Making the Future: The Wisconsin Strategy

Final Evaluation Report

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Wisconsin's *Making the Future* TAACCCT 2 consortium grant brought together 16 technical colleges along with employers and workforce development groups to develop, improve, and expand stacked and latticed pathway programs – often called career pathways – in advanced manufacturing. The focus on stacked and latticed pathways was not new to Wisconsin, but instead emerged from the Regional Industry Skills Education initiative that began in the state in 2007 as part of the Joyce Foundation's multi-state Shifting Gears initiative.

Developing a series of interconnected stacked and latticed pathway credentials was an expectation of the TAACCCT Round 2 grants, as specified in the U.S. Department of Labor Employment and Training Administration's Solicitation for Grant Applications. As such, consortium colleges created new manufacturing pathways and modified existing pathways to enable participants to earn short-term credentials (less than one year) that stack toward one-year and two-year technical diplomas, and in some instances, Associate's degrees. Wisconsin's approach to stacked and latticed pathways consists of embedding short-term certificates or credentials within longer-term "parent" programs.

The goal of the *Making the Future* consortium was to increase the attainment of industry-recognized and industry-valued certifications, certificates, diplomas, and other credentials that better prepare program participants for high-skill, high-wage employment or re-employment in manufacturing careers. Wisconsin's technical colleges aimed to serve more than 2,657 unique participants during the three-year period of the grant. In fact, preliminary performance numbers indicate the consortium widely surpassed its goal, serving 3,795 unique participants or 143% of the goal.

Evaluation Design

The ***implementation study*** was designed to provide formative feedback on program implementation at each technical college during the first two years of the initiative. Additionally, the implementation evaluation documented and assessed key elements of program implementation, ranging from efforts to develop and establish manufacturing stacked and latticed pathway programs (e.g., curriculum and short-term credentials) to sustaining and institutionalizing key grant-supported strategies (e.g., student assessment and supports) upon conclusion of the TAACCCT grant.

As the initiative started, the evaluation team led a consortium-wide meeting with key representatives from participating colleges to design a master logic model that provided colleges with a roadmap outlining the key areas of evaluation focus. Using the logic model as a guide, the evaluation team also developed an outcomes and indicators tool to assess progress over time and better understand and document the contextual factors that influenced implementation.

Over the course of three years, the evaluation team conducted 30 in-depth site visits, including at least one visit to each of the 15 colleges that were developing programs under the auspices of the consortium grant. Additionally, the team conducted a second round of site visits to eight of the colleges in year 2, and a final set of visits to seven of the colleges in years 3 and 4 that included focus groups with participants. The evaluation team also conducted more than 200 phone interviews with internal and external stakeholders during the grant period. In year 2, interviews were conducted with the seven colleges that did not receive site visits. Similarly, in years 3 and 4, interviews were conducted with eight colleges that did not receive site visits. In year 3, phone interviews were also conducted with program deans at all 15 of the colleges.

The implementation study addresses the key implementation research questions identified in the U.S. Department of Labor's Solicitation for Grant Applications. These questions revolved around four implementation areas: 1) curriculum; 2) support services; 3) assessments; and 4) partners. The evaluation team contextualized these implementation research questions to reflect Wisconsin's *Making the Future* initiative as follows:

1. *How were colleges' manufacturing programs – curriculum, instruction, credentials – modified to support short-term, stacked and latticed education and career training?*
2. *What types of support services were offered to enhance student success?*
3. *What assessment tools were used to improve access to manufacturing programs?*
4. *What new contributions did employer and workforce partners make to support college-manufacturing programs?*

The ***impact study*** utilized a rigorous quasi-experimental matched comparison group analysis to examine the impact of participation in stacked and latticed pathways on education and employment outcomes, including credit accumulation, credential attainment, employment after program exit, and earnings increases after program entry.

The evaluation team obtained administrative data from each of the technical colleges in the consortium for the period June 2012 through June 2016, identified specific data elements and created a master data dictionary to use consortium-wide. Additionally, the evaluation team established data sharing agreements with each college, as well as with the Wisconsin Technical College System (WTCS). The data sharing agreement with WTCS provided the evaluation team with access to Unemployment Insurance (UI) records and workforce program data from the Wisconsin Department of Workforce Development. Given reporting lags for UI data, UI records were received for only a portion of the grant period (i.e., through the April-June 2015 quarter) and, thus, labor market outcomes can be examined for only a subset of the overall grant participants. All data were de-identified to protect student privacy.

The evaluation team used propensity score matching (PSM) to generate a comparison group that is similar to the treatment group along a set of background characteristics that could affect the likelihood of receiving treatment. To conduct PSM for the impact study, data from both participants and a comparison pool were requested from colleges. The comparison pool data consisted of students in manufacturing programs at the consortium technical colleges that were not supported by the TAACCCT grant. Participants were students enrolled in a grant-funded stacked and latticed manufacturing pathway during the grant period.

PSM is an increasingly common and popular approach to account for factors that may influence the receipt of treatment, and thus confound analysis of impact. By generating a comparison group that resembles the treatment group on all variables thought to affect likelihood of receiving treatment, researchers can infer that the subsequent observed impact of the treatment is the result of the treatment and not the result of different characteristics in the two groups. The PSM approach enabled the evaluation to meet a moderate rating of rigor for non-experimental research studies as defined by the Clearinghouse for Labor Evaluation and Research (CLEAR).

The impact study focuses on four key outcomes: credential attainment, credit accumulation, employment, and earnings. The specific research questions for each outcome are listed below:

1. *Do grant participants in stacked and latticed pathways earn credentials at a higher rate than students in a matched comparison group?*

2. *Do grant participants in stacked and latticed pathways earn more credits than students in a matched comparison group?*

3. *Do non-incumbent worker grant participants in stacked and latticed pathways get employed at a higher rate than non-incumbent workers in a matched comparison group?*

4. *Do incumbent worker grant participants in stacked and latticed pathways receive earnings increases at a higher rate than incumbent workers in a matched comparison group?*

Implementation Findings

The implementation of stacked and latticed manufacturing pathways was the most common strategy implemented across the *Making the Future* consortium. Eleven colleges focused on a program of study in welding, 10 colleges focused on machine tool/CNC, and two colleges focused on industrial maintenance. Several colleges developed or modified programs of study in more than one manufacturing field. All new or enhanced programs of study were based on employer demand in each community.

Overall, the implementation evaluation documented the following four findings:

- **Wisconsin technical colleges modified their program curricula, and in some cases created new curricula to implement stacked and latticed career pathways in advanced manufacturing**. The most common curricula modifications consisted of bundling existing courses, credits, and competencies into smaller packages of credentials, such as short-term local certificates, embedded technical diplomas, or pathway certificates. These shorter-term credentials were designed for students to attain skills and credits along an occupational pathway more quickly, and required less time in the classroom and lab for students than existing one-year and two-year programs of study.

- **Wisconsin technical colleges implemented enhanced academic and non-academic support services to assist students in enrolling and completing manufacturing programs of study, and to help participants make connections with employers**. Efforts in both of these areas were in addition to the standard supports offered all students through the longstanding college advising, counseling, and tutoring services, and involved new and dedicated grant-funded staff. Two-thirds of the colleges implemented enhanced academic instruction by using basic skills instructors to offer separate support classes and/or workshops for program participants. A typical example was found in blueprint reading, where the subject instructor was complemented by additional academic support targeted at making sure students had sufficient math competencies to understand and master the course content. Five colleges provided enhanced non-academic support services. These non-academic support services typically served students by providing additional supports focused on issues like career planning and job search, as well as addressed personal and family issues that might affect college attendance and success.

- **Wisconsin technical colleges addressed assessment tools to improve access to manufacturing programs by building on existing WTCS policy to award credit for prior learning (CPL)**. During the initiative, colleges received direct assistance from the Council for Adult and Experiential Learning (CAEL) to: 1) assess their existing procedures and capacity for CPL assessments (referred to as process mapping); 2) identify needed modifications in existing policy and practices; and 3) establish capacity within a college to update and refine institutional CPL policy and procedures. In addition, CAEL provided training

to college staff via conferences, workshops, and webinars to advance institutional knowledge on CPL process and issues. The types of issues and areas addressed included faculty pay for CPL evaluation, student cost for assessments, marketing CPL opportunities, and data collection. After the first two years of the initiative, the evaluation team noted in the interim report that credit for prior learning was at a nascent stage of implementation in most colleges. These efforts accelerated in the third and fourth years, and progress on credit for prior learning is considered by the consortium to be positive. Most colleges embraced the overall concept of CPL and the need to ensure that CPL policies and procedures existed to assess and award credits for prior work experience. And a handful of colleges moved to the point within their manufacturing programs of developing and applying assessments for key program areas such as welding, machine tool, and industrial maintenance.

- **Wisconsin technical colleges followed their tradition of engaging employers through advisory committees to establish stacked and latticed manufacturing pathways; a number of colleges also engaged employers in new and innovative ways**. Almost half of the colleges expanded their engagement with employers. This expanded employer engagement included actions to incorporate industry skill standards and competencies into manufacturing program curriculum, and to create more work-based learning experiences and employment opportunities for students participating in TAACCCT-supported manufacturing programs.

Participant Impact

Across the statewide consortium, almost all colleges (n=13) offered at least one stacked and latticed pathway program and 3,178 students in these colleges, representing 84% of grant participants across the consortium, enrolled in a stacked and latticed pathway in welding, machine tool, and/or industrial maintenance. This group of 3,178 students represents the treatment group for the impact study.

The vast majority of grant participants in stacked and latticed manufacturing pathways are male, white, and non-Hispanic, with an average age of 27. Approximately two-thirds of the treatment group had received at least a high school diploma – but no higher degree – prior to entering the sample, and about one-third received a Pell Grant during their first term in the sample. On average, participants entered the sample with five academic credits – earned at the current college or at a different institution – and attempted 11 academic credits during their first term in the sample. Over the course of the grant, 25% of the treatment group enrolled in adult basic education, and 31% enrolled in developmental education. The majority of participants enrolled in a welding program of study (62%) and a little more than one-third (36%) enrolled in a machine tool/CNC program of study. Less than 10% enrolled in an industrial maintenance program of study.

Table 1 provides a summary of the overall impact of stacked and latticed pathways on participant outcomes. The impact study of Wisconsin's stacked and latticed pathways documents four key findings:

1. **48% of participants earned postsecondary credentials, while only 30% of the matched comparison group earned a postsecondary credential**. Stacked and latticed manufacturing pathways helped participants earn more postsecondary credentials and earn them more quickly in three manufacturing areas: welding, machine tool/CNC, and industrial maintenance.

2. **Participants in stacked and latticed pathways earned three more credits, on average, during the grant period than the matched comparison group (25.3 vs. 22.3)**.

3. **33% of non-incumbent worker participants were employed one quarter after program exit, compared with 29% of the matched comparison group**. Although this finding was not statistically significant, exploratory analysis indicates that stacked and latticed pathway participants in machine tool/CNC programs have higher employment rates than comparison group members in machine tool/CNC programs.

4. **Stacked and latticed pathway participants and matched comparison group members had similar earnings increase rates, and a large proportion of each group (~75%) received an earnings increase**.

Table 1: Impact Analysis Results

Outcome	Treatment Group	Comparison Group	ATT	P-value
Credential attainment rate	48%	30%	18%	.000
Average total credit accumulation	25.26	22.25	3.01	.000
Non-incumbent worker employment rate – one quarter after exit	33%	29%	4%	.080
Incumbent worker earnings increase rate at any point after program entry	76%	75%	1%	.721

Lessons Learned and Implications

The evaluation team documented five key lessons that facilitated implementation, or were hurdles that colleges faced during implementation:

1. **Colleges benefited from a supportive Wisconsin Technical College System Office**. WTCS provided a structure and procedures for creating new, and modifying existing technical college programs along a career pathway framework though communication and convening colleges, through system policy and procedural changes, and by providing resources to incentivize colleges to expand their career pathway efforts.

2. **Effective implementation was also facilitated by the commitment of senior administrators at the colleges – especially presidents.** The TAACCCT emphasis on engaging local employers in the initiative seemed to elevate the grant's importance to colleges. Presidents and other senior leaders at the college provided support and direction for the implementation of career pathways that included the allocation of professional staff to design and modify curriculum and to seek WTCS approval for embedded credentials. These procedural and administrative tasks were critical to implementation and sustainability, and the colleges' willingness to work through these details indicated that career pathways were an institutional priority.

3. **Colleges undertook multiple approaches to provide academic and non-academic support services to participants during the grant**. Colleges funded staff and instructors who provided these enhanced supports with grant dollars. Few colleges took intentional steps to find budgetary resources to transition these temporary positions into permanent ones, despite widespread belief among college leaders and grant participants that these enhanced support services were valuable tools for student success.

4. **Only a handful of colleges used data for continuous improvement during the grant period; most colleges were more focused on meeting the unique participant goals established for each college and statewide**. Notably, at the few colleges that did collect and analyze data on enhanced support services, these colleges were able to make some mid-

course corrections to better serve their students, and in some cases expand support services to other college programs.

5. **While colleges effectively used and expanded their partnerships with local employers, they did not appreciably expand and enhance their existing relationships with local workforce groups**. Less than 10% of TAACCCT 2 participants were clients of the Workforce Investment and Opportunity Act, Trade Adjustment Assistance, and Veteran's benefits programs during the grant period. The evaluation was unable to discern why more clients of these workforce programs were not enrolling in stacked and latticed pathways. One possibility is that the TAACCCT grant provided direct resources to colleges that were used for the delivery of education and training programs, participant recruitment, and supports. Thus, colleges did not need workforce groups to provide resources to support the development and delivery of TAACCCT manufacturing programs. Another possibility is that clients coming through the Job Centers may not have been interested in the manufacturing programs offered under the grant. Furthermore, most colleges reported that there were not large numbers of TAA and Veteran clients in their communities.

The evaluation also identified three implications for future workforce and education research:

1. **Access to public administrative records and the sharing of these records across public agencies needs improvement**. The *Making the Future* evaluation benefited from pre-existing data sharing agreements between the Wisconsin Technical College System and the Department of Workforce Development; however, this agreement did not reflect the needs of the third-party evaluation. Records are shared annually (in October), and the timing for matching college and employment records – combined with the significant lag in Unemployment Insurance reporting by employers in Wisconsin – yielded insufficient data to examine employment outcomes for about one-third of grant participants.

2. **Staff responsible for designing and implementing programs and strategies needs an earlier and more robust understanding of the requirements for rigorous evaluation.** Better alignment between program implementation and evaluation can yield better research design and more consistent data collection and reporting processes among all colleges. A clear understanding of evaluation requirements can help staff with responsibility for implementation withstand organizational pressures to deviate from program design and ultimately enhance the types of research questions that can be more robustly analyzed.

3. **Upfront program design could benefit from clear definitions of model fidelity with an eye towards evaluability**. The lack of clarity was particularly notable for enhanced support services, resulting in multiple approaches to delivering such services and uneven implementation among the colleges. This flexibility, along with limited data collection, precluded any rigorous impact evaluation of these efforts.

Introduction

Backed by a $14.9 million, three-year grant awarded in 2012 from the U.S. Department of Labor, Wisconsin's technical colleges expanded and enhanced their programs to close the skills gap in advanced manufacturing. This grant was a result of an unprecedented statewide collaboration between the educational system, industry groups, workforce development groups, and more than 50 businesses who came together to develop and execute *Making the Future: The Wisconsin Strategy*.

As a part of this initiative, the Department of Labor required a third-party evaluator to address: 1) participant outcomes and program impact and 2) program implementation. This final evaluation report of *Making the Future,* developed by DVP-PRAXIS LTD (DVP-Praxis), Equal Measure (EqM), and Brandon Roberts + Associates, presents the participant impact evaluation, which utilizes rigorous statistical methodology to examine program impact, and the summative qualitative assessment of implementation. The final report primarily focuses on the technical colleges' efforts to implement stacked and latticed pathways in advanced manufacturing during the Trade Adjustment Assistance Community College and Career Training (TAACCCT) Round 2 grant period, and is organized around two distinct, though related, sets of analyses.

1. **The impact study** examines education and employment outcomes for grant participants in stacked and latticed pathways, including credential attainment, credit accumulation, employment, and earnings.

2. **The implementation study** examines the key factors that influenced colleges' efforts to develop and establish career pathways in advanced manufacturing (e.g., curriculum and short-term credentials), and that affected the institutionalization and sustainability of grant-supported strategies (e.g., assessment and student supports) upon conclusion of the TAACCCT grant.

The evaluation questions are described in detail in the respective sections of the report.

Background on TAACCCT

In 2009, the American Recovery and Reinvestment Act amended the Trade Act of 1974 to authorize the Trade Adjustment Assistance Community College and Career Training Grant Program. In 2010, Congress appropriated $2 billion over four years for the U.S. Department of Labor to fund the TAACCCT program. The goal of the TAACCCT program is to expand targeted training programs for unemployed workers, especially those affected by foreign trade, and to move unemployed workers into high-wage, high-skill jobs in high-growth industry sectors. TAACCCT provided colleges and other eligible higher education institutions with funds to expand and improve their ability to deliver education and career training programs in a shorter period of time that are suited for workers eligible for training under the TAA for Workers program, and that prepare program participants for high-skilled, high-wage employment. Additionally, the TAACCCT grant aimed to increase the number of workers who earned certificates, degrees, and other industry-recognized credentials.

TAACCCT Round 2 supported a statewide consortium, *Making the Future: The Wisconsin Strategy*, composed of all 16 technical colleges in the Wisconsin Technical College System (WTCS).[1] As part of this comprehensive effort, technical colleges joined with nationally recognized leaders in education,

[1] Fox Valley Technical College collaborated with the statewide consortium as the subject-matter experts for technology assistance – specifically the development of electronic flashcards, but they were not awarded resources to expand adult education training pathways through *Making the Future* and are not included in this evaluation.

statewide educational systems, industry groups, workforce development boards, and businesses to develop, improve, and expand stacked and latticed pathway programs – often called career pathways – in advanced manufacturing.[2] The focus on stacked and latticed pathways was not new to Wisconsin, but instead emerged from the Regional Industry Skills Education (RISE) initiative that began in the state in 2007 as part of the Joyce Foundation's multi-state Shifting Gears initiative.[3]

Prior to receiving the TAACCCT grant, WTCS defined career pathways as a "*way of organizing technical college occupational training as a sequence of credentials that lead adult learners in attainable steps toward better jobs and a degree or technical diploma. Each step improves the learner's career and earning opportunities and provides a skill set needed by an industry or industry sector. Industry sectors that are appropriate for pathway development are those that need significant numbers of skilled workers, can provide good jobs, and contribute to the economic growth of the region.*"[4]

Developing a series of interconnected stacked and latticed pathway credentials was an expectation of the TAACCCT Round 2 grants, as specified in the U.S. Department of Labor Employment and Training Administration's Solicitation for Grant Applications.[5] As such, consortium colleges created new manufacturing pathways and modified existing pathways to enable participants to earn short-term credentials (less than one year) that stack toward one-year and two-year technical diplomas, and in some instances, Associate's degrees. Wisconsin's approach to stacked and latticed pathways consists of embedding short-term certificates or credentials within longer-term "parent" programs.[6]

As noted, this final evaluation report documents findings from the impact and implementation studies with a particular emphasis on the consortium's approach to creating and enhancing stacked and latticed pathways as a key strategy.

Following this Introduction, the report includes the following sections:

- ***Section 1*** provides an overview of the Wisconsin Technical College System, the *Making the Future* initiative, and describes the reasons the technical colleges focused on career pathways and related student supports in advanced manufacturing.
- ***Section 2*** summarizes the comprehensive approach to the evaluation, including its focus on the strategies believed to have the most significant impact on participant outcomes.
- ***Section 3*** documents the results from the impact study on participant outcomes.
- ***Section 4*** documents our summative evaluation of implementation and sustainability.
- ***Section 5*** provides concluding evaluative observations of the *Making the Future* efforts on the delivery of education and training programs in advanced manufacturing, and also provides direction for future research.

The technical appendices include additional information about the impact study, the logic model, and the outcomes and indicators tool used to guide the implementation analysis.

[2] Northeast Wisconsin Technical College, Appendix A: Technical Proposal (2012). *Making the Future: The Wisconsin Strategy.*
[3] See: http://risepartnership.org/Media/Default/pdf/rise_career_pathways_definitions_2011-03-16.pdf.
[4] Ibid.
[5] U.S. Department of Labor, Employment Training Administration, *Solicitation for Grant Applications for Trade Adjustment Assistance Community College and Career Training Grants Program*, SGA/DFA PY 11-09, CFDA 17.282
[6] See http://mywtcs.wtcsystem.edu/student-success/career-pathways for information about career pathways in the Wisconsin Technical College System.

Section 1 – *Making the Future*: The Wisconsin Strategy

As noted, the Wisconsin Technical College System is composed of 16 technical college districts serving every urban and rural community in Wisconsin. There are a total of 49 campuses and a number of additional outreach facilities throughout the state, allowing WTCS to provide learning opportunities close to home to interested students.[7] The system provides opportunities for students to pursue careers in the skilled trades, manufacturing, information technology, health care, agriculture, public safety, and business, among other sectors – all geared toward meeting the needs of local and regional employers. The system also provides on-line learning opportunities, or blended options that combine on-line learning with hands-on skills instruction so students can more easily access programs that may not be offered on their local campus. Finally, each technical college provides customized business solutions to meet the needs of employers and ensure a skilled incumbent workforce that is equipped with the understanding and application of new technology and processes.

Important to the overall context for this work, WTCS operates under a shared governance model, with responsibility for operations and oversight shared by the WTCS Board (System Board) and 16 District Boards. The WTCS Board is the coordinating and oversight body for the system. The 13-member Board, composed of a diverse slate of representatives, establishes statewide policies and standards for educational programs and services provided by the 16 technical colleges, and is responsible for administering state and federal aid to the colleges. The WTCS System Office is the administrative and coordinating agency of the WTCS Board. It helps ensure quality, accountability, and efficiency. The System Office implements statewide policies and standards established by the WTCS Board and oversees state funding provided for technical college programs and services. WTCS is organized into 16 technical college Districts, each with a Board of Trustees that has responsibility for day-to-day college operations. Each District Board consists of nine trustees who are appointed by local officials. Trustees work with the college presidents to ensure that local and regional economic development needs are met, and that there is an overall responsiveness to employer partners and residents.

[7] http://www.wtcsystem.edu/

While each WTCS college has individual authority and autonomy, each college also operates under the guidelines and infrastructure established by the System Office, including opportunities to communicate and share information about programs, services, and data. Importantly for the *Making the Future* strategy was an existing data-sharing agreement between WTCS and the Wisconsin Department of Workforce Development to obtain individual-level data from the unemployment compensation database on employment, retention, and earnings. This strong infrastructure, coupled with the existing precedent for coordination across the consortium colleges, provided the necessary foundation from which to build on the *Making the Future* strategy.

The consortium leveraged existing structures to share information between institutions, and developed several key positions to provide the necessary connectivity among projects at the district-level, as well as the bigger picture objectives and goals of the grant. Northeast Wisconsin Technical College (NWTC) served as the lead in the consortium-wide grant, and in that capacity played a number of key roles, including fiscal agent for the project. Additionally, a project manager hired for the grant and housed at NWTC coordinated all *Making the Future* activities. The project manager reported to NWTC's Dean of Learning Solutions, and was the primary point of contact for USDOL/ETA communication, reporting, and questions from the consortium. The project manager also engaged subject matter experts for the project, and facilitated planning, conferences, and communications between systems and partners. Additionally, an outreach coordinator was hired to promote project successes, develop, implement a system-wide recruitment strategy, and design and deliver marketing and outreach materials about advanced manufacturing career pathways to consortium colleges. Finally, a data specialist and best practices coordinator were hired to support colleges' implementation efforts, and an administrative assistant and accounting assistant provided administrative support and infrastructure to the consortium.

The Wisconsin Context

The great recession resulted in significant hardship in Wisconsin, with approximately 84,000 Wisconsin families affected by the loss of manufacturing jobs in the area.[8] The *Making the Future* project was influenced by data from both the Center on Wisconsin Strategy and the state Department of Workforce Development that projected the economic recovery would provide strong job growth for Wisconsin, and advanced manufacturing was identified as one of the largest growth sectors.[9] A survey of employers in 2012 also found that 70% of respondents planned to hire workers if they had the skills necessary to successfully do the jobs being created.[10]

To prepare Wisconsin's workforce for these job opportunities, the *Making the Future* consortium of technical colleges identified three primary goals to close the manufacturing skills gap:

- Increase the attainment of industry-recognized and industry-valued certifications, certificates, diplomas, and other credentials to better prepare program participants for high-skill, high-wage employment or re-employment in manufacturing careers, by aligning services to place high-skilled individuals more quickly into short-term training that corresponds to immediate employer need;

- Introduce innovative and effective curriculum development and delivery within an industry-informed career cluster, by building on Wisconsin's career pathway strategy to create a more responsive system that supports high-risk adults, and places students into appropriate, transferable pathways; and,

[8] Northeast Wisconsin Technical College, *Making the Future: The Wisconsin Strategy, Part II: Technical Proposal* CFDA #17.282
[9] Ibid.
[10] Ibid.

- Increase and improve employment outcomes, by integrating Wisconsin's career pathway strategy with partner needs and expectations to create navigable roadmaps to family-sustaining careers, providing long-term stability to the manufacturing sector.[11]

The *Making the Future* consortium identified nine key areas for the colleges and their strategic partners to develop, improve, and expand upon to support the achievement of the identified goals:

- Stacked and Latticed Credentials
- Instruction
- Curriculum
- Credit for Prior Learning (CPL)
- Standardized Timing Model (STM)
- Flashcard Technology
- Support Services
- Engagement with Employers
- Engagement with Workforce Boards/Job Services

Altogether, the TAACCCT initiative motivated and supported Wisconsin technical colleges to transform their manufacturing programs to better address the needs of students and local employers. The evaluation team explored and assessed all enhancements during early implementation, and then identified an emergent set of strategies colleges were pursuing that represented the best potential for impact on participant outcomes. These strategies also reflected the existing research and evidence on institutionalization, effective practice, and student success. The final set of strategies is discussed in detail in Section 4.

Using the aforementioned enhancements in targeted manufacturing programs, the *Making the Future* consortium aimed to serve more than 2,657 unique participants during the three-year period of the grant. Preliminary performance numbers indicate **the consortium widely surpassed their original goal –serving 3,795 unique participants or 143% of the goal**. While participants often experienced more than one programmatic enhancement, the common cross-cutting enhancement experienced by the majority of these participants was a stacked and latticed pathway in welding, machine tool/CNC, or industrial maintenance.

Stacked and Latticed Pathways

Given the goals of the initiative, it is not surprising that the creation of stacked and latticed pathways was by far the most robust and widespread strategy implemented across the consortium, with 13 of the 15 colleges creating or enhancing a stacked and latticed pathway in advanced manufacturing.

Stacked and latticed pathways are a package of credit-based courses and competencies that connect and build on each other within a program of study, and that yield a series of credentials for students. The "stacking" aspect of the pathway denotes vertical movement within a pathway, as each new credential in the career path provides a new set of competencies and skills to master. Stackable credentials have value in education as transferrable credits or portable credentials and in the labor market. The term "stacking" denotes a linear relationship, with each credential building on previously learned content, while "latticing" refers to the mobility of students to move in- and out- of the labor market at each level of credentialing. As students progress through a degree plan, earning certificates along the way, they may get to a point where they want to add or shift to another related field of study. Ideally, a stacked and latticed pathway also includes multiple options for an individual to enter or exit a program, maximizing flexibility and providing the opportunity to tailor the pathway as needed.

[11] Ibid. page 12

The *Making the Future* colleges implemented several types of stacked and latticed pathways, offering local or embedded certificates and short-term technical diplomas that stack to one-year or two-year degrees within their advanced manufacturing programs of study. In all cases, the stacked and latticed pathways provided students with a shorter path to a credential and employment, meaning they could take fewer courses and credits within a program of study to earn a credential. Importantly, the credits earned in these short-term credentials, which lead to entry-level employment, count toward subsequent credentials within the program of study.

Section 2 - The Evaluation Design: Implementation and Impact

The comprehensive evaluation of *Making the Future* included regular, formative feedback on the implementation progress among the technical colleges, and a rigorous quantitative analysis of impact using propensity score analysis to identify a matched comparison group. In this section, the methodology and approach to the evaluation is described. Also discussed is the alignment between the implementation and impact studies, using findings and observations from the implementation study to help guide the impact study.

Implementation Study

The implementation evaluation was designed to provide formative feedback on program implementation at each technical college during the first two years of the initiative. Additionally, key elements of program implementation were documented and assessed, ranging from efforts to develop and establish specific manufacturing program career pathways frameworks (e.g., curriculum and short-term credentials) to sustaining and institutionalizing key grant-supported strategies (e.g., student assessment and supports) upon conclusion of the TAACCCT grant.

As the initiative started, the evaluation team led a consortium-wide meeting with key representatives from participating colleges to help them understand the focus of the evaluation. The meeting resulted in a master logic model that was framed to depict the activities and outcomes proposed and expected from colleges as a result of their participation in the initiative. The logic model provided colleges a roadmap outlining the key areas of evaluation focus (Appendix B). Using the logic model as a guide, the evaluation team also developed an outcomes and indicators tool to assess progress over time and better understand and document some of the contextual factors that influenced implementation (Appendix C).

Over the course of three plus years, the evaluation team engaged in several data collection activities to assess and document implementation efforts among the consortium colleges. These data collection efforts included interviews with key stakeholders, such as college administrators, faculty, and support staff, as well as external stakeholders such as employers and workforce groups. Qualitative interviews and focus groups were conducted either in-person during site visits or via telephone:

- **Site visits**: The evaluation team conducted 30 in-depth site visits, including at least one visit to each of the 15 colleges that were developing programs under the auspices of the consortium grant. Additionally, the team conducted a second round of site visits to eight of the colleges in year 2, and a final set of visits to seven of the colleges in years 3 and 4 that included focus groups with participants. The purpose of the initial site visits was to collect qualitative data on program implementation and to draft and share formative feedback memos. Subsequent site visits were structured to inform the summative implementation assessment. Two-person teams conducted all site visits, spending one and a half to two days onsite.

Table 2: Key Data Collection Methods

- Consortium-wide logic model
- Document review
- Site visits to 15 colleges (2013)
- Site visits to eight colleges (2014)
- Semi-structured phone interviews with seven colleges (2014)
- Phone interviews with program deans (2015)
- Site visits to seven colleges (2015-2016)
- Semi-structured phone interviews with eight colleges (2015-2016)

- **Phone interviews**: The evaluation team conducted more than 200 phone interviews with college stakeholders during the grant period. In year 2, interviews were conducted with the seven colleges that did not receive site visits. Similarly, in years 3 and 4, eight colleges were interviewed that did not receive site visits. These phone interviews were conducted by two-person teams and varied from a half-day to a full day in length, with a focus on collecting qualitative data on program implementation and progress to date. Interviews were conducted with a range of internal and external stakeholders. In year 3, phone interviews were conducted with program deans at all 15 of the colleges. The focus of these calls was to better understand how stacked and latticed pathways, and related student supports, were being used in other manufacturing programs on campus.

The data collected through the initial site visits and phone interviews during the first two years of the initiative helped refine the implementation study. For example, fieldwork generated a deeper understanding of college efforts to develop career pathways and the processes and steps required internally and in collaboration with the Wisconsin Technical College System. These processes and rules were particularly important for colleges wanting to create new manufacturing programs of study or make curricula and credential modifications to existing programs. In addition, data collected during the first two years identified a variety of strategies colleges were pursuing to enhance student success, provide greater access to targeted populations, and build stronger connections with local employers. These early evaluation findings were shared with the consortium in an interim report and are summarized in Section 4.[12]

As a result of these early findings, the evaluation team sharpened its implementation data collection efforts to focus on five cross-cutting strategies that appeared most prevalent across the consortium colleges and that had the most potential for affecting student outcomes: stacked and latticed pathways; career pathway bridges; enhanced academic instruction; enhanced student support services; and expanded role for employers.

Through subsequent implementation data collection, the evaluation team sought to document how these strategies were institutionalized and sustained by the colleges.

Impact Study

In the impact study, the evaluation team used a rigorous quasi-experimental matched comparison group analysis to examine the impact of participation in stacked and latticed pathways on education and employment outcomes, including credit accumulation, credential attainment, employment after program exit, and earnings after program entry.

Administrative data were obtained from each of the technical colleges in the consortium for the period June 2012 through June 2016. The evaluation team identified specific data elements and created a master data dictionary to be used consortium-wide. Additionally, data sharing agreements were established with each college, as well as with WTCS. The data sharing agreement with WTCS provided the evaluation team with access to Unemployment Insurance records and workforce program data from the Wisconsin Department of Workforce Development. Given reporting lags for UI data, UI records were received for only a portion of the grant period (i.e., through the April-June 2015 quarter) and, thus, labor market outcomes can be examined for only a subset of the overall grant participants. All data were de-identified to protect student privacy.

Propensity score matching (PSM) was utilized to generate a comparison group that is similar to the treatment group along a set of background characteristics that could affect the likelihood of receiving

[12] Price, D., Sedlak, W., Roberts, B. and McMaken. J. *Interim Making the Future Evaluation Report*. Equal Measure with DVP-PRAXIS LTD and Brandon Roberts + Associates, Philadelphia, PA. December 2014.

treatment. To conduct PSM for the impact study, data were requested from both participants and a comparison pool from colleges. The comparison pool data consisted of students in manufacturing programs at the consortium technical colleges that were not supported by the TAACCCT grant. Participants were students enrolled in a grant-funded stacked and latticed manufacturing pathway during the grant period.

The PSM approach enabled the evaluation to meet standards of rigor for non-experimental research studies as defined by the Clearinghouse for Labor Evaluation and Research (CLEAR)[13] and the Institute of Education Sciences What Works Clearinghouse (WWC).[14] PSM is a quasi-experimental design methodology that can achieve a moderate rating from CLEAR, as well as meet WWC standards with reservations. See Appendix A for detailed information about the PSM process and baseline equivalence for each variable used in the PSM models.

PSM is an increasingly common and popular approach to account for factors that may influence the receipt of treatment, and thus confound analysis of impact. By generating a comparison group that resembles the treatment group on all variables thought to affect likelihood of receiving treatment, researchers can infer that the subsequent observed impact of the treatment is the result of the treatment, and not the result of different characteristics in the two groups.[15]

[13] Clearinghouse for Labor Evaluation and Research. *Causal Evidence Guidelines*, Version 2.1, December 2015.
[14] Institute of Education Sciences, What Works Clearinghouse. *WWC Standards Brief for Baseline Equivalence*, n.d.
[15] Guo, S. & Fraser, M. (2010). *Propensity Score Analysis: Statistical Methods and Applications*. Los Angeles: Sage Publications; and, Austin, P.C. (2011). An introduction to Propensity Score Methods for Reducing the Effect of Confounding in Observational Studies. *Multivariate Behavioral Research*, 46(3), 399-424

Section 3 – The Impact of Stacked and Latticed Pathways on Education and Employment Outcomes

As noted above, the impact study focused on participants in stacked and latticed pathways. The primary reason for this decision is the early implementation findings that identified how widespread this strategy was among consortium colleges. That is, stacked and latticed pathways represented the most robust and prevalent strategy across the *Making the Future* colleges.

A second reason for focusing the impact study on stacked and latticed pathways is the emerging research literature on career pathways that suggests these types of programs can yield better education and employment opportunities for students, especially low-skilled adults who need new skills to compete for jobs in a high-tech economy.[16]

In the coming years, jobs requiring a college credential are projected to grow twice as fast as those requiring no college experience. As baby boomers retire and new jobs are created, almost a third – 17 million out of 55 million – of the new job openings between 2010 and 2020 are going to require middle skills.[17] These are jobs that pay middle-class earnings, don't require a bachelor's degree, but often require some sort of postsecondary credential. These "middle-skill" occupations, according to the Georgetown University Center for Education and the Workplace, include electricians, construction managers, dental hygienists, paralegals, and police officers, training for which is often delivered by community and technical colleges.[18] Nationwide, these positions pay, on average, $35,000 per year, while some pay significantly more. For many potential workers, these credentials, and the jobs they lead to, are difficult to reach – particularly for low-skilled adults. This middle skills gap is both a national issue and a local problem. In Wisconsin, the labor force continues to age and diversify with many workers lacking the skills and training needed to fill technical jobs, often earning less than the state's median wage.

The *Making the Future* strategy emerged from several years of activities focusing on adult career pathways in Wisconsin, building on the work of the Regional Industry Skills Education (RISE) initiative that began in 2007 as part of the Joyce Foundation's multi-state Shifting Gears initiative. RISE was a partnership of the Wisconsin Technical College System and the Wisconsin Department of Workforce Development, whose purpose was to promote the development of adult career pathways in Wisconsin. During Shifting Gears, WTCS changed its policies and procedures manual for program approval and modification, so that colleges could more easily develop and implement career pathways – specifically the chunking of program curricula and stacking of credentials, as well as the development of adult education bridges.[19] Through participation in education and training programs that meet business demands for highly-skilled workers, low-skilled adults could then obtain the necessary skills, competencies and credentials to obtain and advance to better jobs. Moreover, one of the key benefits of the stacked and latticed approach is the opportunity for students to earn more credentials and do so earlier in the educational pathway.

According to the Alliance for Quality Career Pathways, career pathways focus on easing and facilitating student transition from high school to community college, from pre-college courses to credit

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[16] See for example, Alssid, J. L., Gruber, D., Jenkins, D., Mazzeo, C., Roberts, B., & Stanback, R. (2002, August). Building a career pathways system: Promising practices in community college-centered workforce development. New York: Workforce Strategy Center; and, Helmer, M., & Blair, A. (2011, February). Courses to employment: Initial education and employment outcomes findings for students enrolled in Carreras en Salud Healthcare Career Training 2005– 2009. Washington, DC: The Aspen Institute

[17] www.communitycollegetimes.com/Pages/Workforce-Development/Preparing-America-for-middle-skill-work.aspx

[18] Anthony J. Carnevale, Nicole Smith, Jeff Strohl, "Help Wanted: Projections of Jobs and Education Requirements Through 2018: Executive Summary" Washington, DC: Center for Education and the Workforce, (June 15, 2010)

[19] Roberts, B. and Price, D. (2012). *Strengthening State Systems for Adult Learners: An Evaluation of the First Five Years of Shifting Gears.* Chicago: Joyce Foundation.

postsecondary programs, and from community college to university or employment. Inherent in this approach are three key features: 1) multiple entry points; 2) multiple exit points; and 3) well-connected and transparent education, training, support services, and credentials within specific sectors or cross-sector occupations. Put simply, career pathways are "a series of connected education and training programs and student support services that enable individuals to secure a job or advance in a demand industry or occupation".[20] Career pathways can be especially helpful for high school dropouts, holders of GEDs, high school graduates with no college, foreign-born residents, ex-offenders, re-entering workers, and employed persons who seek to upgrade their skills.[21]

Making the Future Participants in Stacked and Latticed Manufacturing Pathways

As noted above, among Wisconsin technical colleges, the most common approach to serving grant participants consisted of stacked and latticed pathways. Stacked and latticed pathways were designed to provide a series of credentials that build upon each other and lead to employment opportunities at each level of credential. During the grant period, Wisconsin technical colleges created new manufacturing pathways and modified existing pathways to enable participants to earn short-term credentials (less than one year) that stack toward one-year and two-year technical diplomas, and in some instances, Associate's degrees. Wisconsin's approach to stacked and latticed pathways consists of embedding short-term certificates or credentials within longer-term "parent" programs.[22] Embedding credentials allows students to receive targeted technical training in a short period of time that generates the skills needed for employment in that field. Stacked and latticed pathways also help students to continue moving forwards toward a technical diploma or Associate's degree if they "job-out" and later return to college, as students can apply the embedded credential's courses and credits toward the "parent" program without having to re-start the training program.

For *Making the Future*, stacked and latticed manufacturing pathways included programs in welding, machine tool/CNC, and industrial maintenance. The most prolific programs across the consortium were in the welding and machine tool/CNC areas (11 and 10 programs, respectively), with only two industrial maintenance programs offered to participants during the grant period.

Across the statewide consortium, almost all colleges (n=13)[23] offered at least one stacked and latticed pathway program, and 3,178 students in these colleges, representing 84% of grant participants across the consortium, enrolled in a stacked and latticed pathway in welding, machine tool, and/or industrial maintenance. This group of 3,178 students represents the treatment group for the impact study, and characteristics of the treatment group are presented in Table 3.[24] The vast majority of grant participants in stacked and latticed manufacturing pathways are male, white, and non-Hispanic, with an average age of 27. Approximately two-thirds of the treatment group had received at least a high school diploma – but no higher degree – prior to entering the sample, and about one-third received a Pell Grant during their first term in the sample. On average, participants in the treatment group entered the sample with five academic credits – earned at the current college or at a different institution – and attempted 11 academic credits during their first term in the sample. Over the course of the grant, 25% of the treatment group enrolled in adult basic education and 31% enrolled in developmental education. The majority of participants enrolled in a welding program of study (62%)

[20] Alliance for Quality Career Pathways. (June 2014). *Shared vision, strong systems*. Executive Summary. Washington, DC: CLASP.
[21] Hinckley et al. (2011), *Adult Career Pathways: Providing a Second Chance in Public Education*, CORD.
[22] See http://mywtcs.wtcsystem.edu/student-success/career-pathways for information about career pathways in the Wisconsin Technical College System.
[23] Gateway Technical College and Southwest Technical College did not offer stacked and latticed pathways as part their grant-funded programs and are excluded from the impact analysis.
[24] The remaining 617 participants enrolled in programs that a) were not stacked and latticed pathways, b) were short-term training programs that were not part of a program of study, or c) were non-credit training programs.

and a little more than one-third (36%) enrolled in a machine tool/CNC program of study. Less than 10% enrolled in an industrial maintenance program of study.[25]

A small proportion of the treatment group participated in workforce development programs during the grant:

- 6% received WIOA Title 1 assistance;
- 2% received Trade Adjustment Assistance; and
- 2% received Veteran's Assistance.

In other words, less than 10% of participants enrolled in stacked and latticed pathways were clients of these workforce development programs at any point during the grant period.

Table 3: Treatment Group Characteristics

	Treatment Group (n=3,178)
Age	
Average age during first term in sample	26.6
Gender	
Male	93%
Female	7%
Race/Ethnicity	
African American	8%
White	82%
Hispanic (any race)	7%
Prior Education	
Highest degree – less than H.S. diploma	14%
Highest degree – H.S. diploma	51%
Highest degree – some college	14%
Highest degree – postsecondary credential	6%
Highest degree – unknown	15%
Average post-secondary credits earned prior to first term in sample	5.14
Academics	
Average number of academic credits attempted during first term in sample	11.00
Enrolled in adult basic education during grant	25%
Enrolled in developmental/remedial education during grant	31%
Pell Status	
Received Pell award during first tem in sample	34%
Workforce Development & Veterans Assistance	
Received TAA program assistance during grant	2%
Received WIOA program assistance during grant	6%
Received Veterans program assistance during grant	2%
Manufacturing Program Area	
Welding	62%
Machine Tool/CNC	36%
Industrial Maintenance	8%

[25] Participants could enroll in more than one manufacturing area. Half of participants in the industrial maintenance area were at Madison College and entered into this program of study after completing Manufacturing Essentials, which is the entry-level local certificate program implemented during the *Making the Future* grant. Manufacturing Essentials was designed to stack into several manufacturing programs of study at Madison College.

Impact Evaluation Research Questions & Methodology

The impact study focuses on four key outcomes: credential attainment, credit accumulation, employment, and earnings. The specific research questions for each outcome are listed below:

- **Credential attainment**: Do grant participants in stacked and latticed pathways earn credentials at a higher rate than students in a matched comparison group?
- **Credit accumulation**: Do grant participants in stacked and latticed pathways earn more credits than students in a matched comparison group?
- **Employment**: Do non-incumbent worker grant participants in stacked and latticed pathways get employed at a higher rate than non-incumbent workers in a matched comparison group?
- **Earnings**: Do incumbent worker grant participants in stacked and latticed pathways receive earnings increases at a higher rate than incumbent workers in a matched comparison group?

Impact Evaluation Results: Overall Summary

In Table 4, a summary of the overall impact of stacked and latticed pathways on participant outcomes is provided. The impact analysis results indicate that participants in stacked and latticed pathway programs earned more academic credits during the grant period, and that more participants earned postsecondary credentials than students in a matched comparison group.[26] These findings are statistically significant, because the p-value is less than .05:

- 48% of participants earned postsecondary credentials, while only 30% of the matched comparison group earned a postsecondary credential; and
- Participants earned, on average, three credits more than the matched comparison group.

By comparison, the analysis was inconclusive on employment and earnings gains. Although the treatment group had a higher employment rate in the first quarter after exiting the program than the matched comparison group, these differences are not statistically significant, because the p-value is greater than .05. Moreover, there is no meaningful difference in the earnings increase rate between the treatment and comparison groups.

Table 4: Impact Analysis Results

Outcome	Treatment Group	Comparison Group	ATT	P-value
Credential attainment rate	48%	30%	18%	.000
Average total credit accumulation	25.26	22.25	3.01	.000
Non-incumbent worker employment rate one quarter after program exit	33%	29%	4%	.080
Incumbent worker earnings increase rate at any point after program entry	76%	75%	1%	.721

The following sections provide detailed discussions of each outcome and the impact analysis results, as well as exploratory follow-up analyses.

[26] There is incomplete information about the manufacturing programs in which the comparison pool enrolled. It is possible that some comparison students also enrolled in stacked and latticed pathways; therefore, the analyses presented here may underestimate the potential impact of stacked and latticed pathways.

Education Outcomes

In this section of the evaluation report, the results from the impact analysis of stacked and latticed pathways for two education outcomes are presented: credential attainment and credit accumulation.

Impact Evaluation Results: Credential Attainment

Research Question: ***Do grant participants in stacked and latticed pathways earn credentials at a higher rate than students in a matched comparison group?***

As noted previously, the research literature on stacked and latticed career pathways suggests that one of the key benefits of this approach is the opportunity for students to earn more credentials and to earn them earlier in an educational pathway. The impact analysis for credential attainment shows that participants in stacked and latticed manufacturing pathways have a significantly higher rate of credential attainment than students in the matched comparison group. As Table 5 shows, almost half (48%) of the treatment group received a credential of some kind, while only 30% of the matched comparison group received a credential – a difference of 18 percentage points.

Table 5: Average Treatment Effect on the Treated – Credential Attainment

Outcome	Treatment Group (n=3150)	Comparison Group (n=3150)	ATT	P-value
Credential attainment rate	48%	30%	18%	.000

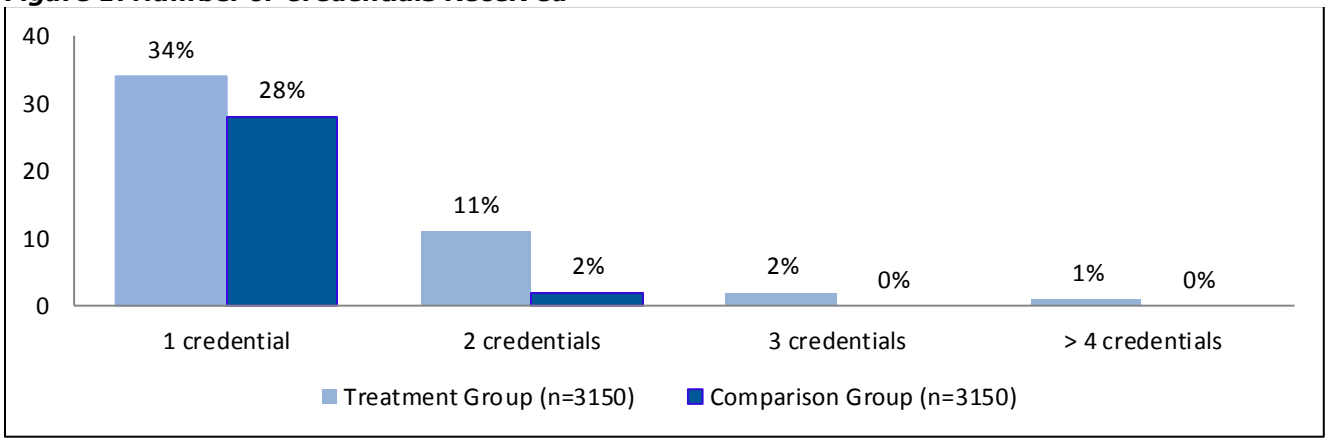
Stacked and latticed pathways are designed to enable students to earn short-term credentials that count toward a one-year or two-year diploma or credential, and the Wisconsin career pathways model embeds short-term credentials into "parent" programs of study. As Table 6 shows, the treatment group received more one-year technical diplomas, more short-term technical diplomas (less than one year) and career pathway certificates, and more short-term local certificates than the comparison group. In contrast, there was not a statistical difference in the percentage of participants and the matched comparison group who earned a two-year technical diploma or Associate's degree.

Table 6: Types of Credentials Received

	Treatment Group (n=3150)	Comparison Group (n=3150)	P-value
Two-Year Technical Diploma or Associate's degree	8%	7%	.501
One-Year Technical Diploma	28%	17%	.000
Less Than One-Year Technical Diploma or Career Pathway Certificate	11%	6%	.000
Local Certificate	14%	2%	.000

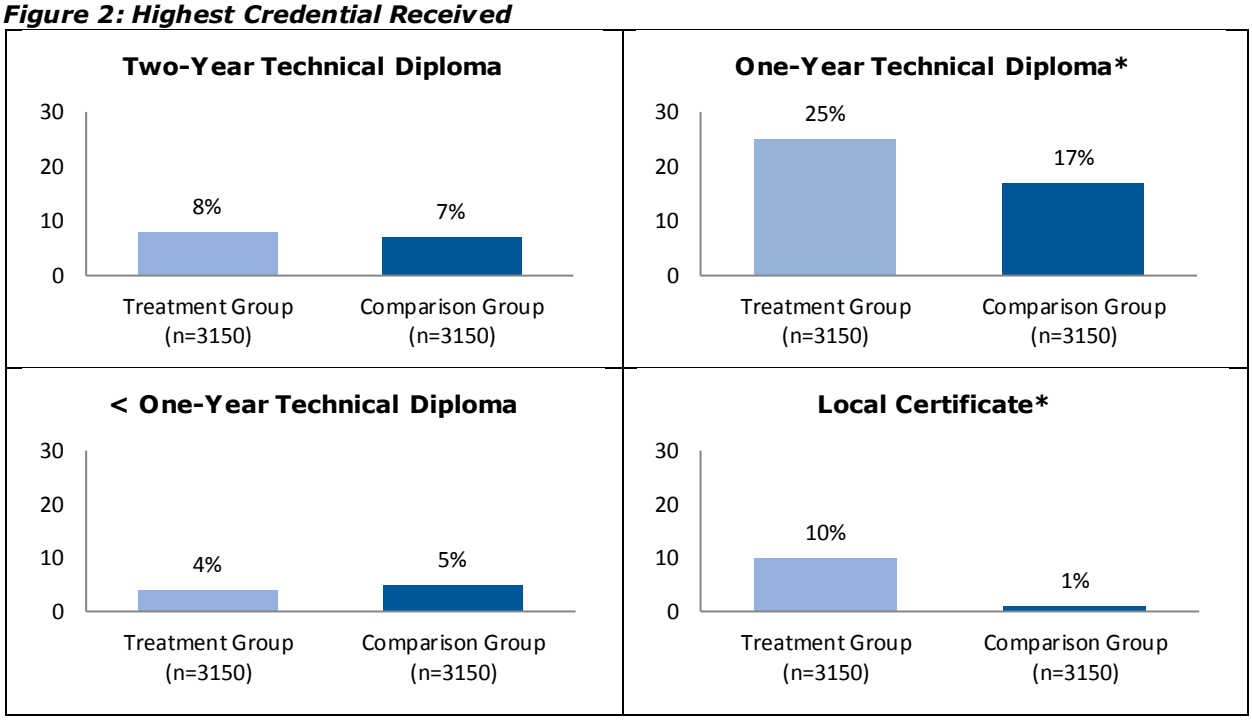
Students may enroll in multiple programs and earn more than one credential, and additional exploratory analysis shows that 14% of participants earned more than one credential, while only 2% of the comparison group earned more than one credential (p-value<.01), and, as Figure 1 shows, no comparison group members received more than two credentials.

Figure 1: Number of Credentials Received



The difference in the highest credential earned among participants and the matched comparison group was also examined. Figure 2 provides credential attainment rates based on the highest credential earned, and shows that – consistent with the results in Table 6 above – participants earn more one-year technical diplomas (p-value<.01) and more local certificates (p-value<.01) as their highest degrees than comparison group members. However, there is no statistically significant difference between groups in the proportion of students earning less than one-year technical diplomas as their highest degree. Together with the results presented above, this finding indicates that participants who received multiple credentials are earning *both* a short-term credential (less than one year) *and* a one-year technical diploma in their programs of study, and suggests that students are not "jobbing out" and leaving the college after receiving a short-term credential within a stacked and latticed pathway.

Figure 2: Highest Credential Received



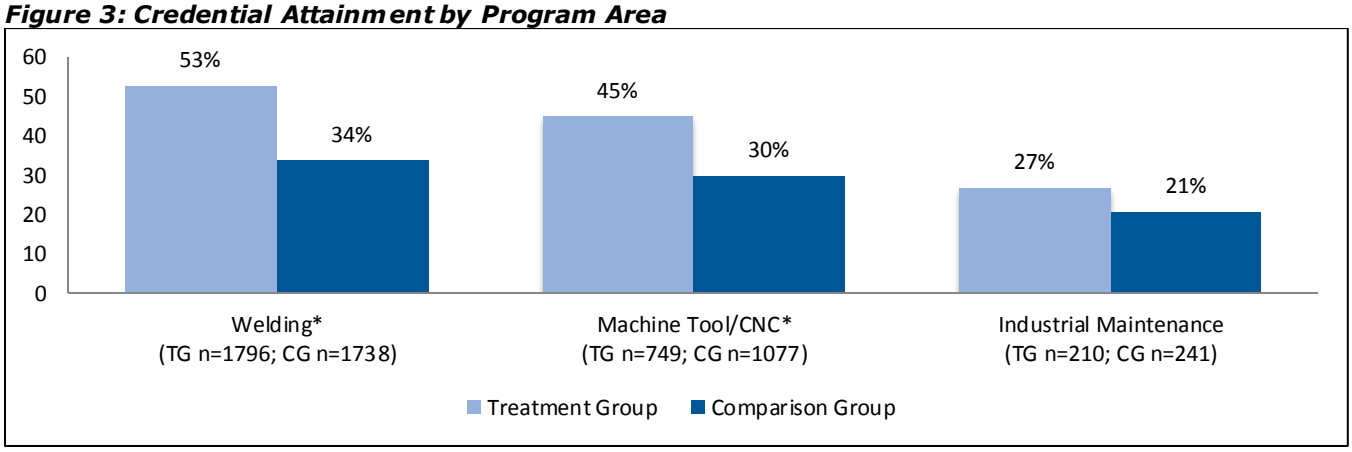
**Difference is significant at the .05 level*

Further exploration suggests that, among those who earn a credential, participants earn these credentials more quickly and they also earn more credentials overall. Participants who earn a

credential take, on average, 2.3 terms to receive it, while comparison group members who earn a credential take 2.8 terms (p-value<.01). Moreover, 29% of participant completers earn more than one credential, while only 7% of comparison completers earn more than one credential. These results are consistent with expectations for stacked and latticed pathways: participants in stacked and latticed programs earn multiple credentials, and they earn these credentials more quickly in their educational pathway.

Given the large impact of stacked and latticed pathways on overall credential attainment, this outcome was further examined for each of the three manufacturing areas that were the focus of the *Making the Future* consortium: welding, machine tool/CNC, and industrial maintenance. As Figure 3 shows, more than half (53%) of welding participants in stacked and latticed pathways earned a credential, as did 45% of machine tool/CNC participants and 27% of industrial maintenance participants. Importantly, in all three manufacturing areas, a higher percentage of participants earned credentials than did the matched comparison group. This finding suggests the impact of stacked and latticed pathways on credential attainment is not limited to a specific manufacturing area. Although the difference between participants in industrial maintenance programs and the matched comparison group is not statistically significant, the lack of statistical significance is likely due to the small number of observations. The substantive difference of six percentage points is noteworthy.

Figure 3: Credential Attainment by Program Area



**Difference is significant at the .05 level*
**TG=treatment group; CG=comparison group*

Finally, the association of stacked and latticed manufacturing pathways and credential attainment was examined by select participant characteristics. As Table 7 shows, differences in credential attainment between participants and the matched comparison group holds among the following groups: students who enrolled in ABE at any point in the grant, students who participated in WIOA at any point in the grant, African American and white students, and both male and female students. This suggests that participating in stacked and latticed pathways is positively associated with credential attainment across many demographic groups, and that it is not limited to a particular type of student or students from particular backgrounds.

In sum, the impact of stacked and latticed pathways on credential attainment is robust, and subsequent exploratory analysis suggests the positive effects hold across program areas and across various demographic groups.

Table 7: Credential Attainment by Select Student Characteristics

Enrolled in ABE		
Participant (n=796)	*Comparison (n=801)*	*P-value*
55%	31%	.000
WIOA Client		
Participant (n=192)	*Comparison (n=181)*	*P-value*
52%	30%	.000
African American		
Participant (n=237)	*Comparison (n=272)*	*P-value*
27%	14%	.000
White		
Participant (n=2585)	*Comparison (n=2562)*	*P-value*
50%	33%	.000
Hispanic		
Participant (n=211)	*Comparison (n=245)*	*P-value*
36%	30%	.226
Male		
Participant (n=2942)	*Comparison (n=2956)*	*P-value*
48%	31%	.000
Female		
Participant (n=208)	*Comparison (n=194)*	*P-value*
46%	20%	.000

Impact Evaluation Results: Credit Accumulation

Research Question: ***Do grant participants in stacked and latticed pathways earn more credits than students in a matched comparison group?***

The impact of participation in a stacked and latticed pathway on total credit accumulation during the grant period was examined, and as Table 8 shows, participants in stacked and latticed manufacturing pathways earned more academic credits during the grant period than the matched comparison group. Grant participants in stacked and latticed pathways earned an average of 25.29 credits during the grant period, or 3.01 more credits than the average earned by the matched comparison group. In other words, participants earned 14% more academic credits on average than the matched comparison group during the grant period.

Table 8: Average Treatment Effect on the Treated – Credit Accumulation

Outcome	Treatment Group (n=3148)	Comparison Group (n=3148)	ATT	P-value
Average total credit accumulation	25.26	22.25	3.01	.000

Differences in credit accumulation between participants and comparison group members were also examined by select participant characteristics. As Table 9 shows, the pattern of credit accumulation varies across student populations. For example, white participants and male participants – the largest groups – earn significantly more credits than their white, male counterparts in the matched comparison group. By comparison, there is no statistical difference in the number of credits earned by participants and matched comparison group members who are African American or Hispanic, female, or who had enrolled in ABE at some pointed during the grant period.

Table 9: Credit Accumulation by Select Student Characteristics

Enrolled in ABE		
Participant (n=794)	*Comparison (n=848)*	*P-value*
23.62	24.34	.394
WIOA Client		
Participant (n=192)	*Comparison (n=175)*	*P-value*
24.29	29.16	.025
African American		
Participant (n=236)	*Comparison (n=308)*	*P-value*
11.31	13.05	.142
White		
Participant (N=2585)	*Comparison (n=2582)*	*P-value*
27.07	23.56	.000
Hispanic		
Participant (N=211)	*Comparison (n=214)*	*P-value*
15.81	18.87	.061
Male		
Participant (n=2940)	*Comparison (n=2933)*	*P-value*
25.59	22.31	.000
Female		
Participant (n=208)	*Comparison (n=215)*	*P-value*
21.21	20.83	.820

Of note, participants in stacked and latticed pathways that enrolled in WIOA at some point during the grant period earned significantly fewer credits than their WIOA counterparts in the matched comparison group. This finding may be the result of WIOA only supporting clients to earn the first credential in a program of study, and as indicated previously, participants in stacked and latticed pathways earn their first credential more quickly.

Labor Market Outcomes

In this section of the evaluation report, the results of the impact analysis of stacked and latticed pathways on two employment outcomes are provided: employment during the first quarter after exit and earnings increase after enrollment.

Impact Evaluation Results: Employment during the First Quarter after Exit for Non-incumbent Workers

Research Question: ***Do non-incumbent worker grant participants in stacked and latticed pathways get employed at a higher rate than non-incumbent workers in a matched comparison group?***

The employment outcome impact analysis was limited to students who were not employed during their first term in the sample.[27] The participant group for the employment outcome impact analysis is older than the overall participant group, is slightly more racially and ethnically diverse, and is slightly more likely to receive a Pell grant in the first term and to have received WIOA assistance at any point during the grant period. See Appendix A for more detailed information.

[27] A small number of cases with missing UI data are included by treating missing UI data in the first term in sample and during the first quarter after exit as not employed. For examples of other research that use this approach, see: Liu, V.Y.T., Belfield, C.R., & Trimble, M.J. (2014). The medium-term labor market returns to community college awards: Evidence from North Carolina. *Economics of Education Review*, 44, 42-55; and, Dadgar, M., & Trimble, M.J. (2014). Labor market returns to sub-Baccalaureate credentials: How much does a community college degree or certificate pay? *Educational Evaluation and Policy Analysis*.

Due to data lags in UI reporting, the sample was further restricted to students who exited the college no later than the 2015 winter/spring term. Thus, the analytic sample for the employment outcome consists of 741 students who were not employed when they entered the sample and who exited prior to the summer of 2015. Consistent with the U.S. Department of Labor TAACCCT metrics, employment is defined as "employed during the first quarter after program exit."[28] PSM generated a matched comparison group that is very similar to the non-incumbent worker participant group.

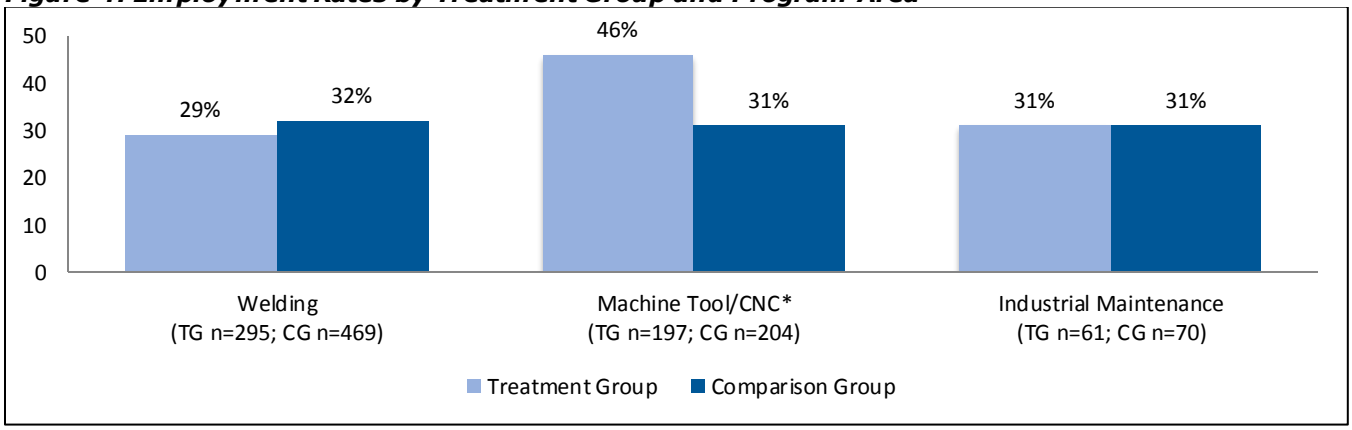
The analysis of the impact of stacked and latticed pathways on employment for non-incumbent workers indicates that grant participants become employed at a higher rate than the matched comparison group. As Table 10 shows, 33% of participants are employed one quarter after exit, compared with only 29% of the comparison group members. This difference in employment is not statistically significant (p-value is greater than .05), thus the results of the impact of stacked and latticed pathways on employment are inconclusive.

Table 10: Average Treatment Effect on the Treated – Employed One Quarter after Program Exit

Outcome	Treatment Group (n=741)	Comparison Group (n=741)	ATT	P-value
Non-incumbent worker employment rate one quarter after program exit	33%	29%	4%	.080

These employment outcomes were further examined for participants and comparison group members within each manufacturing area. As Figure 4 shows, non-incumbent worker grant participants who enrolled in a machine tool/CNC stacked and latticed pathway become employed at a much higher rate than comparison group students in the machine tool/CNC area (46% vs. 31%). There are no differences in the employment rate between treatment and comparison group members in the welding or industrial maintenance areas.[29]

Figure 4: Employment Rates by Treatment Group and Program Area



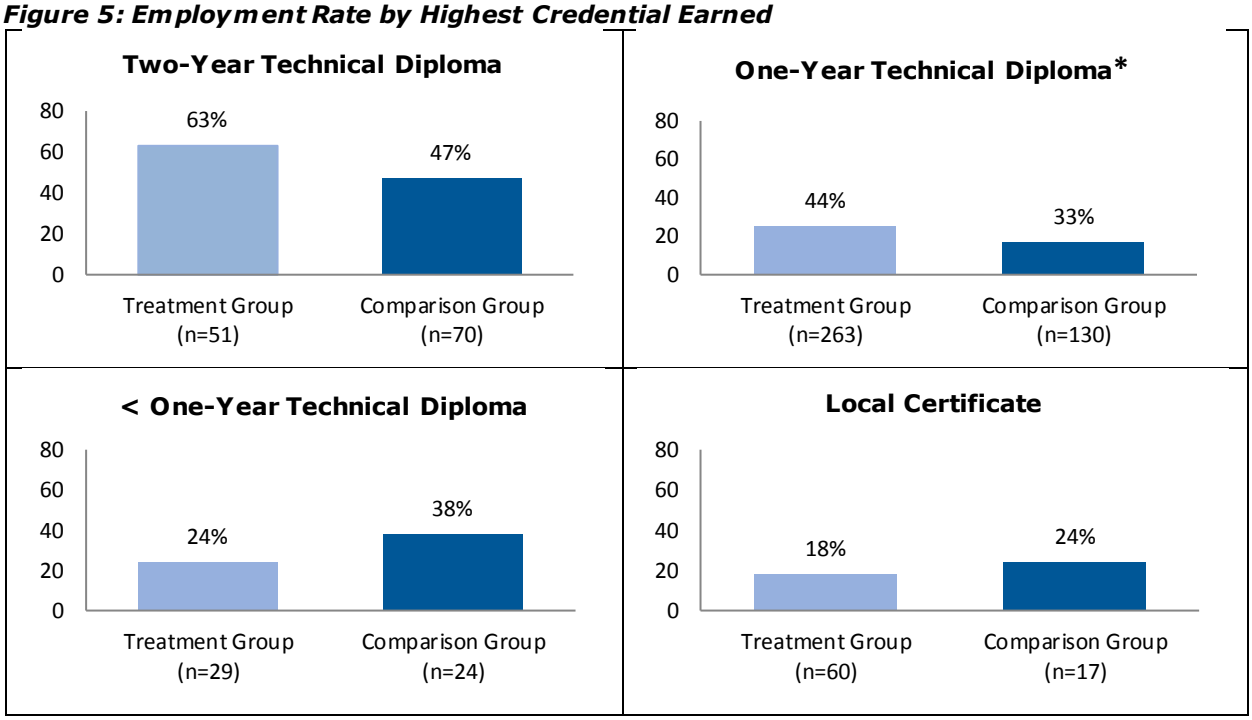
**Difference is significant at the .05 level*
**TG=treatment group; CG=comparison group*

[28] Program exit means a student is no longer enrolled at the college.
[29] Evidence from the evaluation fieldwork suggests that stacked and latticed pathways are more widespread in welding than in other manufacturing areas, therefore it is possible the impact on employment for welding participants is diluted.

As discussed earlier, stacked and latticed pathways are designed to offer shorter-term credentials, and the results show that participants in stacked and latticed pathways were more likely to earn one-year, less than one-year credentials, and local certificates. In order to better understand the possible relationships between credential attainment and employment, the evaluation team conducted exploratory descriptive analyses of employment outcomes by the highest credential earned.

As Figure 5 shows, non-incumbent worker participants in stacked and latticed pathways who receive a one-year technical diploma as their highest credential become employed at a higher rate (44%) than the matched comparison group members who receive a one-year technical diploma (33%). Additionally, although the difference is not statistically significant (p=value > .05), non-incumbent worker participants who receive a two-year credential are employed at a higher rate than comparison group members who receive a two-year credential. In contrast, among those receiving shorter-term credentials as their highest degree, non-incumbent worker participants are employed at a *lower* rate than the matched comparison group; however, it should be noted that the sample sizes for the non-incumbent worker groups earning a short-term diploma or a local certificate as their highest credential are quite small, and these differences between participant and matched comparison groups are not statistically significant. This exploratory analysis suggests that participants who earn a one-year or two-year credential have better employment outcomes than matched comparison group members, because participants in stacked and latticed pathways earn multiple credentials along the way that demonstrate their competencies and skills in manufacturing.

Figure 5: Employment Rate by Highest Credential Earned



**Difference is significant at the .05 level*

Finally, employment outcomes across different groups of students were examined and very few statistically significant differences were found in employment rates between the participant and comparison groups. In most instances, the number of observations for these various subgroups of participants and comparison group members is too small to make meaningful inferences.

Table 11: Employment Rate for Non-incumbent Workers, by Select Student Characteristics

Enrolled in ABE		
Participant (n=215)	*Comparison (n=217)*	*P-value*
30%	32%	.786
WIOA Client		
Participant (n=68)	*Comparison (n=44)*	*P-value*
24%	41%	.051
African American		
Participant (n=83)	*Comparison (n=89)*	*P-value*
19%	20%	.682
White		
Participant (n=578)	*Comparison (n=582)*	*P-value*
37%	32%	.070
Hispanic		
Participant (n=58)	*Comparison (n=53)*	*P-value*
10%	28%	.016
Male		
Participant (n=691)	*Comparison (n=697)*	*P-value*
34%	29%	.057
Female		
Participant (n=50)	*Comparison (n=44)*	*P-value*
30%	34%	.675

Impact Evaluation Results: Earnings Increase among Incumbent Workers

Research Question: ***Do incumbent worker grant participants in stacked and latticed pathways receive earnings increases at a higher rate than incumbent workers in a matched comparison group?***

The impact analysis of stacked and latticed credentials on earnings increase was limited to incumbent workers to be consistent with the U.S. DOL TAACCCT reporting metric, which required grantees to report on earnings increases for incumbent workers at any time after program entry.[30] Incumbent workers were defined as students who were employed in their first term in sample, which is equivalent to having quarterly earnings greater than zero.

Due to lags in UI reporting, the analytic sample for the earnings increase outcome is limited to incumbent workers who entered the sample no later than the 2015 winter/spring term. The resulting treatment group of 1,346 incumbent workers is almost identical to the overall treatment group along key demographic and academic characteristics. See Appendix A for more detailed information.

Consistent with U.S. DOL TAACCCT reporting guidelines, earnings increase is defined as "received an increase in earnings in any quarter after the first quarter in the sample." The impact analysis results are presented in Table 12, and, as this table shows, there is no meaningful difference in the earnings increase rate between participants and comparison group members: 76% of incumbent worker participants and 75% of the matched comparison group receive an earnings increase at some point after program entry.

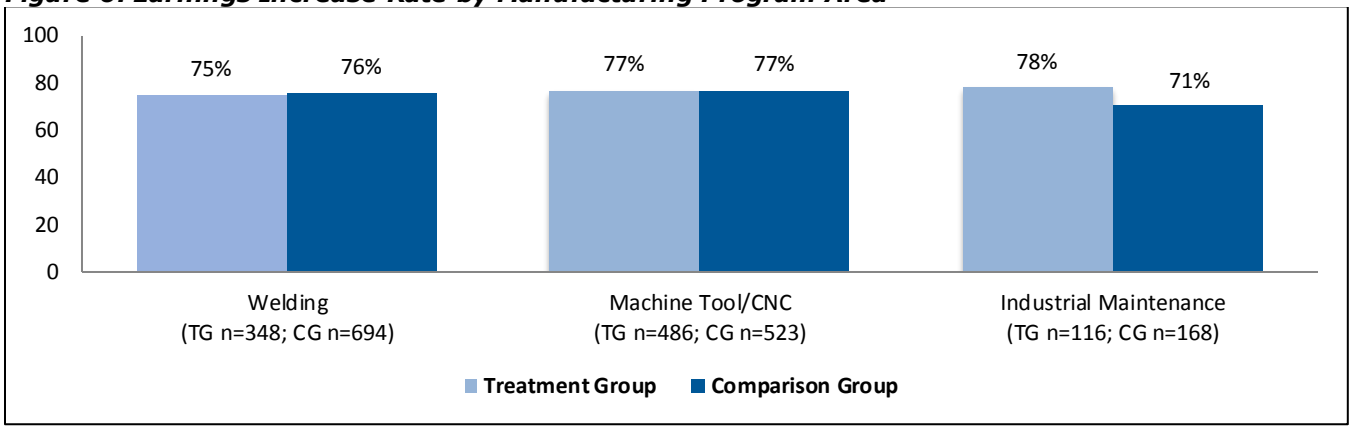
[30] U.S. Department of Labor, Employment Training Administration

Table 12: Average Treatment Effect on the Treated – Earnings Increase after First Term

Outcome	Treatment Group (n=1346)	Comparison Group (n=1346)	ATT	P-value
Incumbent worker earnings increase rate at any point after program entry	76%	75%	1%	.721

In order to develop a more nuanced understanding of the overall earnings increase impact analysis results, the evaluation team descriptively examined the earnings increase rate within each manufacturing program. As Figure 6 shows, there is no difference in earnings increase rates between the incumbent worker participant and comparison groups in the welding, machine tool/CNC, or industrial maintenance programs.

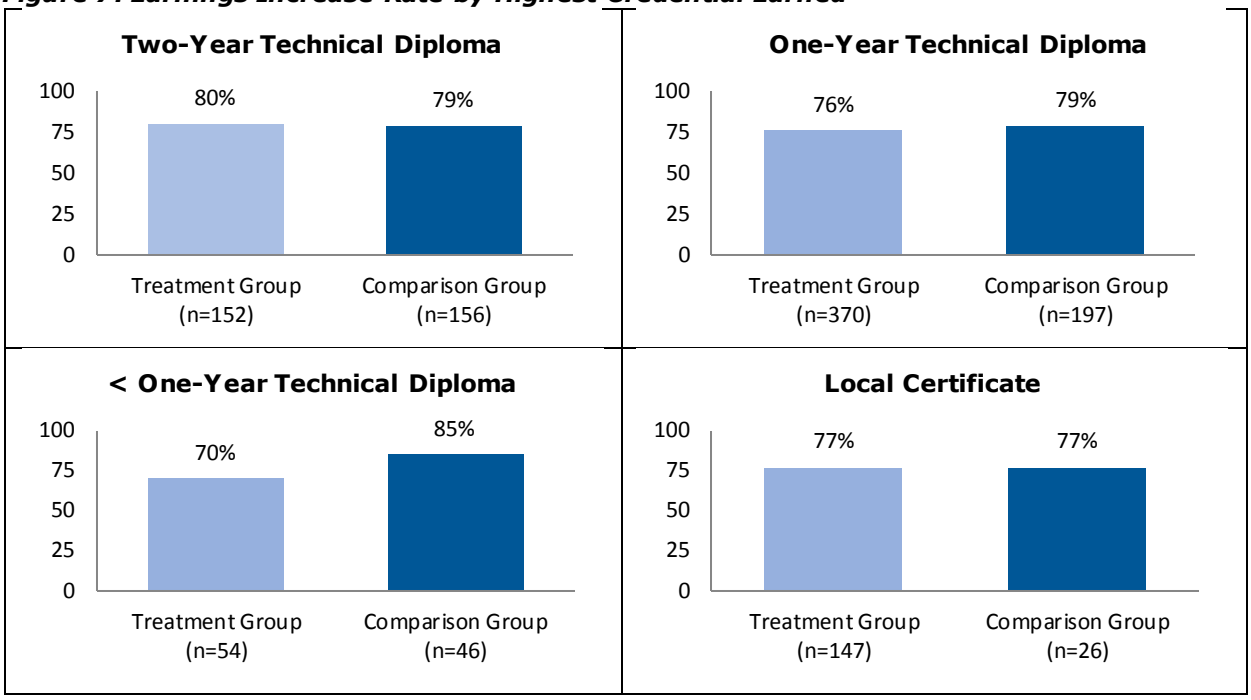
Figure 6: Earnings Increase Rate by Manufacturing Program Area



**TG=treatment group; CG=comparison group*

The evaluation team also examined the relationship between earnings increase rates and the highest credential earned. As Figure 7 shows, there is no statistically significant difference in earnings increase rates between incumbent workers in the treatment and comparison groups, regardless of the credential type. In other words, the participants and comparison group members have similar earnings increase rates across all credential types.

Figure 7: Earnings Increase Rate by Highest Credential Earned



Finally, the evaluation team also examined the earnings increase rate across demographic groups. As the results in Table 13 show, there is no difference in earnings increase rates between incumbent worker participants and comparison group members for any of these demographic groups.

Table 13: Earnings Increase Rate by Select Student Characteristics

Enrolled in ABE		
Participant (n=318)	*Comparison (n=299)*	*P-value*
69.%	74%	.197
WIOA Client		
Participant (n=75)	*Comparison (n=71)*	*P-value*
60.%	73%	.092
African American		
Participant (n=73)	*Comparison (n=90)*	*P-value*
66%	72%	.376
White		
Participant (n=1144)	*Comparison (=1116)*	*P-value*
76%	75%	.468
Hispanic		
Participant (n=65)	*Comparison (n=59)*	*P-value*
74%	76%	.758
Male		
Participant (n=1268)	*Comparison (n=1267)*	*P-value*
75.8%	75%	.512
Female		
Participant (n=78)	*Comparison (n=79)*	*P-value*
74.4%	79.7%	.425

Although there is no impact of stacked and latticed pathways on receiving an earnings increase after program entry, a significant proportion of incumbent workers receive an earnings increase (~75%) at every level of credential earned

Summary: The Impact of Stacked and Latticed Pathways on Educational and Employment Outcomes

The impact evaluation of Wisconsin's *Making the Future* TAACCCT Round 2 consortium grant found large, statistically significant impacts of participation in stacked and latticed pathways on credential attainment and credit accumulation. Participants in stacked and latticed pathways received credentials at a higher rate than the matched comparison group and also earned more academic credits during the grant period. In addition, descriptive analysis documents that participants earned *more* postsecondary credentials than comparison group members and earned them more quickly – a finding that is consistent with the stacked and latticed pathway approach.

Exploratory analysis suggests that the impact on credential attainment is robust and not dependent upon enrollment in a particular manufacturing program. In fact, participants in all three *Making the Future* program areas – welding, machine tool/CNC, and industrial maintenance – earn credentials at a higher rate than the matched comparison group, though the difference for industrial maintenance is not statistically significant. It is notable that participants in stacked and latticed pathways who were enrolled in WIOA or who were enrolled in adult basic education at some point during the grant period appear to earn credentials at a higher rate than their counterparts in the matched comparison group. This finding suggests that stacked and latticed pathways can be helpful for low-skilled adults to improve their skills and earn postsecondary credentials.

The impact analysis did not find a statistically significant impact on employment for non-incumbent workers in stacked and latticed pathways, although participants had a slightly higher employment rate than comparison group members: 33% of the participant group vs. 29% of the comparison group was employed during the first quarter after program exit. Despite the lack of overall impact on employment, exploratory analysis indicates that participants in machine tool/CNC stacked and latticed pathways had a higher employment rate than comparison group students in this program area.

Finally, the evaluation did not find a substantively meaningful difference in the earnings increase rate between participants and comparison group members. Exploratory analysis suggests that both stacked and latticed pathway participants and comparison group members receive earnings increases at every level of credential, in all manufacturing program areas, and across several demographic groups. Enrolling in a stacked and latticed manufacturing pathway does not appear to affect the proportion of participants and comparison group members who receive an earnings increase in the short-term; whether or not stacked and latticed pathways might lead to longer-term earnings gains remains a topic for future research.

In sum, the evaluation identified three key findings in the impact study of Wisconsin's stacked and latticed pathways:

1. Stacked and latticed manufacturing pathways helped participants earn more postsecondary credentials and earn them more quickly in three manufacturing areas: welding, machine tool/CNC, and industrial maintenance.

2. Although participants in stacked and latticed pathways who were non-incumbent workers had slightly higher employment rates after program exit, this finding was not statistically significant. However, exploratory analysis indicates that that stacked and latticed pathway

participants in machine tool/CNC programs have significantly higher employment rates than comparison group members in machine tool/CNC programs.

3. Stacked and latticed pathway participants and matched comparison group members had similar earnings increase rates, and a large proportion of each group (~75%) received an earnings increase.

Section 4 – Summary Implementation Assessment

The *Making the Future* consortium built its proposed TAACCCT initiative around the idea of modifying or developing manufacturing programs in alignment with the concept of stacked and latticed career pathways. For instance, 11 colleges focused on a program of study in welding, 10 colleges focused on machine tool/CNC, and two colleges focused on industrial maintenance. Several colleges developed or modified programs of study in more than one manufacturing field. All new or enhanced programs of study were based on employer demand in each community.

The implementation evaluation focused on program implementation, and provided substantive feedback to the consortium members on the actions taken to create and run the *Making the Future* advanced manufacturing programs, including the operational strengths and weaknesses of the programs.

During the first two years of the initiative, analysis of program implementation was used to provide evaluation-based guidance for continuous improvement. The evaluation team conducted site visits to all consortium colleges and followed each with a detailed memo documenting the specific activities and strategies the college proposed to undertake, as well as initial observations about progress on early implementation. These memos were reviewed by each college, and provided a foundation for documenting and assessing the consortium's work over the next several years. Additionally, the evaluation team identified seven colleges for additional site visits and conducted phone interviews with college stakeholders and external partners at the remaining colleges. The analysis of data identified five core strategies that cut across multiple colleges, and further honed evaluation efforts moving forward.

The summative implementation report for Wisconsin's TAACCCT initiative addresses the key implementation research questions identified in the U.S. Department of Labor's Solicitation for Grant Applications. These questions revolved around four implementation areas: 1) curriculum; 2) support services; 3) assessments; and 4) partners. The evaluation team contextualized these implementation research questions to reflect Wisconsin's *Making the Future* initiative as follows:

1. *How were colleges' manufacturing programs – curriculum, instruction, credentials – modified to support short-term, stacked and latticed education and career training?*

2. *What types of support services were offered to enhance student success?*

3. *What assessment tools were used to improve access to manufacturing programs?*

4. *What new contributions did employer and workforce partners make to support college-manufacturing programs?*

In this section, a brief summary of the evaluation's interim report findings on early implementation of the *Making the Future* initiative is presented, followed by the summative implementation findings for each question.[31]

[31] Price, D., Sedlak, W., Roberts, B., and McMaken, J., December 2014.

Overview of Early Implementation Findings from the Interim Report

As noted earlier, the evaluation team used early implementation findings to refine and hone data collection. In the interim report, five cross-cutting strategies among the consortium colleges were identified:

- ***Career Pathways/Stacked and Latticed Credentials*** was the most common strategy implemented across the *Making the Future* consortium. To implement these pathways, technical colleges modified their program curricula, and in some cases created new curricula. The most common curricula modifications consisted of bundling existing courses, credits, and competencies into smaller packages (short-term local certificates, embedded technical diplomas or pathway certificates), thus allowing students to attain skills and credits along an occupational pathway as well as receive a credential more quickly rather than having to wait until program graduation to obtain a technical diploma or degree. These short-term trainings required less time in the classroom and lab for students than existing one-year and two-year programs of study. *Overall, the evaluation found that colleges were committed to creating stacked and latticed pathways, but were doing so in different ways and paces and with different capacities and experience to secure institutional and state approval for the proposed changes. For some colleges, the slower implementation pace meant that students would not experience and benefit from these changes until 2015 as the TAACCCT initiative was winding down.*

- ***Career Pathway Bridges*** were implemented by a handful of colleges that extended their vision of stacked and latticed pathways to encompass on-ramps to college programs for students with low basic skills. These colleges implemented career pathway bridges for adult education/basic skills students in order to prepare and connect them to enter one or more manufacturing programs. These bridge efforts typically sought to raise math and reading skill levels and introduce core concepts of manufacturing along with the opportunity for students to earn some college credits and a credential. Completion of the bridge would allow a student to continue their manufacturing education along a defined pathway or to move into an entry-level position in the labor market. *Overall, the evaluation found several impressive bridge programs, but this strategy was not widespread and unlikely to evolve into a significant part of the Making the Future initiative.*

- ***Enhanced Academic Instruction*** was implemented by nine colleges to help students improve math and reading skills, and more effectively master the content of technical courses within a manufacturing program. A typical example was found in blueprint reading, where the subject instructor was complemented by additional academic support targeted at making sure students had sufficient math competencies to understand and master the course content. *Overall, the evaluation observed that colleges were pursuing a variety of academic support models, and a common feature was that grant resources were used to support additional staff to provide the enhanced academic support. This raised an important issue of whether such efforts would be sustained and how decisions on that matter would be made.*

- ***Enhanced Non-Academic Support Services*** were implemented at five technical colleges. Non-academic support services typically served students in targeted programs with the idea of providing them additional supports above and beyond what was generally offered by the college. These supports (in contrast to the enhanced academic support strategy) focused on issues like career planning and job search, as well as addressed personal and family issues that might affect school attendance and success. *Overall, the evaluation observed that colleges typically allocated grant resources to support additional staff for this position, similar to enhanced academic instruction. This also raised the issue of whether such efforts would be sustained and how decisions on that matter would be made.*

- ***Expanded Roles for Employers*** were pursued by seven colleges that engaged employers to provide internships and provide priority hiring or interviewing opportunities for graduates of TAACCCT supported programs. The evaluation also observed that colleges were collaborating with industry associations to incorporate "employer-certified" regional or national

competencies and standards into their manufacturing program. Wisconsin technical colleges have longstanding employer advisory committees for each occupational program in their college. Thus, employer engagement with technical college programs was expected, and the evaluation team found early in the initiative that employer involvement is the norm in Wisconsin. *Overall, the evaluation observed that a handful of colleges were expanding their engagement with employers by pursuing innovative practices that could benefit students and be of value to employers.*

The interim report concluded that Wisconsin's technical colleges made important progress implementing stacked and latticed career pathways in advanced manufacturing during the first two years of the TAACCCT initiative. It also noted that the evaluation would delve deeper into the implementation of the five cross-cutting strategies, in part to determine how these various strategies, and the combination thereof, would affect participant outcomes. In other words, the final year of implementation data collection focused on the various models of stacked and latticed pathways that may include local and/or WTCS-recognized embedded credentials, bridges from adult basic education, enhanced academic instruction, and/or enhanced student support services, as well as expanded roles for employers. Importantly, this examination would include a specific focus on how colleges made decisions to institutionalize and sustain these strategies beyond the *Making the Future* grant period.

Summative Implementation Evaluation Results

Wisconsin's TAACCCT initiative was designed and funded to bring the concept of stacked and latticed career pathways into the manufacturing programs of its participating technical colleges. In doing so, Wisconsin proposed to address the primary goal of the TAACCCT program by seeking "to improve the colleges' ability to deliver education and career training programs that can be completed in two years or less … and that can help students succeed in acquiring the skills, degrees, and credentials needed for high-wage, high-skill employment while also meeting the needs of employers for skilled workers."[32] Wisconsin also designed its initiative to address other key TAACCCT program goals of providing support services to advance student success, applying new assessment techniques to enhance students' access to manufacturing programs, and developing stronger ties to external partners to support program operations.

In this section, the summative implementation study results are documented, organized around the four overall implementation questions. For each question, the evaluation team describes the key strategies implemented by consortium colleges; provides an assessment of the strategy, including strengths and challenges; and raises questions about institutionalization and sustainability.

How were colleges' manufacturing programs – curriculum, instruction, credentials – modified to support short-term, stacked, and latticed education and career training?

The most prominent action taken by the consortium of colleges was to build stacked and latticed career pathways in advanced manufacturing. This objective was achieved by modifying curriculum, instruction and credentials to provide more short-term training options for students. This outcome reflected the *Making the Future* proposal, which specifically indicated that the primary focus of the TAACCCT work in Wisconsin would be to support the development of stacked and latticed career pathways in advanced manufacturing programs. The decision to focus the TAACCCT initiative toward this goal was made collaboratively by the college presidents.

As noted earlier, Wisconsin's technical colleges had been working since 2007 to foster the development of adult career pathways in their programs of study. The Wisconsin Technical College System refined program approval and modifications processes to support career pathway

[32] U.S. Department of Labor, SGA/DFA PY 11-08, page 1.

development, specifically the packaging of new or existing programs into shorter training offerings (also referred as chunks) of courses, credits, and competencies. WTCS also provided resources to pilot career pathway development in program areas of importance to the college.[33] Thus, Wisconsin approached the TAACCCT initiative with a state system-policy context that was conducive to stacked and latticed career pathways and a set of colleges that had some experience or at least exposure to the concept.

Description of Stacked and Latticed Pathways

Colleges undertook a variety of approaches to implement career pathways within select manufacturing areas. Overall, the evaluation team identified approximately 50 curricula, instructional, and credential program changes that were implemented across the consortium colleges. A key reason for these many changes is that stacked and latticed career pathways allow for multiple iterations of short-term training programs as part of an overall program of study. In many instances, this meant repackaging existing curriculum and courses into smaller training offerings that might result in a one-semester training program that awarded a new credential indicating the students had learned a certain set of skills and were prepared for entry-level employment in that specific manufacturing area.

The evaluation identified three approaches to stacked and latticed credentials or career pathways that colleges implemented for the *Making the Future* initiative.

The most common approach to stacked and latticed pathways is the establishment of a short-term training program that leads to an embedded technical diploma that stacks to a one-year or two-year program of study.

The predominant career pathway approach involved establishing new short-term training offerings within an existing manufacturing program, so that students could earn a credential in less than one year. This approach to stacked and latticed pathways resulted in students earning a credential that could lead to entry-level employment after completing a subset of courses and credits within a specific manufacturing program. Importantly, the credits earned in these short-term trainings would count or stack toward subsequent credentials within the program.

More than one-third of the technical colleges implemented short-term training offerings or embedded a short-term technical diploma (ETD) in one or more manufacturing areas.[34] For example, Nicolet Area Technical College now offers a 16-credit short-term technical diploma in welding that reflects the first semester of the one-year welding technical diploma program. Wisconsin Indianhead Technical College, by comparison, packaged five ETDs within its one-year welding program, providing students the opportunity to learn one or more specific welding techniques that were identified as in-demand by local employers; all these ETDs stack to a one-year welding technical diploma..

Some colleges worked in multiple manufacturing program areas, implementing different approaches for each program. For example, Western Technical College implemented a *new* two-year industrial maintenance program (Manufacturing Systems Maintenance Technician or MSMT) that combined courses and competencies across three different programs of study (welding, machine tool, and industrial electronics). Embedded within this two-year program of study are new short-term ETDs in

[33] Roberts, B. and Price, D. (2015). *Building Career Pathways for Adult Learners: An Evaluation of Progress in Illinois, Minnesota and Wisconsin after Eight Years of Shifting Gears*. Chicago: Joyce Foundation

[34] Wisconsin technical colleges can create technical diploma programs (1 or 2 year) as well as Associate Degree programs. The basic distinction is a technical diploma program provides technical courses with some general education courses, while an Associate's degree program combines technical courses with all required general education transfer courses.

welding as well as in machine tool. The courses and credits in these short-term trainings stack or count towards the two-year MSMT program.

Northcentral Technical College created a new two-year robotic welding Associate's degree program, and included a new embedded one-year technical program (Manufacturing Technician) that stacked into the two-year robotics program. They also created a short-term, one semester brake press program in machine tool that stacked into an existing one-year machine tool operator technical diploma and eventually into a two-year machine tool technician technical diploma. The credits generated from the first short-term training program (brake press) applied to the program and count towards the completion of the two-year technical diploma.

In all these cases, the newly established trainings are now part of a stacked and latticed pathway within a specific program of study. This provides students an opportunity to start with a short-term entry-level training that can lead to a job, as well as lay a foundation for continuing along an educational pathway that can result in more skills and higher level credentials. Each of these stacked and latticed programs required review and approval at the state level by WTCS. As a result, WTCS has the ability to track student progress and outcomes, and recognize student achievements such as the attainment of a WTCS approved credential.

A second approach to stacked and latticed pathways was to offer institutionally certified short-term training that provided a local certificate and could connect with a manufacturing program of study.

Wisconsin Technical Colleges have the authority to establish their own short-term training programs without approval from WTCS. For some colleges, this provides flexibility in how they shape a training program to meet employer needs, such as offering an array of courses from multiple programs of study. These programs generate a local certificate for completion, but such certificates are not recognized by WTCS. Importantly, students in the short-term trainings can generate course credits, all or some of which can be applied to requirements connecting with an applicable career pathway program.

Making the Future started with a handful of colleges developing *local* short-term trainings. They did this with the goal of providing more options for students to enter manufacturing programs, as well as to address specific needs of local employers. For example Mid-State Technical College developed a short-term training program to learn stainless steel welding, which responded to a special need of the growing dairy industry. The local certificate was designed to prepare students for entry-level employment, but also to support career pathway training as the courses generated credits that could be applied toward a one-year welding program. Lakeshore Technical College also created a local short-term training program in industrial welding. Successful completion of the program generated a local certificate, as well as 10 credits that could be applied to the 27-credit industrial welding technical diploma.

Moraine Park Technical College created a new local short-term training program for its welding program. Uniquely, the program was offered as a boot camp with a cohort of participants receiving concentrated instruction, training, and paid work experience in a 12-15 week period. Although the primary goal of the program is to foster entry-level employment, the program awarded completers a local certificate and eight college credits that stacked toward a one-year technical diploma in welding.

Over the course of the grant, interest in local certificate training programs diminished, as colleges gave more attention to creating ETDs so that that credential attainment would be recognized by WTCS. For example, in 2015, Mid-State converted its local stainless steel welding certificate program to an ETD that stacks to the one-year welding TD program.

A third approach to stacked and latticed credentials was the development of bridges or on-ramp training programs that connect into credit-based career pathway programs of study.

Wisconsin technical colleges had experience with developing bridge programs to help adult students with low-basic skills to transition into career pathway programs as a result of the aforementioned RISE initiative. In fact, WTCS defined bridge or on-ramp efforts as programs that "integrate and connect basic academic skills and technical college occupational instruction for adult basic education participants whose basic skills are insufficient for technical college credit courses."[35] Key features expected from a bridge program included contextualized curricula relating to technical occupation programs, such as manufacturing, and tied to specific instruction to improve math and reading basic skills.

Five technical colleges engaged in efforts to develop career pathway bridge programs. Only one of these colleges effectively developed programs to generate college credits and local or industry-recognized credentials upon completion. Milwaukee Area Technical College developed a Bridge 101 in both welding and machine tool, with considerable input from a regional manufacturing employers group (the Manufacturing Career Partnership) that wanted a common set of competencies and skills for entry-level workers. Bridge 101 students earn 10 credits over a 10-week period, are awarded a local certificate from the college, and are prepared for entry-level employment. These students can apply their credits to the college's welding and machine tool programs of study, respectively, when they choose to continue their education and training. Early in 2016, the college incorporated the welding bridge program into an official welding career pathway for approval by WTCS.[36]

Madison College established a manufacturing bridge that warrants mention. Supported and operated by the college's Adult Basic Education (ABE) program, the effort provided ABE/ELL students a 36-hour non-credit, intensive preparatory course taught by ABE faculty. Basic skills instruction was contextualized to the college's manufacturing curricula, and the program included instruction in employment essentials.[37] Although this program was not supported with TAACCCT grant resources and did not provide credentials or certificates to students, it served as the primary on-ramp into the credit-based entry-level manufacturing program, Manufacturing Essentials, that was established under the *Making the Future* initiative. Manufacturing Essentials generates nine college credits and a local credential for completers, as well as leads into career pathway training for various manufacturing areas including welding, machine tool, and industrial maintenance.

Notable about both the Milwaukee and Madison bridge efforts is that they provided access to students that typically did not have the basic skill levels to be accepted into a manufacturing program of study. As noted in Section 3, 82% of grant participants in Wisconsin were white and 18% were students of color. By comparison, 79% of grant participants at Milwaukee were non-white, as were 29% of grant participants at Madison. The larger percentage of non-white manufacturing students is not a function of college demographics. The percentage of grant participants who are students of color at both colleges is greater than the overall percentage of manufacturing students at each college. At Milwaukee Area Technical College, 60% of all manufacturing students are non-white, compared with 79% of grant participants. Similarly, at Madison College, 21% of all manufacturing students are non-white, compared with 29% of grant participants. Project leaders at Madison College attribute the

[35] Roberts and Price (2012), page 11.

[36] Best Practices & Lessons Learned: TAACCCT Round II, *Making the Future*: The Wisconsin Strategy. Northeast Wisconsin Technical College, October 2016. Page 77.

[37] Employment essentials, a term coined by Fox Valley Technical College, refers to work-ready skills of interest to employers – more typically known as soft skills.

increase in minority students enrolled in manufacturing between 2012 and 2015 to their grant-funded Manufacturing Essentials program.[38]

Implementation Assessment: Factors Affecting the Implementation of Stacked and Latticed Career Pathways

Across each of these three approaches to stacked and latticed pathways, *Making the Future* colleges sought to offer students more shorter-term options than were previously available in their programs of study. Overall, colleges made significant progress in implementing their career pathway models. However, the work to establish bridges or on-ramps programs was not as robust as the other models, as most colleges did not bring their intended effort to fruition.

It is important to note that implementation timelines varied: 16 of the grant-funded stacked and latticed pathway programs began on or before fall 2013, while seven were not fully implemented until spring 2014 or later. At three colleges, stacked and latticed pathways were not implemented until fall 2014, and at one college, the career pathway was not available until fall 2015. Colleges that offered local short-term training programs that did not requires WTCS approval were able to get started more quickly than colleges who chose to significantly revamp existing programs of study, or that were developing new career pathway programs. Moreover, colleges that connected multiple embedded and short-term credentials across various program areas gained WTCS approval for some credentials sooner than others, which influenced the implementation timetable.

The evaluation team identified a number of factors that appear to affect colleges' efforts to effectively implement stacked and latticed pathways. These factors are presented below, with contributing factors that facilitated implementation addressed first, followed by challenging factors:

***Contributing Factors*:**

1. **WTCS System Support**: As noted, the Wisconsin Technical College system had done significant career pathway work prior to the TAACCCT 2 initiative. Importantly, WTCS had already modified its program approval and modifications processes to reflect the movement into career pathways by local technical colleges. This is important, because Wisconsin requires all technical colleges to get state approval when developing a new program of study or attempting to make significant modifications to existing programs, courses, curriculum and credentials. In addition to enhancing state policy and procedures, WTCS also provided grant resources for colleges to pilot the development of career pathway programs, and some colleges used these grants to further support advanced manufacturing programs.

2. **College Senior Leaders' Commitment to Manufacturing and to Local Employers**: Technical college presidents collectively decided to focus the TAACCCT 2 initiative on manufacturing, and to work statewide to enhance opportunities in manufacturing to benefit students and employers. Historically, manufacturing is the most important economic sector in Wisconsin, and all technical colleges have robust programs to meet local industry needs. In addition, most technical colleges already work closely with their local employers. Thus, the TAACCCT emphasis on engaging local employers in the initiative seemed to elevate the grant's importance to colleges, gaining the focus and attention of senior leaders.

3. **Employer Support for Career Pathways**: By the start of the TAACCCT initiative in 2012, Wisconsin's manufacturing had rebounded from the recession, and employers were looking for skilled workers, especially for entry-level positions. The idea of career pathways and specifically stacked and latticed credentials resonated with many employers, who then

[38] Best Practices & Lessons Learned, page 68.

endorsed programs moving to adopt the career pathway concept via their role in program advisory committees. One college reported on an employer extolling the virtues of embedded training: "As the single most recruited tech job, having the embedded welding certificates is invaluable to both our intern program and our ongoing full time position recruiting."[39]

4. **WTCS Performance Funding**: Midway through the TAACCCT initiative, WTCS made significant changes to its funding policies. State and WTCS funding for colleges moved partially to a performance-based funding model that relied on student progress and success metrics to determine the allocation of state resources for technical colleges. The new set of metrics included several that rewarded colleges for achieving outcomes inherent to career pathways. These included earning short-term embedded credentials approved by WTCS and transitioning students from career pathway ABE bridge programs into college programs of study. This policy change resulted in colleges rethinking their use of local certificates and taking steps to convert them to embedded technical credentials.

5. **Project Management and Supports**: The TAACCCT 2 initiative brought significant consortium-wide supports to the colleges, including a dedicated project manager and data specialist. Project management used work plans and performance dashboards to keep colleges focused on meeting the key grant objectives and deliverables associated with their TAACCCT initiative. Regular consortium-wide meetings were leveraged for peer learning and for professional development. The third-party evaluator was also leveraged at the onset to develop a consortium logic model that emphasized stacked and latticed career pathways, and to provide college-specific feedback around early implementation. These efforts provided a structure that helped guide implementation efforts and facilitated implementation consortium-wide.

***Challenging Factors*:**

1. **Limited Institutional Capacity for Career Pathway Work**: Although Wisconsin Technical colleges were familiar with career pathways, and some even had piloted career pathway programs, past work was often project specific and did not always involve staff and faculty in manufacturing. Thus, for most college manufacturing departments, taking steps to revise programs, curriculum, instructions, and credentials in accordance with the career pathway concept was a new experience. Staff had to learn-on-the-job to understand the WTCS processes for program approval and modification, as well as the specific meaning of things like embedded technical diplomas. Staff also had to build support among faculty who expressed concerns that short-term training programs may not produce the workers with the skill levels to which employers were accustomed, and might result in students prematurely leaving or "jobbing out" for employment rather than advancing along an educational pathway. One college, in reflecting on overall experience with this noted, "The process was anything but seamless, and created many challenges for faculty, staff, and grant management," but went on to remark that the "resulting impact was better processes and procedures in curriculum development and marketing and recruitment practices."[40]

2. **Insufficient Collaboration between Manufacturing and ABE/Basic Skill Programs within Colleges**: One-third of colleges started the TAACCCT initiative with the idea of developing career pathways within manufacturing that included bridges or on-ramps for students in the colleges' ABE and basic skills programs. Attention to this area was expected, given the TAACCCT focus on serving low-skilled adults (especially dislocated workers) and the

[39] Ibid. Page 113.
[40] Ibid. Page 56.

attention given adult career pathway bridges under the RISE initiative and the reported success of those efforts.[41] Nonetheless, efforts to develop and institutionalize career pathway bridges did not gain traction among the consortium colleges. In some cases, colleges claimed that the bridge model is cost-prohibitive, and thus decided early on not to build out this type of pathway. Additionally, small rural colleges noted that it was difficult to establish bridge programs in select manufacturing program areas such as welding or machine tool, given low numbers of potential students. The most effective efforts were at Milwaukee and Madison technical colleges. One important feature of the Madison bridge effort was the strong and committed collaboration between senior leaders of the basic skills and manufacturing departments to make the program work. This model has continued, as four more bridges have been implemented or are in the planning stages: Bridge to Construction, Bridge to Biotechnology, Bridge to Electronics, and Bridge to Industrial Maintenance.[42] In general, college leaders and manufacturing program faculty did not effectively leverage their ABE/basic skills colleagues to develop these on-ramps to stacked and latticed pathway programs.

Sustaining TAACCCT-Supported Stacked and Latticed Career Pathways

Despite the challenges noted above, sustainability of colleges' stacked and latticed pathways were a foregone conclusion from the onset of the TAACCCT grant – at least for those career pathways that involved formal approval by WTCS. The WTCS structure and process for program approval and modification are designed for program changes to be institutionalized at the college, as well as for the overall technical college system. This process allows other colleges to take similar actions relative to key program elements, such as curriculum, instruction, and credentials, without having to start from the beginning. It also means that colleges have these programs "on the books" and are essentially sustained, unless decisions are made to no longer offer the programs. Such decisions are typically driven by program enrollment and by demand from local employers.

As *Making the Future* ended, the evaluation team concluded that consortium-wide the colleges had successfully implemented a range of stacked and latticed career pathways, with most including initial short-term, entry level training opportunities for students that yielded postsecondary credentials. The evaluation team fully expects these stacked and latticed pathways will be institutionalized and continue to be offered to students as long as demand by employers for those skills and credentials remains high. There are two reasons for this optimism.

First, interviews with employers, faculty, and administrators indicate that they see value in organizing manufacturing programs in alignment with the stacked and latticed pathway concept. In addition, employers and college stakeholders believe that short-term training options are beneficial to students and employers. Faculty fears of significant numbers of students "jobbing out" were not realized and, in fact, many perceive that the short-term options allow more students to access programs than before, including incumbent workers who might seek to develop specific skill sets such as a specialized type of welding. In addition, the stacked and latticed concept enables students to reenter the program to advance their education and skills on a timeframe that is more conducive to their own family and work situations.

Second, as *Making the Future* was getting underway in 2012, WTCS was in the process of solidifying its system-level commitment to the concept and practice of stacked and latticed pathways. In fact, a newly entering WTCS president made implementing career pathways a primary goal of WTCS, and

[41] See Roberts and Price (2015); and, Childress, L. 2014. *Wisconsin's Regional Industry Skills Education (RISE) Career Pathways Bridges: An Evaluation of Career Pathway Bridge Programming in Wisconsin, 2012 – 2014.*

[42] Best Practices & Lessons Learned, page 64.

working in collaboration with the technical college presidents established an important rationale and foundation for career pathway implementation. This system-level commitment resulted in significant state policy changes and the leveraging of internal and external resources to support the work, including focusing the TAACCCT 2 initiative, as well as the two subsequent TAACCCT grants on career pathway development.[43] Thus, as TAACCCT 2 came to a close in 2016, the stacked and latticed career pathway movement in Wisconsin technical colleges had become a core foundation for organizing and delivering career and technical programs.

What types of support services were offered to enhance student success?

Wisconsin's *Making the Future* proposal acknowledged that is was important for colleges to better align services to help lower-skilled adults increase completion of their first credential in a career pathway. Although support services were identified as one of eight strategies to achieve the grant's goals, clear expectations for the types of supports colleges should provide, or how they should be provided, were not established. The evaluation team discovered early in its work that most colleges were developing and implementing a range of support services to foster academic progress and program completion, as well as to prepare participants for entry into the workforce.

Description of College Enhanced Support Services

The evaluation team identified that colleges were seeking to implement two basic forms of enhanced student supports: 1) enhanced academic instruction and 2) enhanced non-academic support services. These approaches to support services were identified in the interim report. Efforts in both of these areas were in addition to the standard supports offered to all students through the longstanding college advising, counseling, and tutoring services, and involved new and dedicated staff that typically were TAACCCT funded.

Two-thirds of the colleges implemented enhanced academic instruction by using basic skills instructors to offer separate support classes and/or workshops for program participants. Five colleges provided enhanced non-academic support services; four of these were colleges also providing enhanced academic instruction. Overall, the evaluation identified three distinct approaches for providing academic and non-academic supports to students.

Several colleges provided *enhanced academic supports* by targeting program courses in which students with low basic skills struggled to succeed.

Strong math skills are increasingly required for most manufacturing programs, especially as machinery is computerized and high-tech. In Wisconsin, one-year and two-year technical diploma programs, as well as Associate degree programs, require general education courses in math, writing, and communication.

Several of the colleges targeted technical math or math general education courses, as well as blueprint reading courses for additional student assistance. These efforts involved two specific and interrelated actions to improve students' basic skills. One component involved developing new academic curriculum that was contextualized to a specific manufacturing program (e.g., welding, machine tool, etc.) and incorporating it into courses requiring strong math skills. For example, math word problems typically found in technical math courses and blueprint reading would be contextualized to address topics that welders face on the job. The other related component involved

[43] Roberts and Price (2015), page 38.

adding an additional instructor so that students would benefit from a program instructor and a basic skills instructor working together in a particular program course.

Blackhawk Technical College used its TAACCCT grant to hire a new basic skills instructor to support the program instructor in the math course for the one-year industrial mechanic program. In addition, the curriculum for the math course was contextualized. The basic skills instructor assessed students, using the Test for Adult Basic Education (TABE) exam, at the start and end of the 2014-2015 school year, and found a grade-level equivalent improvement in the areas of Basic Computation and Applied Math. A survey of students also revealed that the vast majority thought the additional math instruction was helpful to their understanding of course content and to their overall ability to progress in the industrial mechanic program. This effort also used a team teaching model similar to the I-Best model in Washington State, though the college reported mixed results.[44]

Chippewa Valley Technical College followed a similar path in its two-year machine tool program. CVTC paired a program instructor and math instructor to contextualize and team-teach the program's Math 10 and Math 20 courses. CVTC reported that this approach increased the pass rate of both courses – Math 10 increased from 67% to 89%, while Math 20 increased from 72% to 80% – resulting in 15% more students being retained in the program.[45] Overall, fall-to-fall retention increased from 38.4% in 2012 to 48.6% in 2014.[46] Due to this success, the contextualization of math into program courses is being scaled to other trades programs, with some also adding the team teaching component.

A number of other technical colleges, such as Nicolet, Waukesha, and Wisconsin Indianhead also took important steps to provide enhanced academic supports to students in targeted program courses. For example, Waukesha started its effort by assigning a dedicated academic support instructor to support several classes: Blueprint Reading I, Blueprint Reading II, and CNC, that crossed both the welding and machine tool programs of study. The academic support instructor was present during the full class periods, and offered extended hours outside of class to assist students. Over time, the approach was modified. Rather than be assigned to specific classes, the instructor visits classes by instructor or student request, and maintains open lab hours throughout the day to accommodate both day and evening students.

A handful of colleges provided *enhanced academic supports* by raising prospective student basic skills prior to starting a manufacturing program of study.

Enhanced academic supports are often focused on helping students succeed who are already enrolled in a manufacturing program of study, such as the approach above. During the TAACCCT initiative, technical colleges provided enhanced academic supports to assist prospective students who did not have sufficient skills to enter a manufacturing program of study. In these instances, colleges supported students to raise their basic skill levels and to gain entry into specific manufacturing programs.

As noted in the career pathways portion of this section, two colleges – Milwaukee and Madison – developed bridge programs to prepare students for entry into specific manufacturing programs of study. In both instances, a key feature of these bridge programs was contextualizing basic skills course curricula, especially math, to content associated with manufacturing. Milwaukee applied this approach to two program areas: welding and machine tool. For both program areas, students in adult basic education courses were given the opportunity to take basic skill courses that were contextualized with program content from either the welding or machine tool program. ABE instructors delivered these courses for the respective welding and bridge 101 programs. An internal analysis by the college

[44] Best Practices & Lessons Learned, pages 39-41.
[45] Ibid. page 17.
[46] Ibid. page 17.

of bridge students taking contextualized math versus non-contextualized math found a marked improvement in course grades for those taking the contextualized math.[47]

Western Technical College provided enhanced academic supports to prospective students prior to entry into manufacturing: a 12-hour course, Fast Track for Math, was developed as a brush up math course for adults seeming to take Applied Math for Welding, and was delivered four hours per day for four days during a one-week period. The course began with basic math skills, and then built upon those skills toward the application of math using micrometers, scales, and other tools used in the welding field. The college reported that students who participated in the course had 100% success in the Applied Math course.[48] Although Fast Track was offered several times during the grant, the effort was not continued, despite senior leaders in manufacturing and other program areas acknowledging the need to provide enhanced academic supports to students and continue to explore the most cost-effective ways to do that.

Another effort is the aforementioned Moraine Park boot camp for welding. Entry into the boot camp requires a 10th grade math level on TABE. Students not meeting that level, but otherwise seen as appropriate candidates for the program, are given conditional admission and then assigned to work with college basic skills instructors to raise their scores by the first day of boot camp.

Helping prospective students improve their academic skills to gain access to manufacturing programs had two benefits for these colleges. First, it expanded the number of students in manufacturing programs, thus building a deeper pipeline of qualified workers that employers were demanding. It also allowed a broader group of prospective students access to manufacturing programs, thus diversifying the overall pool of manufacturing students.

A few colleges provided students with *non-academic supports* to foster program completion and employment.

The TAACCCT 2 initiative provided colleges the opportunity to focus on strategies to address student needs beyond the classroom, addressing issues such as career planning and employment development, as well as addressing personal and family issues that might affect school attendance and success. These types of services were most often provided by dedicated staff funded by the TAACCCT grant, and were additional to existing services provided by college advising or counseling staff.

An example of these non-academic supports is at Nicolet Technical College, which hired a full-time Manufacturing Skills and Placement Coach to provide career and employment services to TAACCCT participants in the welding program. The coach position was designed to: 1) develop strong relationships with local employers; 2) provide career and employment development workshops for students; and 3) offer one-on-one guidance and support to students with resume development, interview skills, and most importantly, how to access personnel who interview and hire for new positions at local companies. A college analysis of the impact of this assistance found that graduation and retention of the students increased from 72% to 79%, with exits or stop-outs reduced from 28% to 21% of program participants. In addition, the welding program had a marked increase in the job placement rate for students, going from 46.15% in 2011 to 82.61% in 2015. The analysis also found that the welding program had a 61% increase in revenue due to improved student retention.[49]

Moraine Park's boot camp program also provided non-academic supports to participants; this assistance was referred to as intrusive advisement. A dedicated program advisor, affectionately

[47] Ibid. Pages 73-74.
[48] Ibid. Page 118.
[49] Ibid. Page 88-93.

referred to as the "Boot Camp Mom," was assigned to address student needs. Different from traditional college advisement or counseling that requires a student to seek out the advisor, the "Boot Camp Mom" sought out participants. This meant pushing and assisting students to develop resumes, engage in career skill training and academic skill building, as well as working to identify and solve personal barriers to complete boot camp. It also involved connecting participants with resources, and simply to provide the confidence and encouragement that some participants required.[50]

This type of intrusive advising or case management support is designed to provide students any assistance that might be needed to facilitate their success. Notably, Madison College's transition specialist first encounters students while recruiting for entry into the manufacturing bridge program, and then stays with students even after they transition into the Manufacturing Essentials program. This level of involvement generates a degree of familiarity and trust that allows students to feel secure in seeking and accepting support.

Implementation Assessment: Factors Affecting the Implementation of Enhanced Student Supports

Colleges devoted significant attention and resources to developing and implementing enhanced student supports during the TAACCCT 2 initiative. These efforts included strategies to provide academic and non-academic supports to promote student success in manufacturing programs, which some colleges also provided to prospective students.

Overall, most colleges implemented their student support strategies and delivered services to students. A handful of colleges followed and analyzed their efforts, and generated evidence that suggested such supports contributed to student retention and improved educational performance. Even colleges without data and analysis indicated that they thought their support services were effective and valuable in aiding student success. Despite these strongly positive views, only a handful of colleges decided to sustain their efforts after the TAACCCT grant ended.

The evaluation team identified a number of factors that influenced colleges' work on developing and implementing student support strategies. These factors are presented below, with contributing factors that facilitated implementation addressed first, followed by challenging factors.

***Contributing Factors*:**

1. **Commitment to Student Success**: Across the nation, community and technical colleges have collectively refocused their missions away from student *access* and toward student *success*. Wisconsin technical colleges are at the forefront of this movement, with local colleges taking proactive steps to generate more skilled and qualified graduates to meet local employers' workforce needs, and several colleges participating in Achieving the Dream, a national community college reform effort. Moreover, WTCS enacted numerous reforms and resource allocation policies to support and incent local colleges to increase student outcomes and success. The state and national focus on student success provided a positive context for colleges to implement academic and non-academic supports as a strategy to improve participant outcomes.

2. **Growing Realization of Student Challenges**: Most Wisconsin technical colleges acknowledge the demographic changes over the last decades and the fact that many more students are enrolling with low or outdated basic skills, limited financial resources, and with numerous family responsibilities. The TAACCCT 2 initiative provided an impetus for colleges to focus attention on low-skilled adult workers and thus develop strategies to address their

[50] Ibid. Page 83.

specific needs, which ranged from enhancing basic skill levels to providing supports that addressed barriers to their participation in college.

3. **Financial Resources**: As TAACCCT 2 was getting underway WTCS was already funding colleges on a competitive basis (approximately $1.5 million annually) to implement innovative methods that provided support services to students enrolled in career pathway courses and programs. Thus, the general idea of promoting student success by deploying student support strategies was well known. TAACCCT funding provided additional resources that could be used by colleges to build their capacity to enhance student success, which typically resulted in hiring more staff to work with students already enrolled or seeking to enroll in manufacturing programs of study.

***Challenging Factors*:**

1. **The Lack of Models for Enhanced Student Supports**: Colleges had latitude and flexibility on how to design and implement their enhanced support strategies – without any defined models to guide their efforts. As a result, colleges were largely left on their own to develop support services, which led to multiple approaches to program design and little focus on specific operational details, such as the intensity and duration of supports, criteria for providing supports, and methods to document student specific uses of supports. In some ways, this lack of *a priori* models resulted in a "let a thousand flowers bloom" approach to implementation that did not easily support peer-based learning and exchanges among the colleges. Consortium leadership sponsored a workshop around team-teaching that several colleges attended; however, this effort did not yield sustainable practices for enhanced academic instruction.

2. **Modest College Attention to Managing and Analyzing Student Progress for Program Improvement**: College implementation of student support services was not well orchestrated within most colleges; in most cases, lines of roles and responsibilities were not clearly defined. In addition, most colleges established only modest processes or systems to track student receipt of services or to conduct ongoing analyses of the program performance. As a result, only a handful of colleges ended the grant with concrete data or evidence to demonstrate the effectiveness and value of the support services they provided to participants during the grant.

Sustaining TAACCCT Funded Enhanced Student Supports

Colleges' lack of attention to sustainability was a major factor affecting the continuation and expansion of TAACCCT financed-student support efforts. Although there are a handful of exceptions, most colleges viewed these resources as traditional grants. In addition, this provision of support services was not heavily emphasized in the overall management of the initiative. The lack of sustainability thinking early on was an acute issue for support services, because colleges funded staff and instructors who provided these enhanced supports with grant dollars. Thus, sustainability of support services would require colleges to find additional grant dollars to support the work or reallocate existing resources to do so. In the latter case, sustaining support services meant connecting those supports to institutional priorities through budgeting and strategic planning, which for the most part did not occur. In some instances, the lack of a sustainability plan for support services led to staff leaving before the grant ended in an effort to secure more permanent employment elsewhere before their time-limited contract expired.

A handful of colleges took actions to sustain enhanced supports. For example, Institutional Effectiveness staff at Nicolet Technical College collected data on support service utilization, and analyzed student performance relative to the provision of enhanced support services. As noted, their

analysis found positive results, which led the college to sustain this position, to expand a similar position to other programs, and to engage in an examination on the possible restructuring of the college's overall approach to delivering student services and supports.[51]

Also of note are the enhanced student support efforts at Madison College, where the college offered enhanced academic and non-academic supports to TAACCCT participants in Manufacturing Essentials. The college now sees these wrap around supports as an overall student support model, and have replicated it in other program areas.[52] A similar situation emerged at Wisconsin Indianhead Technical College, where the experience with using a basic skills instructor to provide enhanced academic supports in class with a program instructor led to the solidification of that model college wide.[53]

What assessment tools were used to improve access to manufacturing programs?

The Wisconsin *Making the Future* TAACCCT proposal articulated the need to improve consortium colleges' ability to identify and award Credit for Prior Learning/Experience in career pathways.[54] This was the primary way the consortium chose to address using *assessment tools* to improve access to manufacturing programs.

During the initiative, colleges were expected to examine current practices in assessing adults, in particular, veterans, based on prior experience and to recommend where experiences warranted the awarding of college credit, thus moving individuals into advanced steps along career pathways. TAACCCT resources were allocated to support this work. The proposal specifically identified the Council for Adult and Experiential Learning (CAEL) to provide analysis, guidance, and recommendations for improving CPL processes across the state, noting CAEL's wealth of knowledge and resources on this subject.[55] After the first two years of the initiative, the evaluation team noted in the interim report that credit for prior learning was at a nascent stage of implementation in most colleges. These efforts accelerated in the third and fourth years, and the consortium considers their progress on credit for prior learning as positive.[56]

Prior to the TAACCCT initiative, WTCS had adopted a statewide policy endorsing the concept of CPL and articulating specific procedures for awarding CPL from WTCS institutions. The 2010 state Education Services manual identified six categories in which a student enrolled in a Wisconsin technical college may obtain credit for prior learning. One category involved assessing previous work experience, education, or training, or other prior learning demonstrated as comparable in content and rigor to a specific technical college course or courses.[57] This pre-existing policy provided a solid foundation for the *Making the Future* CPL work.

Description of Credit for Prior Learning at Consortium Colleges

Colleges sought to enhance their capacity to address CPL opportunities within manufacturing programs, especially in regards to awarding credit for work experience. These efforts became more widespread and prominent during the second half of the initiative, and were characterized by colleges

[51] Ibid. Page 93.
[52] Ibid. Page 64.
[53] Ibid. Page 116.
[54] Northeast Wisconsin Technical College, page 13.
[55] Ibid. Page 22.
[56] The evaluation team did not speak to all colleges about credit for prior learning, and relied on the Best Practices & Lessons Learned report to inform this discussion of consortium efforts.
[57] Wisconsin Technical College System. *Education Services Manual, Credit for Prior Learning: 12.10.2*, November 2010.

as expanding existing or resurrecting moribund CPL policies and procedures within manufacturing, which had been limited primarily to making determinations on transcripted credits from other colleges.

Over the course of the *Making the Future* initiative, colleges received direct assistance from CAEL to 1) assess their existing procedures and capacity for CPL assessments (referred to as process mapping); 2) identify needed modifications in existing policy and practices; and 3) establish capacity within a college to update and refine institutional CPL policy and procedures. In addition, CAEL provided training to college staff via conferences, workshops, and webinars with the specific intent to advance institutional knowledge on CPL process and issues. The types of issues and areas addressed included faculty pay for CPL evaluation, student cost for assessments, marketing CPL opportunities, and data collection.

During the grant period, most colleges embraced the overall concept of CPL and the need to ensure that CPL policies and procedures existed to assess and award credits for prior work experience. And a handful of colleges moved to the point within their manufacturing programs of developing and applying assessments for key program areas such as welding, machine tool, and industrial maintenance.

For example, Southwest Technical College developed assessments in four manufacturing program areas. One is an assessment for electro-mechanical technology that will enable students to complete one test to assess abilities in eight core electro-mechanical technology courses. The number and type of correct answers will determine the courses in which students can receive credit. There is the potential for a student to take the test and receive credit for eight different courses or 22 credits. The availability of this assessment, as well as for instrumentation and controls technology, precision machining technology and welding are included on the college's website. In the near future, the website will be configured so any course can be searched by name and number to determine if a CPL assessment is available. In addition, STC implemented a prior learning assessment for applied mathematics, which is a required course for several manufacturing programs. Eight students have taken and passed the assessment, in lieu of taking the course, and thereby earned credit for applied mathematics.[58]

Waukesha County Technical College (WCTC) is another college that has moved forward with CPL as a result of the TAACCCT 2 initiative. The academic advisor for manufacturing and the grant project manager attended introductory CAEL training sessions, and participated in a series of webinars, leading to the updating and streamlining of the college's approach to CPL. This was followed by the manufacturing academic advisor partnering with welding faculty to pilot the assessment design process that CAEL recommends. An assessment was created for GMAW and Metals Tech, and WCTC is moving forward to develop assessments in other program areas and has created a new Academic Master Plan committee to operationalize CPL across WCTC's campus.[59]

One other aspect of CPL has gained traction at several colleges: providing credit for experience gained in the military. WCTC, Wisconsin Indianhead Technical College, and Western Technical College all report taking steps to clarify and enhance their policies and processes to better accommodate veterans seeking entry into various college programs. Wisconsin Indianhead has a section on its website addressing CPL for the military that clearly articulates the opportunity for the college to review a veteran's military transcripts to determine transfer credit based on recommendations from the American Council on Education.[60]

[58] Phone conversation with Louise Bradley, CPL Coordinator at Southwest Technical College, October 4, 2016.
[59] Best Practices & Lessons Learned, Page 110.
[60] http://www.witc.edu/academics/transfer/military.htm

Implementation Assessment: Factors Affecting the Implementation of Credit for Prior Learning

Despite a slow start on CPL, colleges report significant progress in their CPL work. The slow start was driven for two key reasons. First, CPL had not been a topic of significant attention across Wisconsin, thus many colleges were confronted with dusting off policies and practices that were not prominent within their institutions. Second, the work got off to a slow start, because the consortium had to engage in a procurement process to secure its proposed technical assistance expert/provider.

Two important factors that contributed to the progress on CPL over the past two years appear to be the leadership of Northeast Wisconsin Technical College, and the technical assistance of CAEL. NWTC gave priority to CPL as a consortium strategy, and worked closely to ensure that colleges were focused on this activity and were supported in their work. CAEL provided ongoing expert guidance and technical assistance to support colleges' CPL work.

An ongoing challenge to CPL for all technical colleges is that developing prior learning assessments across multiple program areas and courses requires significant time and resources. How colleges set priorities and allocate resources for this work will greatly influence how prominent CPL becomes in the future.

Sustaining Credit for Prior Learning

Colleges are well positioned to continue their CPL work, and even extend it to other program areas in their institution. A primary reason is Wisconsin received consortium awards in TAACCCT 3 and 4, and is continuing CPL work in the IT and health care sectors, respectively.

Perhaps a more promising development to sustaining the CPL work in colleges is that in 2015, Wisconsin Act 55 added a tenth outcomes-based criteria, credit for prior learning, to the state college-wide performance funding model.[61] Work is now underway to determine how best to structure this measure. To support this, WTCS will be working to modify its data system to record and collect student level data on CPL credits awarded.

What new contributions did employer and workforce partners make to support college-manufacturing programs?

As noted earlier, Wisconsin technical colleges have longstanding employer advisory committees for each occupational program in their college; thus, a high-level of employer engagement with technical college programs is standard. Wisconsin technical colleges also have U.S. Department of Labor-sponsored workforce groups in their region, providing services to local workers and employers; however, these partnerships between technical colleges and workforce groups vary significantly across the state.

Overall, the evaluation found a number of colleges that expanded their partnerships with employers and industry groups in new and innovative ways. These efforts included actions to incorporate industry skill standards and competencies into manufacturing program curricula, and to create more work-

[61] http://www.wtcsystem.edu/wtcsexternal/cmspages/getdocumentfile.aspx?nodeguid=be94910b-fe50-4ac2-89e1-c3201f4a780f

based learning experiences and employment opportunities for students participating in TAACCCT-supported manufacturing programs.

While the Wisconsin technical colleges have established relationships with workforce development boards, the evaluation did not find notable examples where technical colleges expanded their partnerships with workforce groups in new and innovative ways. Most technical colleges promoted their TAACCCT initiative and programs to the local Job Centers; however, there was little incentive to expand or build new and potentially deeper relationships. One reason is that the TAACCCT grant provided technical colleges resources that enabled them to directly establish or expand education and training programs. Thus, colleges did not necessarily need the workforce system to finance their new programs or the students in them. In addition, it does not appear that colleges relied on their workforce partners to recruit and refer participants. Rather, most colleges used TAACCCT resources to support college staff to do recruitment. Preliminary performance data on TAACCCT participants also indicate limited workforce support of the TAACCCT initiative: while Wisconsin technical colleges exceeded their participant goals, enrolling 3,795 students, less than 10% or 364 participants were clients in a workforce program (e.g., WIOA, TAA, and/or Veterans).[62] The limited number of workforce clients participating in TAACCCT programs is likely due to a number of items, including lack of TAA and/or Veterans in the region as well as a mismatch in skills and interests between clients and the manufacturing programs offered through the grant. For these reasons, the evaluation concludes that workforce partners provided a limited contribution to the colleges' TAACCCT round 2 efforts.

College's efforts to expand employer engagement and the contributions of employer partners are described below.

Description of Expanded Employer Partnerships

All colleges engaged employers through employer advisory committees, mostly to share curriculum ideas and discuss new short-term technical diplomas, local certificates, and/or industry recognized credentials they wanted to implement through *Making the Future*. Almost half of the colleges expanded their traditional role with employers in new and innovative ways.

A few colleges incorporated national skill standards and competencies into program curricula.

Wisconsin's technical colleges provide skilled professionals for the state's key economic sectors, such as manufacturing, health care, information technology, and agriculture. Colleges are increasingly working to ensure that students have the specific technical and employment skills and competencies needed by local employers. To meet student and employer expectations, a few colleges worked with national and regional industry associations to develop and incorporate industry recognized skill certifications into college programs.

For example, Chippewa Valley Technical College (CVTC) successfully incorporated national industry standards and competencies into its two-year machine tooling technics program of study. CVTC's program became the first metalworking program in the state to be accredited by the National Institute for Metalworking Skills (NIMS). NIMS sets skills standards for the industry, certifies individual skills against the standards, and accredits training programs that meet NIMS' quality requirements. The five-year accreditation indicates that CVTC's program meets national standards in five areas, and allows CVTC students to test for any of 52 NIMS metalworking credentials. CVTC's accreditation focuses on entry-level skills from the NIMS Machining Level I National Standard, with an emphasis on CNC lathe and mill operations. Although local employers were not familiar with NIMS initially, they

[62] Evaluation analysis of unit-record database of participants

now remark, "with this incoming knowledge, CVTC students have the ability to be trained for more meaningful roles, advancing them in the organization".[63]

Another example is Southwest Technical College's focus on industry skill standards. For its one-year welding program, the college repackaged its curriculum of five courses into 24 one-credit modules following standards of the American Welding Society. The college also created a new non-credit, introductory manufacturing program (Gold Collar Certificate), and developed the curriculum using the National Association of Manufacturer's industry recognized credential, Manufacturing Skills Standard Certificate (MSSC). The TAACCCT grant provided resources to conduct MSSC testing and certification for students.

Although these two college efforts are unique to the TAACCCT 2 initiative, colleges indicated in evaluation interviews a strong interest in national skill standards and competencies. Milwaukee Area Technical College developed its two bridge 101 programs with considerable input from a regional manufacturing employers group (the Manufacturing Career Partnership) that wanted a common set of skills and competencies for entry-level workers. In addition, several colleges expressed interest in the NIMS accreditation undertaken at CVTC. One issue that limited action by colleges is the cost associated with testing and awarding national industry certificates. For example, Southwest plans to continue its Gold Collar Certificate, but will no longer test and certify students given the cost of doing so.

A handful of colleges increased internships and priority employment opportunities for manufacturing students.

All Wisconsin technical colleges are focused on producing highly skilled and qualified students to meet local employer workforce needs, whether for entry-level or middle-skilled positions. And all colleges recognize that success is about employment that meets the needs for both the student and the employer. As such, the TAACCCT initiative provided the opportunity and resources that led to a small number of colleges creating new partnerships with employers to develop experiential learning opportunities for students as they prepare to move toward employment.

Moraine Park's welding boot camp represents a unique expansion of the employer's role in education and training at the college. The welding boot camp includes a 72-hour paid internship for all participants with a local employer who selects the interns after reviewing resumes and test scores (math and reading, as well as a mechanical assessment), which then provides entry to the welding boot camp at the college. While the college initially had to recruit employers to participate and offer internships, it now has more employers wanting to participate than available slots. This process has resulted in an overall job placement rate of 86% within three months of boot camp completion.[64] The internship program attracted students who would never otherwise have considered college, but the strong connection with employers and the possibility of a job motivated participation. As one student noted, "my [internship] supervisor tells me I have potential as a welder and I should have no problem getting employed. This is very encouraging. There aren't many people or places willing to teach a skill like this to a beginner."[65]

Both Blackhawk Technical College and Chippewa Valley Technical College developed new internship opportunities for manufacturing students. Blackhawk used an internship coordinator to develop opportunities for students in the industrial maintenance program, while CVTC assigned faculty in the machine tool program to manage its program. Both colleges identified a course within their respective

[63] Best Practices & Lessons Learned, Pages 47-48.
[64] Ibid. Page 83.
[65] Ibid. Page 83.

manufacturing programs where an internship could be taken as an alternative to a program course. And both colleges established formal protocols to guide, manage, and assess the internship activity.

Another aspect of expanded employer partnerships involves preparing students for employment and proving priority consideration in hiring decisions. Southwest Technical College engaged local employers in the development of the Gold Collar Certificate training, and successfully worked with a number of employers to provide student tours of their facilities, help prepare students for job interviews, and offer priority hiring for students who complete the bridge. Notably, the 3M Company adapted its hiring profile to ask if students had earned the GCC, and publicly indicated that completers receive priority consideration.

There are new and unique partnerships with employers emerging at a few colleges.

The TAACCCT initiative encouraged and supported Wisconsin technical colleges to expand their relationship and involvement with local employers. It also opened up the door to explore new partnerships and avenues for better educating students and meeting workforce needs. Evolving efforts at Mid-State Technical College and Northcentral Technical College warrant attention.

Building off the success of its short-term stainless steel program, Mid-State Technical College is working to connect the program to the state Bureau of Apprenticeship Standards to create a stainless steel apprenticeship program. The apprenticeship will likely be three years in duration, and be built as a hybrid model combining time based as well as competency based models. This will allow people who completed the Stainless Steel Welding Certificate prior to entering the apprenticeship program to receive full credit for prior learning, which will shorten the length of time to complete the credential. It also creates an opportunity for the college to better serve employers in the region who are looking to increase the skill levels of incumbent workers.[66]

Northcentral Technical College deepened its partnership with local employers to update its machine tool and welding programs, which helped the college purchase state-of-the-art equipment to meet the training needs of industry. NTC also started working with the Central Wisconsin Metal Manufacturing Alliance to better align welding programs across the region. This alliance includes employers and two other technical colleges, Nicolet Area Technical College and Mid-State Technical College. The colleges are working to align curriculum in welding offerings so graduates from NATC and MSTC's Technical Diploma in Welding program could continue to earn their Associate's degree in welding at NTC. By working together, the three technical colleges are expanding the pipeline of welding students across the broader region and increasing the opportunity for more students to attain higher-level skills and credentials.[67]

Implementation Assessment: Factors Affecting the Implementation of Expanded Employer Partnerships

[66] Ibid. Page 86.
[67] Ibid. Page 96-97.

The evaluation team identified several factors that influenced colleges' work in this area. These factors are presented below. Colleges did not face many challenges in expanding their efforts to engage employers. As noted previously, the long-established program advisory committees provide regular and systematic opportunities to engage employers. Expanded employer engagement is largely driven by college intentionality and by opportunistic events. This section highlights some contributing factors that enabled several colleges to leverage employer contributions in ways that benefited students and employers.

***Contributing Factors*:**

1. **Pre-existing Strong Employer Relationships**: As noted earlier, Wisconsin technical colleges have a positive history as well as formal policies and processes that foster strong relations between technical colleges and employers. This provided a solid foundation for technical colleges to involve local employers in their TAACCCT planning process and to solicit their participation and input into efforts to transform existing manufacturing programs of study to align with the concept and practice of stacked and latticed career pathways. This was more than the traditional employer advisory committee process of reviewing proposed changes to curriculum and other typical actions. The colleges engaged employers in developing new ways of producing workers with greater and more precise skill competencies, which was something all employers supported.

2. **TAACCCT Funds**: One topic that was not a specific evaluation focus was that all technical colleges could spend their TAACCCT grant dollars on purchasing equipment, as this was an allowable grant expenditure. Colleges varied significantly in how much of the grant was allocated to equipment versus other activities. But most colleges did allocate some resources for equipment purchases. This resulted in colleges working closely with local employers in a particular manufacturing area (e.g., welding or machine tool) to determine what specific equipment was needed to ensure that students were sufficiently trained to meet their needs. Colleges reported that employers became very engaged to the point of volunteering to help install the equipment, as well as donating related equipment. This fostered direct contact between employers and faculty, thus deepening employer engagement and commitment to the college.

3. **Increasing Demand for Higher Skilled Workers**: As long as Wisconsin employers have a need for more and better skilled workers, and colleges' doors are open to their participation, employer partnerships are likely to remain significant and will continue to expand in new ways. A key factor that makes this possible is the willingness of manufacturing faculty across the colleges to work closely with employers to ensure that their programs are meeting employer needs. This culture of engagement between faculty and local employers seems fundamental to employer partnerships.

Sustaining Employer Partnerships

There is little question Wisconsin technical colleges will continue their strong partnership and engagement with local employers. After all, WTCS approved technical programs of study have to maintain their focus and commitment to addressing the needs of the local labor market.

It seems likely that as long as Wisconsin's manufacturing economy is robust, employers will stay engaged with the local technical colleges. The TAACCCT initiative provided significant resources to the technical colleges, resulting in funds to procure new equipment and to hire staff to work in new areas, such as developing internship programs with local employers or buying national skills standards curriculum, testing, and certification opportunities. Finding the resources to continue these efforts, especially during times when technical colleges' local authority to raise funds are limited and

enrollments are down, will likely influence the ability of colleges to sustain some of these efforts as well as continue to expand partnerships in additional ways.

Section 5 – Conclusions, Lessons Learned, and Implications for Future Workforce and Education Research

Wisconsin's technical colleges effectively implemented stacked and latticed pathways in advanced manufacturing. These career pathways helped participants earn more postsecondary credentials, and earn them more quickly in three manufacturing areas: welding, machine tool/CNC, and industrial maintenance. Put simply, the impact of stacked and latticed pathways on credential attainment is robust, and holds across program areas and across various demographic groups. Participants in stacked and latticed pathways also earned more credits, on average, than a matched comparison group, which should reassure faculty and administrators that career pathway programs do not encourage students to job-out and discontinue their education and training.

Stacked and latticed manufacturing pathways may improve employment outcomes for non-incumbent worker participants, but the evidence is inconclusive from a rigorous statistical standpoint. Exploratory evidence suggests stacked and latticed pathway participants in machine tool/CNC programs have higher employment rates than comparison group members in those programs. Additional descriptive analysis suggests that employment rates are higher for career pathway participants who earn a one-year or two-year credential than their peers who earn similar credentials, which may be the result of participants in stacked and latticed pathways earning multiple credentials along the way that demonstrate their competencies and skills in manufacturing.

Implementation Strengths

The implementation of stacked and latticed manufacturing pathways benefited from a supportive System Office (WTCS), which provided a structure and procedures for creating new, and modifying existing, technical college programs along a career pathway framework though communication and convening colleges, through system policy and procedural changes, and by providing resources to incent colleges to expand their career pathway efforts. These efforts began in 2007 as part of the RISE initiative and were further catalyzed by the TAACCCT 2 grant.

Effective implementation of stacked and latticed credentials was also facilitated by the commitment of senior administrators at the colleges – especially presidents. The TAACCCT emphasis on engaging local employers resonated with the colleges and elevated the grant's importance. Presidents and other senior leaders provided support and direction for the implementation of career pathways that included the allocation of professional staff to design and modify curriculum and to seek WTCS approval for embedded credentials. These procedural and administrative tasks were critical to implementation and sustainability, and the colleges' willingness to work through these details indicated that career pathways were an institutional priority.

In addition, colleges improved relationships with local employers through existing advisory committees, and in some notable examples, expanded employer contributions to manufacturing programs through work-based learning opportunities, internships for entry level workers, and priority hiring for program completers.

In sum, as the TAACCCT 2 grant ended, the stacked and latticed career pathway movement among Wisconsin technical colleges was established as a core foundation for organizing and delivering career and technical programs statewide.

Implementation Challenges

Wisconsin's technical colleges undertook multiple approaches to provide academic and non-academic supports to participants during the TAACCCT 2 grant, yet few are sustaining these support services.

Colleges funded staff and instructors who provided these enhanced supports with grant dollars, and did not take steps to find budgetary resources to transition these temporary positions into permanent ones, despite widespread belief among college leaders and grant participants that these enhanced support services were valuable tools for student success.

Although colleges leveraged their data capacity to provide annual performance data on unique participants and their outcomes, few colleges used data for continuous improvement during the grant. For example, data collection and reporting processes were not implemented that could have documented the use of students supports or the awarding of credit for prior learning, and examined their relationships with student outcomes. Notably, at the few colleges that did collect and analyze data on enhanced support services, the evidence generated institutional support and commitment to sustain support services positions beyond the grant.

Colleges did not appreciably expand and enhance their existing relationships with local workforce groups. Less than 10% of TAACCCT 2 participants were clients of the Workforce Investment and Opportunity Act, Trade Adjustment Assistance, and Veteran's benefits programs during the grant period. The evaluation was unable to discern why more clients of these workforce programs were not enrolling in stacked and latticed pathways; however, it is noteworthy that the TAACCCT grant provided direct resources to colleges for the delivery of education and training programs. Thus, colleges did not need workforce groups to provide resources to support the development and delivery of TAACCCT manufacturing programs. Colleges also reported that workforce clients were not interested in the manufacturing programs offered under the grant, and that there were few TAA and Veteran clients in their communities.

Insights for Future Workforce and Education Research

At the conclusion of the TAACCCT 2 third-party evaluation, three insights for future workforce and education research are apparent.

First, access to public administrative records and the sharing of these records across public agencies needs improvement. The *Making the Future* evaluation benefited from pre-existing data sharing agreements between the Wisconsin Technical College System and the Department of Workforce Development; however, this agreement did not reflect the needs of the third-party evaluation. Records are shared annually (in October), and the timing for matching college and employment records – combined with the significant lag in Unemployment Insurance reporting by employers in Wisconsin – yielded insufficient data to examine employment outcomes for about one-third of grant participants.

Second, program implementation and evaluation requires better planning and alignment from the onset. Staff responsible for designing and implementing programs and strategies needs an earlier and more robust understanding of the requirements for rigorous evaluation. A clear understanding of evaluation requirements can help staff with responsibility for implementation withstand organizational pressures to deviate from program design, which would enhance the types of research questions that can be more robustly analyzed.

Third, upfront program design could benefit from clear definitions of model fidelity. The lack of clarity was particularly notable for enhanced support services, resulting in multiple approaches to delivering such services and uneven implementation among the colleges. This flexibility along with limited data collection on the utilization of these enhanced supports precluded any rigorous impact evaluation of these efforts.

Appendix A: Technical Information on Propensity Score Matching and the Impact Analysis

This appendix provides a detailed description of the statistical methodology used to generate the impact estimates of stacked and latticed pathways on educational and employment outcomes for participants in Wisconsin's Round 2 Trade Adjustment Assistance Community College and Career Training (TAACCCT) grant program, *Making the Future*.

Data Sources

The evaluation team obtained academic and background data from each of the 15 technical colleges in the consortium, as well as unemployment (UI) records and workforce program data from Wisconsin Technical College System (WTCS) based on their data sharing agreement with the Wisconsin Department of Workforce Development (DWD). In general, data received covered the period June 2012 through June 2016; however, given reporting lags for UI data, UI records were received for only a portion of the grant period. Thus, labor market outcomes can be examined only for a subset of participants and comparison pool members.

Propensity Score Matching

In order to examine the impact of participation in stacked and latticed pathways, the evaluation team conducted propensity score matching (PSM) to generate a comparison group that is similar to the treatment group along a set of background characteristics that could affect the likelihood of receiving treatment. Rosenbaum & Rubin (1983) introduced the propensity score approach to matching and described it as "the conditional probability of assignment to a particular treatment given a vector of observed covariates."[68] In other words, the propensity score reflects the probability of receiving treatment based on a set of background characteristics. PSM is an increasingly common and popular approach for accounting for factors that may influence the receipt of treatment, and thus confound analysis of impact. By generating a comparison group that resembles the treatment group on all variables thought to affect likelihood of receiving treatment, researchers can infer that the subsequent observed impact is the result of the treatment, and not the result of different characteristics in the two groups.[69]

While randomized control trials generate treatment and comparison groups that are expected to differ only in their treatment condition, observational studies face the issue of selection bias, in which receipt of treatment may be the result of meaningful differences between the treatment and comparison groups.[70] In observational studies, the treatment is not randomly assigned and, thus, "baseline characteristics of treated subjects often differ systematically from those of untreated subjects."[71] Balancing on propensity scores is one way to account for differences between treated and untreated cases. PSM uses a set of variables that may influence the receipt of treatment to create propensity scores, or scores that reflect the probability of receiving treatment, for both the treated and untreated cases. The subjects are then matched on their propensity scores, and untreated cases with propensity scores similar to those in the treatment group form the matched comparison group. This approach controls for potential confounds in treatment receipt. After statistical balance has been achieved along the predictor variables (variables that could influence receipt of treatment), outcomes

[68] Rosenbaum, P.R. & Rubin, D.B. (1983). The Central Role of the Propensity Score in Observational Studies for Causal Effects. *Biometrika,* 70(1), pp. 41-55.
[69] Ibid.; Guo, S. & Fraser, M. (2010). *Propensity Score Analysis: Statistical Methods and Applications*. Los Angeles: Sage Publications; and, Austin, P.C. (2011). An introduction to Propensity Score Methods for Reducing the Effect of Confounding in Observational Studies. Multivariate Behavioral Research, 46(3), 399-424
[70] Austin, P.C. (2011) and Rosenbaum, P.R. & Rubin, D.B. (1983).
[71] Austin, P.C. (2011).

for the matched treatment and control group should not differ systematically in the absence of treatment.[72]

The evaluation team conducted separate PSM analyses for each outcome, and for each PSM model, balanced on characteristics that could be related to participation in the grant program.

The PSM approach to generating a matched comparison group enabled the evaluation to meet standards of rigor for non-experimental research studies as defined by the Clearinghouse for Labor Evaluation and Research (CLEAR)[73] and the Institute of Education Sciences What Works Clearinghouse (WWC).[74] PSM is a quasi-experimental design methodology that can achieve a moderate rating from CLEAR as well as meet WWC standards with reservations.

The treatment and matched comparison groups were balanced on all predictor variables used in the PSM model for the educational outcomes; however, a small number of PSM predictor variables were not perfectly balanced for the employment and earnings outcomes.[75] In these instances, post-estimation regression analyses were conducted to account for the imbalance on these variables, and the results reported in the tables reflect the post-estimation analysis results. Consequently, all four outcomes meet CLEAR standards for regression studies using matching techniques.

For each outcome, impact is measured by estimating the average treatment effect on the treated (ATT), which is the average difference in the outcome between the treated and matched comparison groups. As Zeidenberg, Cho, and Jenkins (2010) explained, "The ATT is the average effect of the treatment on the sort of person who participates in the program."[76] In other words, the ATT is the difference in outcome between two groups that have similar probabilities of receiving the treatment (based on the set of covariates used to generate the propensity score).

The evaluation team used the teffects psmatch program in Stata to conduct PSM and estimate the ATT. Teffects psmatch is a relatively new program that was designed to address a significant limitation of the previous – and widely used – propensity score matching program, psmatch2. Stata's previous PSM program (psmatch2) did not account for the fact that propensity scores are estimated when producing standard errors. Therefore, users of psmatch2 needed to bootstrap the standard errors, a process that has recently been demonstrated, in general, as not appropriate for matching estimators.[77] Teffect psmatch accounts for the fact that propensity scores are estimated rather than known when calculating standard errors, and thus produces a more precisely estimated ATT.

Covariates Used for PSM

PSM analyses were conducted separately for each outcome, given the unique subgroups for the two labor market outcomes (employment rate is examined for non-incumbent workers; earnings increase rate is examined for incumbent workers) and the different set of PSM predictor variables for those unique subgroups. For each outcome, the overall analytic sample for the PSM consists of treatment

[72] Guo, S. & Fraser, M. (2010; and, Monaghan, D.B., & Attewell, P. (2014). The Community College Route to the Bachelor's Degree. *Educational Evaluation and Policy Analysis.*
[73] Clearinghouse for Labor Evaluation and Research. *Causal Evidence Guidelines*, Version 2.1, December 2015.
[74] Institute of Education Sciences, What Works Clearinghouse. *WWC Standards Brief for Baseline Equivalence*, n.d.
[75] According to CLEAR's standards for baseline equivalence, PSM predictor variables are balanced if the difference between groups not statistically significant (i.e., p-value is >.05). Clearinghouse for Labor Evaluation and Research. *Causal Evidence Guidelines*, Version 2.1, December 2015.
[76] Zeidenberg, M., Cho, S.W., & Jenkins, D. (2010). Washington State's Integrated Basic Education and Skills Training Program (I-BEST): New Evidence of Effectiveness. CCRC Working Paper No. 20, Teachers College, Columbia University.
[77] Abadie, A., & Imbens, G.W. (2008). On the Failure of the Bootstrap for Matching Estimators. *Econometrica*, 76(6*),* 1537-1557; and, Abadie, A. & Imbens, G.W. (2016). Matching on the Estimated Propensity Score. *Econometrica*, 84(2), 781-807.

and comparison pool students who were enrolled in a manufacturing program at some point during the grant period. Therefore, the matched comparison group is drawn from an overall comparison pool of students in the same occupational area (manufacturing) as the treatment students.

The covariates used in the PSM models consist of demographic and background variables that could influence the likelihood of receiving treatment, after restricting the sample to treatment and comparison pool students in manufacturing programs.[78] The variables are listed here:

College administrative records:

- Gender
- White
- African American
- Hispanic
- First term in the sample (first term in a manufacturing program)
- Age during first term in sample
- Received Pell award during first term in sample
- HS Diploma is highest degree earned before entering sample
- GED is highest degree earned before entering sample
- Credits earned prior to first term in sample
- Credits attempted during first term in sample
- Enrolled in ABE at any point during grant
- Enrolled in a welding program at any point during grant
- Enrolled in an industrial maintenance program at any point during grant

UI and workforce program records from WTCS match with DWD:

- Employed during first term in sample
- Earnings during first term in sample
- Missing UI records in first term in sample
- Participated in TAA at any point during grant
- Participated in WIOA at any point during grant

The following sections provide the results of each PSM analysis, as well as the ATT results for each outcome.

PSM and ATT Results: Credential Attainment

The variables used in the credential attainment PSM model are listed in Table 14 below. As Table 14 shows, the matched comparison group is similar to the treatment group along these treatment model covariates, and tests of mean difference between the treatment and matched comparison group show that the difference for each variable meets CLEAR's equivalence standards (p-value >.05). Table 15 shows the results of the ATT analysis for credential attainment.

[78] An important note about PSM: PSM can balance only on observed characteristics; thus, unobserved differences between the treatment and control groups could influence results. Therefore, the results of PSM do not provide the most robust level of evidence for causality between the treatment and outcome.

Table 14: Means, Standard Deviations, and Baseline Equivalence for the Credential Attainment PSM Predictor Variables

	Unmatched Comparison Pool (n=8674)	Matched Comparison Group (n=3150)	Treatment Group (n=3150)	P-value
Age during first term in sample	27.31 (9.84)	26.89 (9.88)	26.66 (10.24)	.353
Credits earned prior to first term in sample	8.62 (18.53)	5.42 (14.10)	5.19 (13.62)	.513
Credits attempted during first term in sample	11.05 (5.30)	10.79 (5.46)	11.00 (5.47)	.137
Employed during first term in sample	.44 (.50)	.44 (.50)	.44 (.50)	.939
Earnings during first term in sample	2473.22 (4250.72)	1870.82 (3124.29)	1908.16 (3237.44)	.641
Missing UI records during first term in sample	.43 (.50)	.42 (.49)	.40 (.49)	.200
Gender	.93 (.25)	.94 (.24)	.94 (.25)	.471
White	.82 (.37)	.81 (.39)	.82 (.38)	.454
African American	.08 (.27)	.09 (.28)	.08 (.26)	.106
First term in sample	4.67 (3.42)	6.25 (3.23)	6.22 (2.95)	.782
Hispanic	.05 (.22)	.08 (.27)	.07 (.25)	.098
Highest degree before entering sample is H.S. diploma	.39 (.49)	.50 (.50)	.51 (.50)	.529
Highest degree before entering sample is GED	.08 (.27)	.10 (.30)	.09 (.29)	.549
Received Pell Grant during first term in sample	.29 (.45)	.33 (.47)	.34 (.48)	.351
Enrolled in ABE at any point during grant	.15 (.35)	.25 (.44)	.25 (.43)	.885
Participated in TAA at any point during grant	.01 (.12)	.01 (.11)	.02 (.12)	.337
Participated in WIOA at any point during grant	.04 (.20)	.06 (.23)	.06 (.24)	.557
Enrolled in a welding program at any point during grant	.33 (.47)	.61 (.49)	.61 (.49)	1.000
Enrolled in an industrial maintenance program at any point during grant	.10 (.30)	.07 (.25)	.08 (.27)	.130

Table 15: Average Treatment Effect on the Treated – Credential Attainment

Outcome	Treatment Group (n=3150)	Comparison Group (n=3150)	ATT	P-value
Credential attainment rate	48%	30%	18%	.000

PSM and ATT Results: Credit Accumulation

The variables used in the credit accumulation PSM model are listed in Table 16 below. As Table 16 shows, the matched comparison group is similar to the treatment group along these treatment covariates, and tests of mean difference between the treatment and matched comparison group show that baseline equivalence meets CLEAR's standards of having a p-value >.05 for all but two variables. In accordance with CLEAR standards, the evaluation accounted for these variables in a post-estimation regression analysis of the ATT. Table 17 shows the results of the ATT for credit accumulation before and after statistically adjusting for the two variables that do not meet CLEAR standards for baseline equivalence.

Table 16: Means, Standard Deviations, and Baseline Equivalence for the Credit Accumulation PSM Predictor Variables

	Unmatched Comparison Pool (n=8590)	Matched Comparison Group (n=3148)	Treatment Group (n=3148)	P-value
Age during first term in sample	27.31(9.85)	26.78(9.75)	26.65(10.24)	.624
Credits earned prior to first term in sample	8.67(18.57)	5.69(14.47)	5.19(13.62)	.159
Credits attempted during first term in sample	11.09(5.30)	11.09(4.41)	11.00(5.47)	.513
Employed during first term in sample	.44(.50)	.46(.50)	.44(.50)	.085
Earnings during first term in sample	2477.43 (4249.17)	2014.63 (3335.76)	1909.37 (3238.11)	.204
Missing UI records during first term in sample	.43(.49)	.38(.48)	.40(.49)	*.036*
Gender	.93(.25)	.93(.25)	.93(.25)	.725
White	.82(.38)	.82(.38)	.82(.38)	.922
African American	.07(.26)	.10(.30)	.07(.26)	*.001*
First term in sample	4.66(3.43)	6.07(3.21)	6.22(2.95)	.051
Hispanic	.05(.22)	.07(.25)	.07(.25)	.880
Highest degree before entering sample is H.S. diploma	.39(.49)	.53(.50)	.51(.50)	.278
Highest degree before entering sample is GED	.08(.27)	.10(.30)	.09(.29)	.176
Received Pell Grant during first term in sample	.29(.45)	.35(.48)	.34(.47)	.832
Enrolled in ABE at any point during grant	.14(.35)	.27(.44)	.25(.43)	.121
Participated in TAA at any point during grant	.01(.12)	.02(.13)	.02(.13)	.553
Participated in WIOA at any point during grant	.04(.20)	.06(.23)	.06(.24)	.361
Enrolled in a welding program at any point during grant	.33(.47)	.61(.49)	.61(.49)	.518
Enrolled in an industrial maintenance program at any point during grant	.10(.30)	.08(.27)	.08(.26)	.671

Table 17: Average Treatment Effect on the Treated – Credit Accumulation

Outcome	Treatment Group (n=3148)	Comparison Group (n=3148)	ATT	P-value
Average total credit accumulation	25.30	22.21	3.09	.000
Post-estimation average total credit accumulation	25.26	22.25	3.01	.000

PSM and ATT Results: Employment One Quarter after Program Exit

The impact of stacked and latticed pathways on employment one quarter after program exit was examined for non-incumbent workers only. Therefore, the sample was restricted to students who were not employed during their first term in the sample. Additionally, given UI reporting lags, the latest quarter for which UI records were received was April-June in 2015. Given the outcome definition of "employed one quarter after exit," the sample was further restricted by exit term. Only students who exited the sample in the 2015 winter/spring term or earlier are eligible for the PSM and ATT employment analysis, as UI data one quarter after exit was not available for students who exited later than the 2015 winter/spring term. Thus, the final analytic sample for the employment PSM and ATT analysis consists of 741 non-incumbent workers who exited the sample during the 2015 winter/spring term or earlier.

As Table 18 shows, the non-incumbent worker participant group is slightly more racially and ethnically diverse than the overall participant group (19% are African American or Hispanic, compared with 15% of the overall participant group), is older (29.6 years vs. 26.6), enrolled in Adult Basic Education at some time during the grant period at a higher rate (29% vs. 25%), and a larger percentage were clients of the workforce system programs for which we have data (WIOA, TAA, and Veterans). Additionally, the non-incumbent participant group has lower prior education levels and entered the sample with fewer postsecondary credits than the overall comparison group, and a higher proportion received a Pell Grant.

Table 18: Employment Outcome Treatment Group and Overall Treatment Group Demographics

	Non-Incumbent Worker Treatment Group (n=741)	Overall Treatment Group (n=3178)
Age		
Average age during first term in sample	29.6	26.6
Gender		
Male	93%	93%
Female	7%	7%
Race, Ethnicity, and Gender		
African American	11%	8%
White	78%	82%
Hispanic	8%	7%
Prior Education		
Highest degree – less than H.S. diploma	17%	14%
Highest degree – H.S. diploma	44%	51%
Highest degree – some college	13%	14%
Highest degree – postsecondary credential	6%	6%
Highest degree – unknown	20%	15%
Average number of post-secondary credits earned prior to first term in sample	4.21	5.14
Academics		
Average number of academic credits attempted during first term in sample	10.93	11.00
Enrolled in adult basic education during grant	29%	25%
Enrolled in developmental/remedial education during grant	33%	31%
Pell Status		
Received Pell award during first tem in sample	38%	34%
Workforce Development and Veterans Assistance		
Received TAA program assistance during grant	4%	2%
Received WIOA program assistance during grant	9%	6%
Received Veterans program assistance during grant	4%	2%

Employment status during the first term is based on UI records – students with zero earnings in a quarter are flagged as unemployed during that quarter. Students with missing UI data in the first term are also treated as unemployed. A dummy variable, "missing UI records in first term," was created to account for any differences between the treatment and matched comparison groups in rates of missing UI records in the first term. Consistent with other research on labor market outcomes, cases with missing UI records in their first quarter after exit were also treated as unemployed during that quarter.[79]

The variables used in the employment PSM model are listed in Table 19 below. As Table 19 shows, the matched comparison group is similar to the treatment group along these treatment covariates, and

[79] Liu, V.Y.T., Belfield, C.R., & Trimble, M.J. (2014). The medium-term labor market returns to community college awards: Evidence from North Carolina. *Economics of Education Review*, 44, 42-55; and, Dadgar, M., & Trimble, M.J. (2014).

tests of mean difference between the treatment and matched comparison group show that baseline equivalence meets CLEAR's standards of having a p-value >.05 for all variables except one. Table 20 shows the results of the ATT analysis for employment one quarter after exit before and after statistically accounting for the variable that does not meet CLEAR standards for baseline equivalence.

Table 19: Means, Standard Deviations, and Baseline Equivalence for the Employment PSM Predictor Variables

	Unmatched Comparison Pool (n=2605)	Matched Comparison Group (n=741)	Treatment Group (n=741)	P-value
Age during first term in sample	29.25(10.79)	29.66(10.65)	29.57(.11.78)	.871
Credits earned prior to first term in sample	7.42(17.44)	4.39(12.41)	4.21(12.04)	.769
Missing UI records during first term in sample	.66(.47)	.49(.50)	. 51(.50)	.500
Gender	.94(.25)	.94(.23)	.93(.25)	.523
White	.77(.42)	.79(.41)	.78(.41)	.801
African American	.12(.33)	.12(.33)	.11(.32)	.627
First term in sample	3.00(2.25)	4.53(2.40)	4.54(2.14)	.927
Hispanic	.05(.22)	.07(.26)	.08(.27)	.622
Highest degree before entering sample is H.S. diploma	.31(.46)	.46(.50)	.44(.50)	.434
Highest degree before entering sample is GED	.09(.29)	.10(.30)	.12(.33)	.183
Received Pell Grant during first term in sample	.32(.47)	.37(.48)	.38(.49)	.668
Enrolled in ABE at any point during grant	.17(.37)	.29(.45)	.29(.46)	.909
Participated in TAA at any point during grant	.03(.18)	.03(.17)	.04(.18)	.558
Participated in WIOA at any point during grant	.07(.25)	.06(.24)	.09(.29)	*.018*

Table 20: Average Treatment Effect on the Treated – Employed One Quarter after Exit

Outcome	Treatment Group (n=741)	Comparison Group (n=741)	ATT	P-value
Non-incumbent worker employment rate one quarter after program exit	33%	29%	4%	.139
Post-estimation non-incumbent worker employment rate one quarter after program exit	33%	29%	4%	.080

PSM and ATT Results: Earnings Increase after Program Entry

The impact of stacked and latticed pathways on receiving an earnings increase at any point after the first term was examined for incumbent workers only.[80] Therefore, the analysis was restricted to students who were employed during their first term in the sample. Additionally, as mentioned in the previous section, the latest quarter for which we received UI records is April-June in 2015. Given the outcome definition of "received earnings increase at any point after first term," the sample was further restricted by start term. Only students who entered the sample in the 2015 winter/spring term or earlier are eligible for the PSM and ATT analysis, as these are the only students for whom it is possible to examine UI records after the first term. Therefore, the sample for the earnings increase analysis consists of 1,346 incumbent workers who entered the sample during the 2015 winter/spring term or earlier. As Table 21 shows, incumbent worker participants were quite similar to the overall participant group in terms of demographics, education, and workforce program participation.

[80] Incumbent workers are students who had an earnings amount >0 in their first term in the sample.

Table 21: Earnings Outcome Treatment Group and Overall Treatment Group Demographics

	Incumbent Worker Treatment Group (n=1346)	Overall Treatment Group (n=3178)
Age		
Average age during first term in sample	25.71	26.6
Gender		
Male	94%	93%
Female	6%	7%
Race, Ethnicity, and Gender		
African American	5%	8%
White	85%	82%
Hispanic	5%	7%
Prior Education		
Highest degree – less than H.S. diploma	13%	14%
Highest degree – H.S. diploma	53%	51%
Highest degree – some college	13%	14%
Highest degree – postsecondary credential	6%	6%
Highest degree – unknown	15%	15%
Average number of post-secondary credits earned prior to first term in sample	6.81	5.14
Academics		
Average number of academic credits attempted during first term in sample	11.17	11.00
Enrolled in adult basic education during grant	24%	25%
Enrolled in developmental/remedial education during grant	28%	31%
Pell Status		
Received Pell award during first tem in sample	33%	34%
Workforce Development and Veterans Assistance		
Received TAA program assistance during grant	1%	2%
Received WIOA program assistance during grant	6%	6%
Received Veterans program assistance during grant	3%	2%

The variables used in the earnings increase PSM model are listed in Table 22 below. As Table 22 shows, the matched comparison group is similar to the treatment group along these treatment covariates, and tests of mean difference between the treatment and matched comparison group show that baseline equivalence for all variables meets CLEAR's standards of having a p-value >.05.

Table 22: Means, Standard Deviations, and Baseline Equivalence for the Earnings Increase PSM Predictor Variables

	Unmatched Comparison Pool (n=3831)	Matched Comparison Group (n=1346)	Treatment Group (n=1346)	P-value
Age during first term in sample	26.43(9.04)	25.86(9.06)	25.71(9.42)	.666
Credits earned prior to first term in sample	10.92(20.91)	7.57(18.36)	6.81(15.50)	.249
Gender	.93(.25)	.94(.24)	.94(.23)	.935
White	.86(.35)	.83(.38)	.85(.36)	.142
African American	.05(.21)	.07(.25)	.05(.23)	.170
First term in sample	3.47(2.52)	5.06(2.35)	5.01(2.23)	.551
Hispanic	.05(.21)	.04(.20)	.05(.21)	.581
Highest degree before entering sample is H.S. diploma	.42(.49)	.51(.50)	.53(.50)	.263
Highest degree before entering sample is GED	.06(.23)	.11(.31)	.09(.28)	.117
Received Pell Grant during first term in sample	.27(.45)	.31(.46)	.33(.47)	.433
Enrolled in ABE at any point during grant	.13(.33)	.22(.42)	.24(.42)	.384
Participated in TAA at any point during grant	.01(.08)	.01(.09)	.01(.09)	1.000
Participated in WIOA at any point during grant	.03(.17)	.05(.22)	.06(.23)	.734

Table 23: Average Treatment Effect on the Treated – Earnings Increase after Program Entry

Outcome	Treatment Group (n=1346)	Comparison Group (n=1346)	ATT	P-value
Incumbent worker earnings increase rate at any point after program entry	76%	75%	1%	.721

Appendix B: *Making the Future* Logic Model

Inputs	Activities	Short Term Outcomes (within 9 months)	Outcomes (3 years)	Long Term Impacts (Beyond the Grant)
Goal One: Implement *Making the Future* Manufacturing focused Adult Career Pathway (ACP) Credential Programs				
Area of Focus: *Program Structure*				
- WTCS Existing Educational Programs - WTCS staff - NWTC staff - TAACCCT grant - RISE Adult Career Pathway initiative - Advisory committees - Selected manufacturing occupational area for focus - Manufacturing partners - WI curriculum bank – - Articulation agreements	• Clarify elements of *MtF manufacturing credential program* that all consortium members will implement, such as embedded (stacked/latticed) credentials and possibly adult basic education bridges. • Clarify financial aid rules for embedded credentials • Develop/modify selected occupation curriculum • Develop/modify instructional approach and/or service delivery	• *MtF ACP Credential Program* implemented with fidelity to agreed upon program structure elements and serving participants • Curriculum developed, modified, approved and used by college faculty who have participated in professional development • Instructional approach and/or service delivery changed, adopted and utilized • Credentials established for *MtF ACP Credential Program* that meet industry needs, are system-recognized, and	• *MtF ACP Credential Program* incorporated and sustained into college's established program offerings • Regular faculty professional development opportunities are available	• WI technical colleges have expanded and sustained capacity to offer short-term manufacturing training programs highly regarded by industry and adult learners/workers • Industry uses college *MtF* programs to upgrade workforce and remain economically competitive

Inputs	Activities	Short Term Outcomes (within 9 months)	Outcomes (3 years)	Long Term Impacts (Beyond the Grant)
- Third-party certifications (e.g. AWS, NIMS)	• Undertake WTCS program modification process for Adult Career Pathways and credentials • Establish paths/articulations within program structures • Determine faculty professional development needs and implement plan	are valued in the labor market • Programs, credentials, paths and articulations mapped and transparent for participant/industry use • Faculty in *MtF ACP Credential Program* participate in professional development activities		
Area of Focus: *Program Enhancements and Support Services*				
- WTCS Existing Educational Programs - WTCS staff - NWTC staff - TAACCCT grant - RISE Adult Career Pathway initiative	• Establish process for assessing prior learning and experience (PLA/CPL) for credit • Determine protocols and timeline for using STM tools and practices in participant assessment process	• PLA practices delivered as part of *MtF ACP Credential Program* services • STM tool and practices delivered as part of *MtF ACP Credential Program* services • Flash cards delivered as part of *MtF ACP*	• PLA becomes accepted practice for *MtF ACP Credential Program* • STM tool and practices utilized for *MtF ACP Credential Program* • Flash cards and on-line learning become accepted practice for *MtF ACP Credential Program*	• WTCS occupational programs provide enhanced services to increasing numbers of for *MtF ACP Credential Program* participants as normal practice.

Inputs	Activities	Short Term Outcomes (within 9 months)	Outcomes (3 years)	Long Term Impacts (Beyond the Grant)
- Existing support services Workforce partners such as WDBs and Job Service - CAEL - STM - Flash Cards	• Establish protocols and timeline for applying on-line technology based instructional tools (i.e., flash cards) • Determine and establish necessary student support services (e.g. financial, case management, academic, mentors, internships)	*Credential Program* services • Support services are delivered as a part of *MtF ACP Credential Program*	• Support services are available for all *MtF ACP Credential Program participants*	
Area of Focus: *Partnerships and Alignment*				
- WTCS Existing Educational Programs - WTCS staff - NWTC staff - TAACCCT grant - RISE Adult Career Pathway initiative	• Engage local employer, industry representatives, and advisory boards to develop and verify value of the MtF manufacturing program and credentials • Develop on-line case management and support services in coordination with local WDBs	• College *MtF ACP credential program* developed with input from local employers and industry representatives • On-line support assistance is available to *MtF ACP Credential Program* participants • Increased awareness of the *MtF ACP Credential*	• WTCS, local colleges, workforce development organizations and employers work more seamlessly together • More public and private resources aligned to support *MtF manufacturing ACP credential programs*	• College educational programs better meet employer workforce and skill needs • Employers and industry groups more systemically involved in local educational and

Inputs	Activities	Short Term Outcomes (within 9 months)	Outcomes (3 years)	Long Term Impacts (Beyond the Grant)
- Local employer and employer groups - Local workforce development boards, and Job Service - College student services - Existing support services	• Develop communication plan for the *MtF ACP Credential Program* to be shared with staff, faculty, students, and partners • Establish cross-college work groups as appropriate around program structure, occupational fields, and/or enhancements	*Program* and clearer understanding of individual roles and responsibilities as a part of the program. • Increased cross-college collaboration around the *MtF ACP Credential Program*		workforce programming • Public and private resources used more effectively and efficiently in preparing participants to earn credentials and meet industry needs.
Area of Focus: *Data and Metrics*				
- WTCS Client Reporting System - WTCS staff - NWTC staff - TAACCCT grant - RISE Adult Career Pathway initiative	• Clarify protocols for determining participants, tracking and reporting program participation, and measuring outcomes • Establish the necessary participant variables for data collection and determine protocols for sharing of participant data	• Colleges track and report participant data to consortium lead, WTCS, and third-party evaluator • Participant goals and outcomes confirmed by college • College data systems adjusted to capture information on *MtF ACP*	• College data systems enhanced to generate participant progress and outcome data as standard operating procedure	• Students, employers and industry have evidence/confidence that *MtF manufacturing ACP credential programs* produce quality students ready for employment.

Inputs	Activities	Short Term Outcomes (within 9 months)	Outcomes (3 years)	Long Term Impacts (Beyond the Grant)
- College Evaluation Liaison (EL) - Third-Party Evaluator	• Verify and solidify participant outcome goals • Adjust college student information system to track program participants and capture student progress • Collect and report data for performance reporting, evaluation and quality improvement • Prepare college data sets for matching with DWD wage records	*Credential Program* participants • Data collected and reported by college in a timely manner • College files submitted in accordance with protocol for data matching		
Goal 2: Recruit, Enroll, and Serve TAA Participants in *Making the Future* Manufacturing Focused Adult Career Pathway Credential Programs				
- WTCS Existing Educational Programs - WTCS staff - NWTC staff - TAACCCT grant	• Clarify eligibility issues and standards for all participants, including financial aid and other public benefits, and their implications for program activities. • Determine processes for determining and	• Participant eligibility, aid and benefits treated similarly across the consortium • *MtF ACP Credential Programs* participants utilize new/modified curriculum, program	**See Appendix G of Proposal:** 1) Participants served 2) Completing 3) Retained	• Highly capable workforce leading to more competitive firms and stronger local economies and communities

Inputs	Activities	Short Term Outcomes (within 9 months)	Outcomes (3 years)	Long Term Impacts (Beyond the Grant)
- RISE Adult Career Pathway initiative - College existing assessment, eligibility and enrollment processes - Workforce organizations - Employers	designating participant TAA eligibility, and/or other workforce/human services program affiliation • Establish assessment and placement protocols for potential participants • College faculty and administrators provide curriculum, supports and enhancements agreed upon in Goal 1 for *MtF ACP Credential Programs* to participants. • Collaborate with workforce and employer partners to recruit participants for *MtF ACP Credential Program*	enhancements, and support services • Participants recruited for *MtF ACP Credential Program* to meet project goals • Assessments applied to *MtF ACP Credential Program* participants, and placements made accordingly • Participants enrolled in *MtF ACP Credential Program,* and designated appropriately to monitor progress and outcomes	4) Earning Credits 5) Earning Credential 6) Further Education Post Completion 7) Employed Post Completion 8) Retained in Employment 9) Gaining Wages Post Completion	

Appendix C: *Making the Future* Implementation Outcomes and Indicators *(Revised March 2014)*

Program Implementation – Core Elements

A. Program Structure: Modification of Manufacturing Credential Programs

Outcome Areas	Indicators
Stacked and Latticed Credentials: *New or modified credentials that can be earned in one term or less, and stack or lattice to longer-term credentials that take one year or more to obtain.*	• Embedded credentials developed and approved by appropriate college committees (local) and/or state agencies (i.e., WTCS) • New credentials developed with input from local employers and/or industry • New credentials stack to subsequent educational courses and credentials • New credentials aligned with local jobs/employment opportunities • Manufacturing programs are formally articulated career pathways, with multiple entry and exit points, industry-recognized credentials, and clear connections to employment
Bridges: *Pre-college or pre-program onramps to manufacturing programs (can be new or pre-existing), targeted to lower-skilled adults who cannot meet placement test thresholds for program entry, or who need additional basic skills competencies*	• Bridges reflect curriculum that is pre-program or pre-college and serve as an onramp to manufacturing programs • Bridges serve as recruitment mechanism and increase the overall number of students in the TAACCCT programs • Bridges include contextualized curriculum and enhanced supports
Enhanced Instructional Supports: *Supplemental academic instruction provided to participants in program courses (college-level)*	• Colleges are providing enhanced instructional supports in the classroom or via a standalone supplemental course, including basic skills support and/or team teaching • Colleges hire additional faculty or staff to deliver instruction and prepare students for success in the program • General education courses in particular such as math and communications or foundational courses like blueprint reading are often targeted
Modified Curriculum: *Pre-college, pre-program or entry-level program courses that use technical content to contextualize basic skills courses or entry-level math, reading, writing or communication courses*	• Faculty identify necessary changes to curriculum that reflect embedded credentials aligned with local employer/industry needs • Occupational curriculum is modified (e.g., contextualized either to entry-level program courses and/or basic skills courses with manufacturing content; and/or aligned with national standards such as NIMS or MSSC) • Employers and/or industry provide input into curriculum modifications (e.g., through existing advisory boards, one-on-one interactions, or enhanced partnerships/steering committees) • New curriculum provides alternative models to learning (self-paced hybrid online and lab work, competency based)

B. Program Enhancements: Supports for TAACCCT Participants

Outcome Areas	Indicators
Enhanced Support Services: *A dedicated function of coaching or "intrusive" advising at the college-level above and beyond existing support services available to students.*	• Colleges provide dedicated coaches or "intrusive" advisors who serve a case manager or navigator function for participants and support them in accessing (mostly non-academic) support services for which they are eligible and that are available from college and/or workforce system programs. • Increased knowledge by college faculty and staff of support services

C. Partnerships and Alignment: Engagement with Stakeholders within and beyond the College

Outcome Areas	Indicators
Employer Engagement: *Incorporation of internships/externships into the programs, or as an intermediate step between one credential and another; or a prioritization for employment for participants.*	• Support and buy-in for TAACCCT program among local employers • Improved and deepened relationships between local employers and colleges (e.g., via existing and/or expanded advisory committees, one-on-one interactions, new partnerships/steering committees) • Created more direct line to employment through internships/externships and/or assigning hiring priority to TAACCCT program participants
Engagement with Workforce Boards/Job Services	• Strengthened connections between local workforce development boards, job centers, and colleges – especially around recruitment and placement of job center clients in manufacturing credential programs • Clear understanding of roles and responsibilities of local workforce boards and job center staff/managers in supporting TAACCCT program implementation (e.g., recruitment and referral of clients to college; facilitating employer/industry/college partnerships)

Contextual Factors Influencing Implementation

Leadership and Commitment	• Common understanding of TAACCCT program goals among college senior administrators, faculty and staff • TAACCCT program tightly aligns with colleges' strategic plan/goals • Recognition of TAACCCT program and its leadership/management across campus but particularly with administrative leadership • Support and buy-in among occupational faculty (and adult basic education instructors as appropriate) for TAACCCT program implementation • Support and buy-in among student services staff for TAACCCT program implementation

	• Improved collaboration or engagement of key community stakeholders including employers and the workforce system around the TAACCCT program. • Clear roles and responsibilities for faculty, support services staff, and administrators around TAACCCT program development and implementation • Clear and appropriate dedicated resources, authority, capacity, and skills to implement the TAACCCT program • Professional development needs of faculty and staff identified, and regular opportunities provided to support TAACCCT program implementation
Formal Feedback Loops/Communications	• Clear protocols are in place for colleges to determine TAACCCT participants, track and report program participation, and measure program outcomes • Adjustments made to college data systems to capture information on TAACCCT program participants, including WIA and TAA client data • Colleges increasingly use data on TAACCCT participants for performance reporting, evaluation, and quality improvement • Feedback loops are in place between key stakeholders and TAACCCT program management to document implementation progress, and to inform program expansion and sustainability • Improved processes for matching college data with DWD employment and earnings data • Common knowledge of key data points and impact of TAACCCT program on participant outcomes across program staff and key stakeholders • Messaging around the TAACCCT program is disseminated through a variety of venues to reach potential participants and inform faculty and staff not directly involved in the grant (e.g., admission offices and workforce job centers) • Formal and informal communication channels are established and utilized by employer, workforce and college partners to learn about the plans and progress of TAACCCT program implementation • Staff and managers of local workforce boards and job centers are increasingly aware of manufacturing program opportunities for TAA and WIA clients
Sustainability	• Identification of new faculty and/or staff needed to scale and sustain modified manufacturing credential program • Revised/expanded formal responsibilities of front-line staff, administrators, and occupational faculty to sustain the TAACCCT program • Identification of new skills and/or materials needed to sustain modified manufacturing credential program • Incorporation of scaling modified manufacturing credential program into college (and WTCS) strategic planning process • Identification of revenue sources to scale and sustain modified manufacturing credential program