machine Tool student also had a positive, statistically significant impact, but not as large. Status as a full-time student and being TAA funded also have a positive, statistically significant impact. Age has a negatively, statistically significant impact indicating the younger students are somewhat more likely to receive a terminal degree. The year admitted was significant in this model because we are more likely to observe attainment of a terminal degree the longer someone has been under observation.

- In Model 3, students in the Machine Tool program had a large positive, statistically significant impact on number of credits earned compared to Automation/Electronics students. Students in the Welding program had a negative, statistically significant impact. Not surprising, status as a full-time student had a large positive, statistically significant impact on number of credits. Having TAA funds or a Pell grant also had statistically significant positive impacts on credits. Again, age has a negatively, statistically significant impact indicating the younger students are somewhat more likely to earn credits. And, the year admitted was again significant in this model because we are more likely to observe more credits earned the longer someone has been under observation.

- Model 4 was limited to only students who graduated. Being a Welding student had a large positive, statistically significant impact on employment compared to Automation/Electronics students. Being a Machine Tool student had a positive but

non-significant impact over being an Automation/Electronics student. Status as a full-time student had a positive, statistically significant impact, but having a Pell grant had a negative, statistically significant impact.

Students in the Welding program had the best outcomes across the board. The Welding program was set up to be a more compact program with students earning credentials, graduating, and entering the workforce faster. This is reflected in the outcomes where Welding students earned significantly fewer credit hours, but were more likely to graduate and become employed than the other two manufacturing program groups. However, it should also be noted that the Welding program had the smallest number of AMP *PLUS* students enrolled, and these results may be an artifact of the smaller numbers.

Students in the Machine Tool program were more likely to graduate and earn more credits compared to Automation/Electronics students.

Younger students were more likely to graduate and earn more credits. Full-time students were more likely to graduate, earn more credits, and become employed. TAA funds aided students with graduation and credits earned. Students with Pell grants were more likely to have a higher number of credits earned.

Wraparound Services

The exploratory hypothesis concerns the impact of career navigator and veteran specialist services on each of the four outcomes. The outcomes were regressed on measures of each of these variables and the same controls used in the previous set of models. The results are presented in Table B-4.

Across the four models, there is no support for the impact of wraparound services on each of the outcomes. Of the coefficients for career navigator and veteran services in the four separate models, only one is statistically significant (the coefficient for career navigator services in Model 3). However, this coefficient is negative, indicating that students who used career navigator were likely to earn 1.7 less credits.

Full-Time Versus Part-Time Status

Due to some of the patterns observed in the regression models, an alternative set of analyses explored the robustness of the results. There was an imbalance across treatment groups in terms of student enrollment status; 52% of comparison group members are full-time students versus 32% each in participant groups 1 and 2. Additionally, full-time student status was a strong predictor in most of the models.

Therefore, we ran the same regression analyses as in Tables B-3 and B-4 for part-time and full time groups separately. The results are presented in Tables B-5 through B-8.

- Briefly, analyzing the groups separately by part- or full-time status does not yield substantively different results from the main analysis.

- In Tables B-5 (full-time status only) and B-6 (part-time status only), none of the coefficients for group 1 are positive (the hypothesized direction) and statistically significant. This means there is still no support for the research hypotheses.

- In Tables B-7 (full-time status only) and B-8 (part-time status only), none of the coefficients for career navigator services and veteran services are both positive (the hypothesized direction) and statistically significant. This means there is still no support for the exploratory hypotheses.

- These models do show that the positive outcomes seen for students in the Welding and Machine Tool programs accrue largely to full-time students.

Table B-3: Effect of Participation on Selected Outcomes

	Model 1	Model 2	Model 3	Model 4
Outcome Variable	Continuous Enrollment	Earned Terminal Degree	Number of Credits	Employment (Graduates Only)
	Logit	Logit	OLS	Logit
Participant Group 1	.43	-.12	-1.32	-.44
	(.30)	(.30)	(2.92)	(.52)
Participant Group 2	.35	.79**	15.4**	.66*
	(.23)	(.19)	(2.0)	(.33)
Age	.01	-.02*	-.23**	.01
	(.01)	(.01)	(.06)	(.01)
Nonwhite	-.49	-.38	-3.0	-.37
	(.27)	(.23)	(1.9)	(.44)
Disability	-.20	-.28	1.9	-.05
	(.31)	(.28)	(2.2)	(.45)
Full time	.18	.74**	10.2**	.94**
	(.17)	(.15)	(1.4)	(.26)
TAA funded	.53	.68*	10.4**	.33
	(.30)	(.28)	(2.6)	(.45)
Vet benefits	.27	.24	-1.3	.57
	(.52)	(.60)	(3.9)	(.76)
Pell	-.06	.03	2.6*	-.79**
	(.16)	(.14)	(1.3)	(.25)
Veteran	.29	.04	7.0	-.89
	(.53)	(.60)	(4.2)	(.80)
Employed at enroll	-.10	-.06	1.5	.33
	(.16)	(.15)	(1.3)	(.25)
Machine Tool	-.14	.39*	4.6**	.29
	(.18)	(.16)	(1.4)	(.31)
Welding	.44*	1.42**	-4.2*	1.1**
	(.22)	(.19)	(1.7)	(.30)
Year admitted	.08	-.19*	-4.1**	-.11
	(.09)	(.09)	(1.0)	(.16)
Constant	-2.86	1.26	67.9	.00
	(1.05)	(.99)	(11.3)	(1.76)
N	1,158	1,158	1,158	376
(Pseudo) R squared	.03	.12	.27	.11
F statistic			29.6	
Prob.>F			.00	
χ^2	39.6	150.0		48.7
Prob>χ^2	.00	.00		.00

Notes: * p<.05, two-tailed; **p<.01, two tailed. Robust standard errors in parentheses.

Table B-4: Effect of Selected Support Services on Selected Outcomes

	Model 1	Model 2	Model 3	Model 4
Outcome Variable	Continuous Enrollment	Earned Terminal Degree	Number of Credits	Employment (Graduates Only)
	Logit	Logit	OLS	Logit
# career navigator	-.12	-.13	-1.7**	-.02
	(.09)	(.08)	(.51)	(.21)
# vet services	-.08	.01	.58	-.12
	(.18)	(.16)	(1.5)	(.28)
Age	.01	-.02*	-.23**	.01
	(.01)	(.01)	(.07)	(.01)
Nonwhite	-.50	-.39	-3.2	-.37
	(.27)	(.23)	(1.9)	(.45)
Disability	-.17	-.26	1.9	-.06
	(.30)	(.28)	(2.2)	(.44)
Full time	.17	.68**	9.5**	.88**
	(.17)	(.15)	(1.5)	(.25)
TAA funded	.54	.58*	9.0**	.22
	(.29)	(.28)	(2.6)	(.45)
Vet benefits	.27	.14	-3.4	.45
	(.51)	(.59)	(4.0)	(.71)
Pell	-.06	.03	2.6	-.75**
	(.16)	(.14)	(1.4)	(.25)
Veteran	.43	.15	9.0*	-.64
	(.54)	(.61)	(4.5)	(.75)
Employed at enroll	-.09	-.03	2.0	.31
	(.16)	(.15)	(1.3)	(.24)
Machine Tool	-.06	.57**	7.5**	.56
	(.19)	(.16)	(1.5)	(.30)
Welding	.30	1.2**	-7.3**	.93**
	(.20)	(.18)	(1.7)	(.28)
Year admitted	.21**	-.23**	-5.0**	-.21*
	(.06)	(.05)	(.48)	(.11)
Constant	-4.1	1.9	81.9	1.2
	(.81)	(.63)	(6.5)	(1.3)
N	1,158	1,158	1,158	376
(Pseudo) R squared	.03	.11	.21	.09
F statistic			22.0	
Prob.>F			.00	
χ^2	36.1	139.0		42.8
Prob>χ^2	.00	.00		.00

Notes: * p<.05, two-tailed; **p<.01, two tailed. Robust standard errors in parentheses.

Table B-5: Effect of Participation on Selected Outcomes (Full-Time Status Only)

	Model 1	Model 2	Model 3	Model 4
Outcome Variable	**Continuous Enrollment**	**Earned Terminal Degree**	**Number of Credits**	**Employment (Graduates Only)**
	Logit	**Logit**	**OLS**	**Logit**
Participant Group 1	.09	-.47	-7.1	-.26
	(.48)	(.48)	(5.2)	(.68)
Participant Group 2	-.82	.62*	12.4**	.50
	(.44)	(.31)	(3.9)	(.45)
Age	.00	-.02	-.11	-.02
	(.01)	(.01)	(.13)	(.02)
Nonwhite	-.19	.32	-.43	-.73
	(.39)	(.31)	(3.9)	(.49)
Disability	.05	-.01	1.1	-.11
	(.43)	(.44)	(3.4)	(.51)
TAA funded	.87*	.54	8.3*	.14
	(.42)	(.35)	(3.6)	(.53)
Vet benefits	-.10	.67	-.41	1.4
	(.93)	(.93)	(6.0)	(.98)
Pell	-.15	-.21	-.40	-.60
	(.25)	(.21)	(2.2)	(.32)
Veteran	.79	-.62	2.3	-1.4
	(.94)	(.96)	(6.2)	(.99)
Employed at enroll	.14	.15	3.8	.10
	(.24)	(.21)	(2.2)	(.31)
Machine Tool	.13	.35	8.1**	.58
	(.33)	(.27)	(3.1)	(.42)
Welding	.62*	1.7**	-6.3**	1.1**
	(.27)	(.25))	(2.3)	(.36)
Year admitted	.22	-.14	-3.8*	-.06
	(.14)	(.14)	(1.7)	(.20)
Constant	-4.2	1.3	74.8	1.0
	(1.6)	(1.6)	(19.5)	(2.3)
N	485	485	485	216
(Pseudo) R squared	.07	.11	.22	.08
F statistic			13.2	
Prob.>F			.00	
χ^2	32.4	63.4		26.2
Prob>χ^2	.00	.00		.02

Notes: * p<.05, two-tailed; **p<.01, two tailed. Robust standard errors in parentheses.

Table B-6: Effect of Participation on Selected Outcomes (Part-Time Status Only)

	Model 1	Model 2	Model 3	Model 4
Outcome Variable	**Continuous Enrollment**	**Earned Terminal Degree**	**Number of Credits**	**Employment (Graduates Only)**
	Logit	**Logit**	**OLS**	**Logit**
Participant Group 1	.63	.14	3.0	-.67
	(.39)	(.40)	(3.2)	(.88)
Participant Group 2	.81**	.94**	18.4**	.71
	(.29)	(.25)	(2.3)	(.49)
Age	.01	-.02	-.26**	.03
	(.01)	(.01)	(.07)	(.02)
Nonwhite	-.76*	-1.1**	-5.6**	.76
	(.39)	(.39)	(1.8)	(.84)
Disability	-.38	-.39	4.1	.07
	(.46)	(.41)	(2.9)	(.83)
TAA funded	.18	.99*	9.8*	1.5
	(.49)	(.44)	(3.9)	(.90)
Vet benefits	.40	.29	.04	-.36
	(.67)	(.78)	(4.5)	(1.2)
Pell	.04	.26	4.6**	-.98*
	(.22)	(.20)	(1.6)	(.43)
Veteran	.07	.29	11.0*	-1.1
	(.68)	(.73)	(5.2)	(1.1)
Employed at enroll	-.38	-.28	-.42	.84
	(.22)	(.21)	(1.6)	(.46)
Machine Tool	-.22	.39	2.5	-.08
	(.23)	(.21)	(1.5)	(.48)
Welding	-.09	1.1**	.01	.63
	(.43)	(.33)	(2.8)	(.63)
Year admitted	.01	-.24*	-4.0**	-.15
	(.12)	(.11)	(1.1)	(.25)
Constant	-2.0	1.8	66.1	-.18
	(1.4)	(1.3)	(12.8)	(2.8)
N	673	673	673	160
(Pseudo) R squared	.04	.09	.27	.13
F statistic			16.9	
Prob.>F			.00	
χ^2	25.6	59.4		21.3
Prob>χ^2	.02	.00		.07

Notes: * p<.05, two-tailed; **p<.01, two tailed. Robust standard errors in parentheses.

Table B-7: Effect of Selected Support Services on Selected Outcomes (Full-Time Status Only)

	Model 1	Model 2	Model 3	Model 4
Outcome Variable	**Continuous Enrollment**	**Earned Terminal Degree**	**Number of Credits**	**Employment (Graduates Only)**
	Logit	**Logit**	**OLS**	**Logit**
# career navigator	-.17	-.39**	-3.6**	-.28
	(.14)	(.15)	(1.0)	(.34)
# vet services	.21	.29	2.9	-.23
	(.20)	(.20)	(1.7)	(.37)
Age	.00	-.02	-.16	-.02
	(.01)	(.01)	(.13)	(.02)
Nonwhite	-.16	.29	-.99	-.74
	(.40)	(.31)	(3.8)	(.49)
Disability	.10	-.05	.90	-.21
	(.42)	(.44)	(3.4)	(.50)
TAA funded	.90*	.46	6.8	.12
	(.42)	(.36)	(3.7)	(.55)
Vet benefits	-.03	.49	-2.8	1.3
	(.93)	(.89)	(7.0)	(1.0)
Pell	-.16	-.21	-.58	-.54
	(.25)	(.21)	(2.3)	(.31)
Veteran	.49	-.73	2.0	-.96
	(.99)	(.95)	(7.6)	(1.1)
Employed at enroll	.16	.16	3.9	.08
	(.24)	(.21)	(2.2)	(.32)
Machine Tool	.02	.65*	12.5**	.89*
	(.33)	(.26)	(3.2)	(.45)
Welding	.70**	1.6**	-7.9**	1.0**
	(.27)	(.25)	(2.2)	(.34)
Year admitted	.29**	-.19*	-5.1**	-.06
	(.09)	(.08)	(.85)	(.13)
Constant	-5.1	2.1	92.5	1.1
	(1.1)	(.97)	(11.2)	(1.6)
N	485	485	485	216
(Pseudo) R squared	.06	.11	.20	.08
F statistic			11.6	
Prob.>F			.00	
χ^2	30.1	64.7		24.1
Prob>χ^2	.00	.00		.03

Notes: * p<.05, two-tailed; **p<.01, two tailed. Robust standard errors in parentheses.

Table B-8: Effect of Selected Support Services on Selected Outcomes (Part-Time Status Only)

	Model 1	Model 2	Model 3	Model 4
Outcome Variable	**Continuous Enrollment**	**Earned Terminal Degree**	**Number of Credits**	**Employment (Graduates Only)**
	Logit	**Logit**	**OLS**	**Logit**
# career navigator	-.11	-.03	-.99	.21
	(.13)	(.09)	(.62)	(.27)
# vet services	-.67	-.21	-2.2	-.01
	(.36)	(.31)	(2.5)	(.58)
Age	.01	-.02	-.24**	.03
	(.01)	(.01)	(.07)	(.02)
Nonwhite	-.74	-1.1**	-5.6**	.70
	(.39)	(.38)	(2.0)	(.85)
Disability	-.36	-.34	4.2	.29
	(.45)	(.41)	(3.0)	(.87)
TAA funded	.15	.88*	8.6*	1.3
	(.47)	(.43)	(3.8)	(.92)
Vet benefits	.53	.23	-1.1	-.41
	(.65)	(.75)	(4.6)	(1.1)
Pell	.08	.27	4.8**	-.96*
	(.22)	(.20)	(1.7)	(.44)
Veteran	.59	.53	14.9**	-1.1
	(.70)	(.74)	(5.5)	(1.0)
Employed at enroll	-.31	-.21	.76	.71
	(.22)	(.21)	(1.7)	(.44)
Machine Tool	-.09	.54*	5.1**	.13
	(.23)	(.21)	(1.6)	(.46)
Welding	-.42	.83**	-5.2	.42
	(.42)	(.31)	(2.7)	(.59)
Year admitted	.15	-.27**	-4.5**	-.42*
	(.09)	(.06)	(.57)	(.18)
Constant	-3.3	2.3	76.4	3.0
	(1.1)	(.82)	(7.6)	(2.2)
N	673	673	673	160
(Pseudo) R squared	.03	.07	.17	.11
F statistic			10.2	
Prob.>F			.00	
χ^2	22.0	50.3		18.6
Prob>χ^2	.05	.00		.14

Notes: * p<.05, two-tailed; **p<.01, two tailed. Robust standard errors in parentheses.

Validity

While controlling for demographics may have removed some threats to validity, there may be other factors that influenced outcomes that biased estimates of the influence of the project on outcomes. For example, comparison group members completed courses and earned credentials from FVTC during the economic downturn. They were more likely to be full-time and to receive Pell grants than other groups, and were less likely to be employed at enrollment. Although the regression models controlled for these factors, the factors may have affected student outcomes in ways that were not measured.

The research team measured factors that could influence confidence and academic motivation with a portion of the general population of FVTC students, which included some participant group members. Since data were available on only a small portion of participant group members, these were not used in the regression equation. The number of cases was also too small to conduct analysis to determine whether AMP *PLUS* students were different from students in the general population at FVTC in these factors. It is not feasible to identify the extent to which these may have influenced the outcomes.

Appendix C: Student Survey Data

As noted in Appendix B: Methodology, a survey was administered to students enrolled in math courses during the spring and fall 2015 and spring 2016 semesters. The survey was uploaded to the course management system used in these courses and students were given time in class to complete the survey. A total of 1,208 unique responses were collected in this manner, of which approximately 5% were from AMP *PLUS* students.

Internet Access and Computer Proficiency

Overall, most students appear to be fairly comfortable and experienced in the use of computers, and virtually all students reported that they have access to the internet at home (94.1%).

- Over 70% had been using computers for at a minimum of 11 years.
- Four attitude items suggest that most students are proficient and comfortable using a computer. There is, however, a small minority of students for whom computers are less accessible.
- Less than one in ten students (8.0%) said that they had been using a computer for five years or less.
- About one in six students (17.3%) said that computer use was a challenge.

Math Confidence

The majority of students said they understood the relevance of math to their program of study. On the whole, students were moderate in expressing enjoyment of math problems and in their belief that they have a "mathematical mind."

Motivation

Nearly all students appeared to be highly motivated in their studies.

- More than nine in ten students said that scoring well on tests and homework is important, and nearly nine in ten students said that class attendance is a priority.

- About two-thirds said they put in extra time for math classes and nearly three-quarters put in extra time for program classes.

Table C-1: Student Attitudes

	Percentage Somewhat or Strongly Agree	Average Rating*
Attitude Toward Computer Use		
Trying new things on a computer interests me.	82.4	4.2
Using a computer is a challenge for me.	17.3	2.1
I use a computer to access additional learning resources.	83.3	4.3
I wish I could learn things faster on a computer.	45.5	3.4
Attitude Toward Mathematics		
I have a mathematical mind.	54.8	3.4
I enjoy solving new math problems.	52.4	3.4
I understand the relevance of math in my program.	79.2	4.2
Attitude Toward Study Habits		
Scoring well on homework is important to me.	92.7	4.6
Scoring well on tests is important to me.	94.7	4.8
Attending class is a priority for me.	87.7	4.5
I find myself putting in extra time for my math classes.	66.5	3.9
I find myself putting in extra time for my program classes.	73.7	4.1

* On a scale where 1=strongly disagree and 5=strongly agree