Advanced Manufacturing Education (AME) Alliance Evaluation: Final Evaluation Report Grant Number TC-23753-12-60-A-27

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Executive Summary

In September 2012, Central Lakes College (CLC), Pine Technical and Community College (PTCC; formally Pine Technical College), and Saint Cloud Technical and Community College (SCTCC), together with Minnesota's 360º Center for Manufacturing Excellence (360 Center, formerly, 360 Manufacturing and Applied Engineering Center of Excellence), received a grant award through Round 2 of the Trade Adjustment Assistance Community College and Career Training (TAACCCT) program, sponsored by the U.S. Department of Labor (DOL), to form a strategic partnership called the Advanced Manufacturing Education (AME) Alliance to serve the education and training needs of the manufacturing industry in the state of Minnesota. Through this four-year grant, members of the AME Alliance collaborated to provide specialized postsecondary education to trade-impacted and other dislocated workers, the long-term unemployed, veterans, and other adults who seek employment in the manufacturing industry. The DOL AME project is an important and necessary step forward for geographic areas affected by widespread, significant job loss.

Using TAACCCT grant funding, the AME Alliance served a total of 2,163 participants across Minnesota's northeast region in gaining the skills and knowledge needed to be successful in the field of manufacturing, especially in the areas of automation/robotics, plastic technology, precision manufacturing, and prototyping and reverse engineering industries. The demographics of AME participants were primarily Caucasian (85%) and male (83%). About 35% were enrolled full-time; 75% were employed upon enrollment; 8% were veterans or veterans' spouses; 2% reported having a disability; 15% were eligible for Pell grant funding; and 2% were workers eligible for trade adjustment assistance (TAA). The ultimate goal of the DOL AME grant was to provide education, training, and services to ensure participant success in education and employment. This report presents findings of the DOL AME project's implementation and its impact on participants.

A brief description of the project's evaluation design is provided, followed by a summary of implementation findings and impact/outcome findings. Conclusions and recommendations are also provided for future research and evaluation efforts.

Evaluation Design Summary

This section provides a brief overview of the conceptual framework and evaluation design, including the formative and summative evaluation components.

Conceptual Framework

The DOL AME project's design was guided by the career pathways framework of postsecondary education to address the challenge of preparing adult learners (age 18 or older) to complete their program of study and secure high-skilled and high-paid jobs in the field of manufacturing. Specifically, the AME Alliance implemented five key strategies to support the grant objectives:

- Strategy 1. Provide a technology-enriched environment
- Strategy 2. Develop and integrate a hybridized and modularized curriculum
- Strategy 3. Facilitate comprehensive and continuous student support for persistence and engagement
- Strategy 4. Conduct marketing activities and program outreach
- Strategy 5. Collaborate with employer and workforce partners

It was hypothesized that, with enhanced curricula incorporating technology components, intensive and individualized wraparound student support services, active outreach and marketing, and collaborative partnerships with local partners, the AME Alliance would be able to provide the training, education, and services needed to support students' educational success (i.e., prevent withdrawals and support program completion) and employment successes (i.e., gain employment, be retained in employment, and receive wage gains).

Evaluation Design

The DOL AME evaluation contained a formative evaluation component examining the extent to which the project was implemented as intended as well as a summative evaluation component assessing the outcomes and impact of the DOL AME project on participants.

Formative Evaluation Questions and Design. Four overarching formative evaluation questions guided by the TAACCCT Round 2 Solicitation for Grant Applications (SGA) are described below:

1. How were the key strategies and activities of the DOL AME project implemented?
2. To what extent were the key DOL AME project strategies and activities implemented as planned?
3. What changes were made to the program of study during implementation and for what reasons?
4. To what extent is the DOL AME project sustainable and transferable?

Specifically, the formative evaluation (1) analyzed the steps taken by the AME Alliance to create and implement the DOL AME project (Question 1); (2) assessed the operational strengths and weaknesses of the project (Questions 2 and 3); and (3) examined the sustainability of the project beyond the life of the grant (Question 4).

The focus of the formative evaluation was to document the implementation of the DOL AME project components to ensure that all of the key elements were being implemented as planned, and to ascertain whether the components are sustainable and transferable (replicable) beyond the life of the grant. To answer these questions, evaluators conducted mixed methods to gather both qualitative and quantitative data from various groups and sources (e.g., project records,

interviews, surveys, and focus groups), and then triangulating the findings. Additionally, fidelity assessments were conducted four times throughout the performance period to understand the extent to which the project components were being implemented with fidelity in terms of adherence, quality, and participant responsiveness (Century, Rudnick, & Freeman, 2010).

Summative Evaluation Questions and Design. To understand the project's impact and outcomes, three summative questions were investigated:

1. To what extent does the DOL AME project achieve project outcomes (i.e., TAACCCT outcome measures)?
2. To what extent has the DOL AME project changed participants' perceptions related to persistence factors that may further support participant outcomes?
3. How does the DOL AME project work to support participant outcomes?

These summative questions aimed to understand the impact of the DOL AME project on grant participants and identify the underlying mechanisms that have exerted their influence on participant outcomes in education, employment, and wage outcomes. To address the first question related to the DOL AME outcomes, evaluators descriptively described participants' outcomes on the following nine indicators and compared the outcomes against the projected targets:

1. Total unique participants served
2. Total Number Who Have Completed a Grant-Funded Program of Study
3. Total Number Still Retained in Their Program of Study or Other Grant-Funded Program(s)
4. Total Number of Students Completing Credit Hours
5. Total Number of Students Earning Credentials, Diplomas, and Degrees
6. Total Number Enrolled in Further Education After Program of Study Completion
7. Total Number Employed After Program of Study Completion
8. Total Number Retained in Employment After Program of Study Completion
9. Total Number of Those Employed at Enrollment Who Received a Wage Increase Post-Enrollment

To understand the project's impact, evaluators conducted a quasi-experimental design using propensity score matching (PSM) methods to identify a group of matched comparisons from historical cohorts (i.e., individuals who were in AME-like programs before the grant started in the fall of 2012). For this part of the analysis, a subgroup of AME participants, specifically individuals who were enrolled in the fall of 2014 when most of the project components were in place (i.e., close to full implementation), were included (n = 180), as well as the same number of matched comparisons who were identified using PSM. Data sources to address the impact and outcome questions included extant data collected by AME project staff and the Department of Employment

and Economic Development (DEED) in Minnesota, including participants' demographic information, course records, credential and degree records, and employment and wage data.

To address the second question, evaluators conducted a pre- and post-test design study to understand the extent to which the factors associated with persistence changed from enrollment to program completion. Three persistence factors in particular were examined: (1) academic integration, (2) advising effectiveness, and (3) career integration. The reliabilities of the measures of these persistence factors were acceptable, ranging from 0.65 to 0.85. Data sources to address this question included responses from student entrance surveys and student exit surveys.

Lastly, the third question focused on ascertaining the underlying mechanisms through which the DOL AME project has effected participant outcomes. It was hypothesized that through enhanced curricula and wraparound student support services that the DOL AME project may effect participant outcomes through an increase in their sense of career integration. The enhanced curricula was measured by two constructs: academic integration and advising effectiveness. Wraparound student support services was also measured by two constructs: social-emotional support and academic support. The reliability of the measures of academic integration, advising effectiveness, social-emotional support, academic support, and career integration was 0.81, 0.69, 0.88, 0.96, and 0.71, respectively. The outcomes of interest for this question included program completion status and grade point average (GPA). Given that the proposed hypothetical model was a mediation model, four steps of regression analyses of mediation test suggested by Baron and Kenny (1986) were performed. Data sources to examine this question included extant data (i.e., participants' demographic information, course records, credential and degree records, and employment and wage data) as well as student exit survey data. Specifically, using the sample included in the impact study, 64 participants who responded to the student exit survey were also included in this study.

Implementation Findings

Findings of steps taken by the AME Alliance to create and implement the DOL AME project are first summarized (formative question 1), followed by a discussion of the operational strengths and weaknesses of the project (formative questions 2 and 3) and evidence of its sustainability (formative question 4).

DOL AME Implementation

After triangulating all of the data collected throughout the performance period, findings suggest that all five key strategies were largely implemented across the consortium. The findings of each strategy are briefly summarized below.

Technology-Enriched Environment. Ensuring that a technology-enriched environment is in place and that faculty are adequately trained to use the tools are key strategies associated with the technological infrastructure priority of the grant. Using TAACCCT grant funding, the AME Alliance purchased state-of-the-art equipment currently being utilized by the manufacturing

industry so that participants are ready to work when they complete their programs of study. Additionally, to increase accessibility and flexibility of the training program for incumbent workers, the AME Alliance purchased and integrated mediated telepresence (MT) technology with customized training (CT), which allows participants to take courses at their employer's site. Both the employers and CT/MT participants indicated that this feature was one of the main attractions for their involvement and participation in the grant. To enhance participants' hands-on experience, the consortium also invested resources on developing simulation courses; yet, the development and implementation of these courses were delayed and incomplete. Specifically, by the end of grant Year 3, instead of developing the six simulation courses proposed in the project narratives, two were developed and became available for the consortium as well as other colleges within the Minnesota State Colleges and Universities System. The delay in this work was primarily due to staff turnover and because the time needed to develop simulation courses was much more than anticipated. At the end of grant Year 3, the AME Alliance's leadership team made an executive decision to stop the simulation work and invest the time and resources on implementing the CT/MT components given its great success in attracting industry partners and participants.

Hybridized and Modularized Curricula. The main purpose of developing and offering hybridized and modularized curricula is to accelerate student learning. Using TAACCCT grant funding, the AME Alliance developed and offered four hybridized courses and five modularized courses to grant participants. MT technology was also integrated in the delivery of these courses to enhance students' learning experiences. In terms of curriculum development in general, the AME Alliance rolled out 23 certificate programs, 25 diploma programs, and 16 degree programs across the consortium within four program tracks: (1) automation/robotics technology; (2) plastic technology; (3) precision manufacturing; and (4) prototyping and reverse engineering. Developing the program curricula was a collaborative effort among project staff, instructors, and industry partners to fill the training gap needs of the local industry and workforce.

Comprehensive and Continuous Student Support Services. A total of six educational and employment (E&E) advisors (two at CLC, three at SCTCC, 1 at PTCC) were hired by the grant to deliver individualized and comprehensive wraparound student support services. The E&E advisors' primary roles and responsibilities were to provide individualized, continuous, and comprehensive services (e.g., counseling, advising, job searches, and job placement services) to grant participants. As soon as participants enrolled, they were assigned an E&E advisor who worked with them individually and continuously throughout the course of their training program. In addition to providing academic support, E&E advisors also served as service coordinators, helping students navigate the school system and referring them to appropriate services to ensure they have the resources and support needed to be retained in and complete their program of study, and ultimately gaining employment. According to the E&E advisors' service logs, each participant had an average of 3.75 meetings with their E&E advisor; and the E&E advisors, on average, completed 7.66 contacts or outreach activities with each participant. Additionally, one of the E&E advisors' job responsibilities is to establish an individualized learning plan (ILP) with each participant during enrollment. As a result of their outreach efforts, 95% (1,760 out of 1,850) of the grant participants

who were enrolled during the first three years of the grant had an ILP on file.[1] The E&E advisors also played a key role in increasing participants' awareness of processes and procedures for obtaining credits for prior learning (CPL) and military occupational specialties (MOS) credits. According to project records, there were 100 participants who received CPL (a total of 887 credits were awarded; Min. = 1; Max. = 44) and five participants received MOS credits (a total of 27 credits were awarded; Min. = 2; Max. = 13).

Marketing and Outreach. To recruit participants and disseminate project information, the AME Alliance established a website providing general information about the available grant programs (http://www.amealliance.org). The website was first launched in September 2013, and was revamped in grant Year 3 to ensure easy navigation and attract potential partners and participants. Each college was engaged in regularly disseminating the project's marketing collateral to local business partners and prospective participants. At consortium level, a marketing director was hired during grant Year 2 to alleviate the responsibilities from the lead college. However, this individual left the grant within a year; hence, an external marketing firm was hired to support the DOL AME project's outreach efforts. On the CT/MT side, CT representatives were hired and served as a key outreach mechanism for the AME Alliance by coordinating with local businesses to offer training for employees, identifying the training needs within the local industry, and reaching out to potential partners about the opportunities available through the DOL AME project.

Partnerships. When the DOL AME project was first funded, it had 18 partners on board. Over the course of the grant period, the number of partnerships grew to a total of 154 by the end of the performance period. The impressive growth of partnerships was partially contributed to the implementation of CT courses at industry partner sites. Generally speaking, the partnerships contributed to the grant in a number of ways, including curriculum development; participant recruitment (i.e., providing space for their employees to participate in advanced manufacturing courses delivered through the MT equipment); leveraging of resources (the project received a total of $2,237,754.12 in partner donations in terms of time, materials, and resources over the course of the grant period); and sustainability planning. The AME Alliance maintained regular formal (i.e., an advisory group meeting on a quarterly basis and consortium-level newsletter) and informal communication with the project partners to support continuous involvement.

Implementation Fidelity

As mentioned, three aspects of project implementation were examined: (1) adherence, (2) quality, and (3) participant responsiveness. A close examination of the DOL AME project's implementation structures and processes revealed that its strategies were largely implemented as planned with some minor modifications. Findings from each aspect of the project's implementation are summarized below, followed by a summary of modifications.

Adherence. Fifteen indicators were identified from the Project Work Plan as the basis for determining the extent to which the project activities were implemented as planned (adherence).

[1] All implementation data collection activities concluded at the end of the grant Year 3; hence, for participants who were enrolled in grant Year 4, data about their ILP were not collected.

Findings revealed that the project was at the 97th percentile in terms of full implementation by the end of grant Year 3, an overall 40-percentage-point increase since fall 2013 (beginning of grant Year 2). Across all five project strategies, three have been fully implemented: Strategy 2 (Develop and integrate a hybridized and modularized curricula); Strategy 4 (Conduct marketing activities and program outreach); and Strategy 5 (Collaborate with employer and workforce partners). The project was three percentage points shy from full implementation primarily due to two reasons. First, under Strategy 1 (Provide a technology-enriched environment), project leaders decided to not continue the simulation development work due to staff turnover and limited time available. Instead, AME project leaders focused their limited resources on developing and promoting the CT/MT courses and student support services. Secondly, under Strategy 3 (Facilitate comprehensive and continuous student support for persistence and engagement), 95% of the AME participants had an ILP on file, which was five percentage points shy from the target value of 100%.

Quality. McREL evaluators identified 30 quality indicators from the student exit survey (20 indicators) and partner survey (10 indicators) to assess the quality of project implementation on an annual basis. Based on the survey data, two index scores were calculated to present students' and partners' overall perceptions of implementation quality. Overall, from the student perspective, the DOL AME project strategies were implemented with a high degree of quality with the index score percentages being 85%, 94%, and 89% in Years 1, 2, and 3, respectively. Although, there were some variations in terms of quality across different strategies. Specifically, the quality ratings were higher in the area of hybridized and modularized curricula (Strategy 2) and wraparound student support services (Strategy 3); while the ratings were somewhat lower in the areas of technology-enriched environment (Strategy 1) and partner involvement (Strategy 5). The lower ratings regarding the technology-enriched environment may be partially because MT technology plays a greater role for CT/MT students as opposed to traditional students who were the respondents to the survey questions. Regarding participants' perception of partner involvement, the lower ratings may be because the main focus of the DOL AME grant is to actively engage partners at the program implementation level rather than at the participant level.

From the partner perspective, the quality of implementation of the DOL AME project is acceptable, with the overall quality index score percentile being 70%, 65%, and 78% in Years 1, 2, and 3, respectively. Although, variations were observed across the different strategy areas. Specifically, partners perceived the quality to be acceptable in all areas, except the wraparound student support services (Strategy 3). These lower ratings may be attributed to the partners having minimal direct involvement in that aspect of project implementation other than some contact with students through experiential and job placement services (e.g., mock interviews, factory visits, campus visit, job shadowing, and internships).

Participant Responsiveness. Evaluators identified six participant responsiveness indicators from the student exit survey and seven indicators from the partner survey to assess participants' and partners' responses (i.e., satisfaction and enthusiasm) toward the DOL AME project's implementation on an annual basis. Based on the survey data, two index scores were calculated to present students' and partners' responses to implementation. The overall participant responsiveness index score percentile from students was 92%, 100%, and 92% in Years 1, 2, and 3, respectively.

The ratings were especially higher in the areas of hybridized and modularized curricula (Strategy 2) and wraparound student support services (Strategy 3). While the ratings in the area of partner involvement (Strategy 5) is slightly lower comparatively, the overall ratings, especially about their experiences with experiential learning opportunities, were acceptable. From the partner perspective, only one area was assessed – partner involvement (Strategy 5) – and results show that the partners were generally satisfied with the DOL AME project's implementation in the area of partner involvement and collaboration. The overall participant responsiveness index score percentiles from the partners' perspectives was 86%, 79%, and 93%, respectively, in Years 1, 2, and 3.

Taken together, the primary strength of the project in terms of implementation was that the project largely adhered to its original plan and also implemented the elements and activities with a high level of quality, especially in the area of curriculum design (Strategy 2) and wraparound student support services (Strategy 3). These efforts led to continuous engagement and satisfaction from both partners and participants. Comparatively, the project seemed to be a little weaker in the area of technology-enriched environment (Strategy 1) and partner engagement (Strategy 5); yet, the overall ratings in terms of quality and participant responsiveness were still high and acceptable.

Modifications. Several modifications to the Project Work Plan have been made throughout the performance period in order to support the DOL AME project objectives and goals. For instance, instead of creating six interactive simulation courses as proposed, the project was able to develop two courses and rolled out one by the end of grant Year 3. Additionally, to ensure that the project is offering courses and training that meets industry needs, there were some modifications made during the initial stages of project development regarding what programs of study would be implemented and/or emphasized and which colleges would house them. The most significant adjustment of all is the AME Alliance's program outreach and marketing strategy. Specifically, the consortium decided to use an outside marketing firm instead of employing a marketing director to guide the consortium's efforts. This modification has significantly alleviated much of the pressures and complications that the consortium had been experiencing. Taken together, all of the modifications and adjustments were aligned with the DOL AME project's goals and objectives to facilitate the success of project implementation.

Sustainability

To determine a project's sustainability, it is essential to assess the organizational capacity supporting the project beyond the life of the grant. From project staff members' perspective, the DOL AME grant has increased the organizational capacity of the AME Alliance in many ways, including (1) human capacity (i.e., knowledge, expertise, and understanding, as well as the will and commitment, of personnel charged with implementing the targeted change), (2) institutional capacity (i.e., the interaction, collaboration, and communication among members of the organization), (3) structural capacity (i.e., the elements of the organization that exist independently of the individuals who work within the system, such as policies, procedures, and practices), and (4) material capacity (i.e., the fiscal resources, materials, and equipment that the organization uses to meet its needs and to implement targeted change). Yet to sustain the grant components, the AME Alliance leadership team also recognized the importance of generating financial support. Given the success

of the MT model,[2] the AME Alliance invested in a market research and business model development study to determine the feasibility, price sensitivity, and topics of interest to employers as a continuation of the MT model. The AME Alliance also developed a marketing and sustainability plan as a result of the study. Generally speaking, the plan was to work with a professional marketing firm and businesses across the state to inform the design and development of new business models to deliver manufacturing education for incumbent workers as well as traditional academic programs. During grant Year 4, part of the sustainability plan was implemented. For instance, a MT E&E advisor was hired by a Round 4 TAACCCT grant to continue advising services as the CT/MT model moves statewide. Furthermore, the consortium's lead institution developed a plan to incorporate the MT model with traditional academic programs to provide students with greater flexibility that aligns with their different learning styles and schedules. These plans, actions, and continuous conversations between the colleges and partners suggest that the CT/MT model in coordination with the wraparound student support services and partner engagement components are likely to continue and expand beyond the life of the grant. An overview of the CT/MT model is described in the table below.

CT/MT Model: An Innovative New Technology-Enabled Learning Platform for Incumbent Workers
The AME grant developed an innovative new technology-enabled learning platform, so called CT/MT model, to cater to incumbent workers and those in rural areas that have difficulty traveling long distances to attend classes. CT/MT model incorporates mediated telepresence technology in the credit-bearing customized training courses that allow workers to not only advance their skills while working on their jobs, but also earn credits that can further lead to industry recognized credentials or college awarded certificates, diplomas, or degrees. The model provides courses that can be taken a la carte or in sequence to earn two short term certificates in entry-level manufacturing disciplines. For instance, an eight credit Manufacturing Foundations Certificate that is aligned with the industry-recognized Manufacturing Skill Standards Council (MSSC) Certified Production Technologist credential was offered under the model; and a16 credit Production Technologies Certificate that adds four additional courses onto the Manufacturing Foundations Certificate is offered to provide more depth in manufacturing topics. Both certificates stack into a pathway of academic certifications that include diplomas, an AAS, and a BAS degree. The CT/MT model is a step forward for the manufacturing industry as it provides the opportunities for small companies that often face challenges to offer traditional type of customized training for their workers. As part of the CT/MT model, AME modified existing manufacturing curriculum that was designed to be fully delivered online to a hybrid model. These courses were offered to incumbent workers and clients of the workforce centers in 8-week sessions. Students connected live via the internet once per week with their instructor and classmates. The rest of the time was spent on self-study to further develop and learn concepts in each course.

[2] The AME Alliance's MT model was nominated for and won several regional and national awards (e.g., the Minnesota Council for Continuing Education and Customized Training 2015 Exemplary Program Award and the National Council for Continuing Education and Customized Training Exemplary Program Award in 2015).

CT/MT Model: An Innovative New Technology-Enabled Learning Platform for Incumbent Workers

During the AME grant, the mediated telepresence model served over 1,000 unique individuals from nearly 100 companies and workforce partners, including the Minnesota Department of Corrections.

The AME Alliance's CT/MT model won recognition both within Minnesota and nationally. As the AME grant comes to a close, the model is being expanded across the entire state of Minnesota in manufacturing. The model is also being explored by other industry areas for expansion. The sustainability of the CT/MT model was driven by employer partners that wanted to keep the ability to upskill their workforce while minimizing the time employees spend off the manufacturing line. Many companies used the CT/MT training as an internal leadership development program. Some companies used it as a platform to standardize knowledge and create conversations, particularly around qualify improvement, so that all employees could participate in quality improvement projects at any level of the organization.

The list of CT/MT courses offered through the AME grant is provided below:

- CMAE 1510 Print Reading
- CMAE 1514 Safety Awareness
- CMAE 1518 Manufacturing Processes & Production
- CMAE 1526 Maintenance Awareness
- CMAE 1506 Introduction to Computers
- CMAE 1522 Quality Practices
- CMAE 1528 Career Success Skills
- CMAE 1502 Technical Math
- CMAE 1560 Interpreting Symbols
- ETEC 1550 Introduction to Robotics

Participant Impacts and Outcomes

This section presents findings of the impact and outcome evaluation. The project outcome findings, including the nine outcomes articulated in the SGA, are discussed first, followed by the discussion of impact evaluation findings.

Project Outcomes

The overall project outcomes are presented in table below.

	Outcome Measures	*DOL AME Outcomes*	*Performance Targets*
1	Total unique participants served	2,163	3,903
2	Total number of participants who have completed a TAACCCT-funded program	754	3,518
3	Total number of participants still retained in their program of study or another TAACCCT-funded program	683	1,141
4	Total number of participants completing credit hours	1,944	1,483
5	Total number of participants earning credentials	886	1,690
6	Total number of participants enrolled in further education after grant-funded program of study completion	266	1,949
7	Total number of participants employed after grant-funded program of study completion	114	827
8	Total number of participants retained in employment after program of study completion	85	827
9	Number of participants employed at enrollment who received a wage increase post-enrollment	1,163	1,945

To compare the DOL AME's outcomes with the performance targets, percentages were calculated to put the numbers into perspective. Below is a list of the indicators that met the performance targets:

- **Outcome Indicator #3:** 32% (683 out of 2,163) of the participants were still retained in their program of study or were enrolled in other TAACCCT-funded programs in comparison to the target of 29% (1,141 out of 3,903) by the end of the grant.
- **Outcome Indicator #4:** 89% (1,927 out of 2,163) of the participants earned credits, ranging from one to 89 credits, in comparison to the target of 38% (1,493 out of 3,903).
- **Outcome Indicator #9:** 54% (1,163 out of 2,163) of the participants received wage increases after becoming enrolled in a TAACCCT-funded program of study in comparison to the target of 50% (1,945 out of 3,903). Yet, it should be noted that the more accurate estimation for this indicator should use the number of incumbent workers upon enrollment as the denominator, which would result in 72% (1,163 out of 1,619) of the incumbent workers receiving wage increases. There is no information available about the number of projected incumbent workers in the project narrative; therefore,

McREL evaluators are unable to compare the performance target with the actual outcomes with the more accurate estimation.

Below is the list of indicators that did not meet the performance targets:

- **Outcome Indicator #2:** 35% (754 out of 2,163) of the participants completed a grant-funded program of study as compared to the target of 90% (3,518 out of 3,903) by the end of the grant. The low number of program completers can be explained by two factors. First, the total number of completers (Indicator #2) and the total number of participants retained (Indicator #3) should not be more than the total number of participants recruited (Indicator #1). Based on the projected number, this rule was obviously violated. As such, the project might have overestimated the performance target for this indicator as well as Indicator #3 (number of participants retained). Second, the majority of participants (54%) were CT/MT students whose intentions are often to gain skills and knowledge on certain subject matter in a short amount of time. These students regularly enrolled in CT/MT courses that were likely to lead to industry-recognized credentials, but may not have led to college-awarded credentials, diplomas, or degrees without additional advanced courses.
- **Outcome Indicator #5:** 41% (886 out of 2,163) of the participants earned at least one industry-recognized credential or college-awarded certificate, diploma, or degree, which was three percentage points lower than the target of 43% (1,690 out of 3,903). Of those, 69% (607 out of 886) earned one or more certificates (including industry-recognized credentials); 37% (325 out of 886) earned one or more diplomas; and 20% (176 out of 886) earned one or more associate of applied science (AAS) degrees. In total, 32% (286 out of 886) earned two or more certificates (including industry-recognized credentials), diplomas, or degrees.
- **Outcome Indicator #6:** 27% (206 out of 754) of the program completers enrolled in further education (TAACCCT grant funded or not) as compared to the target of 55% (1,949 out of 3,518). The low number of program completers enrolling in further education can be explained by three factors. First, the AME Alliance relied on the StudentTracker data provided by the National Student Clearinghouse (NSC) to track students' enrollment status in further education after exiting the AME program. Not all postsecondary education institutions are the members of the NSC; hence, some students who were enrolled in the institutions that did not provide data to the NSC may be missed. Second, per DOL guidelines, participants who entered in employment cannot be counted again if they also entered in further education. As a result, 50 participants who were both employed and entered in further education after program exit were not counted. Third, the employment market in the AME targeted careers had become stronger during the grant, so program completers were more likely to find a job and less likely to continue their education right after program completion.
- **Outcome Indicator #7:** 15% (114 out of 754) of the program completers gained employment during the first quarter after exiting their program of study in comparison to the target of 24% (827 out of 3,518). It should be noted that this outcome may be

underestimated given the time lag between when the employment and wage data is shared with McREL evaluators for analysis and when the report is completed. In fact, 276 program completers finished their program of study between the second and fourth quarter of grant Year 4. Employment information for this group was not yet available when this report was prepared.

- **Outcome Indicator #8:** 75% (85 out of 114) of the participants who gained employment were retained as compared to the target of 100% (827 out of 827). As discussed in Indicator #7, this outcome is underestimated given the fact that the data needed for this outcome were not available when this report was prepared.

Project Impacts

Three separate studies were conducted to examine the effect of the DOL AME project on participants. Findings from each of these studies are summarized below.

Project Impact on Education and Employment Outcomes. A quasi-experimental design using PSM was performed to understand the extent to which the project has impacted participant outcomes. The outcomes of interest include program completion status, withdrawal status, GAP score, employment status, and wage increases. Results show that participants were more likely to complete a program of study; participants did perform better in their classes, as measured by grade point average (GPA) scores; and were less likely to withdraw from the program as compared to comparisons. Yet, participants and comparisons did not differ in terms of employment status or wage increases.

Project Effect on Persistence Factors. A pre- and post-test design was conducted to understand the extent to which the DOL AME project may have increased or changed the factors associated with persistence. As previously mentioned, three persistence factors were examined: (1) academic integration, (2) advising effectiveness, and (3) career integration. Findings show that participants' perceptions of factors related to persistence were pretty stable from enrollment to program exit. Further examination of the study sample revealed that the majority of the sample (92%) were program completers. These null findings may be because this sample was overrepresented by a group of individuals who had more positive experiences with the program since enrollment. Hence, interpretation of the findings should be made with caution.

Career Integration as a Mediator. A mediation model was examined to investigate the underlying mechanisms through which the DOL AME project may exert its influence on participant outcomes, particularly participants' program completion status, GPA score, and gain employment in the manufacturing fields. It was hypothesized that the DOL AME project may have an effect on participants' educational outcomes through its enhanced curricula and wraparound student support services by increasing participants' sense of career integration. Four steps suggested by Baron and Kenny (1986) were performed to test the mediation effect. Results indicated that there was no evidence to suggest that career integration is a mediator linking the DOL AME project's effects on participants' educational outcomes as measured by completion status, GPA, and employment status in the AME field. There are three possible explanations for the null findings. First, this study is

underpowered. As a result of data cleaning and merging, only 64 individuals were included in this study. Second, while the reliability of career integration is acceptable (Cronbach's alpha = 0.71), it is unclear if this scale measures what it intends to measure (i.e., validity). With limited resources, evaluators were unable to establish the validity of the scale; as such, further research is encouraged to investigate what constitutes career integration and validates the scale.

Conclusions

The DOL AME project was not implemented without challenges; yet, the consortium worked as a unit to identify issues, streamline resources, and establish procedures to overcome the barriers as issues arose. The efforts put forth by the AME Alliance paid-off as evidenced by the findings of the fidelity assessment – project strategies were largely implemented as planned; participants and partners shared the perception that the project strategies were implemented with quality; and participants and partners were satisfied with the project's implementation and felt engaged. The DOL AME project's implementation successes translated into some aspects of the project outcomes. First, while the consortium did not meet the target recruitment number, it served a total of 2,163 individuals in four years across three institutions, which is an achievement by itself. When looking at the performance targets, although the project did not meet the targets on five outcomes, the shortcomings were primarily due to the limitation of data availability when the report was prepared as well as the overestimation of projected numbers when the proposal was written.

Impact study findings also provided some evidence to support the effectiveness of the DOL AME grant. Specifically, the project made a difference on three participant outcomes: (1) participants were more likely to complete a program of study than their comparisons; (2) participants were less likely to withdraw than their comparisons; and (2) participants had better learning outcomes, as measured by their GPA, than did comparisons. While evaluators were unable to find positive effects on other aspects (i.e., supporting persistence factors, or supporting the mediation effect of career integration), the null findings were partially due to data limitations (i.e., a biased sample as a result of data merging; underpowered). In fact, although there is no statistical evidence to explain how the DOL AME project works to support participant success, anecdotes collected from participants through focus groups reveal some promising features of the DOL AME project. During the focus groups, participants were asked about what has been the most valuable aspects of the DOL AME project. Students indicated that having high-quality instructors and being able to complete coursework in a hands-on, technologically advanced learning environment were the most valuable aspects of their programs of study. Furthermore, although evaluators did not find the associations between E&E advising services and participant outcomes, project staff attributed the positive impact of the program (i.e., participants were more likely to complete a program; were less likely to withdraw; and had higher GPA scores as compared to their counterparts) to the E&E advising model. In fact, one of the college created a new position within the college to continue offering E&E advising services for students in the CT/MT courses. More studies are encouraged to further investigate these areas.

Key challenges that McREL evaluators experienced when conducting the implementation and impact evaluation of the DOL AME grant are summarized below:

- **Low survey response rates from participants and partners when conducting online surveys.** Despite efforts to try various methods to secure higher response rates (e.g., shortening the survey, using both paper and online formats, and having E&E advisors go to the classrooms to distribute the surveys), response rates tended to be low. One potential barrier to securing a higher response rate was not being allowed to use incentives.
- **Projected outcomes that were included in the grant application were frequently unrealistic.** This appears to be primarily due to a lack of understanding about the definitions of the indicators when grantees prepared their proposals and those with familiarity or knowledge of realistic targets were not involved in the grant-writing process. The SGA provided some initial descriptions of the outcome indicators, but greater detail provided in future SGAs may result in more realistic projections. Recruitment also became an issue as a result of the upturn in the economy.
- **Lack of a clear understanding about acceptable data sources for the outcome evaluation.** More recently (June 2016), it was made known that other data sources (e.g., surveys and self-reports) were permissible for reporting on the outcome indicators. It would be helpful to have this information in future SGAs so evaluators can plan accordingly to ensure that all required data for reporting are collected using the most rigorous and appropriate approach.
- **Unable to secure individual-level employment and wage data limited evaluators' ability to conduct a more comprehensive evaluation of the project's impact.** Due to limitations of the data sharing agreement, DEED was only able to provide aggregated employment and wage data for the project. As such, the AME Alliance and McREL evaluators worked out a plan with DEED to perform PSM for the impact study, especially on the employment and wage outcomes, and provide the aggregated results for the project. This was a major success for the DOL AME project's impact evaluation; yet, given this limitation, evaluators were unable to further examine the potential mediation effect of career integration on employment and wage outcomes.
- **Understand the limitation of unemployment insurance (UI) data.** While it is cost effective to use employment and wage data collected from the workforce agency (i.e., DEED), it is important to understand the potential data limitations. First, as discussed earlier, too often individual-level data are not accessible for evaluation purposes. Secondly, certain types of workers are not tracked in the UI database, including proprietors, the self-employed, railroad workers (they have their own national system of UI), family farm workers, full-time students working for their school, elected government officials, insurance and real estate salespersons, migrants who move out of the state after program completion, and others who work only on a commission basis. Although, in general, DEED's UI program covers 97% of employment and wage data in Minnesota. It should also be noted that, despite the limitations, UI wage data is still the most comprehensive source of employment and wage data for evaluating workforce,

education, or economic development programs. More information about DEED UI data is available at http://www.uimn.org/employers/wages-taxes/covered/.

Key successes that project staff experienced are summarized below.

- **Collaborate with industry partner is essential to the success of the grant.** Project staff shared that collaboration with industry partners is an essential key to make the grant successful, especially partners' involvement in curriculum development and recruitment efforts. According to project staff, CT/MT model (credit-baring customized training with wrap-around student support) is a new concept in the manufacturing field. AME Alliance spent a lot of time communicating and selling the idea internally with institutional leaders and externally with partners who were initially skeptical about the model. These efforts eventually paid-off as employers started seeing the value of the CT/MT model and what it can do for their companies. Additionally, CT/MT model became the most sustainable component of the AME grant, and the sustainability planning was centered around the CT/MT components.
- **Program curricula have been greatly enhanced as a result of the grant.** Project staff expressed their appreciation for the opportunities that the DOL AME project has given to their institutions to enhance their curricula in the manufacturing field. A project staff shared, "without the grant, we would have never been able to advance our technology components and integrate them in the curricula, not for at least another few years. We have seen how this grant has impacted students and industry partners."

Key successes that McREL evaluators experienced while evaluating the DOL AME project are summarized below.

- **Establish a clear understanding about project staff members' evaluation roles.** A kick-off evaluation meeting with project staff was valuable. It was beneficial for articulating expectations to the DOL AME project's stakeholders, establishing a common understanding of the evaluation, and helping the stakeholders understand the evaluation's value and purpose. Additionally, it was helpful to identify and train staff who will be responsible for assisting with evaluation data collection efforts. This process helped to ensure the quality of data obtained, aptness of project staff to use the evaluation findings, and the overall commitment to support the evaluation.
- **Develop a data tracking system.** With a consortium evaluation, developing a data tracking system is essential to ensure consistent data collection across the participating colleges. Hosting webinars (and archiving for later reference) establishes a common understanding of the data points and definitions.
- **Peer learning is valuable.** As an organization that is evaluating more than one TAACCCT grant, it has been advantageous to build upon economies of scale. Internally, McREL evaluators have learned from each other's projects and used common evaluation methods and scales. It would have been valuable to have all TAACCCT grant evaluators convene for at least one national meeting as proposed in the SGA. These

types of meetings would have built a community of learners that would have permitted each of us to share what was learned with the evaluations, discuss instruments and processes, as well as facilitate networking with one another.

Given the challenges McREL evaluators faced related to the limitation of data availability, several suggestions are provided for future workforce and education research initiatives:

- Explore participants' sense of career integration in career and technical education; along this line, there is a need to develop and establish reliability and validity of the measure.
- Consider funding longitudinal studies to track a sample of participants to examine long-term outcomes and likewise study sustainability of TAACCCT-funded programs at a sample of colleges.
- Include workforce agencies who can supply the UI data in the research and evaluation team as they have access to individual-level employment and wage data and can perform or assist with the analyses needed to address the questions of interest in the field of workforce development and career and technical education.

Chapter 1: Introduction and Overview

In September 2012, Central Lakes College (CLC), Pine Technical and Community College (PTCC; formally Pine Technical College), and Saint Cloud Technical and Community College (SCTCC), together with Minnesota's 360 Manufacturing and Applied Engineering Center of Excellence (360 Center), received a four-year grant award through Round 2 of the Trade Adjustment Assistance Community College and Career Training (TAACCCT) program, sponsored by the U.S. Department of Labor (DOL), to form a strategic partnership called the Advanced Manufacturing Education (AME) Alliance to serve the education and training needs of the manufacturing industry in the state of Minnesota. This chapter first provides an overview of the DOL AME project, followed by a brief description of the evaluation questions and designs.

Overview of the DOL AME Project

In the state of Minnesota, more than 8,700 manufacturing workers have either lost their jobs or have been threatened by job loss since 2007. For many of these unemployed manufacturing workers, particularly those with limited skill sets or no formal training, the options are bleak. Changes in the U.S. labor market due to factors such as technological innovation and globalization require a better-prepared workforce equipped for success in an evolving industrial landscape (Carnevale, Smith, & Strohl, 2010). As the demand for personnel with higher education and skill levels continues to grow, individuals frequently need some form of postsecondary education to be competitive in the workplace and maintain family-sustaining employment (Carnevale et al., 2010; Hoffman & Reindl, 2011). This is especially true in Minnesota, where manufacturers across the state are struggling to recruit and hire high-skilled manufacturing technicians.

To address this issue, the members of the AME Alliance collaborated to provide specialized postsecondary education to trade-impacted and other dislocated workers, long-term unemployed, veterans, and incumbent workers who were seeking employment or seeking to advance their career paths in the manufacturing industry. Particularly, the AME Alliance worked closely with employers and public workforce system partners to develop and offer new and modified industry-aligned credentials (e.g., a variety of advanced manufacturing associate degrees, automation technology diplomas, and the National Career Readiness Certificate) that prepared students for careers in automation/robotics, plastic technology, precision manufacturing, and prototyping and reverse engineering industries. Using TAACCCT grant funding, the AME Alliance served a total of 2,163 participants. Figure 1 shows the service areas of the AME Alliance in which these participants were served.[3] The DOL AME project is an important and necessary step forward for geographic areas affected by widespread, significant job loss. The main focus of this report is to describe the outcomes and impact of the DOL AME project as well as the operation and implementation of the project in supporting participant outcomes.

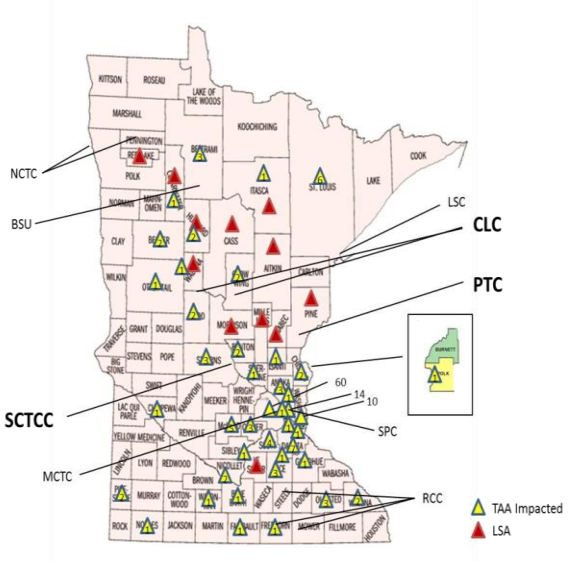


Figure 1. DOL AME Service Areas

Evaluation Questions

Within the context of the TAACCCT grant's overall evaluation strategy, the DOL AME project evaluation addresses both formative and summative questions. As such, in addition to examining the extent to which the project goals were met and outcomes were achieved (i.e., summative evaluation), the DOL AME project's evaluation also examined questions related to its implementation—the structural and procedural fidelity of program implementation. This section briefly describes the evaluation questions being explored.

Summative Evaluation Questions

Within the context of TAACCCT's overall evaluation strategy, the DOL AME project's summative evaluation addressed the three questions described below:

1. To what extent does the DOL AME project achieve project outcomes (i.e., TAACCCT outcome measures)?

[3] The reference period used in preparing the DOL Employment and Training Administration's Labor Surplus Areas was January 2009 through December 2010. Data source: http://www.doleta.gov/programs/lsa.cfm.

2. To what extent has the DOL AME project changed participants' perceptions related to persistence factors that may further support participant outcomes?[4]
3. How does the DOL AME project work to support participant outcomes?

The aim of the summative evaluation was to (1) understand the extent to which the DOL AME project impacted the outcomes (Question 1); and (2) identify the underlying mechanism through which the project impacted participants (i.e., how and what works to support participant success in education and employment) (Questions 2 and 3). This evaluation provided a unique opportunity to contribute to the field's knowledge regarding the essential ingredients of multifaceted career pathways training programs.

Implementation Evaluation Questions

Four overarching formative evaluation questions guided by the TAACCCT Round 2 Solicitation for Grant Applications (SGA) are described below:

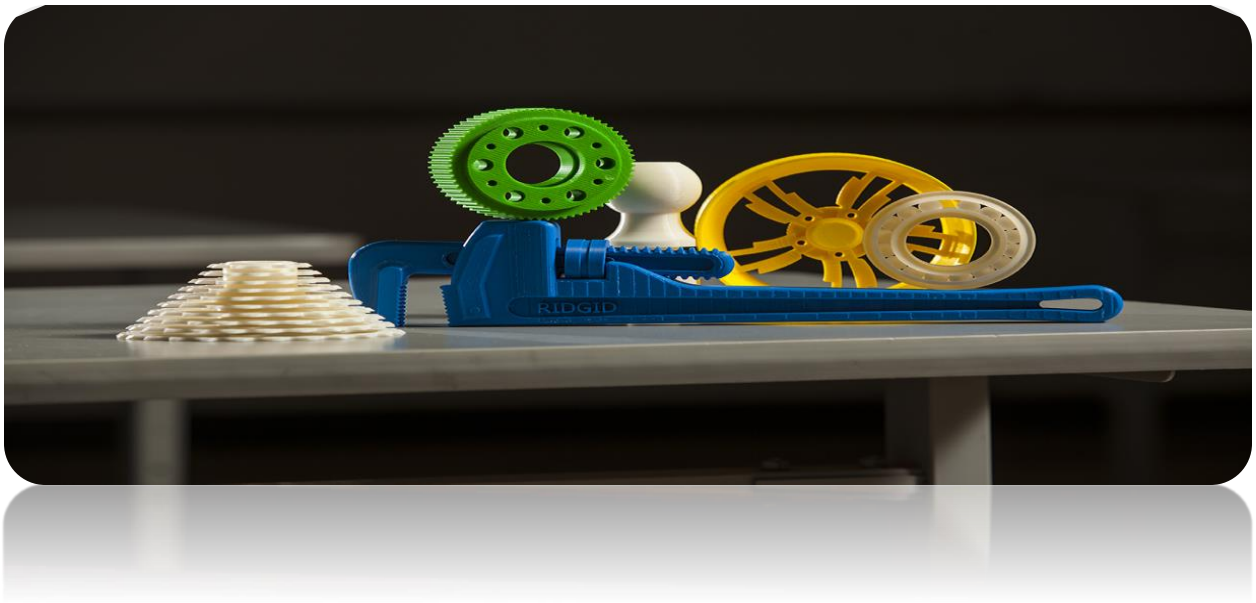
1. How were the key strategies and activities of the DOL AME project implemented?
2. To what extent were the key DOL AME project strategies and activities implemented as planned?
3. What changes were made to the program of study during implementation and for what reasons?
4. To what extent is the DOL AME project sustainable and transferable?

Specifically, the formative evaluation (1) analyzed the steps taken by the AME Alliance to create and implement the DOL AME project (Question 1); (2) assessed the project's operational strengths and weaknesses (Questions 2 and 3); and (3) examined its sustainability beyond the life of the grant (Question 4). Under each question, several subquestions were also examined to describe the operation of the DOL AME grant and address questions specified in the TAACCCT SGA (see Chapter 5 for more detail).

Report Organization

Following this brief introduction, Chapter 2 describes the DOL AME framework/theory of action, depicting the linkages between the project's components and outcomes, while Chapter 3 describes the measures and data sources used for the evaluation. Then, Chapter 4 describes the summative evaluation design and the related data analysis plan, while Chapter 5 presents the findings. Finally, Chapter 6 presents the implementation evaluation design and the data analysis plan, while Chapter 7 presents the findings.

[4] This question was revised from the original evaluation plan given the changes made to the student surveys over the implementation period. Specifically, evaluators shortened the survey to encourage completion by participants; therefore, items and constructs deemed to be less relevant to the target population (i.e., adult learners) were taken out.



Chapter 2: Project Framework

The DOL AME project's design is based on the career pathways framework of postsecondary education to address the challenge of preparing adult learners (age 18 or older), especially individuals in need of advanced training, to secure high-skilled and high-paid jobs in the field of manufacturing. Career pathways, by definition, are "well-articulated sequences of quality education and training offerings and supportive services that enable educationally underprepared youth and adults to advance over time to successively higher levels of education and employment in a given industry sector or occupations" (Center for Postsecondary and Economic Success at CLASP, 2013). A career pathways approach offers a clear sequence of coursework and training credentials that support individuals' career goals and paths while meeting the needs of local employers and growing sectors and industries (Kozumplik, Nyborg, Garcia, Cantu, & Larsen, 2011). Often, a career pathways program also requires a partnership with local partners (e.g., human services, workforce agencies, and industry partners) in order to provide comprehensive services to the targeted populations (Center for Postsecondary and Economic Success at CLASP, 2013; Fein, 2012; Kozumplik et al., 2011).

Presented in Figure 2 is a logic model (i.e., a theory of action) of the career pathways framework as implemented in the DOL AME project and used to conceptualize the formative and summative evaluation designs. In particular, the logic model presents a theory of action describing the connections between resources required to carry out the project; the strategies that are guided by the career pathways framework to support student success; the expected output as a direct result of the strategies; the mediator that explains the underlying mechanisms through which the project exerts its influence on participants; and the main outcome of interest of the DOL AME grant. The following sections of this chapter provide an overview of the project framework as depicted in the logic model. Other factors, including contextual factors and participant characteristics, that are not shown in the logic model but may be associated with the outcomes are also discussed.

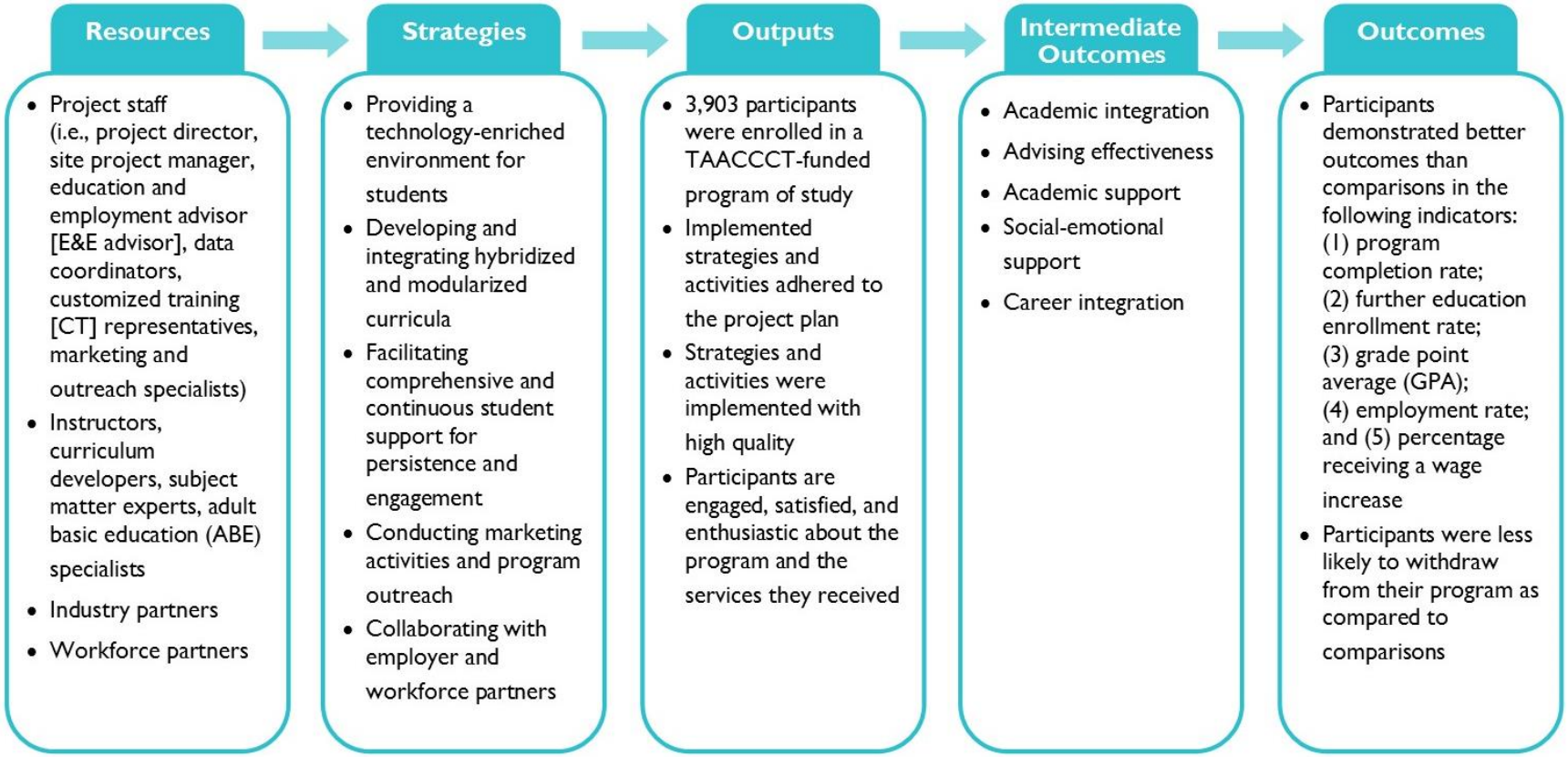


Figure 2. DOL AME Project Logic Model

Resources

The AME Alliance's management structure addressed the hierarchy of responsibilities in overseeing the project's implementation and performance. Specifically, the DOL AME project was led by a director who oversees the operation and implementation of the entire grant. Each of the AME Alliance colleges had a local grant manager who was tasked with handling the day-to-day grant activities and reported to the director. There were also several other grant-funded positions under the project director and college site leaders in the project's hierarchy, including education and employment (E&E) advisors, data coordinators, customized training (CT) representatives, marketing and outreach specialists, curriculum developers, subject matter experts, and lab assistants. Unfortunately, staff turnover is a common issue that is often a distraction and sometimes an interruption of the established implementation processes; when turnover occurs, resources and training sessions were often required to get new staff on board and up-to-speed. Industry, workforce, and community partners were also key resources who contributed to the grant in multiple ways and to varying degrees, particularly in curriculum development, participant recruitment, leveraging of resources, and sustainability planning.

Strategies

The DOL AME project embodied several core components guided by the career pathways framework (Kozumplik et al., 2011).

- **Strategy 1. Provide a technology-enriched environment.** To allow greater flexibility for working learners, the AME Alliance utilized Mediated Telepresence (MT) technology to deliver courses (referred to as MT courses) that enabled participants to take courses at their employer sites. The AME Alliance also provided state-of-the-art equipment currently utilized in the industry so that participants are ready to work after program completion. To further enhance students' learning experiences, resources were devoted to develop interactive simulations to be used in courses.
- **Strategy 2. Develop and integrate a hybridized and modularized curriculum.** The AME Alliance developed new programs and enhanced existing programs in five program clusters: (1) automation/robotics technology; (2) reverse engineering and rapid prototyping; (3) plastic technology; and (4) precision manufacturing. The enhancements included (1) developing hybridized[5] and modularized[6] courses; (2) integrating adult basic education (ABE) and developmental education into manufacturing curricula (i.e., contextualized learning)[7]; and (3) providing opportunities to earn postsecondary credits

[5] Hybridized courses refer to courses that are delivered in various modes, such as online, lectures, and face-to-face hands-on lab time.

[6] Modularized courses are often structured in a comparatively short format and are well-articulated to align with industry-recognized credentials.

[7] Contextualized learning creates explicit connections between the teaching of basic skills (reading, writing, or math) and occupational skills, which makes basic skills training more relevant to individuals seeking career and technical training.

that lead to industry-recognized and/or postsecondary credentials (i.e., stackable and latticed training options).

- **Strategy 3. Facilitate comprehensive and continuous student support for persistence and engagement.** Recognizing that adult learners, especially individuals with lower skill levels, often encounter various barriers and challenges to persist in education and training (Reason, 2009), the AME Alliance delivered individualized and intensive wraparound student support services to ensure student success. These services were delivered by the E&E advisors who were hired by the grant. The advisors provided various services and supports to meet students' needs, including (1) individualized academic advising (i.e., develop individualized learning and career plans; and progress monitoring and follow-up); (2) non-academic support and resource referral; (3) early intervention to support persistence and retention (i.e., Early Warning System); (4) support for successfully navigating the credit for prior learning (CPL) application process; and (5) job placement services (i.e., resume writing, mock interviews, and job searches).
- **Strategy 4. Conduct marketing activities and program outreach.** The AME Alliance had a regional plan to recruit target participants for the DOL AME project, including those eligible for trade adjustment assistance (TAA), the unemployed and underemployed, veterans and their spouses, as well as other adult learners who wish to have a career or advance their career in the field of manufacturing. To recruit these participants a variety of activities and outreach efforts were undertaken, including the development of marketing materials and a project website.
- **Strategy 5. Collaborate with employer and workforce partners.** A key element of the career pathways framework is sector strategy, which often requires frequent collaboration with local partners to identify the needs and skill requirements for employment or career progression in high-demand occupations. The AME Alliance's plan was to nurture existing and cultivate new partnerships to assist with curriculum development, participant recruitment, experiential learning opportunities, job placement, and leveraging of resources to support grant implementation.

It should be noted that, depending on the program track and course requirements, not all participants were exposed to all of the components described above. For instance, participants may have had experiences with the MT equipment given that the technology was often used for courses being delivered via a hybrid mode or for working learners who were enrolled in the MT courses. Another example is that contextualized learning was only relevant to individuals who were enrolled in ABE-integrated courses. Regardless, all of these strategies aimed to ensure that the DOL AME project offered technology and program curricula that met the needs of individuals as well as local industries and workforce. Of all the project elements, Strategy 3 (facilitate comprehensive and continuous student support for persistence and engagement) was expected to be implemented consistently with all participants. In terms of Strategy 4 (Conduct marketing activities and program outreach), it was anticipated that the regional plan would be implemented at the consortium level, while each college reached out to their local partners to support recruitment efforts. Strategy 5

focused on establishing partnerships with local industry, workforce, and community partners to build a solid foundation for sustainability and, most importantly, to provide networking opportunities for AME participants to connect with local employers and possible job placements. For working learners, Strategy 5 also aimed to provide opportunities for skills building and career advancement that may assist those participants in obtaining a wage increase.

Outputs

Outputs are defined as the direct results of the DOL AME project's strategies. Specifically, it was expected that (1) the project would recruit a total of 3,093 participants, (2) all of the components would be in place by the end of the performance period, (3) implementation would adhere to the Project Work Plan, and (4) the quality of implementation, as well as participants' response and engagement in these services, would be high as they are what matters the most to ensure students' success. Therefore, the focus of the implementation evaluation is not only to document the implementation of key strategies, but also evaluate the quality and participant responsiveness (e.g., satisfaction, engagement, and enthusiasm) to the outputs. The assessment of the DOL AME project's outputs was guided by the fidelity assessment framework suggested by Century, Rudnick, and Freeman (2010). Methods to assess the fidelity of implementation are discussed further in Chapter 6: Implementation Design and Methods.

Intermediate Outcomes

The target population for the DOL AME project is adult learners who often encounter multiple barriers and challenges to persistence and retention (Roger, 2009). Empirical studies have identified many variables associated with persistence (Bremer et al., 2011; Davidson, Beck, & Milligan, 2009; Reason, 2009). To assess persistence factors associated with curriculum components, McREL evaluators used two constructs developed by Davidson, Beck, and Milligan (2009): (1) academic integration and (2) advising effectiveness. Academic integration measures student perceptions of instructional quality, and advising effectiveness assesses students' perception of advising services they have received.

McREL evaluators also developed two constructs assessing participants' perceptions of the quality of the support they received via wraparound student support services: (1) academic support and (2) social-emotional support. Academic support measures the extent to which the E&E advisors are knowledgeable, resourceful, and useful to support students' education and career goals. Social-emotional support measures the extent to which students feel comfortable going to their E&E advisors as a resource when they face challenges.

Additionally, in collaboration with the experts who study persistence and retention within community college settings, McREL evaluators developed a scale to assess participants' sense of career integration as a result of grant participation. Specifically, career integration measures participants' sense of the extent to which their program of study has prepared them to be ready (in terms of knowledge and skills) for jobs in the manufacturing field, as well as ascertaining their commitment to secure those positions. Career integration has been found to be an important factor

predicting student persistence within community college settings, especially within career and technical training programs (Bremer et al., 2011).

Through high quality and enhanced curricula (as measured by academic integration and advising effectiveness) and individualized wraparound student support services (as measured by academic support and social-emotional support), it was hypothesized that the DOL AME project would enhance students' sense of career integration, further supporting their success in program completion and employment outcomes.

Outcomes

For the impact study, McREL evaluators, in collaboration with the AME Alliance's leadership team, selected six outcomes of interest to understand the extent to which the DOL AME project has impacted participants as compared to comparisons (i.e., non-TAACCCT grant participants). The outcomes are:

- **Completion status:** An individual is counted as a completer when he or she has successfully completed all course requirements for at least one program of study and has been inactive for two consecutive semesters (fall and spring terms) after program completion regardless of graduation status.[8]
- **Withdrawal status:** An individual is counted as a withdrawal when he or she has left the program without completing any program of study and has been inactive for two consecutive semesters (fall and spring terms) after taking the last course.
- **Grade point average (GPA)**
- **Gain employment:** Individuals who gain employment in a manufacturing field[9] between any point after enrollment and six months after program completion.
- **Receive wage increase:** Individuals, incumbent workers in particular, receiving a wage increase within two years after enrollment.[10]

Additionally, as part of the DOL AME project's summative evaluation, eight outcome measures specified by the DOL as grant performance indicators, in addition to the recruitment number described under Output 1 (see Table 1), were evaluated by McREL staff.

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[8] This definition is used because it is better to capture the completion status within the community college context rather than using graduation status (i.e., exiting the institution after program completion).

[9] This definition is different from the definition specified by the DOL in two ways. First, the colleges are more interested in understanding the extent to which the project has helped participants gain employment in the manufacturing field; hence, only individuals gaining employment in manufacturing fields were counted. For use in the identification process, the AME Alliance provided a list of manufacturing industry codes to the evaluators. Second, only data collected between enrollment and six months after program completion were included so that both participants and comparisons are assessed with the same parameter in terms of duration to gain employment.

[10] Evaluators revised the definition slightly to narrow the data collection timeframe so that both participants and comparisons are assessed with the same parameter in terms of duration to gain a wage increase.

Table 1. DOL AME Project Outcome Measures and the Performance Targets

	Outcome Measures	Performance Targets
1	Total unique participants served	3,903
2	Total number of participants who have completed a TAACCCT-funded program	3,518
3	Total number of participants still retained in their program of study or another TAACCCT-funded program	1,141
4	Total number of participants completing credit hours	1,483
5	Total number of participants earning credentials	1,690
6	Total number of participants enrolled in further education after grant-funded program of study completion	1,949
7	Total number of participants employed after grant-funded program of study completion	827
8	Total number of participants retained in employment after program of study completion	827
9	Number of participants employed at enrollment who received a wage increase post-enrollment	1,945

Note. Indicators listed in this table are slightly different from the indicators reported in the Annual Performance Report (APR), instead, they were specified in the program narrative with set performance targets.

Definitions of each outcome and their projected targets are described below. It should be noted that when comparing the results against the projected targets, percentages were calculated to allow for these comparisons to occur from a better perspective. For instance, if the DOL AME project recruited a lower number of participants than what was projected, the percentage of participants who complete a program of study is calculated and is used to compare against the projected percentage to avoid underestimating the project's performance in reaching the anticipated outcomes. In addition, it should be noted that the denominators used to calculate the percentages differ depending on the definition of each indicator.

- **Total Number Who Have Completed a Grant-Funded Program of Study:** Total number of unique participants who completed any grant-funded program. Completion is defined as having earned all of the credit hours needed for the award of a degree or certificate in that program of study regardless of graduation status. Participants were only included once, even if they completed multiple programs of study. The DOL AME project anticipated that 90% (3,518 out of 3,903) of the grant participants would complete a TAACCCT-funded program.
- **Total Number Still Retained in Their Program of Study or Other Grant-Funded Program(s):** Of the total number of unique participants enrolled who have not completed their programs, the total number of enrollees who are still enrolled either in their original program of study or a different grant-funded program of study at the end of the performance period. The DOL AME project anticipated that 29% (1,141 out of 3,903)[11] of the grant participants would be retained in a TAACCCT-funded program.

[11] The total number of participants who have completed a TAACCCT-funded program of study and the number of participants still retained in their program of study or another TAACCCT-funded program should not exceed the total number of

- **Total Number of Students Completing Credit Hours:** Number of students who have enrolled and completed any number of credit hours. The DOL AME project anticipated that 38% (1,483 out of 3,903) of the grant participants would complete at least some credit hours.
- **Total Number of Students Earning Credentials, Diplomas, and Degrees:** Total number of students who earned certificates (including industry-recognized credentials), diplomas, or degrees. A student can be counted only once in this field even if multiple certificates, diplomas, or degrees were earned by that student. The DOL AME project anticipated that 43% (1,690 out of 3,903) of the grant participants would earn credentials, diplomas, or degrees.
- **Total Number Enrolled in Further Education After Program of Study Completion:** Of the total number of participants who completed at least one grant-funded program, the total number of individuals who entered another program of study (grant-funded or not). The DOL AME project anticipated that 55% (1,949 out of 3,518) of the grant participants who completed a program of study would enroll in further education.
- **Total Number Employed After Program of Study Completion:** Of the total number of participants who were not incumbent workers and who completed at least one grant-funded program, the total number of individuals who entered unsubsidized employment in the first quarter after the quarter in which they exited the college. Per the DOL, the estimation should have been based on the number of non-incumbent workers who gained employment within the first quarter after completing at least one program of study. However, there is no information available about the number of projected non-incumbent workers in the project narrative; therefore, the percentage of program completers who gain employment was instead calculated. The DOL AME project anticipated that 24% (827 out of 3,518) of the program completers would gain employment.
- **Total Number Retained in Employment After Program of Study Completion:** Of the total number of participants who were employed in the first quarter after the quarter in which they exited the college, the total number of individuals who were employed in the second and third quarters after exiting. The DOL AME project anticipated that 100% (827 out of 827) of the participants who gained employment would be retained in employment.
- **Total Number of Those Employed at Enrollment Who Received a Wage Increase Post-Enrollment**: Of the number of incumbent workers (those employed at enrollment) who enter a grant-funded program, the total number who received an increase in their wages at any time after becoming enrolled. Per the DOL, the

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participants recruited. However, the projected numbers violated this rule; therefore, the performance targets for the number of completers and the number of participants retained, either one or both, seemed to be overestimated. While these numbers were set during the proposal development stage, they have continued to be used for the evaluation; as such, readers should keep this in mind when interpreting the findings.

calculation should have been based on the number of incumbent workers. However, there is no information available about the number of projected incumbent workers in the project narrative; hence, the percentage of all participants who receive wage gains was instead calculated. The DOL AME project anticipated that at least 50% (1,945 out of 3,903) of the participants would receive a raise.

Other Factors

Two types of other factors are considered in the DOL AME project's impact evaluation. Each of these factors are described below.

Contextual Factors

Program context can affect the services and activities offered to participants as well as the project's ability to train, place, and retain participants in the job market. Contextual factors often include community resources (e.g., the availability of existing community resources that the project can leverage), institutional capacity (e.g., the experience and capacity to carry out the grant program), partner networks (e.g., the ability to generate sustainable programs), and the labor market itself (e.g., programs being provided to meet the needs of the local market). These factors can influence how the AME Alliance operates the grant program in a way that further impacts participant outcomes and will ultimately sustain the DOL AME project beyond the life of the grant. These factors are examined in the implementation evaluation, and will be discussed when interpreting the impact and outcome evaluation findings.

Participant Demographic Characteristics

Participants' demographic characteristics and socioeconomic backgrounds, such as age, gender, minority status, employment status upon enrollment (i.e., incumbent status), and enrollment status (i.e., full-time versus part-time), are likely to influence participants' program completion status, their ability to obtain jobs and be retained in those positions, as well as their potential for advancement (i.e., wage increases). These factors will be taken into account when examining the DOL AME project's effect on participant outcomes.

Chapter 3: Measures and Data Collection

Given the multifaceted evaluation design, McREL evaluators gathered both quantitative and qualitative information through a variety of methods (e.g., surveys, interviews, and extant data) from multiple sources (e.g., program staff, participants, other stakeholders—such as partners/employers, and project records). This mixed-method design allowed evaluators to triangulate the data from various sources to provide a deeper understanding about the processes and mechanisms that contributed to the outcomes. This section presents the methods, instruments, and activities for data collection. Table 2 shows the alignment of evaluation questions with the data collection methods.

Table 2. Evaluation Questions and Data Collection Methods

Evaluation Questions	Extant Data	Staff and Partner Interviews	Partner Survey	Student Entrance Survey	Student Exit Survey	Student Focus Groups
Summative Evaluation						
1. To what extent does the DOL AME project achieve project outcomes (i.e., TAACCCT outcome measures)?	X					
2. To what extent has the DOL AME project changed participants' perceptions related to persistence factors that may further support participant outcomes?	X			X	X	

Evaluation Questions	Extant Data	Staff and Partner Interviews	Partner Survey	Student Entrance Survey	Student Exit Survey	Student Focus Groups
Summative Evaluation						
3. How does the DOL AME project work to support TAACCCT outcomes?	X	X	X		X	X
Formative Evaluation						
1. How were the key strategies and activities of the DOL AME project implemented?	X	X	X	X	X	X
2. To what extent were the key DOL AME project strategies and activities implemented as planned?	X	X				
3. What changes were made to the program of study during implementation and for what reasons?	X	X				
4. To what extent is the DOL AME project sustainable and transferable?	X	X	X			

Extant Data

Data collected and maintained as a regular part of the DOL AME project were collected by evaluators to be used as part of the evaluation. The records and data included (1) the DOL AME's quarterly reports submitted to the DOL; (2) meeting notes and minutes; (3) student support service logs; (4) participants' demographic information and employment history; (5) CPL records; (6) participants' educational records; and (7) participants' employment and wage data. To access participants' educational records, McREL evaluators established institutional data sharing agreements with CLC, PTCC, and SCTCC individually in grant Year 2. To access employment and wage data, the consortium established data sharing agreements with Minnesota's Department of Employment and Economic Development (DEED) to supply participants' employment and wage data for the evaluation. Participants' educational, employment, and wage data were securely transmitted to McREL's evaluation team on an annual basis for evaluation and reporting purposes.

Project Staff and Partner Interviews

During grant Years 2 and 3, project staff and partners were interviewed three times to gather their perceptions and experiences with the grant across various stages of project implementation. In late October 2013, 30 interviews[12] were conducted with staff members and partner representatives

[12] All interviews were conducted in person, except one that was conducted over the phone due to a scheduling conflicts when evaluators were on site for data collection. Individuals who shared similar roles were interviewed in groups.

who were involved with the AME Alliance. Interviewees included the project director, college site leaders, project instructors, student support staff (i.e., E&E advisors), data coordinators, marketing and outreach staff (i.e., CT representatives), and curriculum development specialists. The interview protocols for staff members were designed to assess each individual's role in grant development and implementation, their involvement in implementation activities, successes and challenges faced, and perceptions of outcomes and sustainability. Additionally, questions were tailored to each staff member's specific responsibilities to gain a more comprehensive understanding of the project's implementation from the various perspectives of those participating. Interviews with partners, including workforce agencies, employers, and community organizations, were designed to gather information about their experiences with and perceptions of the project itself as well as project staff and their roles in supporting the project activities.

The second round of interviews was conducted in late October 2014. Evaluators made some minor revisions to the interview protocols to include questions related to sustainability planning and the perceived impact on project participants. A total of 25 individual and group interviews were conducted over the phone; interviewees included the project director, college site leaders, 360 Center staff, instructor and curriculum experts, student support staff (i.e., E&E advisors), marketing and outreach staff (i.e., CT representatives), and workforce and industry partners.

A third round of interviews was conducted in late August and early September 2015. Some additional revisions were made to the interview protocols to remove items that were no longer relevant (e.g., start-up activities). A total of 26 individual and group interviews were conducted. All of the interviews were about 30 to 90 minutes in length, depending on the individual's responsibilities and the extent of involvement with the project.

Partner Survey

During grant Years 2 and 3, a survey was administered three times to employer, workforce, and community partners of the DOL AME project. The purpose of the partner survey was to assess their perceptions of the partnership, the extent to which they have been engaged in project activities, and the extent to which their level of engagement met their needs and expectations. Table 3 displays the survey administration timeframe, the number of partners who were invited to take the survey, the number of partners who responded, and the response rate. During the first survey administration, three separate surveys were created for each type of partner: industry, workforce, and community. For the second administration, each of these surveys was shorten in length from needing 20 minutes for completion to 10 minutes. Finally, during the third administration, the three surveys were merged into one with "skip items" being carefully set up so that questions irrelevant to certain types of partners could be skipped. This combined survey was expected to take respondents 10 minutes to complete.

Table 3. Partner Survey Administration Timeframe and Response Rates

Survey Round	Timeframe	Number Invited	Number Responded	Response Rate
First Administration	December 2013	90 (71 industry; 11 community; 8 workforce)	46 33 industry; 8 community; 5 workforce)	51.1%
Second Administration	October 2014	129 (96 industry; 11 community; 22 workforce)	39 (28 industry; 3 community; 8 workforce)	30.2%
Third Administration	September and October 2015	145 (100 industry; 8 community; 6 workforce; 31 unspecified)	36 (21 industry; 4 community; 7 workforce; 4 unspecified)	24.8%

Student Surveys

Two student surveys were also developed for the DOL AME project: a Student Entrance Survey and a Student Exit Survey.

Student Entrance Survey

All of the AME participants, except students enrolled in the CT/MT courses,[13] were invited to take the Student Entrance Survey four to six weeks after enrolling in their program of study. Project staff were asked to assist with survey administration by distributing an online survey link to students. The Student Entrance Survey was comprised of three parts. The first part asked participants to respond to questions about their basic identification information, such as name and student ID, so that evaluators were able to link the survey data with extant data (e.g., student educational records and employment and wage data). The second part included a series of questions about factors associated with persistence, as measured by the College Persistence Questionnaire (CPQ) (Davidson et al., 2009). The 30-item short version of the CPQ, validated with community and technical college populations, assesses 10 factors associated with college retention and persistence, including (1) institutional commitment, (2) academic integration, (3) financial strain, (4) social integration, (5) degree commitment, (6) collegiate stress, (7) advising, (8) scholastic conscientiousness, (9) academic motivation, and (10) academic efficacy. Additionally, evaluators collaborated with CPQ developers to develop one additional construct – career integration – that has also been found to be relevant to adult learners' persistence and retention in postsecondary education (Bremer et al., 2011). The third section of the survey assessed students' perceptions related to various factors (e.g., family support, proxy of socioeconomic status [i.e., living situation], access to child care, and access to transportation) that might facilitate or hinder their success in completing their program of study.

[13] Students in the CT/MT courses did not take the Student Entrance Survey because students enrolled in those courses typically completed them within one semester. Hence, project staff administered a course evaluation form with CT/MT students at the end of the courses and provided the data to McREL evaluators for further analyses.

The first version of the Student Entrance Survey took participants about 20 to 25 minutes to complete. However, due to low response rates, evaluators revised and shortened the online survey in the spring of 2014 and, in addition to administering an online survey, evaluators also created a paper version for project staff to utilize, as appropriate, to increase the survey response rate. Another major change was to remove the CPQ constructs that project staff considered to be least relevant to the DOL AME project. Therefore, instead of including all 10 of the CPQ constructs, only three constructs deemed to be most relevant to the project were retained: (1) academic integration, (2) advising effectiveness, and (3) financial strain; items related to career integration were also retained. These four factors are referred to as persistence factors hereafter. The revised survey was expected to take respondents about 10 minutes to complete. Table 4 shows the number of respondents by cohort and college. Overall, between Fall 2013 and Spring 2016, a total of 518[14] out of 987 participants who were invited to respond to the Student Entrance Survey did so, with a response rate of 53%.

Table 4. Number of Student Entrance Survey Respondents by Cohort and College

Participant Cohort	Number Responded			
	All	CLC	PTCC	SCTCC
Fall 2013	148	33	8	107
Spring 2014	11	1	2	8
Summer 2014	4	0	1	3
Fall 2014	167	58	5	104
Spring 2015	29	0	0	29
Fall 2015	144	74	2	69
Spring 2016	34	0	5	29
Total	**537**	**166**	**23**	**349**

Note. The Student Entrance Survey was administered to each cohort between the first and second month after the school semester started with two exceptions. Specifically, administration was delayed for the Fall 2013 and Spring 2014 cohort due to technical challenges.

Student Exit Survey

Starting in the spring of 2014, all of the AME participants, except students who were enrolled in CT/MT courses,[15] who were about to exit the college before completing their program of study, were invited to take a Student Exit Survey. Project staff assisted with the survey data collection efforts and invited participants who were eligible to graduate to take an online or paper-based version of the survey, whichever was more convenient for them. The Student Exit Survey contained three parts. The first part contained questions related to student identification (i.e., name

[14] Due to the nature of the DOL AME grant, participants were likely to earn multiple certificates, diplomas, and degrees; hence, some participants may have been invited to take the Student Entrance Survey more than once. A total of 535 Student Entrance Surveys were collected from 518 unique participants. The first survey completed was used in analyses as it reflected participants' baseline information when enrolling in the DOL AME grant programs.

[15] Students in the CT/MT courses did not take the Student Exit Survey because students enrolled in those courses typically completed them within one semester. Hence, project staff administered a course evaluation form with CT/MT students at the end of the courses and provided the data to McREL evaluators for further analyses.

and student ID). The second part included three CPQ constructs (i.e., academic integration, advising effectiveness, and financial strain) as well as items related to the career integration construct. The third part included questions related to participants' perceptions and experiences with all aspects of program activities. Particularly, eight items were included assessing the two aspects of E&E advising services: social-emotional support (three items) and academic support (five items). The survey took respondents about five to 10 minutes to complete. Table 5 shows the number of survey respondents by cohort and college. Specifically, between Spring 2014 and Spring 2016, a total of 262 out of 754 participants who were invited to respond to the Student Survey did so, with a response rate of 35%. [16]

Table 5. Number of Student Exit Survey Respondents by Exit Term and College

Participant Cohort	Number Responded			
	All	CLC	PTCC	SCTCC
Spring 2014	14	12	2	0
Summer 2014	50	44	0	6
Fall 2014	1	0	0	1
Spring 2015	65	9	7	49
Summer 2015	84	60	0	24
Fall 2015	2	0	1	1
Spring 2016	91	25	19	37
Total	**307**	**150**	**29**	**128**

Note. The Student Exit Survey was administered at the end of each semester before participants exited their respective colleges.

Customized Training / Mediated Telepresence (CT/MT) Survey

Participants who were enrolled in CT/MT courses were asked to take a CT/MT Survey at the end of their training course. The CT/MT Survey contained two parts. The first part asked questions related to participants' interactions and experiences with their CT E&E advisors, while the second part of the survey asked about participants' perceptions of the training content, use of technology, and instructor effectiveness. Throughout the grant, a total of 1,171 participants took CT/MT courses. Of those, 746 responded to the questions related to their experiences with the E&E advisors, with a response rate of 64%; and 1,117 responded to the questions related to their instructors and course content, with a response rate of 95%. The survey was administered by grant staff and data were transmitted to McREL evaluators for analyses.

[16] Due to the nature of the DOL AME grant, participants were likely to earn multiple certificates, diplomas, and degrees; hence, some participants may have been invited to take the Student Exit Survey more than once. A total of 307 Student Exit Surveys were collected from 262 unique participants. The last survey completed was used in analyses as it reflected participants' overall experience with the DOL AME grant.

Student Focus Groups

Two rounds of student focus groups were conducted during grant Years 2 and 3. The first round was conducted in April 2014 with AME participants being selected by the colleges at four campuses: CLC – Brainerd campus (n = 5), CLC – Staples campus (n = 6), PTCC (n = 7), and SCTCC (n = 7). The second round, conducted in April 2015, also took place at the four campuses: CLC – Brainerd campus (n = 10), CLC – Staples campus (n = 7), PTCC (n = 6), and SCTCC (n = 9). The focus group protocol used during these sessions was designed to gather rich perceptual information about participants' experiences and engagement with the program curricula, activities, and services.

Chapter 4: Impact Study Design and Analysis Plan

This chapter elaborates on the summative questions presented in Chapter 1, followed by a detailed description of the impact study's design, sample, and data analysis plan.

Summative Evaluation Questions

As mentioned in Chapter 1, three summative evaluation questions were examined. The first question, *To what extent does the DOL AME project achieve project outcomes (i.e., TAACCCT outcome measures)?*, addresses questions related to the project's impact and outcomes. In particular, evaluators examined the extent to which the project met its performance targets as described in Chapter 2 (Outcomes section). Then, evaluators conducted a quasi-experimental design with a matched comparison group to understand the extent to which the DOL AME project impacted participants' educational and employment outcomes. A detail description of the evaluation methods and analysis plan for Study 1 is discussed in the following section.

The second question was: *To what extent has the DOL AME project changed participants' perceptions related to persistence factors that may further support participant outcomes?* The target population for the DOL AME project is adult learners who often encounter multiple barriers and challenges to persistence and retention (Roger, 2009). With this in mind, the AME Alliance implemented an evidence-based design (e.g., enhanced curricula and individualized and wraparound student support services) to help students overcome barriers and ensure that they stayed motivated to persist and ultimately complete their program of study. Hence, the second question was designed to understand if the project had increased participants' perceptions related to academic integration, advising effectiveness, and career integration (i.e., persistence factors). A detail description of the evaluation methods and analysis plan is discussed in the Study 2 section.

The third question, *How does the DOL AME project work to support participant outcomes?*, aimed to further examine the underlying mechanisms through which the DOL AME project exerted its influence on participant outcomes. As discussed in Chapter 2 (Intermediate Outcomes section), it was hypothesized that the effect of the DOL AME project, as measured by (1) academic integration, (2) advising effectiveness, (3) academic support, and (4) social-emotional support, on participant outcomes (e.g., program completion and gaining employment) is mediated by participants' perceptions of career integration. A detail description of the evaluation methods and analysis plan for Study 3 is discussed in that section.

Study 1

This section provides details on the methods, sample, and analysis plan for the impact and outcome evaluation.

Methods

The main data sources for Study 1 were extant data collected by AME project staff, including student demographic data and outcome tracking data (i.e., educational records and employment and wage data). A detailed description about these data are described in Chapter 3.

Outcome Evaluation Sample

All participants (n = 2,163) enrolled in an AME program through the first 42 months of the grant were included in the outcome analysis. Table 6 provides the demographic characteristics of these participants. Overall, 83% of the participants were male; 85% were Caucasian; 35% were full-time students; 75% were incumbent workers; 8% were eligible veterans or veterans' spouses; 2% reported having a disability; 15% were eligible for Pell grant funding; and 2% were workers eligible for trade adjustment assistance (TAA). About 54% of the participants were students who were enrolled in CT/MT courses; and the remaining 46% were traditional students enrolled in certificate, diploma, and degree types of the DOL AME programs of study. On average, participants are about 33 years old (SD = 12.44).

Table 6. AME Participant Characteristics (*N* = 2,163)

Demographic Characteristics	*n*	%	*M (SD)*
Gender			
Male	1,799	83%	--
Female	364	17%	--
Race/Ethnicity [a]			
Hispanic/Latino	28	1%	--
American Indian or Alaskan Native	18	1%	--
Asian	32	1%	--
Black or African American	75	3%	--

Demographic Characteristics	*n*	%	*M (SD)*
Native Hawaiian or Other Pacific Islander	1	0%	--
White or Caucasian	1,841	85%	--
More than One Race	68	3%	--
Enrollment Status [a]			
Full-time Status	752	35%	--
Part-time Status	1,411	63%	--
Other			
Incumbent Worker	1,619	75%	--
Eligible Veterans	165	8%	--
Age	--	--	32.98 (*12.44*)
Persons with a Disability	47	2%	--
Pell-Grant Eligible	320	15%	--
TAA Eligible	44	2%	--

[a] Percentages may not add up to 100% due to missing.

Of all the participants, a subgroup is included in the impact evaluation. A description of the selection procedure is described below.

Impact Evaluation Sample

To examine the DOL AME project's impact on participant outcomes, evaluators conducted a quasi-experimental design using propensity score matching (PSM) methods to identify a group of matched comparisons (Guo & Fraser, 2010). Of all the participants enrolled in AME programs, only participants who were enrolled in the fall of 2014 when most of the project components were in place (i.e., close to full implementation) were included in the impact study; of those, participants who were enrolled in CT/MT courses and exited the programs right after CT/MT course completion were removed from the sample. The CT/MT group was distinctly different from participants pursuing AME certificates, diplomas, and degrees in many ways. For instance, the CT/MT courses were short and often took less than one semester to complete. These students were also more likely to be employed upon enrollment, having taken the CT/MT courses to advance their knowledge and skills in their current job. Most importantly, there were no programs offering training opportunities similar to the CT/MT courses before the grant was funded; hence, McREL evaluators were unable to identify a comparison group using historical cohorts. As a result of this selection process, 219 participants were retained in the impact study sample.

The primary source for the comparison groups were students who were enrolled in programs similar to those being offered through the DOL AME project within the consortium institutions and had sufficient time to complete their programs before the grant (Appendix A provides a list of AME programs and AME-like programs [i.e., comparison programs] that were included in the impact evaluation). Because PSM is most appropriate when a large pool of comparison students (at least two to three times greater than the number of participants) is available

from where evaluators can draw individuals who are most similar (i.e., a good match) to the participants, McREL evaluators and AME project staff determined that a sufficient number of potential comparisons existed by including all students who were enrolled in the AME-like programs between Fall 2005 and Fall 2010 (i.e., a historical pool; n = 972). Using this historical pool, evaluators conducted PSM to identify a group of comparisons who were similar to the selected AME participants in the following characteristics (i.e., covariates): age; gender (male and female); minority status (i.e., Caucasian, non-Caucasian, and more than two races); incumbent worker status (i.e., employed and unemployed); enrollment status (i.e., part-time vs. full-time); educational attainment (i.e., GED, high school diploma, and some college); and program type (i.e., certificate, diploma, and degree).[17]

Utilizing the specified covariates and removing cases with missing data,[18] PSM was based on 181 participants and 592 comparisons. Specifically, 1:1 matching was performed in the R Statistical Software Program using the "MatchIT" package. A logit model was used to determine propensity scores, on which nearest neighbor matching was utilized. A caliper of 0.01 was applied to strengthen the balance of the matching and replacement was not utilized as the improvement in balance did not outweigh the risk of biasing the model, particularly given that some controls were being selected upwards of 10 times. Finally, two records (one participant and one comparison) were removed from the matching process because their propensity scores were so extreme that they produced noticeable effects on the balance of the model. The final sample for the impact evaluation included 180 participants and 180 comparisons. A full report of the methodology and procedure for conducting PSM is provided in Appendix B.

Table 7 shows the characteristics of the final sample included in the impact evaluation. As expected as a result of PSM, participants and comparisons were very similar on all of the covariates. The majority of the sample are Caucasian males who were high school graduates, employed upon enrollment, and taking DOL AME courses on a full-time basis. In terms of program type, the majority were enrolled in diploma or associate of applied science (AAS) degree programs. The average age for both participants and comparisons is 21, ranging from 18 to 37.

Table 7. Sample Demographic Characteristics by Group

Variables	*Participants (N = 180)*		*Comparisons (N = 180)*	
	n	%	*n*	%
Gender				
Male	170	94.4	170	94.4
Female	10	5.6	10	5.6
Minority Status				

[17] Evaluators also considered including several other covariates in the matching process, including disability status, Pell grant status, veteran status, TAA enrollment status, and ACCUPLACER score. However, due to large amount of missing data, these variables were removed from the matching procedure.

[18] To conduct PSM, complete data for all matching covariates is required. Hence, cases with missing data were removed from the matching procedure.

Variables	Participants (N = 180)		Comparisons (N = 180)	
	n	%	*n*	%
Caucasian	166	92.2	166	92.2
Non-Caucasian	7	3.9	7	3.9
Two or more races	7	3.9	7	3.9
Employment Status upon Enrollment				
Employed	132	26.7	128	71.1
Unemployed	48	73.3	52	28.9
Enrollment Status				
Part time	37	20.6	32	17.8
Full time	143	79.4	148	82.2
Educational Attainment				
GED	11	6.1	8	4.4
High school diploma	117	65.0	151	83.9
Some college	52	28.9	21	11.7
Program Type				
Certificate	21	11.7	6	3.3
Diploma	82	45.6	109	60.6
AAS	77	42.8	65	36.1
Age				
Age Mean *(SD)*	180	21.53 (4.84)	180	21.56 (4.90)

Note. Data on veteran status and disability status were not collected consistently throughout the consortium before the grant; hence, there were a lot of missing data.
* Variables were not included in the PSM.

Data Analysis

To examine the DOL AME project's outcomes, evaluators conducted descriptive analyses of the nine TAACCCT outcome indicators listed below (see Chapter 2, Outcomes section for definitions). Percentages of participants meeting each of the outcome indicators were calculated and compared against the performance targets.

- Total number of unique participants served
- Total number of participants who have completed a TAACCCT-funded program
- Total number of participants still retained in their program of study or another TAACCCT-funded program
- Total number of participants completing credit hours
- Total number of participants earning credentials
- Total number of participants enrolled in further education after grant-funded program of study completion
- Total number of participants employed after grant-funded program of study completion

- Total number of participants retained in employment after program of study completion
- Number of participants employed at enrollment who received a wage increase post-enrollment

The estimates of the impacts of the DOL AME project are based on a comparison of participants with comparison students on the following five outcomes (see Chapter 2, Outcomes section for definitions):

- Completion status
- Withdrawal status
- Grade point average (GPA)
- Gain employment
- Receive wage increase

To compute impacts on group differences, evaluators conducted regression statistical models that predict the outcome of interest (depicted above) as a function of program participation status (i.e., AME participants vs. comparison students) while controlling for a set of background characteristics (i.e., age, gender, minority status, incumbent worker status, enrollment status, and program type). Specifically, logistic regressions are conducted for binary outcomes (i.e., completion status, withdrawal status, gain employment, and receive wage increase); while linear regression is conducted for the outcome that is a continuous variable (i.e., GPA).

Study 2

This section provides details on the methods, sample, and analysis plan for the exploration of changes in persistence factors as a result of DOL AME participation.

Methods

The main data sources for Study 2 were the student survey data, including the Student Entrance Survey and Student Exit Survey. Details about these instruments are described in Chapter 3.

Sample[19]

A total of 535 Student Entrance Surveys and 307 Student Exit Surveys were collected throughout the grant. After merging the datasets together, 155 unique students responded to both of the surveys and have been included in Study 2.[20] Table 8 shows the characteristics of the sample. The average age of the sample is 25 (*SD* = 10.05), and the vast majority are Caucasian males. About

[19] Students taking CT/MT courses did not take the Student Entrance and Exit Surveys; hence, they were excluded from Study 2.

[20] When students responded to the Student Entrance Survey more than once, the first completed survey was used. When students responded to the Student Exit Survey more than once, the latest completed exit survey was used.

two thirds were incumbent workers upon enrollment, which means these students were working, either part-time or full-time, while taking classes to earn a certificate, diploma, or degree.

Table 8. Study 2 Sample Characteristics (*n* = 155)

Characteristics	*n*	%	*M (SD)*
Age	148	--	25.00 (10.05)
Male	144	92.9%	--
Female	6	3.9%	--
Caucasian	144	92.9%	--
Minority (non-Caucasian and multiracial)	5	1.9%	--
Incumbent workers upon enrollment	98	63.2%	--
Non-incumbent workers upon enrollment	49	31.6%	--

Note. Percentages may not add up to 100% due to missing

Data Analysis

Three persistence factors were explored in this study to understand the extent to which DOL AME participation may have changed participants' perceptions of academic integration, advising effectiveness, and career integration as a result of enhanced program curricula as well as individualized wraparound student support services. A series of paired samples *t*-tests were conducted to examine individual changes on persistence factors from enrollment to program completion. Regression statistical models were also conducted to explore if student demographic characteristics (i.e., age, gender, minority status, and incumbent worker status) predict changes in the persistence factors. Table 9 shows the variables used in the analysis, while Table 10 shows the reliabilities of the persistence factors. Overall, the reliability of all constructs has met What Works Clearinghouse standards ($\alpha >= 0.50$) (2013).

Table 9. Study 2 Variables

Items by Constructs	Scale	Value for Analysis
Sample Characteristics (Student Entrance Survey)		
Age	Age range	Item value
Gender	0 (female) or 1 (male)	Item value
Minority Status	0 (Caucasian) or 1 (non-Caucasian and mixed race)	Item value
Incumbent workers	0 (non-incumbent worker) or 1 (incumbent worker)	Item value
Academic Integration (Student Entrance and Exit Surveys)		
• How would you rate the quality of the instruction you are receiving here? • How much do the instructors and the courses make you feel like you can do the work successfully?	1-5	Scale mean

Items by Constructs	Scale	Value for Analysis
• In general, how satisfied are you with the quality of instruction you are receiving here?		
Advising Effectiveness (Student Entrance and Exit Surveys)		
• How satisfied are you with the academic advising you receive here? • How easy is it to get answers to your questions about things related to your education and training here? • How would you rate the academic advisement you receive here?	1-5	Scale mean
Career Integration (Student Entrance and Exit Surveys)		
• How likely is it that the training you are receiving here will help you to get the job you want? • How confident are you that the career training you receive here will give you the necessary knowledge and skills? • How much do you know about the duties and responsibilities of the career and field in which you are receiving training? • How committed are you to getting a job in the field for which you are training?	1-5	Scale mean [a]

a. Five items were originally developed to assess participants' perceptions of career integration. Using all of the Student Entrance Survey data, principal component analysis was conducted to establish scale reliability. Based on the results of this analysis, one item was further removed.

Table 10. Reliabilities of Persistence Factors [21]

Constructs	Entrance Survey		Exit Survey	
	n	Cronbach's Alpha	n	Cronbach's Alpha
Academic Integration	151	0.81	153	0.85
Advising Effectiveness	147	0.79	149	0.74
Career Integration	147	0.65	148	0.77

Study 3

This section provides details on the methods, sample, and analysis plan for exploration of the underlying mechanisms through which the DOL AME project may have exerted its influence on participants' educational outcomes, including program completion and GAP scores.

[21] Reliability is how well a test consistently measures what it is supposed to measure. A measure is said to have a high reliability if it produces similar results under consistent conditions.

Methods

The main data sources for Study 3 were student survey data, including the Student Exit Survey, as well as extant data provided by project staff, such as students' educational records. Details about the instruments are described in Chapter 3.

Sample [22]

The sample included in Study 1 (i.e., participants who were enrolled in the fall of 2014 when most of the implementation strategies were in place) was used in this study (*n* =180). Of those, 64 participants responded to the Student Exit Survey providing information related to their experience with the curricula, instruction, and wraparound student support services. Therefore, the final sample included 64 participants whose characteristics are further described in Table 11 below.

Table 11. Study 3 Sample Characteristics (*n* = 64)

Characteristics	*n*	%	*M (SD)*
Age	64	--	20.95 (4.33)
Male	62	96.9%	--
Female	2	3.1%	--
Caucasian	62	96.9%	--
Minority (non-Caucasian and multiracial)	1	1.6%	--
Incumbent workers upon enrollment	44	68.8%	--
Non-incumbent workers upon enrollment	20	31.3%	--

Note. Percentages may not add up to 100% due to missing

Data Analysis

As described in the DOL AME project's framework (Chapter 2, Intermediate Outcomes section), it was hypothesized that the project would enhance students' sense of career integration (i.e., a mediator) that further supports their success through two elements: (1) enhanced curricula measured by academic integration and advising effectiveness; and (2) individualized wraparound student support services measured by academic support and social-emotional support (see Figure 3 for a visual presentation of the proposed pathways). DOL AME strategies refer to the enhanced curricula and individual wraparound student support services; mediator refers to participants' sense of career integration; and participant outcome includes participants' program completion status, GPAs, and employment status in a manufacturing field.

[22] Students taking CT/MT courses did not take the Student Entrance and Exit Surveys; hence, they were excluded from Study 2.

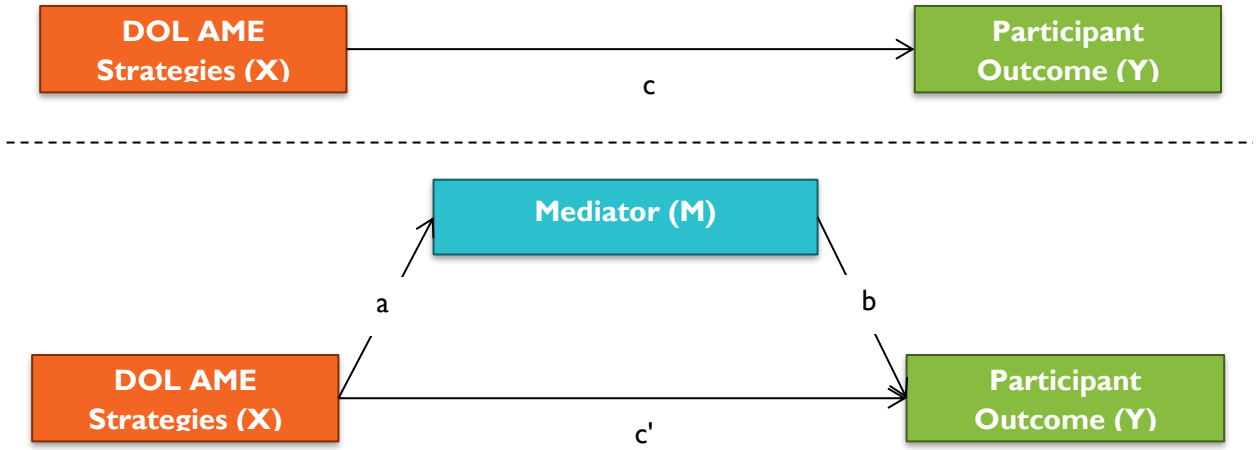


Figure 3. Hypothesized Mediation Pathways

To test for mediation effect, four steps suggested by Baron and Kenny (1986) were examined, including (1) conducting a simple regression analysis with X predicting Y to test for Path c; (2) conducting a simple regression analysis with X predicting M to test for Path a; (3) conducting a simple regression analysis with M predicting Y to test the significance of Path b,[23] and (4) conducting a multiple regression analysis with X and M predicting Y [24] (Baron & Kenny, 1986; Preacher & Hayes, 2004). The estimation of Path c refers to total effect; while the estimation of Path c refers to the direct effect of X on Y while controlling for M. The estimation of Path a x Path b refers to indirect effect. The purposes of Steps 1 to 3 is to establish that zero-order relationships among the variables exist. If the results of Steps 2 and 3 were statistically nonsignificant, it suggests that there is no mediation effect (MacKinnon, Fairchild, & Fritz, 2007). Table 12 shows the variables and measures used in the analysis, while Table 13 shows Cronbach's alpha for each construct. Overall, the reliabilities of all constructs have met What Works Clearinghouse standards ($\alpha >= 0.50$) (2013).

Table 12. Study 3 Variables

Items by Constructs	Scale	Value for Analysis
DOL AME Strategies (Student Exit Survey)		
Academic Integration • How would you rate the quality of the instruction you are receiving here? • How much do the instructors and the courses make you feel like you can do the work successfully? • In general, how satisfied are you with the quality of instruction you are receiving here?	1-5	Scale mean
Advising Effectiveness	1-5	Scale mean

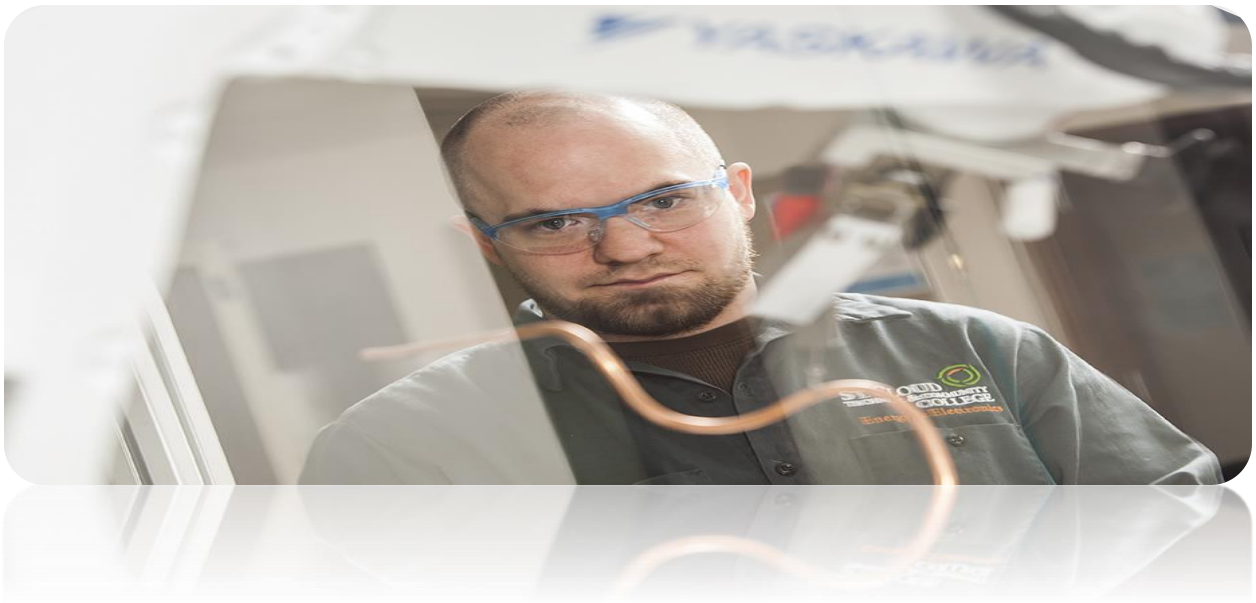
[23] A logistic regression is performed when the outcome is a binary variable.
[24] A logistic regression is performed when the outcome is a binary variable.

Items by Constructs	Scale	Value for Analysis
• How satisfied are you with the academic advising you receive here? • How easy is it to get answers to your questions about things related to your education and training here? • How would you rate the academic advisement you receive here?		
Social-Emotional Support • I felt comfortable going to my E&E advisor when I had school-related problems. • I felt comfortable going to my E&E advisor when I had personal issues that affected my academic performance. • My E&E advisor was sensitive to my personal problems and needs.	1-5	Scale mean
Academic Support • My E&E advisor provided information and resources I needed to support my learning needs and career goals. • My E&E advisor was knowledgeable about his/her profession. • My E&E advisor worked with my instructor to make sure my learning needs were met. • My E&E advisor helped me stay on track to complete my program. • My E&E advisor understood my career interests and goals.	1-5	Scale mean
Mediator (Student Exit Survey)		
Career Integration • How likely is it that the training you are receiving here will help you to get the job you want? • How confident are you that the career training you receive here will give you the necessary knowledge and skills? • How much do you know about the duties and responsibilities of the career and field in which you are receiving training? • How committed are you to getting a job in the field for which you are training?	1-5	Scale mean [a]
Outcomes (Extant Data)		
• Completion Status	0 (non-completer) or 1 (completer)	Item value
• GPA	0-4	Item value

[a.] Five items were originally developed to assess participants' perceptions of career integration. Using all of the Student Entrance Survey data, principal component analysis was conducted to establish scale reliability. Based upon results of this analysis, one item was further removed.

Table 13. Reliabilities of Constructs Measuring DOL AME Strategies and the Mediator

Constructs	n	Cronbach's Alpha
Academic Integration	62	0.81
Advising Effectiveness	64	0.69
Social-Emotional Support	56	0.88
Academic Support	58	0.96
Career Integration	61	0.71



Chapter 5. Participant Impact and Outcome Findings

This chapter presents the summative evaluation findings by evaluation question.

Q1. To what extent does the DOL AME project achieve project outcomes (i.e., TAACCCT outcome measures)?

Evaluators addressed this question in two ways. First, McREL evaluators examined the extent to which the project has met its targeted TAACCCT outcome measures. Second, evaluators studied outcome differences between participants and comparisons to determine the extent to which the DOL AME project has impacted participant outcomes. Findings for each method are described below.

DOL AME TAACCCT Outcomes

Table 14 shows the DOL AME project's outcomes as compared to the performance targets. Methods and definitions to calculate the performance targets are described in detail in Chapter 2 (see Outcomes section). Although the number of participants recruited was lower than anticipated (55th percentile in terms of meeting the performance target), the project did meet the performance targets on several key outcome indicators:

- **Outcome Indicator #3:** 32% (683 out of 2,163) of the participants were still retained in their program of study or were enrolled in other TAACCCT-funded programs in comparison to the target of 29% (1,141 out of 3,903) by the end of the grant.
- **Outcome Indicator #4:** 89% (1,927 out of 2,163) of the participants earned credits, ranging from one to 118 credits, in comparison to the target of 38% (1,493 out of 3,903).

- **Outcome Indicator #9:** 54% (1,163 out of 2,163) of the participants received wage increases after becoming enrolled in a TAACCCT-funded program of study in comparison to the target of 50% (1,945 out of 3,903). Yet, it should be noted that, per the DOL, the estimation should be based on the number of incumbent workers who received wage increases after enrollment. The DOL's definition would result in 72% (1,163 out of 1,619) of the incumbent workers receiving wage increases. However, there is no information available about the number of projected incumbent workers in the project narrative; therefore, McREL evaluators are unable to compare the performance target with the actual outcomes with the more accurate estimation based on the DOL definition.

Table 14. DOL AME Performance Outcomes

	Outcome Measures	Actual Outcomes		Performance Targets	
		n	% [a]	*n*	% [b]
1	Total unique participants served	2,163	--	3,903	--
2	Total number of participants who have completed a TAACCCT-funded program [c]	754	34.9%	3,518	90.1%
3	Total number of participants still retained in their program of study or another TAACCCT-funded program	683	31.6%	1,141	29.2%
4	Total number of participants completing credit hours	1,944	89.9%	1,483	38.0%
5	Total number of participants earning credentials	886	40.9%	1,690	43.3%
6	Total number of participants enrolled in further education after grant-funded program of study completion [d, e]	266	35.3%	1,949	55.4%
7	Total number of participants employed after grant-funded program of study completion [e]	114	15.1%	827	23.5%
8	Total number of participants retained in employment after program of study completion [f]	85	74.6%	827	100.0%
9	Number of participants employed at enrollment who received a wage increase post-enrollment	1,163	53.8%	1,945	49.8%

[a] The denominator for calculating the percentage was 2,163; otherwise is noted.
[b] The denominator for calculating the percentage was 3,903; otherwise is noted.
[c] The AME Alliance defines program completers as individuals who have completed at least one program of study; if participants completed more than one program of study, the latest program completed was counted.
[d] The AME Alliance utilizes StudentTracker data from the National Student Clearinghouse (NSC) to track students who have taken courses in other non-TAACCCT programs after program completion.
[e] Given the definition, the denominator for calculating the percentage was the number of program completers (Indicator 2).
[f] Given the definition, the denominator for calculating the percentage was the number of participants employed after program completion (Indicator 7).

Below is the list of indicators that did not meet the performance targets:

- **Outcome Indicator #2:** 35% (754 out of 2,163) of the participants completed a grant-funded program of study as compared to the target of 90% (3,518 out of 3,903) by the end of the grant. The low number of program completers can be explained by two factors. First, the total number of completers (Indicator #2) and the total number of participants retained (Indicator #3) should not be more than the total number of

participants recruited (Indicator #1). Based on the projected number, this rule was obviously violated. As such, the project might have overestimated the performance target for this indicator as well as Indicator #3 (number of participants retained). Second, the majority of participants (54%) were CT/MT students whose intentions are often to gain skills and knowledge on certain subject matter in a short amount of time. These students regularly enrolled in CT/MT courses that were likely to lead to industry-recognized credentials, but may not have led to college-awarded credentials, diplomas, or degrees without additional advanced courses.

- **Outcome Indicator #5:** 41% (886 out of 2,163) of the participants earned at least one industry-recognized credential or college-awarded certificate, diploma, or degree, which was three percentage points lower than the target of 43% (1,690 out of 3,903). Of those, 69% (607 out of 886) earned one or more certificates (including industry-recognized credentials); 37% (325 out of 886) earned one or more diplomas; and 20% (176 out of 886) earned one or more associate of applied science (AAS) degrees. In total, 32% (286 out of 886) earned two or more certificates (including industry-recognized credentials), diplomas, or degrees.
- **Outcome Indicator #6:** 27% (206 out of 754) of the program completers enrolled in further education (TAACCCT grant funded or not) as compared to the target of 55% (1,949 out of 3,518). The low number of program completers enrolling in further education can be explained by three factors. First, the AME Alliance relied on the StudentTracker data provided by the National Student Clearinghouse (NSC) to track students' enrollment status in further education after exiting the AME program. Not all postsecondary education institutions are the members of the NSC; hence, some students who were enrolled in the institutions that did not provide data to the NSC may be missed. Second, per DOL guidelines, participants who entered in employment cannot be counted again if they also entered in further education. As a result, 50 participants who were both employed and entered in further education after program exit were not counted. Third, the employment market in the AME targeted careers had become stronger during the grant, so program completers were more likely to find a job and less likely to continue their education right after program completion.
- **Outcome Indicator #7:** 15% (114 out of 754) of the program completers gained employment during the first quarter after exiting their program of study in comparison to the target of 24% (827 out of 3,518). It should be noted that this outcome may be underestimated given the time lag between when the employment and wage data is shared with McREL evaluators for analysis and when the report is completed. In fact, 276 program completers finished their program of study between the second and fourth quarter of grant Year 4. Employment information for this group was not yet available when this report was prepared.
- **Outcome Indicator #8:** 75% (85 out of 114) of the participants who gained employment were retained as compared to the target of 100% (827 out of 827). As

discussed in Indicator #7, this outcome is underestimated given the fact that the data needed for this outcome were not available when this report was prepared.

Project Impact on Participant Outcomes

To examine the extent to which the DOL AME project has impacted participants, evaluators conducted a quasi-experimental study using PSM methods to identify a group of matched comparisons (see Chapter 4, Impact Study Sample for more detail). The results are organized by outcome. Although, it should be noted that while examining the educational outcomes (i.e., completion status, withdrawal status, and GPA), individual characteristics were entered in the statistical model for control purposes. These individual characteristics included: age, gender (male versus female), minority status (non-Caucasian or multi-race versus Caucasian), enrollment status (part-time versus full-time), incumbent worker status (incumbent versus non-incumbent), and program type (AAS degree versus certificate or diploma). For employment and wage outcomes, age, gender, and minority status were also entered in the statistical models for control purposes.

Program Completion. Due to the stackable nature of the DOL AME programs, participants are likely to complete one TAACCCT-funded program and continue their education to pursue other TAACCCT-funded programs. Therefore, for the evaluation, an individual was counted as a completer when he or she successfully completed all course requirements for at least one program of study and was inactive for two consecutive semesters (fall and spring terms) after completing the program of study regardless of graduation status. If a student completed more than one program, the latest program completed was counted. The same definition was applied to the comparisons when determining completion status.

Of the 180 AME participants and 180 matched comparisons, 92 participants (51%) and 78 comparisons (43%) completed a program. A logistic regression was performed to ascertain the effect of DOL AME project participation on the likelihood of program completion while controlling for individual characteristics (i.e., age, gender, minority status, enrollment status, incumbent worker status, and program type). The model explained 25% (Nagelkerke R^2) of the variance in program completion. After controlling for individual characteristics, group membership (i.e., participants versus comparisons) was a significant predictor of program completion status (β = 0.48, SE = 0.24, p = 0.043). Specifically, AME participants were 1.62 times more likely than comparisons to complete a program of study. Additionally, although not the main interest of the impact study, it is interesting to note that minority students (i.e., non-Caucasian or multiracial students) were 0.24 times less likely to complete a program than their Caucasian counterparts (β = -1.43, SE = 0.54, p = 0.008); students who were enrolled in AAS degree were 0.26 times less likely to complete a program as compared to students in certificate or diploma programs (β = -1.34, SE = 0.25, p < 0.001); while full time students were 5.78 times more likely to complete a program as compared to part-time students (β = 1.75, SE = 0.38, p < 0.001) regardless of their group membership (i.e., AME participants vs. comparisons).

Withdrawal Status. An individual is counted as a withdrawal when he or she has left the college without completing any program of study and has been inactive for two consecutive

semesters (fall and spring terms) after taking the last course. Of those who did not complete a program, 47% of participants (41 out of 88) and 94% of comparisons (96 out of 102) exited the college without completing a program. A logistic regression was performed to ascertain the effect of DOL AME project participation on the likelihood of students withdrawing from their programs of study while controlling for individual characteristics (i.e., age, gender, minority status, enrollment status, incumbent worker status, and program type). The model explained 47% (Nagelkerke R^2) of the variance in withdrawal status. After controlling for individual characteristics, participants were 0.05 times less likely than comparisons to withdraw from a program (β = -3.06, SE = 0.50, p < 0.001), and students enrolled in AAS degrees were 0.36 times less likely than students enrolled in certificate or diploma programs to withdraw from the program (β = -1.01, SE = 0.44, p = 0.022). Additionally, older students were 1.15 times more likely to withdrew from their program in comparison with their younger counterparts (β = 0.14, SE = 0.06, p = 0.015).

GPA. A descriptive statistical analysis revealed that the average GPA for AME participants and comparisons is 2.70 (SD = 1.09) and 2.42 (SD = 1.30), respectively. A linear regression was performed to ascertain the effect of DOL AME project participation on GPAs while controlling for individual characteristics (i.e., age, gender, minority status, enrollment status, incumbent worker status, and program type). Results indicated that the regression model accounted for 25% of the variance in GPAs, and group membership (i.e., participants versus comparisons) was a significant predictor of individual GPAs (β = 0.30, SE = 0.13, p = 0.019) while controlling for individual characteristics. Additionally, full-time students tended to have higher GPA scores as compared to part-time students (β = 0.58, SE = 0.17, p = 0.001).

Gain Employment. By definition, gain employment is defined as individuals who were employed upon enrollment who gained employment in a manufacturing field [25] at any point between enrollment and six months after program completion. This definition was used in the impact analysis given that, as part of the project's design and strategy, participants were often employed as a result of participating in the experiential learning opportunities before completing their program of study. Hence, it is better to capture the effect of the DOL AME project on employment outcomes by including individuals who were employed after enrollment and before program completion.

A descriptive analysis revealed that 42% of participants (39 out of 92 program completers) and 46% of comparisons (36 out of 78 program completers) gained employment in a manufacturing field after enrollment. A logistic regression was performed to ascertain the effect of DOL AME project participation on the likelihood of obtaining employment while controlling for individual characteristics (i.e., age, gender, and minority status). The model explained 5% (McFadden R^2) of the variance in gain employment. After controlling for individual characteristics, group membership

[25] This definition is different from the definition specified by the DOL in two ways. First, the colleges are more interested in understanding the extent to which the project has helped participants gain employment in manufacturing fields; therefore, only individuals who gained employment in manufacturing fields were counted. A list of manufacturing industry codes were provided by the AME Alliance and used in the identification process. Second, only data collected between enrollment and six months after program completion were included so that both participants and comparisons were assessed with the same parameter in terms of duration to gain employment.

(i.e., participants versus comparisons) did not predict employment outcomes (β = -0.08, SE = 0.34, p = 0.820).

Wage Increase. By definition, wage increase is defined as individuals who received a wage increase at any point between enrollment and six months after program completion. Only incumbent workers, including those who were not in a manufacturing field upon enrollment, were included in the analysis. Descriptive analyses revealed that 92% (116 out of 126) of the AME incumbent participants received a wage increase while 88% (106 out of 121) of the incumbent comparisons received a wage increase. A logistic regression was performed to ascertain the effect of DOL AME project participation on the likelihood of receiving a wage increase while controlling for individual characteristics (i.e., age, gender, and minority status). The model explained 3% (McFadden R^2) of the variance in receiving a wage increase. After controlling for individual characteristics, group membership (i.e., participants versus comparisons) did not predict wage increase outcomes (β = 0.55, SE = 0.43, p = 0.208). Additionally, older individuals were less likely to receive a wage increase after enrollment (β = -0.06, SE = 0.03, p = 0.048).

In summary, the DOL AME project did not impact on participants' success in gaining employment, or receiving a wage increase post-enrollment, but it did impact participants' program completion rates, withdrawal rates, and help them earn better grades as measured by their GPAs.

Q2. To what extent has the DOL AME project changed participants' perceptions related to persistence factors that may further support participant outcomes?

A series of paired-samples t-tests were performed to examine the extent to which participants demonstrated changes in their perceptions about three factors related to persistence and retention: (1) academic integration, (2) advising effectiveness, and (3) career integration. Results showed that, as presented in Table 15, participants' perceptions on all three persistence factors remained stable and unchanged statistically from enrollment to program completion. Effect size (ES; i.e., Hedge's g) was calculated to understand the magnitude of change over time (Hedges & Olkin, 1985). According to Wolf (1986), an ES value of 0.25 or greater is educationally significant and an ES value of 0.50 is practicably significant. As shown in Table 15, the effect size was minimal.

Table 15. Changes in Factors Related to Persistence and Retention (n = 153)

Factors	Entrance Survey (pretest)		Exit Survey (posttest)		t (df = 152)	p	Effect Size
	M	*SD*	*M*	*SD*			
Academic Integration	4.54	0.51	4.48	0.63	1.16	0.246	-0.11
Advising Effectiveness	4.23	0.66	4.30	0.66	-1.42	0.159	0.11
Career Integration	4.43	0.46	4.46	0.58	-0.76	0.447	0.06

A series of linear regressions were performed to ascertain the extent to which individual demographic characteristics (i.e., age, gender, minority status, and incumbent worker status) are

associated with changes in persistence factors from enrollment to program completion. Results showed that individual characteristics did not predict participants' changes in persistence factors with one exception. That is, incumbent worker status was negatively associated with an increase in participants' perceptions of advising effectiveness (β = -0.352, p = 0.008). In other words, non-incumbent workers, individuals who were unemployed upon enrollment, reported positive changes on advising effectiveness from enrollment to program completion (an increase of 0.27 points, SD = 0.84); while incumbent workers reported negative changes from enrollment to program completion (a decrease of 0.02 points, SD = 0.69).

Further examination of the study sample revealed that the majority of the sample (92%) were program completers. Hence, the null findings may be because this sample was over-represented by a group of individuals who had more positive experiences with the program since enrollment. Based on their pretest ratings shown in Table 15, on average, participants who responded to both the Student Entrance and Exit Surveys reported high ratings on all three persistence factors. For instance, participants generally *agreed* (a mean between 3.50 and 4.49) that the DOL AME project supported advising effectiveness and career integration, and they *strongly agreed* (a mean between 4.50 and 5.00) that it facilitated academic integration at the baseline. Before program completion, these individuals, on average, continued to *agree* that the project supported advising effectiveness and career integration. Although the average rating decreased slightly on their perceptions of academic integration, the change was not statistically significant. Taken together, the interpretation of findings should be with caution. The null findings did not suggest that the DOL AME project had an effect on factors that supported the persistence factors; instead, this study is limited because of its over-representation of program completers who may have had more positive experiences with the project since enrollment in the study sample.

Q3. How does the DOL AME project work to support participant outcomes?

Three outcomes of interest were examined to understand the underlying mechanisms that may explain the effect of the DOL AME project on participant outcomes, including program completion status, GPAs, and employment status. Four steps suggested by Baron and Kenny (1986) were performed to test the mediation effect of career integration on participant outcomes (see Table 16). Results indicated that career integration did not mediate the effect of enhanced curricula, as measured by academic integration and advising effectiveness, and wraparound student support services, as measured by social-emotional support and academic support, on participants' completion status, GPAs, or employment status in manufacturing fields.

There are two possible explanations for the null findings. First, only a small number of participants responded to the Student Exit Survey and after merging the survey data with extant data, the sample size became quite small (n = 64). Hence, this study is under powered. Second, although the reliability of career integration is acceptable (Cronbach's alpha = 0.71), it is unclear if this scale measures what it intends to measure (i.e., validity). With limited resources, McREL

evaluators were unable to establish the validity of the scale. Further research is encouraged to identify what constitutes career integration and validate the construct.

Table 16. Mediation Modeling Results by Outcome

Effects	*β*	*SE*	*P*
Completion Status			
Step 1: Path c (Total Effect)			
Academic Integration → Completion Status	3.43	5.94	0.563
Advising Effectiveness → Completion Status	2.18	6.03	0.718
Social-Emotional Support → Completion Status	-17.30	10.25	0.092
Academic Support → Completion Status	10.03	6.44	0.119
Step 2: Path a			
Academic Integration → Career Integration	4.53	0.17	0.011
Advising Effectiveness → Career Integration	0.18	0.16	0.269
Social-Emotional Support → Career Integration	-0.08	0.13	0.553
Academic Support → Career Integration	0.07	0.12	0.544
Step 3: Path b			
Career Integration → Completion Status	3.35	3.77	0.374
Step 4: Path c' (Direct Effect)			
Academic Integration → Completion Status *While Controlling for the Effect of Career Integration*	1.73	6.15	0.778
Advising Effectiveness → Completion Status *While Controlling for the Effect of Career Integration*	2.64	6.28	0.675
Social-Emotional Support → Completion Status *While Controlling for the Effect of Career Integration*	-19.63	11.65	0.092
Academic Support → Completion Status *While Controlling for the Effect of Career Integration*	3.35	3.77	0.374
GPA			
Step 1: Path c (Total Effect)			
Academic Integration → GPA	-0.12	1.21	0.919
Advising Effectiveness → GPA	0.45	1.13	0.695
Social-Emotional Support → GPA	-1.67	0.90	0.855
Academic Support → GPA	-0.12	0.80	0.876
Step 2: Path a			
Academic Integration → Career Integration	4.53	0.17	0.011
Advising Effectiveness → Career Integration	0.18	0.16	0.269
Social-Emotional Support → Career Integration	-0.08	0.13	0.553
Academic Support → Career Integration	0.07	0.12	0.544
Step 3: Path b			
Career Integration → GPA	0.30	0.927	0.750

Effects	β	SE	P
Step 4: Path c' (Direct Effect)			
Academic Integration → GPA *While Controlling for the Effect of Career Integration*	-2.61	1.30	0.841
Advising Effectiveness → GPA *While Controlling for the Effect of Career Integration*	0.40	1.15	0.732
Social-Emotional Support → GPA *While Controlling for the Effect of Career Integration*	-0.14	0.91	0.877
Academic Support → GPA *While Controlling for the Effect of Career Integration*	-0.15	0.81	0.857
Employment Status			
Step 1: Path c (Total Effect)			
Academic Integration → Employment Status	-4.29	5.25	0.414
Advising Effectiveness → Employment Status	0.383	4.88	0.433
Social-Emotional Support → Employment Status	-5.97	4.087	0.221
Academic Support → Employment Status	6.38	5.09	0.210
Step 2: Path a			
Academic Integration → Career Integration	4.53	0.17	0.011
Advising Effectiveness → Career Integration	0.18	0.16	0.269
Social-Emotional Support → Career Integration	-0.08	0.13	0.553
Academic Support → Career Integration	0.07	0.12	0.544
Step 3: Path b			
Career Integration → Employment	-1.29	3.81	0.736
Step 4: Path c' (Direct Effect)			
Academic Integration → Employment Status *While Controlling for the Effect of Career Integration*	-3.78	5.44	0.487
Advising Effectiveness → Employment Status *While Controlling for the Effect of Career Integration*	4.10	5.01	0.413
Social-emotional Support → Employment Status *While Controlling for the Effect of Career Integration*	-6.24	4.97	0.210
Academic Support → Employment Status *While Controlling for the Effect of Career Integration*	6.68	5.24	0.203

While there is no statistical evidence to explain how the DOL AME project works to support participant success, anecdotes collected from participants through the focus groups reveal some promising features of the DOL AME project as it is depicted in the logic model. During the focus groups, participants were asked what they perceived to be the most valuable aspects of the DOL AME project and why. Students indicated that having high-quality instructors and being able to complete the coursework in a hands-on, technologically advanced learning environment were the most valuable aspects of their programs of study. Students commented on instructors' strong understanding of their trade and vast amount "personal experience" in the field, acknowledging that "you can't get that from a textbook." In addition to feeling supported academically, students were also very satisfied with the close relationships they have been able to develop with their instructors

and some of the support staff. One student compared his or her experience in an AME program of study with a previous experience at a larger state school by sharing, "The teacher [at my last college] would never care about what you did. They just care if you pass or not." This student continued, "It's a lot more comfortable here. It's like a family-oriented thing."

Further, focus group participants agreed that the excellent instruction they received was made even more valuable by "being able to get in the shop, hands-on, [to] work on the machines and get that experience for a job." One student commented, "You can learn something in a book, you can know it front to back, but to actually know how to do it with your hands is major and we have a lot of that here." Another student expressed a similar perception, stating, "I learn a lot more here because of the hands-on stuff." Generally, students were grateful for this opportunity and were excited about the "respect" they anticipate receiving from current and/or future employers and the job opportunities they expect to have. One student concluded, "I think anybody coming out of these programs is pretty darn marketable."

Chapter 6: Implementation Design and Analysis Plan

This chapter elaborates on the formative questions presented in Chapter 1, followed by a detailed description of the formative evaluation design, methods, and data analysis plan.

Formative Evaluation Questions

The implementation evaluation examines the extent to which the DOL AME project's implementation strategies, services, and activities (e.g., program outputs) have been implemented as planned (i.e., adherence and dosage) and how well (i.e., service quality and participant responsiveness). Although full implementation of the original program is desired, McREL evaluators recognize that, in practice, model modification (e.g., program adjustments and strategic refinement) may occur to support and enhance the project's feasibility and sustainability (Century et al., 2010; Fixsen, Naoom, Blase, Friedman, & Wallace, 2005). However, any deviation (e.g., low implementation levels or frequent modification) from the originally designed program also creates a potential threat to program fidelity (Century et al., 2010). When a program is implemented with low fidelity, it is unclear whether the successes or failures are due to the program itself or a lack of fidelity in implementation. Therefore, the focus of the DOL AME project's implementation evaluation was to measure and monitor all implemented activities (whether it is by original design or modification) throughout the grant period. This design also allowed evaluators to provide timely and actionable recommendations for project staff regarding improvements and refinements for strengthening the program that balanced implementation fidelity and data-based modifications to enhance the potential for sustainability while still maintaining the rigor of the impact analysis.

Overall, four overarching formative evaluation questions and subquestions guided by the TAACCCT Round 2 SGA were examined. Specifically, the formative evaluation (1) analyzed the steps taken by the AME Alliance to create and implement the DOL AME project; (2) assessed the

operational strengths and weaknesses of the project; and (3) examined the sustainability of the project beyond the life of the grant.

To address the first question: *How were the key strategies and activities of the DOL AME project implemented?*, evaluators examined the strategies and processes that the AME Alliance implemented to support student outcomes as described in the logic model (see Chapter 2). The strategies examined included (1) hybridized and modularized curricula, (2) wraparound student support services, (3) outreach and marketing, and (4) partner involvement. Additionally, under this formative question, the following implementation questions specified in the TAACCCT Round 2 SGA are also answered:

SGA.Q1. How was the particular curriculum selected, used, or created?

SGA.Q2. How were the programs and program design improved or expanded using grant funds?

SGA.Q3. What delivery methods were offered?

SGA.Q4. What was the project's administrative structure?

SGA.Q5. What support services and other services were offered?

SGA.Q6. Was career guidance provided and if so, through what methods?

SGA.Q7. Did the grantees conduct an in-depth assessment of participants' abilities, skills, and interests to select participants into the grant program? What assessment tools and processes were used? Who conducted the assessment? How were the assessment results used? Were the assessment results useful in determining the appropriate program and course sequence for participants? Was career guidance provided and if so, through what methods?

SGA.Q8. What contributions did each of the partners make in terms of (1) program design, (2) curriculum development, (3) recruitment, (4) training placement, (5) program management, (6) leveraging of resources, and (7) commitment to program sustainability?

SGA.Q9. What factors contribute to partners' involvement or lack of involvement in the program? Which contributions from partners were most critical to the success of the grant program? Which contributions from partners had less of an impact?

For the second question: *To what extent were the key DOL AME project strategies and activities implemented as planned?*, fidelity assessments were conducted four times to document, assess, and monitor DOL AME project activities and outputs. The fidelity measure is a key evaluation tool that was used to monitor the project's progress, strengths, weaknesses, and achievement throughout the implementation years. Details on the fidelity assessment is described in detail under the Fidelity Assessment section in this chapter.

As part of the fidelity assessment, McREL evaluators also addressed the third question: *What changes were made to the programs of study during implementation and for what reasons?* For this question, evaluators documented any deviations from the original implementation plan and identified the reasons for the modification(s).

Finally, for the last question: *To what extent is the DOL AME project sustainable and transferable?*, evaluators explored and described how the successful program components will be sustained beyond the life of the grant, and identified the components and strategies that can be duplicated in other settings and programs.

Fidelity Assessment

To understand the fidelity of project implementation, McREL evaluators developed a fidelity assessment tool to examine three aspects of project implementation: (1) *adherence*, (2) *quality*, and (3) *participant responsiveness* (Century et al., 2010). Adherence focuses on the "structural" aspects of implementation, while quality and participant responsiveness focus on the "procedural" aspects of implementation.

Adherence

By definition, *adherence* refers to the extent to which the critical components of an intended program are present when it is enacted (Century et al., 2010). To assess adherence, evaluators identified a total of 15 implementation indicators based on the Project Work Plan and project narrative to evaluate the extent to which the AME project team has made progress toward full implementation over time (see Table 17 for the number of indicators identified across the implementation areas). During each assessment round, McREL evaluators reviewed project records and objectively assigned a rating to each indicator.[26] The project director and site managers were provided the opportunity to review the ratings and provide feedback. A sum score (Adherence Score) was then calculated by adding all of the individual ratings together presenting the project's implementation status. Percentiles[27] were also calculated to present the DOL AME project's progress toward full implementation within each implementation areas as well as the overall implementation. As part of the adherence assessment, any modification made to the project plan and reasons for the modification were also described.

Table 17. Numbers of Implementation Indicators Across Implementation Areas

Implementation Area	Number of Indicators Identified		
	Adherence	Quality	Participant Responsiveness
Strategy 1. Provide a technology-enriched environment	5	3	0
Strategy 2. Develop and integrate a hybridized and modularized curriculum	3	10	3

[26] Each indicator was rated on a five-point scale from 0 (has not yet been implemented) to 4 (fully implemented). Therefore, for the overall implementation, the lowest possible score was 0 and the highest possible score was 60.

[27] Percentiles were calculated using the following formula: (sum score / highest score possible) * 100.

Implementation Area	Number of Indicators Identified		
	Adherence	Quality	Participant Responsiveness
Strategy 3. Facilitate comprehensive and continuous student support for persistence and engagement	3	10	2
Strategy 4. Conduct marketing activities and program outreach	1	1	0
Strategy 5. Collaborate with employer and workforce partners	3	6	8
Total	**15**	**30**	**13**

A total of four adherence assessments were conducted throughout the implementation period on the following timeline.

T1: December 2013 (using data collected between July and December 2013)
T2: June 2014 (using data collected between January and June 2014)
T3: December 2014 (using data collected between July and December 2014)
T4: September 2015 (using data collected between January and September 2015)

Quality

Because a program's effectiveness is impacted by the quality in which it has been implemented, *implementation quality* is measured as part of the fidelity assessment using two data sources. First, a total of 20 items from the Student Exit Survey (see Chapter 3 for more details) that assess participants' perceptions of the quality of implementation across specific project components were included in the quality assessment. From these data, an overall *Quality Index_Student Report* (QI_SR) score was calculated to better understand participant perceptions at the program level over time. Second, 10 items from the Partner Survey asking about partners' perspectives of the DOL AME project's implementation quality, especially in areas where they were expected to be involved to support the project objectives, were included as part of the quality assessment (see Chapter 3 for additional info). From these data, an overall *Quality Index_Partner Report* (QI_PR) score was calculated. Table 17 shows the number of quality indicators identified across the implementation areas.

To calculate the QI_SR and QI_PR scores, individual responses on each survey item were first reclassified into two categories: endorsed response and not-endorsed response. Specifically, all items were measured on a 5-point Likert-type scale ranging from 1 to 5. A response of 4 or 5 was recoded as 1 (endorsed response), and a response of 1, 2, or 3 was recorded as 0 (not-endorsed response). Frequencies were then calculated to present the percentage of participants or partners who endorsed the items. A score of 1 was given when 25% or less of the participants or partners endorsed an item; a score of 2 was given when 26% to 50% endorsed an item; a score of 3 was given when 51% to 75% endorsed an item; and a score of 4 was given when 76% or more endorsed an

item. A sum score was then calculated for the QI_SR and QI_PR scores. Percentiles[28] were also calculated and reported. Quality assessments were conducted on an annual basis using the data collected during the reporting timeframe.

Additionally, to understand the quality of the CT/MT training model, data collected from the CT/MT Survey were analyzed to explore the quality of (1) CT E&E support, (2) course content, and (3) instructor effectiveness. These data were collected by AME grant staff throughout the project, and were submitted to evaluators toward the end of the grant for analysis. Thus, data collected throughout the life of the grant were aggregated and reported.

Participant Responsiveness

Participant responsiveness is a measure of stakeholder responses (i.e., those received from participants and partners) and their engagement in project activities. It is hypothesized that the higher the level of enthusiasm and engagement among stakeholders, the better the outcomes will be. To assess participant responsiveness, two data sources were used. First, evaluators utilized data collected from the Student Exit Survey to assess participants' level of satisfaction with the DOL AME project's services and activities, as well as their participation in and enthusiasm for the project services. A total of six items were included in the assessment. From these data, an overall *Participant Responsiveness Index_Student Report* (PRI_SR) score was calculated to better understand students' perceptions at the program level over time. Second, seven items from the Partner Survey that asked about partners' involvement in the project were included as part of the assessment. From these data, an overall *Participant Responsiveness Index_Partner Report* (PRI_PR) score was calculated. The number of participant responsiveness indicators identified across the implementation areas are presented in Table 17. The same methods used to calculate the QI_SR and QI_PR scores were also used to calculate the PRI_SR and PRI_PR scores, followed by calculations of percentiles. Assessments of participant responsiveness were conducted on an annual basis using data collected during the reporting timeframe.

Taken together, the fidelity assessment provides information related to the DOL AME project's strengths and weaknesses, and provides actionable and timely information to strengthen the quality of implementation. As such, it was utilized as a tool to guide strategic planning that supported continuous improvement and ensured that all of the project elements were implemented as planned within the performance period so outcome analyses could be conducted without interference.

Data Analyses

For the fidelity assessment, descriptive statistics (e.g., frequencies, percentages, means, standard deviations, or cross-tabulations) were conducted for the Student Exit Survey and Partner Survey as well as other relevant project records (e.g., student services log and CT/MT evaluation

[28] Percentile was calculated using the following formula: (sum score / highest score possible) * 100.

data). Before data analyses were performed, McREL evaluators screened the data for data entry errors and improbable responses.

A variety of qualitative data sources were also collected during grant Years 2 and 3 and used to amass a body of contextual knowledge about the DOL AME project from multiple stakeholders. These data help ensure a comprehensive understanding of how and why the project results were achieved. Further, the triangulation of qualitative and quantitative data enable evaluators to corroborate patterns and/or identify discrepancies in data obtained through mixed methods. The general approach to analyzing qualitative data include the following concepts from interview analyses: *Life world*, to enter and understand what is being expressed by the interviewee; *Meaning*, to understand and interpret the meaning of central themes; *Specificity*, to obtain descriptions of specific situations; *Focus*, to focus the interview on themes as they emerge; *Qualitative knowledge*, to obtain qualitative knowledge as expressed by the interviewees; and *Deliberate näiveté*, to be open to any new and unexpected phenomena (Kvale, 1996). As appropriate, qualitative data were analyzed using NVivo software, and prevalent themes and emerging issues were identified. Thematic analysis focuses on identifying words or phrases that summarize the information being shared in the interviews. As such, data were segmented into passages through coding and emerging themes were identified, then the data were reviewed for replicating categories. These categories were given broad codes; finer coding was employed to identify patterns emerging within each coded set. Themes were then summarized by salient, prevalent issues.

Chapter 7. Implementation Findings

This chapter describes the implementation of the DOL AME project during the first 42 months of the grant (performance period). Findings are presented by evaluation question.

Q1. How were the key strategies and activities of the DOL AME project implemented?

Evaluators drew upon the findings from project records, interviews, focus groups, and surveys to evaluate the DOL AME project's implementation across five specified strategies and discuss the successes in implementation.

Technology-Enabled Components

Ensuring that a technology-enriched environment is in place and that faculty are adequately trained to use the tools are key strategies associated with the technological infrastructure priority of the grant. Below are the major activities and accomplishments related to the implementation of technology-enabled components during the performance period, followed by the major successes shared by project staff, instructors, partners, and participants.

MT Operation and Lab Equipment Installation. New lab equipment was purchased and installed during the first two years of the grant. Training sessions for instructors to learn how to utilize the new equipment was provided as needed. The majority of MT units (12 out of 13) were purchased and installed at the colleges and partner sites in grant Year 1; the last MT unit was installed in grant Year 2. In Year 3, project staff transferred some MT units between the partner sites to maximize the equipment's utilization. To support the operation of the MT units and effective instruction using the MT model, the structure of the MT Consortium Governing Board

was established in grant Year 1; training sessions in the basic use of the MT equipment were provided for instructors by technicians as needed; and a New Instructor Toolkit was developed by project staff for CT/MT course instructors. CT courses were offered via MT for the first time during the third quarter of grant Year 2, and were continued to be offered. Throughout the performance period, a total of 10 CT courses were offered via MT: (1) CMAE 1502 Technical Math; (2) CMAE 1506 Intro to Computers; (3) CMAE 1510 Print Reading; (4) CMAE 1514 Safety Awareness; (5) CMAE 1518 Manufacturing Processes; (6) CMAE 1522 Quality Practices; (7) CMAE 1526 Maintenance Awareness; (8) CMAE 1528 Career Success Skills; (9) ETEC 1550 Intro to Robotics; and (10) CMAE 1560 Interpreting Symbols. All courses were offered via hybrid mode, except that the ETEC 1550 was offered in person.

Simulation Course Development and Implementation. Conversations between project staff and the Johnson Center for Simulation (JCS, located on the PTCC campus) were held to discuss the inclusion of gaming and simulations in project-supported courses started in grant Year 1. In Year 2, instead of developing six to seven interactive simulation courses as proposed in the Project Work Plan, project staff and JCS staff decided to develop four courses: (1) CMAE 1510 Print Reading, (2) CMAE 1514 Safety Awareness, (3) CMAE 1518 Manufacturing Processes and Production, and (4) CMAE 1522 Quality Practices. Development of two courses were completed by the end of grant Year 3. Specifically, the simulation for the CMAE 1510 Print Reading course was completed and has been shared with faculty members at 15 colleges. The full version of the CMAE 1518 Manufacturing Processes and Production course also became available by the end of grant Year 3. Given staffing changes at the JSC toward the end of grant Year 3, the AME Alliance made an executive decision to stop the development of other selected courses.

Successes. According to project staff and partners, MT equipment has been an asset to the project. It allows staff and faculty at each college to reach out to more students and give students the option to take certain courses remotely. Delivering CT courses via the MT equipment has also been an attractive aspect of the project for industry partners as these courses provide opportunities for partners to fill the skills gaps of their current employees through credit and non-credit lab classes. The MT model has also increased employer partners' engagement with the DOL AME project because it allows employees to participate in training from their place of business so that time off from the manufacturing production line is reduced. In fact, 54% (1,171 out of 2,163) of the AME participants are CT/MT students.

Particularly noteworthy is that the AME Alliance's MT model won the Minnesota Council for Continuing Education and Customized Training 2015 Exemplary Program Award and was nominated for manufacturing awards from Minnesota Business Magazine as well as the National Council for Continuing Education and Customized Training Exemplary Program Award in 2015. By the end of the grant performance period, the AME Alliance's MT model has been shared with the other 12 colleges that are part of the 360 Center. The MT model has also been adapted by Round 3 and 4 TAACCCT grant recipients and is being used in both state and federally funded apprenticeship programs. Furthermore, the MT model has allowed a new partnership to develop with the Minnesota Department of Corrections to offer advanced manufacturing training to inmates to prepare them for successful careers once their time is served.

Hybridized and Modularized Curricula

To accelerate student learning, the DOL AME project provided hybridized and modularized courses. Plans for hybridization included finding different ways to deliver courses (e.g., in-person, online, or via a hybrid mode, combining traditional content with simulations or gaming). With regard to modularized courses, the plan was to partition courses into discrete sections so that students only took the sections they needed, thereby accelerating their progress through the program. Additionally, the project planned to integrate ABE into content courses to ensure that students acquired basic educational skills while completing their required courses. Below are the major activities and accomplishments related to the implementation of hybridized and modularized curricula components during the first three years of the grant, followed by the major successes shared by project staff, instructors, partners, and participants.

Curriculum Development and Implementation. All programs of study were launched during grant Year 2. Additionally, in response to partner requests, AME project staff developed and rolled out a new 8-credit credential aligned to the Manufacturing Skill Standards Council's (MSSC's) National Certified Production Technician credential. This new certificate program is stackable onto the existing 16-credit Production Technologies Certificate, and can be articulated into career pathways that include additional certificates, diplomas, an AAS degree, and a bachelor of science degree. PTCC also developed a new 18-credit Plastic Production Certificate that is better aligned to industry and student needs. In Year 4, PTCC also worked with employer partners to develop career pathways from MT certificates to AAS degrees.

At the consortium level, AME Alliance leaders continue to work with partners to identify training needs and develop new training programs to supplement the offerings developed with the AME grant funding. To assist in future curriculum development efforts, the consortium developed a curriculum review process for third-party subject-matter experts (SMEs) in grant Year 4. The process includes a review by both an instructional designer and a technical SME using rubrics developed by the consortium. For the DOL AME grant, five external reviewers were selected by the AME Alliance leadership team: one instructional design expert and four technical experts. These SMEs continued to review curricula as new ones were developed in Year 4.

Hybridized Course Development and Implementation. During grant Year 2, four courses were hybridized and offered to grant participants: (1) CMAE 1514 Safety Awareness; (2) CMAE 1518 Manufacturing Processes; (3) CMAE 1522 Quality Practices; and (4) CMAE 1526 Maintenance Awareness. The utilization of MT equipment was integrated in the delivery of these hybridized courses.

Modularized Course Development and Implementation. A total of five courses were modularized. Specifically, three courses were modularized in grant Year 3: (1) CMAE 1514 Safety Awareness; (2) CMAE 1518 Manufacturing Processes and Production; and (3) CMAE 1522 Quality Practices. These courses tended to be offered via a hybrid mode, with portions being online and portions being delivered in-person in either a classroom or laboratory setting. The design of the eTECH courses and modules was aligned with the MSSC's industry-recognized National Certified

Production Technician credential. In Year 3, two more CMAE courses were modularized, including (1) CMAE 1502 Technical Math, and (2) CMAE 1526 Maintenance Awareness. These courses are part of the CT/MT courses being delivered via MT technology.

ABE Integrated Course Development. During the first two years of the grant, ABE was integrated into several courses, including (1) CMAE 1502 Technical Math, (2) MTTP 1208 Measuring Tools, and (3) MTTP 1262 Blueprint Reading II. During grant Year 3, there was a discussion of providing an ACCUPLACER® Preparatory course with ABE. In Year 4, partnering with local ABE instructors, the consortium developed and delivered the ACCUPLACER® Preparatory course via MT to support students who would like to enroll in the Technical Math course (CMAE 1502), a requirement for the Production Technologies certificate program.

Successes. Throughout the performance period, the DOL AME project has successfully developed hybridized and modularized courses. These courses were integrated with MT technology as well as ABE, as appropriate. Table 18 shows a snapshot of these courses.

Table 18. Hybridized, Modularized, MT Technology Integrated, and ABE Integrated Courses

Course	Hybridized	Modularized	MT Integrated	ABE Integrated
CMAE 1502 Technical Math	X	X	X	X
CMAE 1514 Safety Awareness	X	X	X	
CMAE 1518 Manufacturing Processes	X	X	X	
CMAE 1522 Quality Practices	X	X	X	
CMAE 1526 Maintenance Awareness	X	X	X	
MTTP 1208 Measuring Tools				X
MTTP 1262 Blueprint Reading II				X
ACCUPLACER® Preparatory course			X	X

According to project staff, instructors, partners, and participants, the DOL AME project provided positive experiences for all groups. For instance, during the staff interviews, project staff emphasized that the hybridized and modularized curriculum design and the integration of curriculum with MT technology has provided students and employers with a convenient means to access high-quality training that adheres to industry standards. Additionally, to ensure the curricula are aligned with national standards, there was more cross-training and collaboration among instructors at the college level (i.e., between departments) and consortium level (i.e., between colleges). From participants' perspectives, they were not only satisfied with their programs of study and the associated coursework, but were also unequivocally and enthusiastically excited about the instructors who delivered the content. According to findings from the focus groups, students described their instructors as "extremely helpful," "talented," "easygoing," "knowledgeable," "accessible," "accommodating," and "dedicated" – true professionals who have, through a combination of work and teaching experience, mastered the material they are presenting. Overall, students expressed that AME instructors have been "making sure that [they are] on the right path

with everything," whether it relates to academics, job searches, family life, or any other facet of their lives. Students also expressed confidence that their courses were adequately preparing them for a career in manufacturing and providing them with "a lot of skills" that they need to succeed. One student stated, "You can go anywhere with what we learn here." Another student shared the perception that the AME project put him or her in a better position in terms of employability than some other schools with similar programs.

Wraparound Student Support Services

As students enrolled, they were assigned an E&E advisor who was tasked with providing individualized counseling and support services to them throughout their program of study. Project plans called for two E&E advisors to be available at each school to manage the student case load for their respective colleges. Below are the major activities and accomplishments related to the implementation of comprehensive and continuous student support services during the first three years of the grant, followed by the major successes shared by project staff, instructors, partners, and participants.

Student Support Services Implementation. All six E&E advisors across the AME colleges were hired by the end of grant Year 1. These advisors generally had prior experience providing support services for students before being hired to fill the student support and case management roles in the DOL AME project. Throughout the performance period, the E&E advisors met with all students during enrollment and registration events, and during courses to explain the project and assist students in formally enrolling and completing the required intake form. In addition to making their contact information available to students, the E&E advisors arranged individual meetings with each student to discuss their plans, goals, and needs and to inform them of their options related to program completion and employment pathways. Support services were offered based on best practices in student support, the advisors' professional judgment, and students' individual needs.

The wraparound individualized student support services were delivered through various means (e.g., phone calls, in-person meetings, group meetings, e-mail, and so on). These efforts were well documented in the student support service logs with additional data being provided during the project staff interviews with E&E advisors. Based on the student support service logs, each AME participant had an average of 3.75 meetings with their E&E advisor (SD = 3.75, Min. = 0, Max. = 42); and the E&E advisors, on average, completed 7.66 contacts or outreach activities with each participant (SD = 8.58, Min. = 1, Max. = 49) during their course of study. According to interview data, the E&E advisors from one college implemented a weekly newsletter through the Desire2Learn system that addresses a variety of topics related to the DOL AME project's support mechanisms. The E&E advisors and instructors from another college are utilizing the Starfish EARLY ALERT™ system to sufficiently track student progress, highlight student successes, and notify all necessary parties about concerns related to excess absences, academic struggles, and any other issues. Project staff also reported that the E&E advisors across colleges formed a network to share ideas, resources, and effective practices for advising students; in addition, they proactively presented ideas for changes and improvements to the AME Alliance leadership team for discussion.

As part of the E&E advisors' responsibilities, they shared information related to Minnesota State College and Universities System's prior learning assessment (PLA) processes with students. The E&E advisor's role was to make sure that all participants were aware of the processes and able to take advantage of obtaining credits for prior learning (CPL) and military occupational specialties (MOS) credits. For instance, brochures about CPL and MOS credits were distributed to students at the E&E advisors' monthly informational sessions with additional information being provided in a follow-up e-mail. In addition, students were asked by their E&E advisors to discuss any prior credits they may have during their registration sessions. Students deciding to apply for these credits were instructed to fill out an application form and create a portfolio of documents (e.g., transcripts from former schools to demonstrate prior learning or MOS documentation from the student's branch of service). Faculty members then reviewed the portfolios and decided whether to accept or deny each student's request for credit. Students also have the option to test out of courses if they have had hands-on experience with the content in the past. Throughout the performance period, the AME project team held several workshops to discuss these available opportunities as well as the PLA processes with faculty and students.

By the end of the performance period, efforts to disseminate information to students and faculty members related to the CPL and MOS credits are paying off. During the first two years of the grant, while students were aware of these credit options, both faculty members and E&E advisors mentioned that a low percentage of students decided to apply for these credits or to test out of courses based on their prior knowledge and skills. Students perceived the process as arduous and indicated that they would rather take the course to refresh their knowledge and be on the same level as their cohort. Yet, during grant Year 3, staff put forth extra effort to clarify misconceptions about CPL and MOS credits by streamlining the PLA processes across the entire consortium. As a result, participants who applied for CPL or MOS credits started seeing the benefits of those credits with decreased time required for program completion as well as associated costs. According to project records, as of the end of grant Year 3, 100 participants received a total of 887 CPL (Min. = 1; Max. = 44) and five participants received a total of 27 MOS credits (Min. = 2; Max. = 13).

To better serve students enrolled in the CT courses, the AME Alliance also began providing student support services through a CT E&E advisor, a new position created for the grant project. This E&E advisor utilized MT equipment and similar communication strategies as those used by the "traditional" E&E advisors to reach out to this segment of the AME student population. Project staff commented that this positively impacted students.

Additionally, as the project enrolled more students in the CT courses, the CT advising model improved to better support students who are not on campus. The integration of intensive advising services into the CT classes has been critical to the success of the new MT model.

To support job placement for participants, project staff invested in significant efforts to form and foster relationships with the partners to raise their awareness of the qualified workers that they could hire from the AME programs. Both informal and formal networking opportunities between the E&E advisors, instructors, and partners were reported by project staff members. Examples of these networking opportunities included inviting partners to campus events/activities

and classes, stopping by businesses to give a presentation about the AME programs, and calling partners to explain their role as an E&E advisor and to ask for their support.

Successes. Data collected from staff, instructors, and students, overall, suggested that the support services provided by the E&E advisors have consistently been one of the DOL AME project's major strengths throughout the performance period. For instance, data collected from the student focus groups revealed that students were appreciative of the individualized support services they received from their E&E advisors. Generally, students were effusive in their praise, commenting that the E&E advisors have been "extremely helpful," "very good at what [they do]," and "pretty awesome." According to staff interviews, project staff members expressed the perception that the E&E advisors are "fantastic" at their jobs and have established successful and mutually beneficial relationships with both the AME instructors and students.

Employer partners also praised the work of the E&E advisors during the interviews. One partner shared, "It's great for our people to have someone they can go to, someone to keep them on track and get them signed up for everything they need. They've done a phenomenal job of keeping track of everyone and making sure they are doing exactly what they need to do to get through their programs successfully." Multiple faculty and staff members recounted individual student success stories that occurred because of the immense support they had received. An E&E advisor paraphrased a thank you e-mail received from a student that said,

> *I was beginning to feel that I couldn't get hired anyplace, but I walked in today and filled out an application, and I remembered what you told me: . . . to make sure and present myself well and have confidence. They ended up testing my skills in manufacturing and they said that I scored [the] highest that they've ever seen, and they're offering me a job. So thank you.*

AME Alliance staff also indicated that Year 3 saw drastic improvement in collaboration across the consortium in both providing and refining student support services. "I would say, in Year 3, probably the biggest success in the student support services area is taking our campus-based models and being able to replicate the majority of those services into the MT program and at other schools," explained one interviewee. "We've been identifying things that work well at certain campuses and bringing them to the other campuses. We've done a lot of that, that sharing of ideas or processes, which I think has enhanced the services at every campus."

With regard to successes in job placement, E&E advisors reported that they are seeing the majority of students graduate from their programs and go straight into the manufacturing field. Project staff attributed such success to the strategic planning of engaging partners early in the DOL AME project's implementation and programming, as well as E&E advisors' dedication to serve students. From the student perspective, they had participated in tours of local manufacturing employers' facilities and found these tours to be of major benefit to them. Students also expressed their appreciation for the on-campus visits from manufacturing employers. Both types of activities were viewed as opportunities that will better equip them to make program and employment decisions.

Outreach and Marketing

To support recruitment efforts, AME project staff planned to launch a website and collaborate with project partners to disseminate information about the programs to the targeted population, including TAA-eligible individuals, dislocated workers, veterans and their spouses, incumbent workers, and other adult learners. Below are the major activities and accomplishments related to the implementation of the DOL AME project's outreach and marketing plan during the first three years of the grant, followed by the major successes shared by project staff, instructors, partners, and participants.

Marketing Effort. Project staff regularly disseminated the project's marketing collateral (e.g., flyers, posters, and brochures) to local business partners and prospective participants. In addition, a project website (http://www.amealliance.org) was launched in September 2013 to provide information about the training available through the grant to the general public. The website included information about the program offerings, project partners (including links to the partners' websites), and resources for job seekers. A major revamping of the website occurred in Year 3 to ensure easy navigation and attract potential partners and participants.

To disseminate program information to the targeted populations, AME project staff regularly engaged in personal outreach activities (e.g., meeting with workforce center staff and employer partners) and participated in college fairs, events for veterans, and Manufacturers' Week[29]. Regular meetings with industry and workforce partners were held to keep them informed about updates or refinements to the project's structure or offerings (i.e., CT/MT courses).
CT representatives also served as a key outreach mechanism for the consortium by coordinating with local businesses to offer training for employees, identifying the training needs within the local industry, and reaching out to potential partners about the opportunities available through the DOL AME project. Additionally, to increase interest in the AME programs of study, faculty, advisors, and the admissions team held monthly informational sessions for potential students.

To assist with marketing efforts, a marketing director was hired during grant Year 2 to alleviate the responsibilities from the lead college (i.e., CLC). However, the marketing director left the grant in Year 3; hence, an external marketing firm was hired to support the DOL AME project's outreach efforts. In addition, to reach out to a bigger population, the AME Alliance also published articles about the training opportunities in regional trade publications.

Successes. According to staff interview data, there appeared to be a consensus among project staff and partners that the most effective marketing strategies were word-of-mouth (e.g., local community members and partners hearing about student successes after AME graduates entered the workforce.) This perception is consistent with the findings from participants' responses on the Student Entrance Survey. According to the survey, as shown in Table 19, the most effective

[29] Manufacturers Week in Minnesota is an annual weeklong event sponsored by several entities, including the Minnesota DEED, the Minnesota Precision Manufacturing Association, the Minnesota Chamber of Commerce, and Dream It, Do It. Organizers encourage local communities and partners to plan events that acknowledge the importance of the manufacturing industry to the economy and local communities in Minnesota.

marketing efforts were word-of-mouth (e.g., from family and friends, or personal contact with college faculty or staff) and web-based information (e.g., college or program website, or online searches). This pattern was pretty consistent throughout the life of a grant.

Table 19. Program Dissemination Methods (%)

How did you hear about the program in which you are currently enrolled?	Year 2 (*N* = 15)		Year 3 (*N* = 196)		Year 4 (*N* = 178)		Overall (*N* = 389)	
	n	%	*n*	%	*n*	%	*n*	%
Advertisements (such as TV, radio, newspaper, online ads, or billboards)	0	0.0%	3	1.5%	11	6.2%	14	3.6%
News or media reports (such as TV interviews, news releases, or a story in the paper)	1	6.7%	1	2.0%	4	2.2%	9	2.3%
Newsletter from the program	0	0.0%	2	1.0%	5	2.8%	7	1.8%
Newsletter from a company or trade union/ association	0	0.0%	2	1.0%	2	1.1%	4	1.0%
Social media or social networking (such as Facebook, Twitter, LinkedIn, YouTube, blogs, or RSS feeds)	1	6.7%	7	3.6%	14	7.9%	22	5.7%
E-mail (such as through a listserv)	0	0.0%	2	1.0%	5	2.8%	7	1.8%
College or program website	5	33.3%	62	31.6%	60	33.7%	127	32.6%
Other websites (such as a workforce/unemployment center)	1	6.7%	7	3.6%	4	2.2%	12	3.1%
Program brochures, flyers, postcards, or posters	0	0.0%	9	4.6%	10	5.6%	19	4.9%
Online search I initiated	7	46.7%	46	23.5%	47	26.4%	100	25.7%
Community events (including college, career, or employment fairs)	1	6.7%	14	7.1%	16	9.0%	31	8.0%
From family and friends	6	40.0%	94	48.0%	104	58.4%	204	52.4%
From workforce center staff (job counselor, social services, public assistance programs, etc.)	1	6.7%	22	11.2%	8	4.5%	31	8.0%
From employers/potential employers	3	20.0%	28	14.3%	27	15.2%	58	14.9%
Personal contact with college faculty or staff	2	13.3%	39	19.9%	33	18.5%	74	19.0%

Note. Only participants who were enrolled in traditional certificate, diploma, and degree programs were invited to take the Student Entrance Survey; CT/MT students were omitted. Year 2 includes responses collected between October 2013 and September 2014. However, marketing data were not collected from the Fall 2013 cohort; therefore, the data were based on the Spring 2014 and Summer 2014 cohorts. Year 3 includes responses collected between October 2014 and September 2015. Year 4 includes responses collected between October 2015 and September 2016.

Another success acknowledged by project staff members was the consortium-wide partnership among the institutions and local businesses with the shared goal of reaching out to students who could enhance their careers with the DOL AME project. The relationship among the partners, businesses, and colleges has created a vast array of resources available to all project stakeholders. One AME project staff member shared, "We've been able to reach out to . . . [and] engage new business partners, which [has] led to more students and more participants." This staff

member added, "I would just summarize and say [that] there are many students whose lives have been changed by the grant."

Partner Involvement and Contribution

The colleges constituting the AME Alliance built upon existing relationships with local manufacturing companies, workforce agencies, and community partners to facilitate partner engagement and collaboration for the DOL AME grant. Upon learning of the federal approval for the project, leaders of the AME Alliance reached out to core partners to begin collaborating on start-up activities. Below are the major activities and accomplishments related to the implementation of partner involvement and support strategies during the first three years of the grant, followed by the major successes shared by project staff, instructors, partners, and participants.

Partner Involvement. When the DOL AME grant was funded, the project had a total of 18 industry partners. Of the initial group, some had been actively engaged with the advisory boards to discuss training and education needs in their companies and industries before the grant began. AME project staff capitalized on those existing relationships to constitute advisory boards that would help inform and guide program development, review new and revised curricula, and provide feedback to project staff about how the project activities can best serve employer needs. Also, as a result of active outreach efforts, the DOL AME project expanded the number of partnerships to 129, 145, and 154 by the end of grant Years 2, 3, and 4, respectively.

The existing and new partnerships contributed to the grant in various ways. For instance, employer partners provided feedback on curricula and training topics, especially when related to their needs and interests in the CT courses, and provided feedback, time, and space for their employees to participate in AME courses delivered through the MT equipment. Employers also participated in various job placement activities, such as career fairs, mock interviews, internship opportunities, and so on. According to project records, during the performance period (between October 2012 and September 2015), 17% (306 out of 1,850) of the AME participants had some sort of experiential learning experience (i.e., job shadowing, paid internships, or unpaid internships) with the project partners. AME project staff also actively reached out to employers to provide information sessions about the available AME programs to help workers advance and for the employers to close their skill gaps. In addition, the AME Alliance colleges cohosted several events to promote the DOL AME project and its programs of study during Manufacturers Week in Minnesota. Finally, to engage industry, workforce, and community partners and promote continuous communication about the project's progress, AME project staff maintained regular formal (i.e., advisory group on a quarterly basis, and a consortium-level newsletter) and informal communication with the employer partners to provide information and updates about the project and listen to any other feedback or ideas that the partners wanted to share.

Successes. Throughout the performance period, project staff actively engaged partners in meetings and offered presentations to key stakeholders in person, via phone, and through other media. In addition to the regular meetings with key partners (e.g., advisory board and other partner meetings), project staff members interacted with partners through manufacturing events and job

fairs. By doing so, AME project staff were able to capitalize on existing events not directly sponsored by the grant to reach out to current and potential partners. Additionally, both the partners and project staff expressed the perception that the advisory board meetings were a positive element of the grant. Staff reported that workforce and industry partners were not afraid to provide candid input and critiques of the program design and each of its components. When something was not working as expected, they gave thoughtful advice on how it should be changed. Throughout the first three years of the grant, the DOL AME project developed a great reputation in the community and within the workforce, and local businesses are eager to partner with the program.

Q2. To what extent were the key DOL AME project strategies and activities implemented as planned?

This set of questions examines the fidelity of implementation—to what extent the project was implemented with high quality and a high level of participant engagement while adhering to the original plan. Specifically, four aspects of implementation were examined: (1) *adherence*, (2) *dosage*, (3) *quality*, and (4) *participant responsiveness*. A total of four fidelity assessments were conducted in grant Years 2 and 3, and the results are discussed by evaluation question.

Implementation Adherence

Adherence documents the extent to which a project has been implemented as planned. A snapshot of the DOL AME project's progress in implementing various strategies over time is presented in Table 20.

Table 20. Adherence Ratings by Strategy Over Time

Adherence Indicators	T1	T2	T3	T4
Strategy 1. Provide a technology-enriched environment	**11**	**14**	**17**	**19**
1. Provide a technology-rich environment with MT equipment installed at the partner sites (five MT partners per college).	4	4	4	4
2. Purchase and install new lab equipment before relevant courses start.	1	2	3	4
3. Develop six to seven interactive simulation courses.	1	2	3	3
4. Provide training to instructors to support the use of MT equipment; training is provided at each college before relevant courses start.	3	4	4	4
5. Provide training to instructors to support the use of new lab equipment; training is provided at each college before relevant courses start.	2	2	3	4
Strategy 2. Develop and integrate a hybridized and modularized curriculum	**7**	**10**	**12**	**12**
1. Integrate ABE and developmental education into the manufacturing curricula (contextualized and supported instruction); ABE-integrated industry courses are implemented at CLC and PTCC.	2	4	4	4
2. Develop and revise the program tracks for the Automation/Robotics, Reverse Engineering/Rapid Prototyping, Plastic Technology, and Precision Manufacturing/Machine Tool programs.	3	4	4	4

Adherence Indicators	T1	T2	T3	T4
3. Develop five modularized courses.	2	2	4	4
Strategy 3. Facilitate comprehensive and continuous student support for persistence and engagement	**5**	**10**	**11**	**11**
1. Establish individualized case management: All students have an individualized learning plan (ILP) on file.	2	2	3	3
2. Increase student awareness of the PLA protocol: PLA protocols and brochures are developed and distributed to students.	2	4	4	4
3. Increase veterans' awareness of the MOS protocol: Refine and expand MOS credits to all courses.	1	4	4	4
Strategy 4. Conduct marketing activities and program outreach	**3**	**3**	**3**	**4**
1. Develop marketing materials; the marketing materials and AME program website are fully developed by the lead institution.	3	3	3	4
Strategy 5. Collaborate with employer and workforce partners	**8**	**11**	**12**	**12**
1. Recruit new employer partners (18 employer partners are listed in the program narrative).	4	4	4	4
2. Incorporate industry partners' feedback into curriculum development and revision.	3	4	4	4
3. Route students into jobs: Before program completion, students have some sort of experiential learning experience (e.g., site visits, job shadowing, or internships).	1	3	4	4
Total Adherence Score [a]	**34**	**48**	**55**	**58**

Note. Each indicator was rated on a 5-point Likert-type scale: 0 = not yet implemented; 1 = partially low implementation; 2 = partially moderate implementation; 3 = partially high implementation; and 4 = full implementation.

T1 was conducted in December 2013 (using data collected between July and December 2013); T2 was conducted in June 2014 (using data collected between January and June 2014); T3 was conducted in December 2014 (using data collected between July and December 2014); and T4 was conducted in September 2015 (using data collected between January and September 2015).

[a] The highest score possible for the total adherence score is 60.

After converting the ratings into percentiles, results are shown in Figure 4. In particular, findings indicate that the project was at the 97th percentile in terms of full implementation by the end of grant Year 3, an overall 40-percentage-point increase since Fall 2013 (beginning of grant Year 2). Across all of the DOL AME project strategies, three have been fully implemented (i.e., Strategies 2, 4, and 5). The project was just three percentage points shy from full implementation (100%), which is primarily due to two reasons. First, under Strategy 1, because of staffing changes at JCS, project leaders decided to discontinue the simulation development work. Instead, AME Alliance project leaders focused their limited resources on developing and promoting the CT courses and student support services. Secondly, under Strategy 3, according to the Project Work Plan, all participants would have an individualized learning plan (ILP) on file. Data showed that, as of the end of grant Year 3, only 95% (1,760 out of 1,850) of the AME participants had an ILP. While this did not meet the project goal, the effort put forth by AME project staff resulted in 95% of students having ILPs on file.

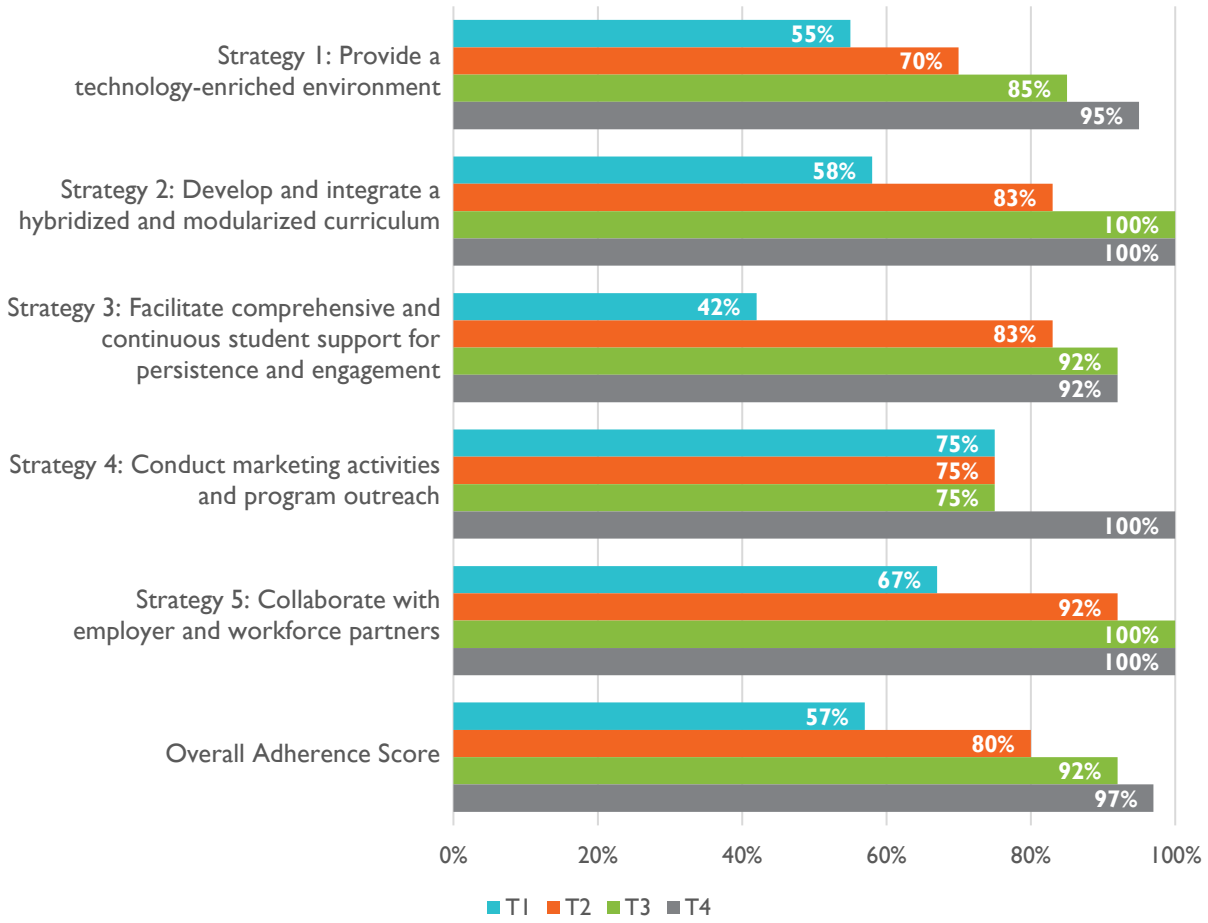


Figure 4. Adherence Findings: Percentile of Reaching Full Implementation Over Time

Note. The total score of each strategy was divided by the highest possible score. T1 was conducted in December 2013 (using data collected between July and December 2013); T2 was conducted in June 2014 (using data collected between January and June 2014); T3 was conducted in December 2014 (using data collected between July and December 2014); and T4 was conducted in September 2015 (using data collected between January and September 2015).

Implementation Quality

To assess the *quality* of implementation of the DOL AME project, evaluators identified 30 indicators from the Student Exit Survey (20 indicators) and Partner Survey (10 indicators). Table 21 shows the results of implementation quality across each project strategy over time from the student perspective. The scores shown in Table 21 are the index scores, which have been calculated based on the percentage of Student Exit Survey respondents who endorsed the items.[30]

Table 21. Quality Index Score by Project Strategies Over Time: Student Perspectives

[30] A score of 1 was given when 25% or less of the AME participants endorsed an item; a score of 2 was given when 26% to 50% endorsed an item; a score of 3 was given when 51% to 75% endorsed an item; and a score of 4 was given when 76% or more endorsed an item.

Quality Indicators	Y2	Y3	Y4
Strategy 1. Provide a technology-enriched environment	**5**	**7**	**6**
1. Students indicated that their training program provided a technology-rich environment (e.g., the use of MT equipment or iTV) that facilitated their learning experience.	2	3	3
2. Students indicated that the project provided state-of-the-art lab equipment that prepared them to be competitive in the job market.	3	4	3
Strategy 2. Develop and integrate a hybridized and modularized curriculum	**25**	**26**	**26**
1. Students indicated that the training they are receiving will be somewhat likely or very likely to help them get the job they want.	4	4	4
2. Students indicated that they are *somewhat confident* or *very confident* that the career training they receive here will give them the necessary knowledge and skills to succeed in their future job.	4	4	4
3. Students indicated that *a little* or *very little* of what they are learning in the AME programs is irrelevant to their future jobs.	2	3	2
4. Students rated the quality of their training program as *good* or *excellent*.	4	4	4
5. Students indicated that they know *much* or *very much* about the duties and responsibilities of the career and field in which they are receiving training.	3	3	4
6. Students indicated that the quality of the instruction they are receiving is *good* or *excellent*.	4	4	4
7. Students indicated that the instructors and courses make them feel like they can do the work successfully.	4	4	4
Strategy 3. Facilitate comprehensive and continuous student support for persistence and engagement	**34**	**36**	**35**
1. Students indicated that they feel it is *somewhat easy* or *very easy* to get answers to their questions about things related to their education and training.	4	4	4
2. Students rated the quality of academic advisement as *good* or *excellent*.	4	4	4
3. Students indicated that they *agree* or *strongly agree* that their E&E advisor was knowledgeable about his/her profession.	4	4	4
4. Students indicated that they *agree* or *strongly agree* that their E&E advisor was sensitive to their personal problems and needs.	4	4	4
5. Students indicated that they *agree* or *strongly agree* that their E&E advisor understood their career interests and goals.	4	4	4
6. Students indicated that they *agree* or *strongly agree* that their E&E advisor provided information and resources they needed to support their learning needs and career goals.	4	4	4
7. Students indicated that they *agree* or *strongly agree* that their E&E advisor worked with their faculty advisor (or academic advisor) to make sure their learning needs were met.	3	4	4
8. Students indicated that they *agree* or *strongly agree* that their E&E advisor helped them stay on track to complete their program.	3	4	3
9. Students indicated that they rated the overall quality of the coaching and counseling services they received as *good* or *excellent*.	4	4	4

Quality Indicators	Y2	Y3	Y4
Strategy 5. Collaborate with employer and workforce partners	**4**	**6**	**4**
1. Students indicated that the project provides opportunities *often* or *all the time* to build a network of professional contacts (including peers, mentors, employers, and so on).	2	3	2
2. Students indicated that the project provides opportunities *often* or *all the time* to build connections with potential employers.	2	3	2
Total Quality Index_Student Report (QI_SR) Score	**68**	**75**	**71**

Note. Only participants who were enrolled in traditional certificate, diploma, and degree programs were invited to take the Student Exit Survey; CT/MT students were omitted. Y2 includes responses collected between October 2013 and September 2014; Y3 includes responses collected between October 2014 and September 2015; and Y4 includes responses collected between October 2015 and September 2016.

After converting the quality index scores into percentiles, results are shown in Figure 5. Overall, the DOL AME project strategies were implemented with high quality, especially in the area of hybridized and modularized curricula and wraparound student support services, and the quality has been pretty consistent throughout the grant. The ratings were somewhat lower in the technology-enriched environment and partner involvement components. Although, the lower ratings on the technology-enriched environment component may be partially attributable to the fact that MT technology plays a greater role for CT/MT students as opposed to traditional students who were the survey respondents. Regarding participants' perceptions of partner involvement, the lower ratings may be because the main focus of the DOL AME grant is to actively engage partners in project implementation at the program level rather than at the participant level.

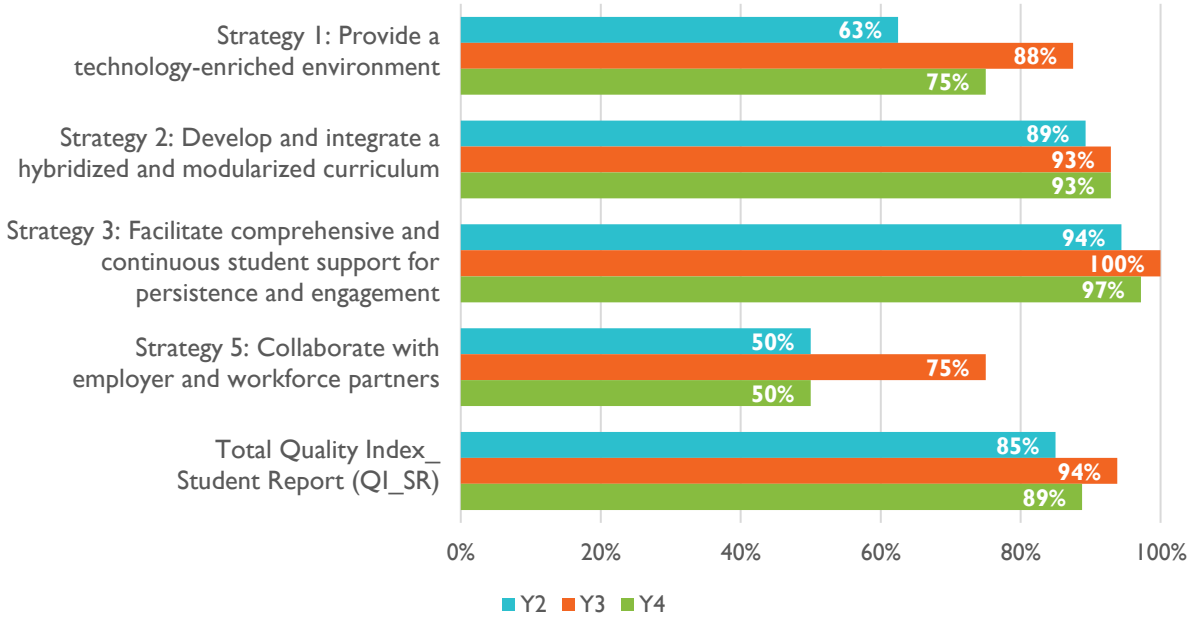


Figure 5. Participant Perspective of Implementation Quality: Percentile of Reaching the Highest Quality Index Score by Project Year

Note. The total score of each strategy was divided by the highest possible score. Y2 includes responses collected between October 2013 and September 2014; Y3 includes responses collected between October 2014 and September 2015; and Y4 includes responses collected between October 2015 and September 2016.

Table 22 shows the results of implementation quality across each project strategy over time from the partners' perspective. The index scores have been calculated based on the percentage of Partner Survey respondents who endorsed the items.[31]

Table 22. Quality Index Score by Project Strategies Over Time: Partner Perspectives

Quality Indicators	Fall 2013	Fall 2014	Fall 2015
Strategy 1. Provide a technology-enriched environment	**3**	**3**	**3**
1. Partners indicated that the quality of technology and equipment support is of high quality.	3	3	3
Strategy 2. Develop and integrate a hybridized and modularized curriculum	**10**	**9**	**11**
1. Partners rated the quality of curriculum design and development as high quality.	3	2	3
2. Partners indicated that they *agree* or *strongly agree* that AME programs offer certificate and degree programs that meet manufacturing industry needs.	4	4	4
3. Partners indicated that they *agree* or *strongly agree* that AME programs prepare workers with the knowledge and skills needed to be successful in the manufacturing industry.	3	3	4
Strategy 3. Facilitate comprehensive and continuous student support for persistence and engagement	**2**	**2**	**2**
1. Partners indicated that the quality of student support and placement services is of high quality.	2	2	2
Strategy 4. Conduct marketing activities and program outreach	**2**	**2**	**3**
1. Partners indicated that the project's participant recruitment components are of high quality.	2	2	3
Strategy 5. Collaborate with employer and workforce partners	**11**	**10**	**12**
1. Partners indicated that the quality of partnership support is of high quality.	3	2	3
2. Partners indicated that they *agree* or *strongly agree* that the AME project offers programs that support local workforce development.	3	4	4
3. Partners indicated that they *agree* or *strongly agree* that AME programs prepare high-skilled workers who meet local industry needs.	3	2	3
4. Industry partners indicated that they *agree* or *strongly agree* that AME programs prepare high-skilled workers who meet their company's needs.	2	2	2
Total Quality Index_Partner Report (QI_PR) Score	**28**	**26**	**31**

[31] A score of 1 was given when 25% or less of the partners endorsed an item; a score of 2 was given when 26% to 50% endorsed an item; a score of 3 was given when 51% to 75% endorsed an item; and a score of 4 was given when 76% or more endorsed an item.

After converting the quality index scores into percentiles, results are shown in Figure 6. Overall, the quality of the DOL AME project's implementation has been acceptable from partners' perspectives in almost all areas, except the wraparound student support services. The lower rating for this component may be attributed to the fact that partners have less direct involvement in that aspect of project implementation other than some contact with students through experiential and job placement services (e.g., mock interviews, factory visits, campus visit, job shadowing, and internships).

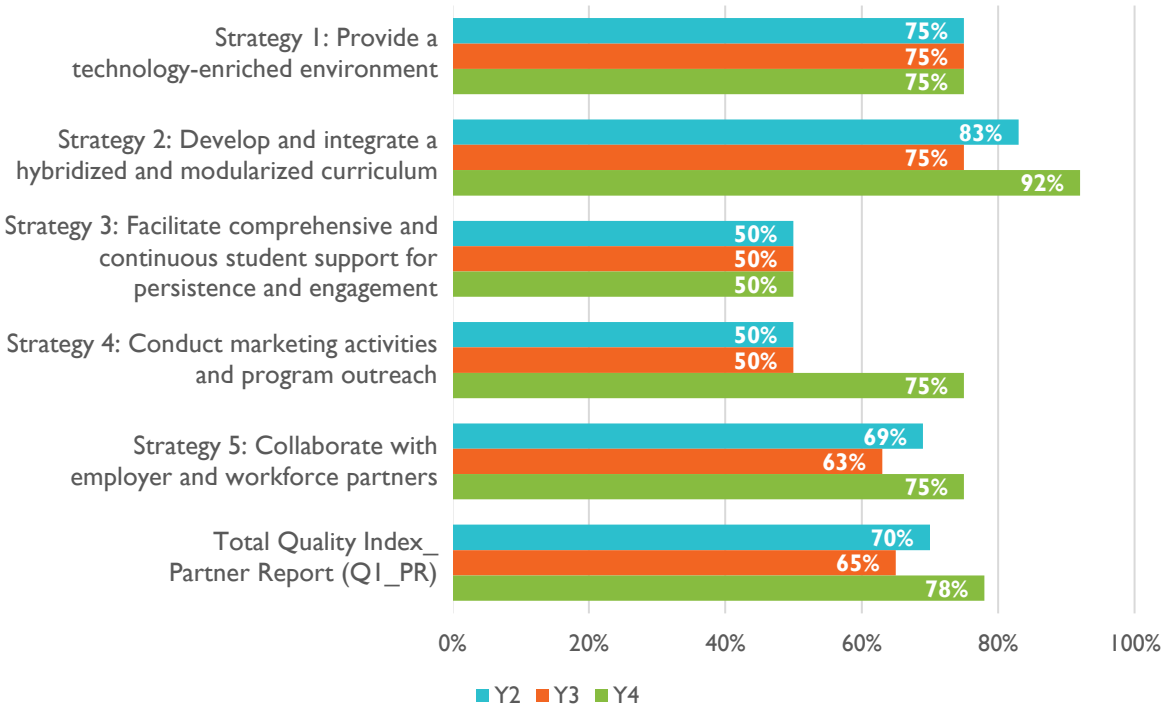


Figure 6. Partner Perspective of Implementation Quality: Percentile of Reaching the Highest Quality Index Score by Project Year

Note. The total score of each strategy was divided by the highest possible score. Y2 includes responses collected between October 2013 and September 2014; Y3 includes responses collected between October 2014 and September 2015; and Y4 includes responses collected between October 2015 and September 2016.

CT/MT Quality. Four aspects regarding the quality of CT/MT were examined: (1) CT/MT course content; (2) instructor effectiveness; (3) MT technology support; and (3) CT E&E advisor support. As shown in Table 23, overall, CT/MT participants gave high ratings to all aspects of their CT/MT courses and experiences. For instance, participants generally *agreed* (a mean score between 3.50 and 4.49) that the content of the CT/MT courses was relevant and enhanced their learning experiences, and they learned new skills and knowledge. Participants also gave high ratings with regard to their instructors' instructional strategies. For instance, participants *agreed* that instructors were knowledgeable about the subject matter, responded to questions effectively, respected different viewpoints, and utilized relevant materials and activities to enhance their learning experiences. Additionally, participants *agreed* that the use of technology supported their learning experiences. With regard to the support services they received, participants gave high ratings. On average,

participants *agreed* that their E&E advisors provided the individualized support needed (academic and social-emotional) to make sure they stayed on track and were successful.

Table 23. CT/MT Implementation Quality

Quality Indicators	*n*	*M*	*SD*
CT/MT Course Content	**1,110**	**4.01**	**0.60**
The course content was relevant to my job.	1,106	4.23	0.79
My understanding of this topic was increased.	1,108	4.24	0.68
I learned new skills to use on my job.	1,107	4.02	0.77
The instructional materials enhanced my learning experience.	1,100	4.05	0.74
The exercises/activities enhanced my learning experience.	1,101	4.00	0.76
Overall, I am satisfied with the course content.	1,107	4.12	0.76
Instructor Effectiveness	**1,114**	**4.25**	**0.63**
The instructor explained the purpose and goals of the training.	1,109	4.25	0.69
The instructor was knowledgeable about the topics presented.	1,109	4.43	0.68
The instructor responded effectively to questions.	1,109	4.28	0.77
The instructor respected different viewpoints.	1,108	4.25	0.71
The instructor used relevant examples to enhance learning.	1,107	4.24	0.74
The instructor provided opportunities for active participation.	1,109	4.22	0.83
The instructor presented information in an organized manner.	1,109	4.23	0.75
The instructor managed class time effectively.	1,110	4.20	0.79
Overall, I was satisfied with the instruction.	1,111	4.22	0.82
MT Technology Support	**1,104**	**3.94**	**0.81**
The use of technology (e.g., ITV) supported my learning experience.	1,104	3.94	0.81
CT E&E Advisor Support [a]	**273**	**4.14**	**0.85**
My E&E advisor was knowledgeable about his/her profession.	219	4.04	1.07
My E&E advisor was sensitive to my personal problems and needs.	219	3.98	1.09
My E&E advisor understood my career interests and goals.	216	3.88	1.05
I felt comfortable going to my E&E advisor when I had course-related problems.	215	3.98	1.06
I felt comfortable going to my E&E advisor when I had personal issues that affected my academic performance.	217	3.88	1.04
My E&E advisor provided information and resources I needed to support my learning needs and career goals.	218	4.02	1.07
My E&E advisor worked with my instructor to make sure my learning needs were met.	217	4.02	1.05
My E&E advisor helped me stay on track to complete my course.	216	3.94	1.05
My E&E advisor clearly communicates what is my responsibility and what he/she can help with.	217	4.05	1.07
I felt confident my E&E advisor would follow up on any unresolved issues or my questions were followed up on in a timely manner.	218	4.06	1.10

Quality Indicators	*n*	*M*	*SD*
Overall, how would you rate the quality of the E&E advising services you received?	273	4.45	0.64
Overall, how satisfied were you with the frequency of the E&E advising services you received?	273	4.55	0.77

Note. All items are rated on a 5-point scale: (1) Strongly disagree; (2) disagree; (3) neither agree nor disagree; (4) agree; and (5) strongly agree.

a. Of all CT/MT participants who responded to questions related to the CT E&E advising support services, 273 indicated that they had interactions with their CT E&E advisors. Hence, the data presented here are based on these students' experiences.

Participant Responses to Implementation

The last component of the fidelity assessment describes *participant responsiveness* to the DOL AME project's implementation. Evaluators identified 13 indicators related to participants' and partners' satisfaction and engagement with the project activities based on responses to the Student Exit Survey (six indicators) and the Partner Survey (seven indicators). Table 24 shows the results of participant responsiveness to implementation from the student perspective. The index scores have been calculated based on the percentage of Student Exit Survey respondents endorsing the items.[32]

Table 24. Participant Responsiveness Index Score by Project Strategies Over Time: Student Perspectives

Quality Indicators	Y2	Y3	Y4
Strategy 2. Develop and integrate a hybridized and modularized curriculum	**12**	**12**	**12**
1. Students indicated that they are *somewhat satisfied* or *very satisfied* with the quality of instruction they are receiving.	4	4	4
2. Students rated their satisfaction with the training program as satisfied or *very satisfied*.	4	4	4
3. Students indicated that they are *likely* or *very likely* to recommend their training program to friends or prospective students.	4	4	4
Strategy 3. Facilitate comprehensive and continuous student support for persistence and engagement	**7**	**8**	**7**
1. Students indicated that they were *somewhat satisfied* or *very satisfied* with the academic advising they received.	4	4	4
2. Students indicated that they were *satisfied* or *very satisfied* with the frequency of the coaching and counseling services they received.	3	4	3
Strategy 5. Collaborate with employer and workforce partners	**3**	**4**	**3**
1. Students reported that they were somewhat satisfied or very satisfied with the quality of the experiential learning opportunities in which they have participated.	3	4	3
Overall Participant Responsiveness_Student Report (PRI_SR) Score	**22**	**24**	**22**

Note. Only participants who were enrolled in traditional certificate, diploma, and degree programs were invited to take the Student Exit Survey; CT/MT students were omitted. Y2 includes responses collected between October 2013 and

[32] A score of 1 was given when 25% or less of the participants endorsed an item; a score of 2 was given when 26% to 50% endorsed an item; a score of 3 was given when 51% to 75% endorsed an item; and a score of 4 was given when 76% or more endorsed an item.

September 2014; Y3 includes responses collected between October 2014 and September 2015; and Y4 includes responses collected between October 2015 and September 2016.

After converting the index scores into percentiles, results are shown in Figure 7. Overall, participants were satisfied with the DOL AME project's implementation, especially in the areas of hybridized and modularized curricula and wraparound student support services. While the ratings of partner involvement is slightly lower comparatively, especially about their experiences with experiential learning opportunities, it is generally acceptable.

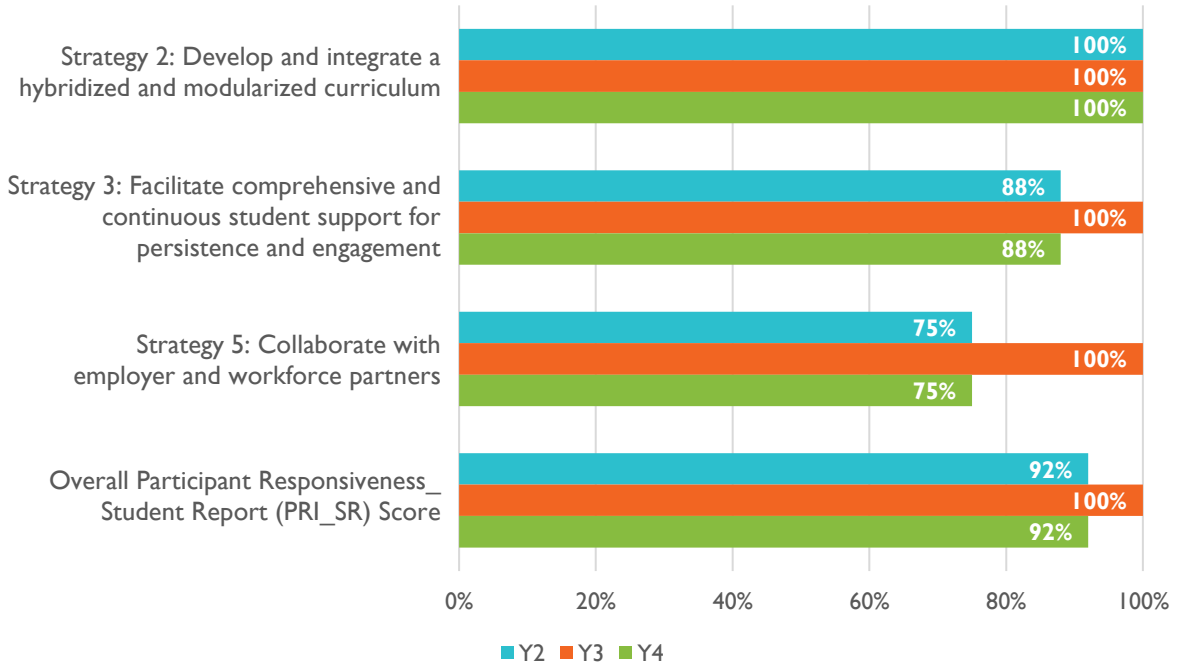


Figure 7. Participant Perspective of Participant Responsiveness to Implementation: Percentile of Reaching the Highest Participant Responsiveness Index Score by Project Year

Note. The total score of each strategy was divided by the highest possible score. Y2 includes responses collected between October 2013 and September 2014; Y3 includes responses collected between October 2014 and September 2015; and Y4 includes responses collected between October 2015 and September 2016.

Table 25 shows the results of participant responsiveness to implementation from partners' perspectives in the area of partner involvement. The index scores have been calculated based on the percentage of Partner Survey respondents endorsing the items.[33] Overall, the ratings increased from Fall 2013 to Fall 2015 with a slight decrease in Fall 2014.

[33] A score of 1 was given when 25% or less of the partners endorsed an item; a score of 2 was given when 26% to 50% endorsed an item; a score of 3 was given when 51% to 75% endorsed an item; and a score of 4 was given when 76% or more endorsed an item.

Table 25. Participant Responsiveness Index Score by Project Strategies Over Time: Partner Perspectives

Participant Responsiveness Indicators	Fall 2013	Fall 2014	Fall 2015
Strategy 5. Collaborate with employer and workforce partners	**24**	**22**	**26**
1. Industry partners indicated that they are *satisfied* or *very satisfied* with their current level of engagement.	3	2	3
2. Industry partners indicated that they are *satisfied* or *very satisfied* with the project's efforts to engage partners.	3	3	4
3. Partners indicated that they are *likely* or *very likely* to recommend the AME programs to others (e.g., companies, organizations, and community partners with which they collaborate).	4	3	4
4. Industry partners indicated that they are *likely* or *very likely* to recommend the AME programs to their current or prospective employees.	4	3	4
5. Partners indicated that they *agree* or *strongly agree* that the partnership between their organization and the AME programs will continue and expand beyond the life of the grant period.	3	3	3
6. Partners indicated that they *agree* or *strongly agree* that they will consider collaborating with the AME colleges on other projects in the future.	4	4	4
7. Industry partners indicated that they will consider hiring AME program graduates if new positions open within their company.	3	4	4
Total Participant Responsiveness_Partner Report (PRI_PR) Score	**24**	**22**	**26**

After converting the index scores into percentiles, results are shown in Figure 8. Overall, partners were satisfied with the DOL AME project's implementation in the area of partner involvement and collaboration, and the ratings were high.

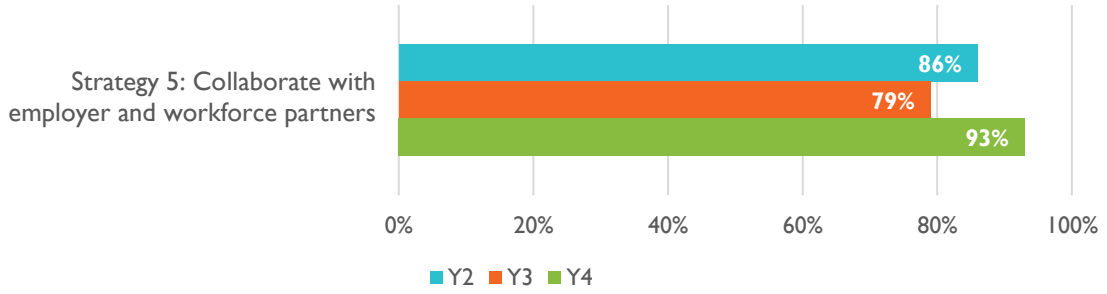


Figure 8. Partner Perspective of Participant Responsiveness to Implementation: Percentile of Reaching the Highest Participant Responsiveness Index Score by Project Year

CT/MT Student Perspective. In the CT/MT survey, students were asked if they would recommend the training course to their colleagues, friends, or others, 82% of the respondents *agreed* or *strongly agreed* that they would do so.

Q3. What changes were made to the programs of study during implementation and for what reasons?

As part of the adherence assessment, evaluators also gathered information from various sources (i.e., project records and interviews) to document any changes or modifications that have been made to the DOL AME project's implementation. Hence, this set of questions addressed the challenges faced by AME staff and the strategies and refinements made to overcome these barriers and support implementation.

Implementation Barriers

Data collected from the staff and partner interviews and student focus groups revealed that, while the DOL AME project made significant progress in implementing various strategies throughout the first three years of the grant, there were challenges along the way. This section describes those challenges by project strategy.

Challenges in Implementing Technology-Enabled Components. During the first two years of implementation, delays in the purchasing and shipment of lab equipment made it difficult to get the equipment up and running for the courses and related hands-on training. As discussed earlier, the delays were primarily caused by the federal government shut down in 2012, and such delays often caused domino effects on the implementation timeline. For instance, during grant Year 2, some of the new lab equipment was not installed until May 2014, which was more than six months later than originally expected, and staff were required to complete initial training on the equipment within
30 days of its arrival. However, some of the faculty members indicated that this 30-day training requirement was an inconvenience because if they completed the training for a certain machine in May and then the machine was not used until the fall term, it was difficult for them to recall the knowledge they had previously acquired. These issues were also reflected in students' perspectives about the quality of training they received. During the focus groups conducted in Spring 2014, students expressed their frustrations with the delays in equipment installation. Students from one campus also reported that their instructors were inexperienced with the new equipment and did not allow the students to utilize it. To address this issue, the AME Alliance leadership team provided additional training to AME program instructors on the new equipment during Fall 2014 as the new equipment was installed.

Additionally, while the MT equipment enabled AME partners to provide more flexible and convenient courses and schedules for students, implementation proved to be more challenging than staff originally anticipated. During the first two years, project staff expressed that they faced some challenges in coordinating the training sessions and schedules across the partner sites. Yet, as the MT course offerings became more routine, staff were better able to coordinate the schedules and ensure consistency in the services offered.

During the student focus groups held in the spring of 2014, some of the students expressed their frustration with constant malfunctions, breakdowns, and other technical difficulties with the

MT equipment and technology. To resolve this issue, in Year 3, project staff transitioned from ITV to Acano, a new telecommunication platform, to better support the implementation of the MT equipment and technology across the AME colleges and partner sites. Project staff were unanimous in their opinion that the adoption of this new platform greatly improved the effectiveness of the training and instruction being offered.

According to staff interviews in October 2014, some of the staff members indicated that the unequal distribution of MT equipment across the AME Alliance's different campuses was problematic and expressed concern that certain sites were not using the equipment effectively. To address this issue, during grant Year 3, project staff arranged for the MT equipment to be moved from low-utilization sites to high-utilization sites.

Challenges in Implementing the Hybridized and Modularized Curricula Components. According to AME project staff, the implementation of curriculum components did not go exactly as planned for the colleges. First, during grant Year 2, the development work for modularized courses was delayed due to difficulties in identifying SMEs. However, this issue was resolved by the end of grant Year 2 and the project was able to continue the work during grant Year 3. It should be noted that as the project invested more resources in the development and roll out of the CT courses via the MT platform during grant Year 3, the development and implementation of modularized courses became less important as initially described in the Project Work Plan. Regardless, the DOL AME project managed to complete the development of all five modularized courses as of the end of grant Year 3.

In addition, at the conclusion of each semester, instructors became aware of modifications that were necessary for each course. Project staff indicated that it was difficult to develop curricula for courses that have never been taught. As a result, many changes were necessary at the end of each semester with a lot of "fine tuning along the way." For example, the Measuring Tools course at one college changed formats from a one-hour lecture to a two-hour lab course because instructors realized that students needed more hands-on training for that course. In all, the design of the curricula is a constant work in progress and requires continuous revision to ensure that the materials and content are up-to-date and meeting students' learning needs.

Challenges in Implementing Comprehensive and Continuous Student Support Services. During grant Year 2, student focus group data indicated that students had different experiences with their E&E advisors depending on which college they attend. Specifically, students at two of the campuses described their advisors as active, readily available, and extremely helpful. At a third campus, students described their advisors as ambiguous, inactive, and unaccountable in relation to their direct assistance to students. Students from a fourth campus reported that they were generally satisfied with the assistance they have received from their advisors; however, they would appreciate their advisors spending additional time communicating grant-related information to them. These issues were addressed through internal staff meetings. During grant Year 3, across all of the campuses, focus group participants were universally positive about the support they have received from their E&E advisors, lauding them for their dedication, persistence, caring nature, and willingness to assist with any issue.

During the Fall 2014 and 2015 interviews, project staff also shared some challenges related to the PLA processes. In the interviews, staff mentioned that students would often take a course rather than go through the PLA process because they wanted to be completely immersed in the same classes as their cohort and go through everything again so as to not "feel behind" in comparison. In addition, the PLA process is entirely contingent upon the instructors of specific courses, rather than resulting from a consensus between instructors, advisors, and students. One project staff member commented, "Ultimately, the instructor is the person that really has the final say, and sometimes I wish that weren't the case." Regardless of these challenges, E&E advisors' efforts to promote and increase students' awareness of CPL and MOS credits started paying off during grant Year 3 as more students began to apply for their credits to decrease their time required for program completion as well as associated costs.

AME project staff and partners also reported that the sheer workload taken on by the majority of students enrolled in the grant-funded programs of study is a major challenge. "We have a huge number of nontraditional students who are enrolled in these courses and holding jobs at the same time. It's a lot for the students and advisors to keep on top of," explained one interviewee. E&E advisors agreed with this sentiment, expressing the opinion that this made it all the more important for them to be active in seeking out and engaging students. AME Alliance staff and partners alike expressed that they believe the E&E advisors would benefit from additional supports in this regard.

Additionally, several instances were reported by AME project staff where they had to work on curbing partners' expectations for job applicants. As one staff member said,

> *Sometimes, the partners want a perfect employee and our college students are not perfect employees yet. They're still learning. So sometimes, I cannot give partners the people that they want. For the most part, they understand this, but sometimes the job descriptions they're putting out are three pages long and it's like they're looking for someone that doesn't exist. It's just a matter of stepping in, almost as a mediator, and reminding them that they've got to be realistic. They're not going to find anybody with some of the skills they're after for $18 an hour.*

Project staff also described instances in which the early engagement and employment by the partners has resulted in students failing to complete their programs of study. One interviewee explained,

> *It only happens every once in a while, and certainly not as much as it used to. Part of why we don't see it so much anymore, thankfully, has to do with the employers seeing the value of having their people have an award, I think. There's one partner in particular, they want every single person in their plant to have at least a certificate.*

Challenges in Implementing the Program Outreach and Marketing Components. Since the DOL AME project's inception, project staff have faced a slight challenge in their outreach efforts to TAA-eligible workers and dislocated workers that continued throughout the course of the grant. Specifically, due to certain regulations and guidelines, project staff were not permitted to

directly contact clients of the workforce centers (i.e., TAA-eligible workers, dislocated workers, and others using the centers' services). Therefore, AME project staff had to rely on workforce center staff to serve as intermediaries in relaying information about the project, including what programs of study and courses are being offered, enrollment timelines and requirements, and who to contact for more information or assistance. Project staff are aware of these restrictions and, to overcome this challenge, are working closely with workforce center staff to ensure they understand the DOL AME project and are providing relevant information to eligible clients.

In terms of marketing efforts, the project struggled with communicating and staff turnover during the first two years of the grant. According to interview data collected in Fall 2014 from project staff members, while marketing collateral for the grant was developed during the first year, the materials had not been disseminated or made available to all of the sites. Staff at two of the AME Alliance colleges expressed frustration that the marketing element of the grant was centralized at the third. Without a fully coordinated and integrated marketing effort across the colleges, it was difficult to effectively market the AME programs and reach out to a broad variety of eligible students in their local communities. To resolve the issue, the project team hired a new marketing director in June 2014. This individual developed a revised marketing plan and outreach support materials to be implemented in grant Year 3. However, the marketing director resigned from the project during the first quarter of grant Year 3; rather than hiring another full-time staff member, the AME Alliance leadership team decided to hire an external marketing firm to support the consortium-wide marketing efforts.

AME project staff also discussed during the staff interviews the challenges in recruiting veterans. Project staff members shared that veterans are less interested in joining a long-term program than traditional students and are less likely to remain in a program long enough to complete it, stating "They don't want to have a program. They want to take one class or two months [of training] and then start working." One project leader reported that in order to address this issue, one campus designated someone at the leadership level to target and reach out to the veteran population.

Lastly, project staff shared that the low unemployment rate throughout the state in the past few years has made recruitment more difficult. As such, project staff indicated that it is important to maintain consistent communication and foster positive relationships with the workforce and industry partners to remind them of what the DOL AME project and its programs of study can offer in order to strengthen recruitment and increase referrals overall.

Challenges in Implementing the Partner Involvement Components. According to project staff, the primary challenge faced by the DOL AME project with respect to partner engagement is keeping the partners actively involved throughout the implementation process. The partners, when asked about challenges related to maintaining their engagement, sometimes described the implementation process as "lengthy and arduous," suggesting that it may feel frustrating and slow for some stakeholders. Project staff members also faced the challenge of coordinating schedules with local industry leaders who have many other commitments and appointments that require their participation. Despite these challenges, industry partners continued to be impressed

with the progress that the DOL AME project was making to meet their needs and many have expressed interest in becoming more deeply involved. While expressing interest in the CT/MT courses, industry partners continue to struggle with providing time for their employees to participate in the MT training due to budget constraints and the limited nature of CT that the consortium can provide. Recognizing these challenges, project staff are continuing to work and communicate with industry partners to ensure that the courses offered meet their individual needs and help the company fill skill gaps of their workers.

Barriers across Sites

As discussed in the previously, AME project staff encountered a variety of challenges across all of the strategy areas depending on their roles and responsibilities. However, these experiences have been consistent across the different groups of implementers, and challenges reported by one group often effects another group. For instance, constant delays in installing the MT equipment and technology not only caused major delays in the implementation timeline, but also caused dissatisfaction among instructors about the timing for the required training and among students regarding their learning experiences. Regardless, the AME project team has addressed these challenges as they occurred through frequent communication among the consortium members, including weekly leadership team meetings as well as regular advisory board meetings with industry partners.

Modifications

Several modifications to the Project Work Plan have been made throughout the performance period in order to support the DOL AME project's objectives and goals. First, interviewees reported that the most significant adjustment to the implementation of a technology-enriched environment across the consortium was the transition from ITV to Acano in supporting the MT courses and equipment. Additionally, instead of creating six to seven interactive simulation courses, the project was able to develop two courses and rolled out one by the end of grant Year 3.

Second, to ensure that the project is offering courses and training that meets industry needs, there were some modifications made during the initial stages of project development regarding what programs of study would be implemented and/or emphasized and which colleges would house them. For example, CLC had originally planned to offer a plastics and reverse engineering training program. However, after project staff surveyed industry partners and received feedback on their needs, AME project leaders decided that both CLC and SCTCC would offer programs in mold making and the plastics program would move to PTCC. Another example is that CLC did not plan on modifying their robotics and automation program because they already considered it to be a strong program, but after hearing from industry partners, college leaders decided to add advanced certificates in that area. Additionally, SCTCC added a robotics and welding program and expanded its computerized numerical control (CNC) options based on the input it received from industry partners.

Lastly, the most significant adjustment to the AME Alliance's program outreach and marketing strategy was the utilization of an outside marketing firm instead of employing a marketing director to guide the consortium's efforts. Given the initial delay in bringing someone on board to fill this role, as well as subsequent difficulties in replacing their initial hire, project staff reported that working with this outside marketing firm has helped alleviate much of the pressures and complications they had been experiencing. Taken together, all of the modifications and adjustments made aligned with the DOL AME project's goals and objectives and facilitated the success of project implementation.

Q4. To what extent is the DOL AME program sustainable and transferable?

This set of questions addresses the sustainability and transferability of the project beyond the life of the grant. Specifically, these questions focus on how the project addresses and plans for sustainability and transferability, and if any modifications made during the implementation period have been designed to support project sustainability.

Organizational Capacity to Support Sustainability

McREL evaluators interviewed project staff and partners on an annual basis throughout the performance period to gain a better understanding of the DOL AME project's plans and approach to support sustainability. Information gathered throughout the years show that project staff designed and implemented the AME programs with sustainability in mind, and the TAACCCT grant has increased the capacity of the consortium and the colleges to sustain the programs of study that have been supported by grant funding. Specifically, during the August 2015 staff and partner interviews, interviewees were asked to share how the DOL AME project has increased the consortium's and colleges' capacity in the following domains: *human capacity* (i.e., knowledge, expertise, and understanding, as well as the will and commitment, of personnel charged with implementing the targeted change), *institutional capacity* (i.e., the interaction, collaboration, and communication among members of the organization), *structural capacity* (i.e., the elements of the organization that exist independently of the individuals who work within the system, such as policies, procedures, and practices), and *material capacity* (i.e., the fiscal resources, materials, and equipment that the organization uses to meet its needs and to implement targeted change). Findings from these interviews are summarized as follows.

Human Capacity. According to project staff, one aspect of the DOL AME project that could be sustained is the processes and skills developed as part of the new positions or support programs established. For instance, some of the project staff members felt that the ongoing work with the student support/advising component could serve as a model for the future. In addition, the relationships developed between the E&E advisors, students, local employers, and other stakeholders could translate into long-term connections with beneficial outcomes in terms of sustainability. Additionally, project staff shared that the TAACCCT grant has cultivated a level of expertise across the consortium in the administration of manufacturing programs and the engagement of industry, workforce, and community partners. As one project staff member

commented, "I think, at this point, there are many internal experts. You know, we've been working on this project for years now. All that experience has definitely given us some know-how." Other interviewees responded similarly, one of whom explained,

> *Our human capacity, our knowledge, and our understanding of how these kinds of courses work, and how many classes a student should take at any given time, has definitely broadened over time. It's been a long process of trial and error, but I think it has gotten us where we need to be.*

Institutional Capacity. The majority of project staff members and partners agreed that sustainability will come from continued support from the partners and maintaining positive relationships with industry leaders. A project director commented, "The impetus on us [will] be how we continue to structure and evolve [those] relationships to where they truly are partners upfront versus just a rubber stamp at the end." Therefore, project staff have invested a lot of resources and energy to continue building and fostering relationships with the partners to keep them focused and invested in the AME Alliance once DOL funding ends. Other members of the AME project staff agreed that sustainability will depend on the ability of the group to meet partners' needs and adjust to the needs of the manufacturing industry.

Structural Capacity. Project staff and partners also expressed their perception that the AME Alliance has the structural capacity necessary for sustaining the grant-funded programs of study into the future, praising the consortium's continual refinement of policies and procedures. As one interviewee described, "We've really made our procedures idiot-proof, especially in Year 3. I think anyone could pick up our procedure manual and start running with it, everything's so cemented into place." Moreover, program personnel reported that established policies, processes, and procedures related to the DOL AME project's administration have continued to develop in order to streamline project management to the greatest extent possible. A consortium staff member commented,

> *I think that we really challenged the organization to think through some of its policies and procedures and to focus within really gray, murky areas about the types of courses and offerings that we can offer as an institution that are normally not done in higher education the way that we're doing it. I think we've really gone a long way into bridging the gap between traditional academics and customized training to meet the needs of our community.*

Interviewees specifically highlighted the implementation of the MT equipment across the consortium as instrumental in this regard. As one AME staff member shared, "I would point to the MT [equipment] as a huge support for this. We have the equipment and structure in place to keep this going." Another member of the staff described the implementation of the MT equipment as perhaps the consortium's greatest success, setting tools in place that can be used for years to come. As he or she explained,

> *I think it's our biggest opportunity for both sustainability and transferability. Just rethinking how we [come together as a consortium] to make it as cost effective and fluid as possible. We've made the initial investment and I think it will pay off for a while yet.*

Material Capacity. In general, project staff and partners all shared the perception that many of the resources and materials developed under the grant could be sustained, including curricula and equipment (e.g., laboratory tools/instruments and MT). One workforce partner shared that the curricula, which focuses on new technology such as robotics and automation, is a "good move [in terms of sustainability] because we do see the industry continuing to move in that direction." Similarly, a project staff member added,

> *I am 110% positive that the things that we have done curricular wise are exactly what our business partners are looking for and we're hearing that time after time. You guys really hit it this time. This is where you need to be. The alignment as far as our new program plans and the new equipment we're adding and so on is very well aligned to [the] industry.*

In terms of the sustainability of the equipment, project staff recognized that it might be challenging to maintain laboratory equipment because of changes in the equipment's technology and software; yet, the fees to upgrade the systems are relatively inexpensive compared to the cost to replace the equipment. Additionally, partners' contributions of equipment and supplies, if continued, will likely be crucial material assistance in promoting project sustainability.

Some partners also expressed concern that participation in the AME Alliance might become cost-prohibitive for many businesses after the expiration of grant funding. "There are ways to go about making the preparations that we need to. The money being spent on this program is an amazing investment, but we only have so much that we can contribute and need to continue to see a return on that investment," explained one partner.

Additionally, AME project staff shared concerns regarding the components that require further funding for sustainability beyond the life of the grant. For instance, both groups indicated that a number of SMEs have been brought in throughout the life of the grant to teach some of the courses and provide training to students, and many of the staff members expressed concern as to how long these SMEs would be able to remain employed by the consortium, along with other personnel employed using grant funds.

Sustainability Plan

Recognizing that the DOL AME project has increased the consortium's and colleges' capacity to carry out the grant components, project leaders understand the importance of generating financial support to sustain these components. As part of this effort, during grant Year 3, tuition for the CT/MT courses increased from free to a $99 flat fee per course. This was done to bridge into a full-price model once the CT/MT programs become self-sustaining (i.e., after grant funding ends). The majority of employers have reacted positively to the new fee structure because they see the value the training has brought to their company. Industry partners are actively participating in the development of a sustainability model for the CT/MT courses because they want to see them continue after the grant ends.

Additionally, starting in grant Year 3, the AME Alliance invested in a market research and business model development study to determine the feasibility, price sensitivity, and topics of interest to employers as a continuation of the MT model. This research was supported by the 360 Center for Manufacturing Excellence under their National Science Foundation grant and a grant from a private economic development organization in Minnesota. As a result of this study, the AME Alliance developed a marketing and sustainability plan. Generally speaking, the plan was to work with a professional marketing firm and businesses across the state to inform the design and development of new business models to deliver manufacturing education for incumbent workers as well as traditional academic programs. As part of the plan, permanent CT representatives and academic advisors were expected to be trained on the MT advising model. This plan was put into action in Year 4. For instance, a MT E&E advisor was hired in Year 4 by a Round 4 TAACCCT grant to continue advising services as the model moves statewide. Furthermore, the lead institution of the DOL AME grant, CLC, developed a plan to incorporate the MT model with traditional academic programs to provide students with greater flexibility that aligns with different learning styles and schedules. This plan was launched during the third quarter of grant Year 4. These plans and actions and continuous conversations between the colleges and partners suggest that the CT/MT model, in cooperation with the wraparound student support services and partner engagement components, are likely to continue and expand beyond the life of the grant.

To support the sustainability of the DOL AME project, it is critical to share the success, values, and impact of the grant with the community and public. During each round of interviews, evaluators gathered AME staff members' and partners' perceptions about the impact of the project on the local community and industry. Below is a collection of encouraging quotes from project staff and partners.

> *I think it's serving the needs [of the industry and community] because in this area that we are in, for anybody that's doing any kind of manufacturing, the more manufacturing that we can keep in this geographic region or to bring into this region because we have the right set of skilled people helps everybody.*
>
> ~ DOL AME industry partner, Fall 2013

> *Everybody thinks it's wonderful, and everybody thinks it's a good idea. I think the program, from what I've seen, has done an excellent job of getting students the training they need.*
>
> ~ DOL AME industry partner, Fall 2015

> *In one word, gratitude. They see us as just an incredible tool in their toolbox, and have greatly appreciated our taking the time to help them think more long-term. Many of them, due to the economy, have stepped away from any training through their workforce center. So taking the time to really assess and help them along with a one- to three-year plan, they've been really grateful for that. Then, being able to provide this particular training model to support that training strategy.*
>
> ~ DOL AME industry partner, Fall 2015

> *Honestly, we have a lot of testimonials from individuals and we continue to hear things like, "This exceeded my expectations, I'm actually able to apply what I'm learning in my job." And over and*

over again, how the eight-week course length, the online homework, and just the convenience of connecting to the class has been a huge reason why people are participating. So overall, that's been a real positive coming out of what we're doing. Our students are definitely getting something out of this. It's all been so positive.

~ DOL AME project staff member, Fall 2015

You can see a change in the way a lot of these students walk around in the way they carry themselves. Remember, a lot of these people have never taken college classes before, have never thought they'd be able to manage in that sort of environment. But now, they're getting the opportunity to do it and are succeeding in doing it, and you can see it's having this immediately affirming effect as they realize they have what it takes. We've had partners and companies get in touch with us and say how they've seen immediate changes with the people they're sending us, how their attitudes and demeanor are changing, how they just walk and talk differently, and how they feel about what they've done and what they've accomplished.

~ DOL AME project staff member, Fall 2015

I think all of the employees are getting really good support during these classes and it's helping them build confidence as they grow and develop a broad understanding of their fields.

~ DOL AME industry partner, Fall 2015

The model that has been used for student support services has been very effective. To have participants with access to the kind of guidance they are providing has been a great asset.

~ DOL AME partner, Fall 2015

I have placed very few students locally. I've got people coming from 500 miles away to hire a student. For whatever reason, I'm not getting a whole lot of people within a 100-mile radius knocking on my door for my students. They're coming from much farther away.

~ DOL AME project staff member, Fall 2015

They have done well in evolving with an evolving industry. I think when the original grant was written, it made sense for that snapshot in time. Then, the economy changed dramatically and they had to really go with the flow of business. I was very impressed because it seems like sometimes higher education lags so far behind in trying to get things done and this has been so flexible in meeting the constant changes that we're seeing in the current economy.

~ DOL AME partner, Fall 2015

Transferability

In terms of transferability, project staff and partners were unanimous in their opinion that the programs being implemented as part of the DOL AME project could be replicated at other colleges, in other programs, or in future projects. Several consortium staff members even indicated that the replication of AME processes and programs has already begun, both within the AME Alliance and beyond. "I'm taking what I've been using for classes I teach covered by the grant and

[have been] applying them to classes I teach that aren't," commented one instructor, with several others indicating they had made similar modifications to their courses. Another interviewee reported, "We've seen other colleges, too, adopting the curriculum we have developed here and implementing our hybrid model. And I know our staff have been contacted by individuals working on other grants who are interested in what we have done here with AME." Program personnel reported that this has been steadily becoming more and more common as the grant continues to be successful. As one consortium member shared, "We regularly get calls, both from within our state and other states, asking about what we've done with our grant and wanting to learn from our experiences. We're talking with folks involved in other projects and other grants on a fairly regular basis and hopefully helping them identify some of the pitfalls that they'd best not step into." Interviewees also revealed that not only have the policies, programs, and practices of the DOL AME project been attractive to personnel working on other grants, some of the AME staff members have been attractive for these other grant programs as well. "The experience that our team is getting is giving them knowledge and skills that will give them opportunities for similar positions on other DOL grants or in similar roles at other institutions," commented an AME staff member, "and as our funding runs low a lot of them are going to begin looking for opportunities elsewhere."

Interviewees indicated that, to the best of their knowledge, no formal plan for program transferability had been developed as of the time of the interviews. As one AME staff member explained, "We're focusing our efforts right now, as we come to the last year of the grant, to figure out a process or model for transferability. We're really looking at how we can best utilize the structures and resources we have put into place to make the effects of this grant as widespread as possible." As previously mentioned, during grant Year 3, the AME Alliance's MT model won the Minnesota Council for Continuing Education and Customized Training 2015 Exemplary Program Award and was nominated for manufacturing awards from Minnesota Business Magazine as well as the National Council for Continuing Education and Customized Training's Exemplary Program Award. Additionally, several Round 3 and 4 TAACCCT grantees in the area of information technology and manufacturing, as well as other non-grant-funded programs within the consortium colleges, are adapting the MT model in their programming and program design.

Program Modification to Support Sustainability

As described in Question 3, each college made some modifications regarding program offerings and plans during grant Year 1 to ensure the courses and training offered was meeting local industry partners' needs. Such modifications were essential to ensure that the programs were providing the training needed by the local workforce and providing high-quality workers for Minnesota's manufacturing industry, which is critical to the sustainability of the DOL AME project beyond the life of the grant. Additionally, due to a very low unemployment rate in Minnesota (less than 4%), the AME Alliance leadership team shifted its efforts to support employer partners by focusing on incumbent worker development and training during grant Years 2 and 3 (i.e., the implementation of the MT model).

SGA Questions

This section specifically addresses the questions posed by the DOL in the SGA for the Round 2 TAACCCT grants.

SGA.Q1. How was the particular curriculum selected, used, or created?

Starting in grant Year 2, the DOL AME project successfully rolled out 23 certificate programs, 25 diploma programs, and 16 degree programs at CLC, SCTCC, and PTCC across four program tracks: (1) automation/robotics technology; (2) plastic technology; (3) precision manufacturing; and (4) prototyping and reverse engineering (see Appendix C for detailed information about each program of study). The development of the program curricula was a collaborative effort among project staff, instructors, and industry partners. For instance, during the initial planning stage, AME instructors reported that they helped project staff develop industry partner surveys to collect data for determining current and future industry needs and participated in advisory board meetings to solicit advice related to the curricula, equipment purchases, and usage decisions. The investigation revealed that the consortium colleges lacked the capacity to provide certain courses and degree programs. For instance, none of the colleges offered either a diploma or an AAS degree in plastic technology, and all of the institutions needed to better align their computer-controlled precision manufacturing AAS degrees with the skill sets required by the manufacturing industry. Further, two of the colleges lacked certificate programs in prototyping/reverse engineering and diplomas or AAS degrees in automation technology. Hence, the focus of the grant is to fill the training gap needs of the local industry and workforce.

As part of the curriculum development efforts, partners were involved through regular participation in the advisory boards. Specifically, industry partners provided input on the skills and training necessary for their employees to succeed. Some industry partners went beyond the consultation role and actually became involved in the creation of new programs of study and courses, purchasing of tools/equipment for the laboratories, and identifying other manufacturing needs within the community that the DOL AME project could assist in meeting. Additionally, CT representatives played a key role in making sure the courses being offered to industry partners' employees was meeting their needs. Specifically, CT representatives have been responsible for contacting industry partners to identify their training needs, especially for the CT/MT courses, and subsequently schedule the training sessions for the employers and their employees.

SGA.Q2. How were the programs and program design improved or expanded using grant funds?

The DOL AME Project Work Plan was designed to address five core elements that support the project's goals and objectives, including (1) providing a technology-rich environment for students; (2) developing and integrating hybridized and modularized curricula; (3) facilitating comprehensive and continuous student supports for persistence and engagement; (4) conducting marketing activities and program outreach; and (5) collaborating with employer and workforce partners. The project's implementation progress of each core element is addressed in SGA.Q1.

SGA.Q3. What delivery methods were offered?

According to project records (e.g., the curriculum inventory), the courses being offered through the DOL AME project were delivered in various modes, including traditional face-to-face, online only, and hybrid formats.

SGA.Q4. What was the project's administrative structure?

The DOL AME project has a director located at the lead institution (CLC) who provides oversight for the entire grant. Each of the AME Alliance colleges have a local grant manager who manages the day-to-day grant activities at each college. Several other grant-funded positions also fall under the project director and college site leaders in the project's hierarchy, including E&E advisors, data coordinators, CT representatives, marketing and outreach specialists, curriculum experts, and lab assistants. These positions contribute to the implementation activities of the DOL AME project in various ways, often in the form of specialized tasks. Additionally, industry, workforce, and community partners have been engaged with the program on a consistent basis. In addition to participating in regular discussions and meetings with project leaders, the partners serve in a consultative capacity on advisory boards and provide key information and insight to guide the program's design and implementation. In particular, project staff are engaging partners through the use of MT equipment to provide on-site training at employers' locations through the technology-enabled learning component of the grant.

During the first and second quarters of grant Year 2, the DOL AME project had several major changes in personnel. Specifically, the initial project director at CLC resigned from the project during the second quarter. While waiting for the new project director to be hired, the site manager at PTCC served as the interim director and oversaw the operation of the grant. The new project director was hired during the third quarter of the year. PTCC also replaced its site manager during the first quarter of the year; and CLC hired a site manager to manage day-to-day grant activities at the college after the new project director was hired. Additionally, the project team continued to hire new staff to support the grant's success (i.e., lab assistants, CT representatives, and E&E advisors), as needed.

SGA.Q5. What support services and other services were offered? and SGA.Q6. Was career guidance provided and if so, through what methods?

For the DOL AME project, student support services (SGA.Q5) and career guidance services (SGA.Q6) were provided by the E&E advisors. Specifically, E&E advisors' roles and responsibilities have included:

- Meeting with all of the new students during enrollment and registration events or during class sessions early in the semester to explain the DOL AME project and its programs of study and help students formally enroll and complete the required intake form;

- Meeting with all AME participants individually throughout the semester to discuss their plans, goals, and needs, and to provide information and guidance about their options;
- Providing wraparound individualized support services for all grant participants, including (1) academic advising; (2) assistance with developing individualized educational and career plans; (3) intervening when necessary to promote retention and assistance; and (4) providing intensive career assistance, such as writing and revising resumes, searching for jobs, and following up on job leads;
- Customizing services—both in content and intensity—based on students' needs to ensure that they are receiving individualized and appropriate support;
- Providing generalized information (e.g., announcements, reminders, timelines, job opportunities, and study tips) to all AME participants through group meetings, mass e-mails, and posts through mechanisms like the Desire2Learn sites for the programs at each college; and
- Providing career guidance on an individual basis to all AME participants by assisting them with resume and cover letter writing, mock interviews, job fair preparation, and internship placement. Career guidance services are provided in various forms, such as workshops, in person, e-mail, and so on, and usually occurs in the spring semester because students are applying for jobs during that time.

SGA.Q7. Did the grantees conduct an in-depth assessment of participants' abilities, skills, and interests to select participants into the grant program? What assessment tools and process were used? Who conducted the assessment? How were the assessment results used? Were the assessment results useful in determining the appropriate program and course sequence for participants?

According to AME project staff, aside from one prerequisite test (i.e., ACCUPLACER®), there are no formal assessments of students' skills or abilities to decide where to place them – it is more of a discussion process. The ACCUPLACER® test is given to those students who plan to enroll in a technical math course to determine if they have enough background knowledge to succeed in the course. If a student does not score high enough on the ACCUPLACER®, they are given the option of enrolling in developmental/ABE courses to update their skills or choose a different program of study. The E&E advisors work very closely with incoming students to make sure they are getting the best fit based on their skills and abilities.

If interested, potential students can tour the campuses and meet with an E&E advisor to obtain all the information needed to enroll. Upon enrollment, the student will meet with an E&E advisor for registration and orientation sessions to discuss the programs that will best fit his or her interests and needs. Most students come in with an idea of what training or program of study they want to complete and just need help navigating the system. One partner stated, "It's a matter of counsel, best guidance, best input, and helping people understand the tools that are available to them."

To ensure student success, starting in grant Year 2, the DOL AME project implemented a more proactive and aggressive enrollment process. Specifically, for the Fall 2014 semester, project staff reached out to each student and had the whole enrollment process completed at least two weeks prior to the start of the semester; whereas in the Fall 2013 term, students received a packet on the first day of class and enrollment forms were completed during the next few weeks. Project staff anecdotally noticed that retention rates have increased with the new enrollment protocol, which ensures that a student is officially enrolled and has all the necessary hardware and software installed on his or her computer and working (if applicable) before the first day of class. This new process also allows students to fully focus on the coursework and not worry about turning in forms or deciding if a class is the best fit for them after having already started the coursework.

SGA.Q8. What contributions did each of the partners make in terms of (1) program design, (2) curriculum development, (3) recruitment, (4) training placement, (5) program management, (6) leveraging of resources, and (7) commitment to program sustainability?

McREL evaluators collected both interview and survey data to understand the extent to which the partners have been involved in various project components. According to interview data, partners have made significant contributions to the DOL AME project in several areas, including program design, curriculum development, recruitment, training placement, leveraging of resources, and commitment to program sustainability. Partner involvement in the area of program management has been minimal, with the extent being primarily for monitoring purposes via the advisory board. Partners' involvement in each of the key areas are discussed in detail in this section, and relevant survey data are presented accordingly in each area to better understand their level of involvement over time.[34] It should be noted that individuals who were invited to participate in the interviews were key partners who have been actively involved in the DOL AME project and have extensive knowledge about it. Individuals invited to take the Partner Survey were listed as partners according to project records and had at least some involvement in the aspects of the project. As such, the findings from the staff interview and survey data should not be compared directly. Instead, interview data should be viewed as providing in-depth insights regarding how partners have been involved in the various project activities, while the survey data provides an overview of the extent of involvement from partners who responded to the survey over time.

Partnership Support on Program Design. AME Alliance staff indicated that the partners have played a key role in the program's design throughout the first three years of the grant. "Our partners have been excellent in providing us with ongoing feedback and letting us know when they see something that could be changed or improved. Their suggestions and recommendations have been extremely important," commented one project staff member. Project staff noted that many of the partners serve as members of the AME Alliance's advisory board and provide valuable insight

[34] The Partner Survey was administered annually to gain an understanding of partners' perspectives about and involvement in the project. Because the number of partners grew significantly over the years, individuals who were invited to take the survey differed from year to year. The response rates for Fall 2013, 2014, and 2015 were 51% (46 out of 90), 30% (39 out of 129), and 25% (36 out of 145), respectively.

for modifications that need to be made to the grant-affiliated programs. As a staff member shared, "The advisory board helped us identify classes that should be developed with the grant at its inception and they've let us know right away when they think there's anything we need to add. A lot of programs we have here are because they wanted them." The partners also discussed their involvement in the DOL AME project's design. For instance, the partners indicated that the AME Alliance remains in frequent contact concerning program development and actively solicits their feedback as far as what program supports they find most valuable. One interviewee indicated, "They'll get in touch [with us] and ask what we think would be beneficial to improve, or what sort of needs we see in the workforce. I know a lot of people take advantage of those opportunities to provide input."

Partnership Support on Curriculum Development. According to AME project staff members, industry partners have played a key role in supporting curriculum development and refinement throughout the life of the grant. As one staff member explained during the Fall 2015 interviews, "Our partners always have input to provide, even though most of the work for this component was finished before this past year. There's still partner involvement in curriculum development, but not the same volume that there was during Year 1 and Year 2." Program personnel indicated that most of the curriculum modifications made during the third year of the grant involved courses utilizing the MT equipment. "We want to be sure that we're maximizing the use of our telecommunications equipment since that is such a focal point of the grant," a project staff member noted. "I would say that our partners have played a significant role through [the] advisory board in reviewing our existing content that's being taught, as well as guiding us in trying to grow the curriculum to teach more advanced skills based on the new equipment that we were able to get through the DOL grant."

Project partners also indicated that the AME Alliance is in frequent contact with them, asking for recommendations regarding curriculum development and modifications. Partners reported that they have acted as intermediaries for communicating with other businesses not affiliated with the AME Alliance to solicit additional feedback. "We've acted as a sort of conduit for the schools to get in touch with more manufacturers that we have professional relationships with, and they'll all look at the curriculum and the programs and give their two cents." In addition, several partners reported that they were currently serving on the AME Alliance's advisory board, through which they and other partners frequently review the programs and curricula being offered across the consortium. "We've been involved with the development of the curriculum since the beginning," explained one such partner, "and I know there has been a huge amount of effort spent on that. We let them know what classes work and what classes need work to meet business and industry needs."

Through the Partner Survey, evaluators gathered perceptual data regarding partners' level of involvement in curriculum design and development. As shown in Figure 9, on average, partners indicated that they were *slightly engaged* (a mean between 1.50 and 2.49) in curriculum design and development over time with some minor decreases occurring during grant Year 2. The decline in partners' involvement in curriculum design and development in Year 2 is somewhat expected given the nature of the curriculum development process. Specifically, partners were more involved in

Year 1 to guide the direction and content of curriculum design and development. When moving to Year 2, partners' focus was on implementation rather than development. After initial implementation, project staff and instructors revised the curricula, as needed, based on instructors' and students' input; hence, partners' involvement in curriculum development increased again in Year 3.

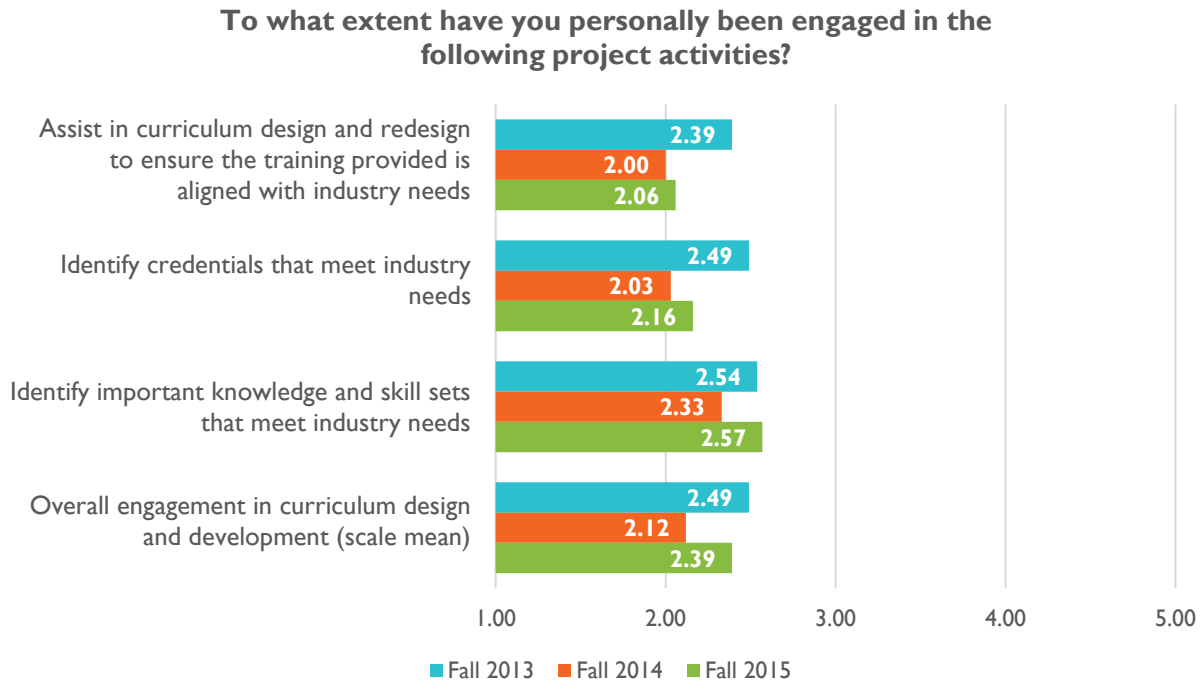


Figure 9. Level of Partner Involvement in Curriculum Design and Development

Note. Each item was rated on a 5-point scale: (1) Not engaged at all; (2) slightly engaged; (3) moderately engaged; (4) very engaged; and (5) highly engaged. Sample sizes for Fall 2013, 2014, and 2015 was 35, 30, and 21, respectively.

Partnership Support on Recruitment. Project staff reported that the partners have been extremely engaged in supporting the recruitment of both students and additional partners throughout the first three years of the grant. Additionally, partners are consistently reaching out to project staff concerning opportunities to meet and speak with their employees and business affiliates. "They've invited us to employee lunchrooms to set up our information tables, and we get to work with their employees on exploring classes they might like to take and talk about how it would align with their current jobs," explained one staff member. Another shared,

> *We've been invited to speak with the Central Minnesota Manufacturers Association and Enterprise Minnesota, two organizations in the manufacturing industry in our region, during their monthly meetings. It's become an ongoing expectation that a representative from the consortium will speak about what's going on in the grant every month before their business meeting even starts.*

Project staff indicated that such opportunities have resulted in noticeable increases in the number of students and partners participating in the DOL AME grant. One interview participant

said, "I think our courses are selling themselves, but I think our industry partners are helping as well. We continue to increase how many companies are sponsoring students through scholarships and tuition reimbursement."

Similar efforts in supporting participant recruitment as those described by program personnel were shared by the partners, indicating that they had worked extensively on making current employees aware of the programs being offered by the AME Alliance and networking with other businesses not yet affiliated with the grant. Partners also shared their experiences in recruiting additional businesses to partner with the AME Alliance. As one partner shared, "It's coming from a completely different perspective now. It's been fantastic because there have been companies that are using the program and have shown the success of the model. It's given an impetus for others to jump in."

According to Partner Survey data, partners' level of involvement in participant recruitment was low during grant Years 1 and 2 (*slightly engaged*; a mean between 1.50 and 2.49); yet, the level increased significantly during grant Year 3 (*moderately engaged*; a mean between 2.50 and 3.49) (see Figure 10). This increase is likely a result of promoting the MT model and collaborating with partners in enrolling employees in the CT/MT courses.

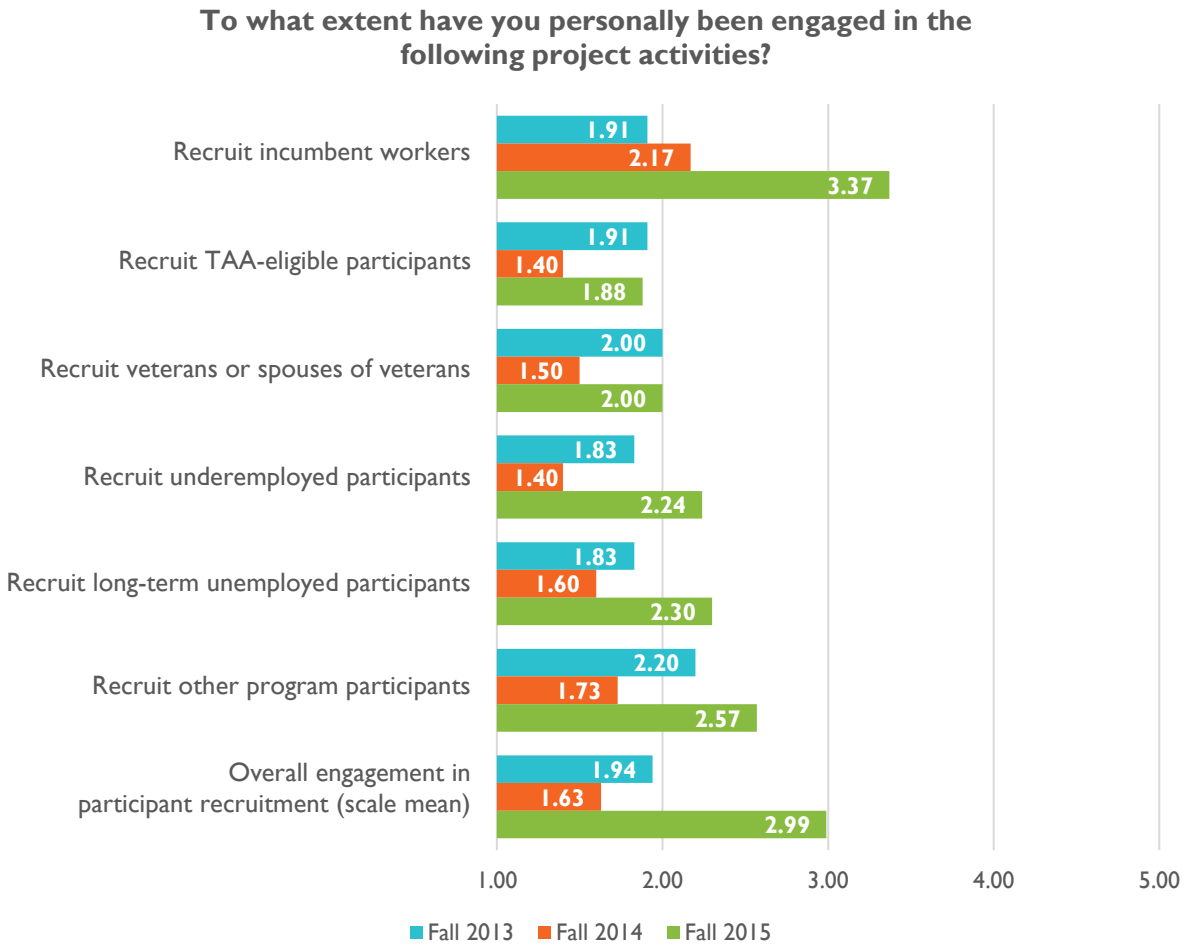


Figure 10. Level of Partner Involvement in Participant Recruitment

Note. Each item was rated on a 5-point scale: (1) Not engaged at all; (2) slightly engaged; (3) moderately engaged; (4) very engaged; and (5) highly engaged. Sample sizes for Fall 2013, 2014, and 2015 was 35, 30, and 32, respectively.

Partnership Support on Training Placement. AME Alliance staff reported that the partners have been instrumental in securing training placement opportunities for students enrolled in the grant-funded programs of study. In addition to providing internships, project staff indicated that some of the partners have hired current students as part-time employees, which often results in those students being hired on a full-time basis once they complete their programs of study. Project staff also indicated that the process of securing training placements for students has grown increasingly efficient as the implementation of MT equipment across the consortium continues. As one staff member shared, "More partners have been able to engage with our students through our MT [equipment]. That's definitely helped in setting up the trainings."

Partners also indicated that they have been supporting participant training placement by working with the E&E advisors to ensure students are receiving internships and part-time work opportunities relevant to their areas of study and professional goals. "Based upon students' current career locations and projected career targets, we assign various training responsibilities or class requirements to support that progression," commented one partner. "As far as internships and apprenticeships go, as the labor market tightens and as the need for skilled, knowledgeable, talented workers in precision manufacturing grows, it's tools like these that are going to be real helpful."

As shown in Figure 11, Partner Survey data revealed that partners' level of involvement in student support and placement services, on average, was moderate, but did increase over time. This upward trend was expected as the DOL AME project moved forward, with more and more students completing their programs of study and in need of placement services from the partners. As a result, project staff and partners collaborated closely during grant Years 2 and 3 to replace students in these "positions".

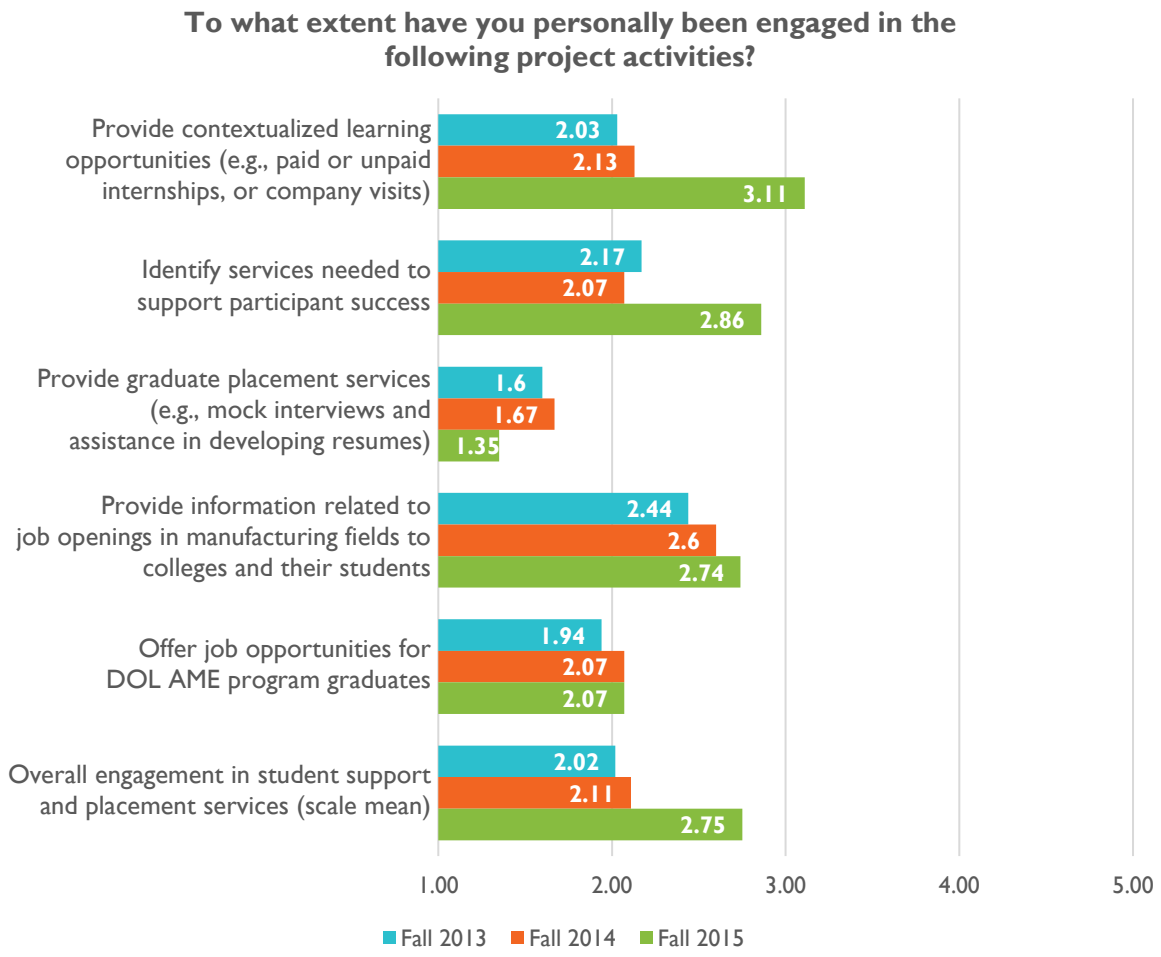


Figure 11. Level of Partner Involvement in Student Support and Placement Services

Note. Each item was rated on a 5-point scale: (1) not engaged at all; (2) slightly engaged; (3) moderately engaged; (4) very engaged; and (5) highly engaged. Sample sizes for Fall 2013, 2014, and 2015 was 35, 30, and 23, respectively.

Partnership Support on Leveraging of Resources. Project staff reported that the partners have provided major support in leveraging resources to support the AME Alliance. During the staff interviews, one staff member commented,

> *I think our partners have been great in contributing financial resources for students and scholarships as well as donating equipment. Frankly, they donate tons of time as well. Whether it's coming to speak to students and do experiential learning by talking about what it's like working in the industry, or as a member of the advisory board, or as a subject-matter expert.*

Table 26 shows the donations received from industry partners in monetary values based on information included in the quarterly reports. Overall, the project received a total of $2,237,754.12 in partner donations.

Table 26. Leveraged Resources from Partners During the First Three Years of the Grant

Reporting Timeframe	Resources	Item Detail
Year 1		
First Quarter	--	No leveraged resources during this quarter
Second Quarter	--	No leveraged resources during this quarter
Third Quarter	--	No leveraged resources during this quarter
Fourth Quarter	$ 382,811.87	Equipment purchased through a previous DOL grant; development fund from other grant; and equipment and material donations
Year 2		
First Quarter	$ 233,726.72	Equipment donations; material donations; a cash donation; and a FastTRAC grant
Second Quarter	$ 12,706.00	Equipment and supplies donations
Third Quarter	$ 18,082.44	Manufacturing supplies donations and SME input into the curricula
Fourth Quarter	$ 5,441.70	Metal supplies to be used in the machine labs by grant participants and industry partner time to attend the quarterly Manufacturing Alliance meetings
Year 3		
First Quarter	$ 9,050.84	Cash donation to purchase a piece of equipment; and SME time to attend in a Manufacturing Advisory Board meeting
Second Quarter	$ 150,799.80	Equipment and material donations; and SME time to review curricula
Third Quarter	$ 187,603.11	Equipment and material donations; SME time to attend advisory council meetings; and partners' supplies for IT equipment and books for employees to attend MT classes
Fourth Quarter	$ 203,543.14	Equipment and material donations; SME time to attend advisory council meetings; and partners' supplies for IT equipment and books for employees to attend MT classes
Year 4		
First Quarter	$ 38,246.55	Equipment and material donations; industry partners' time to attended advisory board meetings
Second Quarter	--	No leveraged resources during this quarter
Third Quarter	$ 995,741.95	Equipment and material donations; industry partners' time to attended advisory board meetings; faculty and staff time for AME programs of study that were not charged to the federal funds since the beginning of the grant
TOTAL	**$2,237,754.12**	

Data Source: Quarterly reports

In addition to the efforts described by AME staff, project partners described additional ways in which they leveraged resources to support the grant. Many of the partners indicated that they reached out to other companies in the industry through various associations and committees of which they are members, securing additional resources for the AME Alliance in addition to bringing in new partners. Partners also indicated that they are utilizing their own advertising and marketing

space to share information about the grant. "We publish anything the schools will give us on our websites and in our newsletters and things like that, just trying to let other companies know about all of these opportunities for training their employees." Partners expressed the opinion that this collaboration is particularly important and stressed the need for strong relationships between the colleges and manufacturers: "That's why we're trying so hard to set up that link, that relationship, so they can get the best feedback possible."

Partnership Support on Program Sustainability. AME Alliance staff members reported a major push from partners to begin planning for project sustainability during the third year of the grant. Specifically, partners were eager to start the conversation about how to support and sustain the programs that have been developed through the grant. For instance, project partners are offering to support the sustainability of the AME programs of study however they can, particularly through offering their facilities and equipment for training. Partners expressed that they are strongly invested in the programs being offered through the DOL AME grant and want to see them continue. "They've spent a lot of time putting the foundation of this thing into place, and so have we," commented one partner. "So now, we need to continue building. It would be so irritating to have someone give us something this awesome and then just take it away. We need this. This is working." The partners also emphasized that sustainability entails not only the continuation of the grant-funded programs of study, but also ensuring that the market can bear the finances required to do so. "If we're going to continue it, it needs to be continued at a price that people can afford," said one project partner. "With the loss of grant funding, I can see this being an issue. But, they've got enough businesses saying this is good for them that the word-of-mouth is out there, and I think we can figure it out."

SGA.Q9. What factors contribute to partners' involvement or lack of involvement in the program? Which contributions from partners were most critical to the success of the grant program? Which contributions from partners had less of an impact?

Interview data revealed a number of factors contributing to partners' involvement in supporting the DOL AME project from the perspectives of project staff. Many consortium staff members indicated that they perceive partners' participation in the grant to be in their best interest as it ensures access to quality employees and facilitates professional development and growth for existing employees. One staff member commented, "They need skilled laborers and there's such a lack out there right now. They're involved because they're looking for good, high-quality employees. If you don't have those, you aren't going to be profitable." Another staff member provided a similar comment, "[At the] end of the day, it's all about the bottom line. If your employees don't know what they're doing, you're in for a rough time. This is a business investment."

Project staff also shared the perspective that partner involvement has been facilitated by active and open communication. As one staff member shared, "There's consistent communication, and that leads to awareness. There's personal engagement going on. We're going to tour facilities, meeting with hiring managers in person, [and] actually taking the certificates to the companies. We're showing we're involved, that we're doing more than just training. We are there for a partnership and for their employees' success, and that has been key." Additionally, AME Alliance

staff members explained that the inclusion of partners on the advisory boards and various committees has fostered greater engagement as well, which in turn, generates buy-in. "There's a give-and-take, and it provided synergy with everyone coming together and seeing that this is really something that's going to be a success for their organization."

Partners also shared the reasons for their involvement. Confirming what has been reported by AME project staff, partners generally believe that their involvement in supporting the AME Alliance is in their own best interest because it ensures access to a pool of skilled laborers for employment. One partner explained,

> *Me, personally, I'm not a teacher or an academic or anything like that. My business just needs employees. I think that's the biggest factor for my involvement. I need employees here and I need them to have the skills to do what needs to be done. And these programs, they've shown that they teach students what they need to know. The schools have been bringing in content experts, and their graduates are having no trouble finding work, so it's a no-brainer. It works.*

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Appendices

Appendix A. DOL AME Programs of Study and Historical Comparison Programs

Table A1. Programs of Study at Central Lakes College

AME Programs			Historical Comparison Programs		
Program of Study	Program Type	# Credits	Program of Study	Program Type	# Credits
Program Cluster: Automation/Robotics					
Automation Technology**	CERT	30	Automation Technology**	CERT	30
Production Technology**	CERT	16	Production Technology**	CERT	15
Welding Technology**	CERT	30	Welding Technology**	CERT	30
Manufacturing Foundations	CERT	8			
Robotic Welding	CERT	16			
Robotic Vision Advanced Certificate	CERT	10			
Robotic Welding Advanced Certificate	CERT	12			
Manufacturing Welding Technician	DIP	63	Manufacturing Welding Technician	DIP	64
Mechatronics	DIP	40	Mechatronics	DIP	39
Robotics Automated Systems Technology	DIP	61	Robotics Automated Systems Technology	DIP	64-66
Welding and Fabrication	DIP	44	Welding and Fabrication	DIP	32-44
Applied Engineering Technology	AAS	60	Applied Engineering Technology	AAS	60-72
Robotics Automated Systems Technology	AAS	70	Robotics Automated Systems Technology	AAS	78
Welding and Fabrication	AAS	60	Welding and Fabrication	AAS	64
Program Cluster: Plastic Technology					
Advanced Tool and Die/Mold Making Emphasis	CERT	10			
Machine Tool Technology: Tool and Die/Mold Making Emphasis	DIP	44			
Machine Tool Technology: Tool and Die/Mold Making Emphasis	AAS	60			
Program Cluster: Precision Manufacturing					
Advanced Machine Tool Technology: CNC Emphasis	CERT	10			
Machine Technology	CERT	30			
Manufacturing Technician Certificate	CERT	18	Machine Shop Assistant	DIP	32
Machine Tool Technology: CNC	DIP	44	Machine Tool Technology	DIP	44-64
Manufacturing Maintenance Technician	DIP	64	Manufacturing Maintenance Technician	DIP	64
Machine Tool Technology: CNC	AAS	60	Machine Tool Technology	AAS	60
Other AME-like programs			Mechanical Design	CERT	26-27
			Mechanical Design	Diploma	26-60
			Mechanical Design	AAS	60-72

Note. CERT = Certificate; DIP = Diploma; AAS = Associate in Applied Science
** Programs offered through 360 Center

Table A2. Programs of Study at St. Cloud Technical and Community College

AME Programs			Historical Comparison Programs		
Program of Study	Program Type	# Credits	Program of Study	Program Type	# Credits
Program Cluster: Automation/Robotics					
Manufacturing Foundations	CERT	8			
Production Technologies	CERT	16	Production Technologies	CERT	15
Mechatronics	CERT	30	Electronics Technician I; Mechatronics	CERT	30-31
Welding and Fabrication	DIP	37	Welding/Fabrication	DIP	37
Instrumentation and Process Control	DIP	56	Instrumentation and Process Control	DIP	60
Mechatronics	DIP	56	Industrial Electronics; Mechatronics	DIP	60
Robotics and Automation	DIP	67	Industrial Electronics; Mechatronics	DIP	60
Bio-Medical Technician	AAS	60	Biomedical Equipment Technology	AAS	60
Energy Technical Specialist	AAS	60	Energy Technical Specialist	AAS	60
Energy Technical Specialist - Nuclear	AAS	74	Energy Technical Specialist	AAS	74
Instrumentation and Process Control	AAS	60	Instrumentation and Process Control	AAS	64
Mechatronics	AAS	60	Industrial Electronics; Mechatronics	AAS	64
Robotics and Automation	AAS	71	Industrial Electronics; Mechatronics	AAS	64
Program Cluster: Plastic Technology					
Machine Tool Technology: CNC Moldmaker/CAM Machinist Concentration	DIP	63	Machine Tool Technology	DIP	68
Machine Tool Technology: CNC Moldmaker/CAM Machinist Concentration	AAS	68	Machine Tool Technology	AAS	72
Program Cluster: Precision Manufacturing					
Machine Operator	DIP	32			
Machine Tool Technology: CNC Machinist	DIP	55	Machine Tool Technology	DIP	68
Machine Tool Technology: Advanced CNC/CAM Machinist Concentration	DIP	63	Machine Tool Technology	DIP	68
Machine Tool Technology: CNC Machinist	AAS	60	Machine Tool Technology	AAS	72
Machine Tool Technology: Advanced CNC/CAM Machinist Concentration	AAS	68	Machine Tool Technology	AAS	72
Mechanical Design and Manufacturing Technology	CERT	20	Mechanical Design and Manufacturing Technology	CERT	20
Program Cluster: Prototyping and Reverse Engineering					
Mechanical Design Concentration	DIP	66	Mechanical Design Technology	DIP	64
Reverse Engineering/Rapid Prototype Concentration	DIP	58	Mechanical Design Technology	DIP	64
Mechanical Design Concentration	AAS	68	Mechanical Design Technology	AAS	65
Reverse Engineering/Rapid Prototype Concentration	AAS	60	Mechanical Design Technology	AAS	65

Note. CERT = certificate; DIP = diploma; AAS = Associate in Applied Science; CAM = Computer-aided Manufacturing; CNC = Computerized Numerical Control

Table A3. Programs of Study at Pine Technical and Community College

AME Programs			Historical Comparison Programs		
Program of Study	Program Type	# Credits	Program of Study	Program Type	# Credits
Program Cluster: Automation/Robotics					
Manufacturing Foundations	CERT	8			
Production Technologies**	CERT	16	Production Technologies**	CERT	15
Automation Technology**	CERT	30	Automation Technology**	CERT	30
Machine Technologist**	CERT	30	Machine Technologist**	CERT	30
Welding Technology**	CERT	30	Welding Technology**	CERT	30
Robotics/Automation	AAS	68			
Program Cluster: Plastic Technology					
Plastic Production	CERT	18			
Plastic Set-up and Processes	CERT	18			
Plastic Production	DIP	45			
Plastic Production	DIP	32			
Plastic Technology	AAS	60			
Program Cluster: Precision Manufacturing					
Advanced Manufacturing Technology: Precision Machining	CERT	28	Machine Tool; Precision Machining	CERT	29
Advanced Manufacturing Technology: Prototyping and Reverse Engineering	CERT	16	Advanced Manufacturing Technology: Prototyping and Reverse Engineering	CERT	20
Advanced Manufacturing Technology: Computer Controlled Machining Emphasis	DIP	45	CNC Operations; Precision Machining; Computer Controlled Precision Machining	DIP	44
Advanced Manufacturing Technology: Computer Controlled Manufacturing Emphasis	AAS	60	CNC Operations Technician; Precision Machining; Mechanical Engineering Technology-Manufacturing Program	AAS / AS	60-64
Advanced Manufacturing Technology: Robotics Emphasis	DIP	45			
Advanced Manufacturing Technology: Robotics Emphasis	AAS	60			

Note. AAS = Associate in Applied Science; AS = Applied Science

** Programs offered through 360 Center

Appendix B: Propensity Score Matching Results

McREL researchers conducted propensity score matching (PSM) to identify a group of 180 comparisons who were similar to the participant group in the following characteristics: age; gender (male and female); minority status (Caucasian, non-Caucasian, and more than two races); incumbent worker status (employed and unemployed); enrollment status (part-time vs. full-time); educational attainment (GED, high school diploma, and some college); and program type (certificate, diploma, and degree).

After the matching process was complete, balance diagnostics were conducted to check the quality of the matches. It was expected that the selected comparison group would be similar to the participating group on all covariates being used for the PSM process (Rubin, 2001). As shown in Figure B1, an examination of the distribution of propensity scores was first conducted to assess common support via a graphic diagnostic; then, three numerical balance measures were used to check covariate balances at the student level (Rubin, 2001):

- The ratio of the variances of the propensity scores in the two groups must be close to 1.0. Rubin (2001) suggests that the variance ratios should be between 0.5 and 2.0.
- The difference in the means of the propensity scores in the two groups being compared must be small. Rubin (2001) suggests that the standardized differences of means should be less than 0.25.
- For the percent of balance improvement, the larger the percent, the better the PSM results.

A visual examination of Figure B1 suggests that the selected comparisons and participants have similar distributions of propensity scores across all three matching groups. As shown in Table B1, the ratio of the variances of the propensity scores equals 1.14, which is within the range suggested by Rubin (2001). The analyses of standard mean differences suggest that the matching procedures have significantly minimized the group mean differences between the participant and comparison groups. Most importantly, after the PSM process, all covariates had a standardized mean difference smaller than 0.25, as suggested by Rubin (2001). The percent of balance improvement ranged from 70% to 100%, with few exceptions.[35] Taken together, these diagnostic criteria suggest that the participants and selected comparisons were similar by key demographic characteristics.

[35] Three variables, including enrollment status, educational attainment, and program type, seemed to cause some imbalance when performing the PSM process; however, given that these factors are associated with the main outcomes of interest, these variables were retained in the matching process.

Figure B1. Jitter plots of the distribution of propensity scores by matching groups.

Table B1. Balance Diagnosis Before and After the PSM Process[36]

Variables	Participants		Comparison				Balance Diagnosis			
			Before		After		Variance Ratio	Standard Mean Differences		% Balance Improvement
	M	*SD*	*M*	*SD*	*M*	*SD*		Before	After	
Propensity Score	0.43	0.16	0.17	0.18	0.40	0.14	1.32	0.26	0.03	87.05
Age	21.54	4.84	21.95	4.68	21.56	4.90		-0.41	-0.03	93.22
Gender	0.94	0.23	0.95	0.21	0.94	0.23		-0.01	0.00	100.00
Minority Status	1.12	0.43	1.67	0.51	1.12	0.43		-0.56	0.00	100.00
Employment Status	0.71	0.45	0.64	0.48	0.69	0.46		0.07	0.02	70.05
Enrolment Status	1.80	0.41	1.79	0.40	1.82	0.38		0.00	-0.03	-1572.16
Educational Attainment	2.23	0.55	2.23	0.60	2.07	0.40		0.00	0.16	-14521.13
Program Type	2.30	0.67	2.32	0.49	2.33	0.54		-0.01	-0.02	-38.76

[36] Balance diagnosis is a process to determine whether baseline equivalence is established.

Appendix C: DOL AME Programs of Study

Table C1. Programs of Study at Central Lakes College

Program of Study	Program Name	Program Type	Program Status	# of Credits
Program Cluster: Automation/Robotics				
Automation Technology	Automation Technology [a]	Certificate	Existing	30
	Production Technology [a]	Certificate	Existing	16
	Welding Technology [a]	Certificate	Existing	30
	Manufacturing Foundations	Certificate	New	8
	Robotic Welding [b]	Certificate	New	16
	Robotic Vision Advanced Certificate	Certificate	New	10
	Robotic Welding Advanced Certificate	Certificate	New	12
	Manufacturing Welding Technician	Diploma	Enhanced	63
	Mechatronics	Diploma	Enhanced	40
	Robotics Automated Systems Technology	Diploma	Enhanced	61
	Welding and Fabrication	Diploma	Enhanced	44
	Applied Engineering Technology	AAS	Existing	60
	Robotics Automated Systems Technology	AAS	Enhanced	70
	Welding and Fabrication	AAS	Enhanced	60
Program Cluster: Plastic Technology				
Plastic Technology	Advanced Tool and Die/Mold Making Emphasis [c]	Certificate	New	10
	Machine Tool Technology: Tool and Die/Mold Making Emphasis	Diploma	New	44
	Machine Tool Technology: Tool and Die/Mold Making Emphasis	AAS	New	60
Program Cluster: Precision Manufacturing				
Computer Controlled Precision Manufacturing	Advanced Machine Tool Technology: CNC Emphasis [c]	Certificate	New	10
	Machine Technology [a]	Certificate	Existing	30
	Manufacturing Technician Certificate	Certificate	New	18
	Machine Tool Technology: CNC	Diploma	Enhanced	44
	Manufacturing Maintenance Technician	Diploma	Enhanced	64
	Machine Tool Technology: CNC	AAS	Enhanced	60

Note. AAS = Associate in Applied Science; CNC = Computerized Numerical Control

a. Programs offered through the 360 Center.

b. The program is a stand-alone certificate program.

c. The program is for incumbent or dislocated workers with previous experience.

Table C2. Programs of Study at St. Cloud Technical and Community College

Program of Study	Program Name	Program Type	Program Status	# of Credits
Program Cluster: Automation/Robotics				
Automation Technology	Manufacturing Foundations	Certificate	New	8
	Production Technologies [a]	Certificate	Enhanced	16
	Mechatronics	Certificate	Existing	30
	Welding and Fabrication	Certificate	Enhanced	37
	Instrumentation and Process Control	Diploma	Enhanced	56
	Mechatronics	Diploma	Enhanced	56
	Robotics and Automation	Diploma	Enhanced	67
	Bio-Medical Technician	AAS	Existing	60
	Energy Technical Specialist	AAS	Existing	60
	Energy Technical Specialist - Nuclear	AAS	Existing	74
	Instrumentation and Process Control	AAS	Enhanced	60
	Mechatronics	AAS	Enhanced	60
	Robotics and Automation	AAS	Enhanced	71
Program Cluster: Plastic Technology				
Plastic Technology	Machine Tool Technology: CNC Moldmaker/CAM Machinist Concentration	Diploma	Enhanced	63
	Machine Tool Technology: CNC Moldmaker/CAM Machinist Concentration	AAS	Enhanced	68
Program Cluster: Precision Manufacturing				
Computer Controlled Precision Manufacturing	Machine Operator	Diploma	New	32
	Machine Tool Technology: CNC Machinist	Diploma	Enhanced	55
	Machine Tool Technology: Advanced CNC/CAM Machinist Concentration	Diploma	Enhanced	63
	Machine Tool Technology: CNC Machinist	AAS	Enhanced	60
	Machine Tool Technology: Advanced CNC/CAM Machinist Concentration	AAS	Enhanced	68
	Mechanical Design and Manufacturing Technology (ATC)	Certificate	Existing	20
Program Cluster: Prototyping & Reverse Engineering				
Prototype/Reverse Engineering	Mechanical Design Concentration	Diploma	Enhanced	66
	Reverse Engineering/Rapid Prototype Concentration	Diploma	Enhanced	58
	Mechanical Design Concentration	AAS	Enhanced	68
	Reverse Engineering/Rapid Prototype Concentration	AAS	Enhanced	60

Note. AAS = Associate in Applied Science; CAM = Computer-aided Manufacturing; CNC = Computerized Numerical Control

[a.] Program offered through 360 Center.

Table C3. Programs of Study at Pine Technical and Community College

Program of Study	Program Name	Program Type	Program Status	# of Credits
Program Cluster: Automation/Robotics				
Automation Technology	Manufacturing Foundations	Certificate	New	8
	Production Technologies [a]	Certificate	Enhanced	16
	Automation Technology [a]	Certificate	Existing	30
	Machine Technologist [a]	Certificate	Existing	30
	Welding Technology [a]	Certificate	Existing	30
	Robotics/Automation	AAS	New	68
Program Cluster: Plastic Technology				
Plastic Technology	Plastic Production	Certificate	New	18
	Plastic Set-up and Processes	Certificate	New	18
	Plastic Production	Diploma	New	32-45 [b]
	Plastic Technology	AAS	New	60
Program Cluster: Precision Manufacturing				
Computer Controlled Precision Manufacturing	Advanced Manufacturing Technology: Precision Machining	Certificate	Existing	28
	Advanced Manufacturing Technology: Prototyping and Reverse Engineering	Certificate	Existing	16
	Advanced Manufacturing Technology: Computer Controlled Machining Emphasis	Diploma	Existing	45
	Advanced Manufacturing Technology: Robotics Emphasis	Diploma	New	45
	Advanced Manufacturing Technology: Robotics Emphasis	AAS	New	60
	Advanced Manufacturing Technology: Computer Controlled Manufacturing Emphasis	AAS	Existing	60

Note. AAS = Associate in Applied Science

[a.] Programs are offered through 360 Center.

[b.] The plastic production diploma program offered between Fall 2013 and Spring 2015 required 45 credit; starting fall 2015, the number of credits required for the program decreased to 32.