TAACCCT Final Evaluation Report

Northwest State Community College of Ohio Industrial Automation Manufacturing innovative Strategic Training Achieving Results (IAM iSTAR) Initiative

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Wright State University is a national public research university in Dayton, Ohio – the home of the Wright Brothers – offering over 230 degree programs across eight colleges, three schools, and a branch campus. The University selected experts from three of those colleges and the branch "Lake" campus to form a specialized team to deliver program evaluation services using tested research methods and the latest statistical tools.

Applied Policy Research Institute

- Project Direction and Management
- Implementation Analysis and Reporting
- Outcomes Evaluation
- Institutional Review Board and Data Sharing Agreement Liaison
- Report Production

College of Science and Mathematics

- Statistical Analysis via the Statistical Consulting Center
- Impact Evaluation

College of Education and Human Services

- Quality Matters Instructional Design Course Review
- Implementation Analysis

Lake Campus

- Engineering Technology Department Technical Course Content Review

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TAACCCT Project and Purpose

In October 2014, Northwest State Community College was awarded a Round 4 grant from the Trade Adjustment Assistance Community College and Career Training (TAACCCT) program, sponsored by the U.S. Department of Labor. The TAACCCT grant was to convert traditional courses in the industrial technologies division, which trains industrial automation maintenance technicians, to an intensive modularized hybrid format, using competency-based curriculum, virtual trainers, open labs, and career coaching as support. This program, called IAM iSTAR (Industrial Automation Manufacturing innovative Strategic Training Achieving Results) trained trade-impacted and other dislocated workers, veterans, and other adults seeking employment in the advanced manufacturing industry.

IAM iSTAR Program Components that were evaluated

Component Descriptions and Intended Effect on IAM iSTAR Participants

Strategy 1: Develop new and modified competency-based curriculum	**Intended Effect on Participants**
• Convert existing industrial based courses to a competency-based model versus a seat time model. • Create short-term credit certificate programs in industrial technologies that align with jobs that are in high demand. • Engage industry partners to identify competencies and credentials required for their employees. • Embed industry-recognized credentials such as the National Career readiness Certificate (NCRC) and National Association of Manufacturers (NAM) into the curriculum. • Develop stackable and latticed credentials from assistance with current TAACCCT partner that align with employer needs.	• Participants learn the same amount of material in a significantly shorter period of time with equal learning gains as compared to students in traditional instruction • Immediate post-exit job placement which also meets industry needs for skilled maintenance technicians • Allows students to move up a career ladder and/or streamline additional education
Strategy 2: Transform the academic process to accelerate student learning and completion	**Intended Effect on Participants**
• Develop a standard model for awarding credit for Prior Learning Assessments (PLA). • Allow students to start into a certificate program immediately through the use of “massively open online courses” (MOOC). • Build multiple career pathways from Certificate to Associate to Bachelor degree and beyond. • Deploy curriculum for individualized or cohort accelerated delivery models that will allow for a faster student completion of a program.	• Accelerates certificate and degree completion • Allows students to move up a career ladder and/or streamline additional education

Strategy 3: Create innovative instructional media and technology to accelerate learning	Intended Effect on Participants
• Develop modularized Online Learning Modules for new and modified curriculum to expand student access. • Design hands-on training simulators that align with industry standard equipment and machinery. • Create hands-on assessments and lab exercises that align directly with the hands-on competencies specified by employer partners. • Create and deploy online simulations that align with equipment and processes found in a manufacturing environment. • Build a virtual computer farm to give full software access to students on a 24/7 basis. • Design a flexible lab-time system that will allow working students to schedule lab times to fit their schedules.	• Accelerates learning • Allows students to learn course objectives anytime, anywhere • Participants that exit ready to work • Saves participants money on expensive technical software
Strategy 4: Redesign student support services to increase student success[1]	**Intended Effect on Participants**
• Utilize full-time Career Coaches to assist students from the start of their program to job placement. • Reach out to, and contract with local community-based organization(s) (CBOs) to provide Career Coaching services. • Strengthen partnership and existing Workforce Systems and One-Stop Career Centers to better support the needs of the students. • Develop opportunities and establish employer sites for work based learning, including apprenticeships, paid internships, co-ops, and on-the-job training (OJT).	• Increases participant educational and job placement success • Trains trade-impacted and other dislocated workers, veterans, and other adults seeking employment in the advanced manufacturing industry • Application of learning in real-world setting; make connections between competencies and job descriptions

Source: IAM iSTAR U.S. Department of Labor Employment and Training Administration Grant Proposal

Population Served

Northwest State Community College (NSCC) served a total of 589 participants in Northwest Ohio through the IAM iSTAR program. The students served by NSCC primarily come from a rural, six-county area dominated by farming, industrial and small business. All students are commuters. NSCC's typical student is an adult learner who enrolls part-time, comprising 81% of the student body.

DEMOGRAPHIC SUMMARY (ALL GRANT PARTICIPANTS)	Year 1	Year 2	Year 3	3-year Total	
	n	n	n	Sum	Percent
Total Participants	200	174	215	589	N/A
Sex					
Male	189	160	188	537	91.2%
Female	11	14	27	52	8.8%

[1] Forty-two percent of people ages 18 to 24 are enrolled in all of higher education, according to the National Center for Education Statistics, but only 29 percent come from rural areas, compared to nearly 48 percent from cities. The Atlantic, "The Rural Higher Education Crisis," September 27, 2017

DEMOGRAPHIC SUMMARY (ALL GRANT PARTICIPANTS)	Year 1	Year 2	Year 3	3-year Total	
	n	n	n	Sum	Percent
Race/Ethnicity					
Hispanic/Latino	12	15	25	52	8.8%
American Indian or Alaskan Native	0	0	0	0	0.0%
Asian	0	0	0	0	0.0%
Black or African American	7	11	17	35	5.9%
Native Hawaiian or Other Pacific Islander	0	0	0	0	0.0%
White	162	130	116	408	69.3%
More Than One Race	2	2	2	6	1.0%
Refused					15%
Enrollment Status					
Full-Time Status	52	53	55	160	27.2%
Part-Time Status	148	121	160	429	72.8%
Other					
Incumbent Workers	54	75	19	148	25.1%
Eligible Veterans	2	6	3	11	1.9%
Participant Age (mean)	32	32	33	N/A	32
Persons with a Disability	4	4	5	13	2.2%
Pell-grant eligible	74	58	29	161	27.3%
Trade Adjustment Assistance eligible	5	24	5	34	5.8%

Source: Northwest State Community College Banner System and TAACCCT participant-reported data

Evidence-based Model that Guided IAM iSTAR

The IAM iSTAR project was guided by the Carnegie Mellon University Open Learning Initiative (OLI),[2] which provides a strong base of evidence that learners using the OLI course in hybrid mode (a mix of online and face-to-face instructional methods) learn the same amount of material in a significantly shorter period of time with equal learning gains, as compared to students in traditional instruction, and this was the ***IAM iSTAR hypothesis.*** In the OLI study, results showed that OLI-Statistics students learned a full semester's worth of material in half as much time and performed as well or better than students learning from traditional instruction over a full semester. In the IAM iSTAR program, participants learned 10-15% more content in half the time, and their workforce outcomes compare favorably to those in traditional programs.

Evaluation Design Summary

This section provides an overview of the conceptual framework and the evaluation design, including implementation, outcome, and impact evaluation approaches.

[2] Marsha Lovett, Oded Meyer, Candace Thille. "The Open Learning Initiative: Measuring the Effectiveness of the OLI Statistics Course in Accelerating Student Learning," Carnegie Mellon University, 2008.

Goals of the Evaluation

Wright State University developed a customized evaluation plan that used data to inform the continuous improvement of the program as well as its lasting impact. The evaluation goals were to:

1. Analyze progress against strategy implementation to improve the capacity of the College and collaborators to deliver a successful program, using internal data such as student interviews, site visits, meeting minutes/observations, and document review, as well as external data via structured interviews and online employer surveys.
2. Provide evaluation of deliverables produced under the grant such as marketing, online courses, competencies, curricula, course materials and learning objects, knowledge and hands-on assessments, and teacher guides.
3. Assess student outcomes to measure the extent to which the IAM iSTAR program improves academic, employment, and wage outcomes compared with traditional programs.
4. Implement a quasi-experimental design to measure program impact compared to students at other non-TAACCCT community colleges, using State of Ohio administrative higher education and Unemployment Insurance (UI) wage records.

Implementation Analysis Study Design

To analyze ***program implementation***, the Evaluator applied a technical evaluation, in keeping with the technical nature of the NSCC TAACCCT proposal, along with qualitative approaches. The technical evaluation involved instructional design experts at Wright State University (WSU) as well as WSU experts in engineering and technical training course development.

Qualitative approaches for the implementation analysis included: (1) two stakeholder surveys conducted in the first and last year of the grant; (2) three student focus group sessions and individual student, faculty and staff interviews; (3) analysis of classroom evaluations completed by students; (4) document and data review; (5) conference calls every two weeks with NSCC throughout the entire grant period; and (6) an initial on-site planning meeting and annual site visits during each of the three years of the grant using the National Implementation Research Network (NIRN) matrix to capture data and assess the degree to which project components were being implemented with fidelity to the proposed plan.

Implementation Analysis Research Questions

Program Design Questions

1. What is the program's administrative structure? What are the qualifications of program administrators?
2. How was the particular curriculum or activity selected, used or created?
3. How were programs improved or expanded using grant funds? What delivery methods were offered?

Assessment of Participant Abilities, Skills, and Interests Questions

4. Are in-depth assessments of participant abilities, skills, and interests conducted to enroll individuals into programs? How were student support services and work-based learning opportunities improved and perceived? Was career guidance provided?

5. Are Prior Learning Assessment policies in place; are they tied to learning outcomes?

Stakeholder Involvement Questions

6. What contributions did each of the partners and other key stakeholders make? What factors affected partner involvement? Which contributions from partners were most critical to success?

Transferability and Sustainability Questions

7. What is the level of fidelity to the program; that is, was the program implemented as planned? If the program deviated, how did changes affect outputs?
8. To what extent are components of the program transferable and sustainable?

Implementation Analysis Conceptual Framework

To guide the implementation analysis, the Evaluator customized a National Implementation Research Network (NIRN) matrix using content from the NSCC IAM iSTAR logic model. The NIRN recommends four-stages of implementation analysis: ***exploration, installation, initial implementation, and full-implementation.*** The Evaluator recorded the evolution of the IAM iSTAR project across all four NIRN stages using the categories and questions listed above.

Applying the Conceptual Framework

In the ***Exploration*** stage, the Evaluator used the NIRN matrix to organize observable evidence of "proof of concept" into categories, which were mainly structural at this point in the project. "Structural" items included the grant's leadership and administrative support, team qualifications, a communications plan, specified technology and equipment needs, data systems, program fit with employer and workforce development needs, and stakeholder support. A key finding at this stage was that hoped-for outside sources of curriculum content, program competencies, and learning objects like simulations and simulators, were nonexistent or outdated. The NSCC team would have to rely on its own inventiveness and innovativeness to accomplish the program vision — to convert highly technical advanced manufacturing material to an intensive hybrid format.

In the ***Installation*** stage, the focus was on gearing up for implementation. The primary focus of NSCC was technology and equipment budgeting and installation, and personnel installation including the instructional designer to carry out the technical conversion of traditional courses to an online hybrid format, the career coach, and replacing faculty who left because they preferred traditional course teaching. Upskilling of staff and faculty to enable course conversions, including Quality Matters professional development, was also a focus. Site visits to all three campuses by the Evaluator were the key method to observe and assess implementation at this stage.

In the ***Initial Implementation*** stage, the topics included an Evaluator's review of internal communication protocols to identify barriers and adaptive solutions, as well as external communication plans to keep stakeholders informed and begin to ramp up participant recruitment. The Evaluator looked for evidence of participant abilities, skills, and interest assessment protocols, as well as Prior Learning Assessment protocols and policies. The coaching system, plan, and processes were also points of inquiry, and fidelity to the program model was closely evaluated by experts in instructional design at Wright State University. Program deviations were recorded and discussed with NSCC.

In the ***Full Implementation*** stage, each of the IAM iSTAR strategic components was reviewed and validated by engineering and technical training course developers from Wright State University to evaluate the content and the courses' transferability in the public domain, using an analysis rubric that went beyond the NIRN. Strategic components include the competency based curriculum, the modularized intensive hybrid courses, the virtual trainers and learning objects, the open labs, and the knowledge and hands-on assessments. The Evaluator also assessed policy changes, stakeholder involvement, institutionalization of program elements, and sustainability via document review, surveys, and interviews.

Implementation Data and Methods

Qualitative Study: While the NIRN matrix enabled a rich documentation of the program, in addition to the matrix, the NIRN recommends that the Evaluator create a "map" of the implementation drivers to identify critical milestone functions of the grant program and describe how those functions are carried out by the grantee. The map and the NIRN matrix were the data collection tools used by the Evaluator to collect information. Site visits were aligned with key meetings which enabled observation of an employer round table session, students in labs, student focus group sessions, an employer tour, and interviews with staff, faculty, and partners. Other data collection tools used were discussion guides developed and used for focus group sessions with students; interview question sets for students, staff, and faculty; guided questions for the employer round table discussion; Qualtrics for online stakeholder surveys; and content analysis of documents utilizing both inductive and deductive content analysis approaches.

Technical Quality Matters review: Quality Matters Higher Education Rubric is designed for use with courses that are delivered fully online or have a significant online component (hybrid and blended courses).[3] The rubric was used to assess the degree to which the first converted course under IAM iSTAR met Quality Matters (QM) standards and highlighted areas for improvement. Based on the recommendations of Wright State University, NSCC became an institutional member of QM and received organization-wide QM training and professional development, which further enabled future course conversions to meet QM standards.

Technical Course Content Review: The engineering and technical training course development experts at Wright State University developed a Microsoft Excel course review tool to capture information on the fourteen TAACCCT converted courses. Each course was systematically reviewed and rated and this required Evaluators to open and review every Knowledge Assessment Activity (KAA), Hands-on Assessment (HOA), learning object, course lecture, syllabus—essentially every item for every converted course.

Capacity-building Measurements and Indicators

The sustainability framework, which is a joint development between the National Science Foundation Advanced Technological Education program centers and the TAACCCT Learning Network, was used to obtain evidence of program sustainability. The measurements and indicators in the framework are:

- Innovations to sustain: instructional methods, employer partnerships, and career planning services
- Priorities they align with: college-wide goals, regional economic development initiatives, statewide higher education policies
- Data to show success: student retention and completion, employer testimonials, job placements

[3] https://www.qualitymatters.org/qa-resources/rubric-standards/higher-ed-rubric

- Mechanism to sustain the innovation: MOU with partners, college or statewide policy, professional development

The results of the sustainability framework were refined by assessing capacity along four lines.

- 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)
- Material capacity (i.e., the fiscal resources, materials, and equipment that the organization uses to meet its needs and to implement targeted change)

Outcomes and Impact Study Design

The Evaluator conducted an outcome evaluation, a delivery methods evaluation, and an impact evaluation. The intent of the outcome evaluation is to measure the degree to which IAM iSTAR performance targets for the treatment group were met. The NSCC Banner System and self-reported data were used for this analysis. The intent of the delivery methods evaluation is to measure the degree to which NSCC's TAACCCT participant workforce outcomes exceed the workforce outcomes of NSCC students prior to the TAACCCT grant. State of Ohio administrative Unemployment Insurance (UI) and Higher Education Information (HEI) records, via the Ohio Longitudinal Data Archive (OLDA), were used for this analysis.

The intent of the impact evaluation is to conduct a quasi-experimental evaluation using State of Ohio administrative UI and HEI records via the OLDA to develop an objective analysis that determines whether the wage and employment results for the IAM iSTAR participants (i.e., the treatment group) surpass the results for students in the same courses at other community colleges in Ohio (i.e., the comparison group), selecting those rural community colleges that have not participated in any TAACCCT grants for the comparison group.

Outcome, Delivery Methods Evaluation, and Impact Evaluation Research Questions

- Did the IAM iSTAR TAACCCT-funded program meet and/or exceed the targets it set for the program's annual performance section B participant outcome measures?
- Do NSCC participants in the TAACCCT program of study have better employment, job retention, and wage increase outcomes than students at NSCC prior to the TAACCCT grant?
- Do NSCC participants in the TAACCCT program of study make greater progress and have better program of study completion outcomes (such as credits attempted, credits completed, and grade point average (GPA)) than NSCC students prior to the TAACCCT grant ?
- Do participants in the treatment group have better workforce outcomes than students in the comparison group (such as employment, job retention, and wage increases)?

Implementation Findings

How the grant was used to build institutional capacity

Human capacity (i.e., knowledge, expertise, and understanding, as well as the will and commitment, of personnel charged with implementing the targeted change):

- Project staff shared that the TAACCCT grant has cultivated a level of expertise in the industrial technology program and the engagement of industry, workforce, and community partners.
- Top NSCC administrators have articulated their commitment to continue to convert traditional courses to the intensive hybrid format, using hard budget dollars, if grant funding is not awarded.
- NSCC still needs to articulate a succession plan for the core faculty talent team of the TAACCCT grant, which was recommended by the Evaluator at the time of the Interim Evaluation.

Institutional capacity (i.e., the interaction, collaboration, and communication among members of the organization):

- The institution has created a new position within the student advising center to retain the Workplace Learning/PLA - Apprenticeship Coordinator previously funded under the TAACCCT grant. This position will ensure that the work-based learning opportunities including the Internship Program, job readiness, and job placement activities developed under the TAACCCT grant are scaled up to and supported by the institution. This position will spend half time off campus to continue to cultivate employer partnering for work-based opportunities.
- Furthermore, NSCC has hired the TAACCCT project manager who will coordinate NSCC's Industrial Technologies department so that knowledge gains under TAACCCT continue to benefit the college.
- Quality Matters (QM) professional development will continue to build institutional capacity for converting courses to the intensive hybrid format, because under the TAACCT grant and the advice of the Evaluator, NSCC became QM members.
- NSCC's membership in Ohio TechNet will increase transferability of NSCC's expertise in converting traditional courses to hybrid courses across the State of Ohio.

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):

- NSCC's new student advising center, PLA policies, continued commitment to convert courses to the intensive hybrid format, the Comprehensive Case Management and Employment Program (CCMEP) involvement with Ohio Means Jobs, and NSCC's membership in Ohio TechNet are critical structural changes that occurred at NSCC due to the TAACCCT grant.
- The NSCC procurement process was improved under the TAACCCT grant and that will continue to benefit the college.

Material capacity (i.e., the fiscal resources, materials, and equipment that the organization uses to meet its needs and to implement targeted change):

- Ohio TechNet has developed a one-year budget of $154,000 for continuing to convert and deliver intensive hybrid courses in industrial technology. NSCC has a critical role in this strategy as it has

committed to share its know-how across all Ohio TechNet colleges. No request for equipment funds has been made given the recent equipment upgrades made under the TAACCCT grant.

Key Steps taken to create and run the Training Program

Create short-term credit certificate programs in industrial technologies that align with jobs in high demand: The certificates in Industrial Automation Maintenance, Industrial Maintenance, Programmable Controller, and Industrial Electrical demonstrate mastery are linked to multiple occupations such as: 49-2091 Avionics Technicians; 49-2093 Electrical and Electronics Installers and Repairers, Transportation Equipment; 49-2094 Electrical and Electronics Repairers; Commercial and Industrial Equipment; and 49-2096 Electronic Equipment Installers and Repairers, Motor Vehicles. Core occupations include 49-9041 Industrial Machinery Mechanics and 49-9043 Maintenance Workers Machinery. The Northwest Ohio region has outpaced the national growth rate for these occupations every year since 2016 and that is projected to continue to 2028. As of 2017, Northwest Ohio employed 3,618, with a growth rate of 5.8% (versus the national rate of 3.9%), and median hourly earnings of $24.37.

Convert existing industrial based courses to a Competency-Based Education (CBE) model: Competency-based courses allow students to advance based on their ability to master a skill or competency at their own pace regardless of environment. Beyond employer engagement to translate courses to a competency based model, NSCC developed 40 hands-on assessments (HOAs) based on those competencies. The assessments are deployed through the Learning Management System (LMS) to the virtual farm, allowing students to prepare in advance for HOAs conducted in the lab for faculty assessment.

Installation of Equipment: The NSCC IAM iSTAR program invested in updated equipment and software on three different campuses across Ohio—Vantage Career Center, Scott Park at the University of Toledo, and at NSCC.

Engage Industry Partners to identify competencies and credentials required for their employees: NSCC used a DACUM process to redesign the courses and validate the skills needed by local employers for maintenance technicians. DACUM is an acronym for Developing a Curriculum. NSCC determined that to engage employers, a course overview sheet followed by a list of competencies, was needed to streamline the DACUM industry feedback process. NSCC recruited employers to participate in industry roundtables. Involving about four employers at a time for different aspects of curriculum change turned out to work optimally. NSCC also visited employer sites to gather targeted feedback, especially on the competencies required. In an ongoing fashion, the internship and apprenticeship programs have provided continuous communication between hiring managers and instructors.

Embed industry-recognized credentials into the curriculum: NSCC researched options to embed industry-recognized credentials into the program, and found early support from ConAgra Foods for the Manufacturing Skill Standards Council (MSSC) Certified Production Technician (CPT) program. NSCC is offering the MSSC at the Scott Park location but not on the main campus of NSCC, but is moving toward offering the MSSC on campus. Of course, the CPT content is integrated into the TAACCCT courses taught at the main campus.

Develop stackable and latticed credentials from assistance with current TAACCCT partner that align with employer needs: NSCC organized a new associate's degree called an Associate of Industrial Technologies. This new degree was approved for offering through academic affairs on November 12, 2015. The degree has been articulated to Bowling Green State University and to the University of Toledo. Fourteen students were awarded this degree during the TAACCCT program years.

Movement from one of the TAACCCT-funded short-term certificates to the associate's degree was made easy, transparent, and promoted as was employer reimbursement for continuing education. The MSSC CPT 1 and 2 are the earliest levels of the stackable certificates, offered as IND 105 and IND 100. CPT 3 and 4 are embedded into other TAACCCT-funded courses. The PLC robotics course prepares students for the FANUC certification, wherein NSCC students conclude the course with a "practice test" to prepare them to take the FANUC certification test at a testing center. Latticing creates horizontal pathways so that certain classes apply to several certificates at NSCC.

Allow students to start into a certificate program immediately through the use of "massively open online courses." (MOOC): The intensive hybrid courses provide students flexibility, and many students complete the 8-week courses in less than 8 weeks. For those finishing early, instructors provide three open learning modules for the next course to allow students to audit future courses prior to semester start, and all hands-on assessments are open for the course.

Build multiple career pathways from Certificate to Associate to Bachelor degree and beyond: There are multiple career pathways that can be pursued.

- The MSSC Certified Production Technician certificate as well as preparation for the FANUC certification test, held at an official testing center
- The certificates in Industrial Automation Maintenance, Industrial Maintenance, Programmable Controller, and Industrial Electrical
- The AAS in Industrial Technologies is a generalist degree that provides the opportunity for students to select courses in areas such as Industrial Electrical, Machining/CNC Programming, and Maintenance/Mechatronics

Deploy curriculum for individualized or cohort accelerated delivery models that will allow for faster student completion of a program: The traditional 16-week courses that were modified to intensive hybrid 8-week courses under this NSCC TAACCCT-grant accelerate completion. A student can take about three courses in each 8-week semester and finish their certificate in three semesters, or twenty-four weeks of education, with 29 credit hours to earn the Industrial Automation Maintenance (IAM) certificate. Students in the hybrid courses are required to earn a grade of A or B on the knowledge assessments and 100% mastery is required on all hands-on assessments.

Develop modularized Online Learning Modules for new and modified curriculum to expand student access: NSCC organized all but one of the TAACCCT courses into 8 modules, or organizational units used to organize the components of the course. The one course not organized into 8 modules is CIS 195 which has been organized to be completed in 4 or 8 weeks. Each module includes learning objectives, required resources,

in some cases simulators and/or simulations, learning objects (including YouTube videos) and activities (including practice quizzes), and Knowledge Assessment Activity (KAA's) and HOA's.

Design hands-on training simulators that align with industry standard equipment and machinery: The NSCC created simulators for the 5 courses targeted for simulators under this grant. Third-party Evaluator content experts who reviewed TAACCCT course content noted that the Programmable Logic Controller courses are particularly exceptional. These courses provide state-of-the-art content, training exercises, evaluation materials, and offer students the ability to work at home using online simulators not found at many colleges or universities in the United States. These courses will prepare students for immediate employment in industrial companies upon completion of this program.

NSCC programmed a PLC simulator so students can practice programming online before coming to the laboratory to take their hands-on assessment. Students can access the expensive software through the 24/7 virtual farm. Here they can program the PLC so that indicators in the lab simulation turn off and on per instructions. The online PLC trainer replicates the look and feel of the actual PLC trainer. Students are able to save the programming that they write for the virtual PLC and build on it to take their hands-on test in the lab on campus. This lack of duplication saves time for the student and accelerates learning and instruction.

Create and deploy online simulations that align with equipment and processes found in a manufacturing environment: Due to NSCC's success in developing highly technical online simulations, NSCC was asked by TAACCCT to mentor Central Community College (CCC) in Nebraska as that college sought to develop simulations. NSCC's simulations allow students access to 15% more content, while coming to campus half the time of a traditional course model.

NSCC created 15 interactive simulation objects as well as virtual trainers: The simulations – PLC simulation, Allen Bradley trainers, and Siemens trainers and fluid power simulations--enable student access through an emailed link in the LMS that launches via the virtual farm onto students' virtual machines. Such learning objects greatly accelerate student learning. At a rural college, these simulations also save student travel time to the labs. At an average of thirty-five miles one-way for NSCC Workforce Development students, this time savings can be reinvested back into student learning.

The Evaluator noted that ideally institutions seeking to replicate the NSCC curriculum should provide access to equipment similar to the training equipment used at NSCC. However, at a minimum, implementation of all online simulation tools developed by NSCC could substitute for the equipment, if fiscal resources are restricted. The online simulation tools are effective and will provide sufficient technical training to provide students with an entry-level knowledge-set to obtain employment in their manufacturing and industrial communities.

Build a virtual computer farm to give full software access to students on a 24/7 basis: NSCC successfully implemented the virtual farm, resulting in substantial software cost savings for students as well as accelerating student learning. Access to simulations via the virtual farm is made easy—students can click on a link to the simulations via email on Sakai and open the simulation on the student's virtual machine. Another major advantage to each student having their own virtual machine (computer) is that they will have

24/7 remote access to the proprietary software that they would typically have to come to the college campus to access.

Design a flexible lab-time system that will allow working students to schedule lab times to fit their schedules: NSCC initially experienced several challenges with the effort to create an open lab. Early on, NSCC tried offering time blocks that students could sign up for, but this attempt failed. So an NSCC faculty member developed software for open lab scheduling called "NSCC Lab Sites." Students are able to take labs that would have been cancelled previously due to low enrollment, and this use of labs is leading to higher student completion rates, according to NSCC grant staff.

Important IAM iSTAR Partnerships

The two primary players in this TAACCCT funded program, contributing the most to its success, were educators and employers. The role of the NSCC grant team was a leadership role that ensured the success of this project. The team's content and grant expertise, jump-starting the TAACCCT grant with an NSF ATE grant, along with its IT acumen, inventiveness, and innovation, were critical roles. The school partners—NSCC, Vantage Career Center, and University of Toledo Scott Park—spread the NSCC success across Northwest Ohio, with NSCC providing faculty to teach the TAACCCT courses at all three locations, while a coordinator at each site scheduled classroom space, lab time, etc. At Scott Park, the MSSC certification has been made available, resulting in partnerships in the Toledo area with the JFS offices, Goodwill, and others to recruit candidates and promote the program, resulting in a more diverse potential manufacturing workforce. Beyond these original roles, the NSCC partnership is also involved with Ohio TechNet (OTN), the consortia round 4 TAACCCT grant team in Ohio, which is seeking sustainability via philanthropic and State of Ohio support. The role of NSCC in the future of Ohio TechNet is to mentor and contribute to assist other colleges in the consortium to convert their technical manufacturing courses to a hybrid model.

The employers were a strong contributing force to the success of this TAACCCT grant, as they contributed time to: validating course descriptions and specified the required competencies in DACUM processes; giving feedback on course learning objects; providing workplace tours (roughly one per month) that are structured career awareness activities in which students visited a workplace, learned about the business, met employees, asked questions, and observed work in progress; expanded internship opportunities from 16 to 62 students; and continually came to the NSCC campus to champion the transition to accelerated, intensive hybrid courses. One employer provided facility space and equipment for an electricity class.

Factors contributing to less than optimal involvement of public workforce development included the timing of WIOA roll out and its requirements which took substantial time of workforce development employees; as well as an administrative issue in the Northwest Ohio area that resulted in a centralized administration of TAA.

Factors contributing to a sub-optimal community-based contribution pertained to WSOS Community Action Commission. WSOS experienced high staff turnover in the career coaches that it assigned to work at NSCC on the IAM iSTAR program.

Fidelity of IAM iSTAR Program Implementation

Studying IAM iSTAR's four strategies and twenty project objectives, NSCC was able to implement with fidelity eighteen of the twenty project objectives. The eighteen objectives met were described above in the section, "Key Steps taken to create and run the Training Program." The two project objectives that were not implemented with fidelity pertained to the fourth strategy, "Redesign student support services to increase student success." The specific activities related to career coaching services: (1) assisting students from the start of their program using an in-depth assessment of participant abilities, skills and interests, and (2) providing consistent career coaching services.

NSCC is using its currently awarded Title III funding to stand up a centralized student advising center. NSCC tried, under the TAACCCT grant, to use an external subcontractor to implement career coaching services, but learned that such services are better delivered when they are part of the institution's internal core services. In the last year of the TAACCCT grant, when the external contract for career coaching derailed for the fourth time, the NSCC project manager identified an internal expert to lead the career coaching. He is a former NSCC faculty member and therefore had a ready alliance with faculty to get in front of students during classroom time to market the career coaching services. He also transitioned the focus to career readiness, placement, and advancement, making the services relevant to incumbent worker and non-incumbent worker students alike. For example, internships are available to incumbent worker students, too, and have already led to career advancement for some students. In the year three student focus group session, students expressed a high level of satisfaction with the student support services and even more so with the internship program.

The participant assessment of abilities, skills and interests was not carried out to fidelity during the TAACCCT grant. While grant staff wanted to implement WorkKeys, institutional support was not forthcoming. However, under the Title III grant, the advising model is intended to help students (a) develop the knowledge required to identify (or confirm) their educational goals, (b) develop an appropriate educational plan, and (c) self-monitor, with advisor support, their progress toward achieving those goals. The "Entry" segment of the advising center will enable students to meet with their assigned professional advisors and further develop their relationship with and connection to NSCC. Students will be asked a series of questions and complete an open-ended, self-assessment worksheet that helps the advisor provide prescriptive and intrusive advising for the student. The questions and worksheet help the student consider factors that influence their progression and completion and allow the advisor to identify supportive services targeted toward the students' needs.

Operational Strengths and Weaknesses of the Program after the Implementation

Collaboration Factors: One means of assessing program operation was via the stakeholder online survey. In a series of questions, the survey probed stakeholders about nine collaborative partnership characteristics, using the Collaboration Factors Inventory and the Coalition Effectiveness Inventory. In February 2016, early into the grant, the twenty-three stakeholders responding to the survey showed varying degrees of uncertainty about the program for all nine of the factors. In 2018, with twelve respondents (four employers, seven educators, and one faith-based organization), confidence in the partnership had grown; however, the lower number of responses could indicate less buy-in from stakeholders who did not respond (see table below).

Stakeholder Collaboration Factors	Before Implementation 2016	After Implementation 2018
The organizations that are partnering on this IAM iSTAR effort have a history of working together.	80%	100%
My organization will benefit from being involved in this partnership.	90%	100%
Partners in this group have a clear sense of their roles and responsibilities.	65%	92%
I have a clear sense of my organization's roles and responsibilities on this initiative.	65%	92%
So far, this group is effective in making decisions and getting the work done.	65%	83%
This group is able to adapt to changing conditions such as less funds than expected or change in leadership.	45%	92%
This group has adequate funds to accomplish what it needs to do.	45%	50%
This group has adequate "people power" to accomplish what it needs to do.	45%	75%
This group has a good track record of getting the resources it needs to get a job done.	60%	83%

Source: Stakeholder Survey conducted by Wright State University

Course Content Strengths and Weaknesses: Another key means of assessing operational strengths and weaknesses was via the technical content evaluation conducted by the Evaluator from March-July 2018. The engineering and technical training course development experts at Wright State University developed a Microsoft Excel course review tool to capture information on the fourteen TAACCCT converted courses using the following rating system.

Term	Definitions for Review Criteria
Exceptional:	Content is ready for implementation. Content is robust and rigorous. Content utilizes "best practices" for instruction.
Effective:	Content is complete with only minor corrections, such as typographical errors, that may need to be made.
Acceptable:	Content is adequate but there are opportunities for improvement.
Developing:	Content is weak and requires significant improvement.
N/A:	Content has not been provided/does not apply for a given section.

Source: Wright State University, Third Party Evaluator

Course Number	Course Title	Review Topics	Review Criteria
IND 105	**Industrial Safety**	Syllabus	• Initial course information is easily identifiable • Course includes objectives and/or outcomes that relate to the course and are appropriate for the course • Course objectives and/or outcomes are measureable • Assessment methods are described
		Assignments/ Instructional Materials	• Materials relate to course objectives and/or outcomes • Materials are presented in an appropriate format for the learner to understand • Instruction follows a logical format • Instruction and materials reflect direct application to current industry standards and practices • The instruction and materials are appropriately organized and provide clear structure • Provides option(s) for multiple learning styles in order to engage students
		Modules/ Learning Tasks	• Activities clearly support course objectives • Activities utilize various learning styles and provide opportunities for interaction • Activities allow students to connect the content they are learning to real-world application • Activities are easy to understand and follow
		Assessments and Evaluations	• Assessments accurately measure the stated learning objectives and align with course content taught • The assessment instrument used is appropriate to measure student understanding and mastery of concept(s)/skill(s)

Source: Wright State University, Third Party Evaluator

Each course was systematically reviewed and rated for each item listed as "review criteria" in the table below; the table presents just one course as an example. This required Evaluators to open and review every Knowledge Assessment Activity (KAA), Hands-on Assessment (HOA), learning object, course lecture, syllabus—essentially every item for every converted course. For 11 of the 14 courses, every review criteria item listed in the table below was rated "exceptional." For the Bench Work, Industrial Electricity II, and Safety courses, the items were generally rated "effective" while some items were rated exceptional.

Administrative Strengths and Weaknesses: Now that seventeen courses in the Industrial Technologies division have been converted to intensive hybrid format (14 TAACCCT-funded courses and 3 NSF funded-courses), most students prefer the hybrid model (student survey 2017). The modularized courses using Quality Matters standards are consistently presented, structured, and supported. But other courses in the Industrial Technologies division are delivered in a traditional, 16-week format. Students who have worked on their certificate and are moving on to obtain their associate's degree have to go back to a 16-week format for many courses. Student retention is critical for NSCC's sake and for the sake of building the maintenance technician workforce for employer partners. This is an issue for immediate attention. NSCC top administrators have articulated support for continued course conversion in industrial technologies. NSCC also needs a succession plan for its faculty leaders in the Industrial Technologies Department.

Participant Outcomes and Impacts

Outcome Measures Results

The following table shows the project's outcomes as compared to the performance targets. The SGA had defined 9 outcome measures, while annual performance reporting had 10 outcome measures, so the reader should read the definition of the measure. NSCC outperformed its numerical targets for measures 1, 3, 4, 5, and 6. NSCC did not meet its numerical targets for 2, 7, 8, and 9. It should be noted that NSCC struggled to obtain employment and wage information from participants, and is still collecting this information at the time of this report. Therefore, the Evaluator's impact analysis, using Unemployment Insurance (UI) wage records, will augment that part of the analysis.

Outcome Measures	Program Outcomes	Target Outcomes
	n	*n*
1. Total Unique Participants Enrolled	589	320
2. Total Number of Participants Who Have Completed a Grant-Funded Program of Study	192	240
3. Total Number Still Retained in Their Programs of Study (or Other Grant-Funded Programs)	345	124
4. Total Number of Participants Completing Credit Hours	354	290
5. Total Number of Participants Earning Certificates/Degrees	297	258
6. Total Number of Participants Enrolled in Further Education After Program of Study Completion and Exit	85	41
7. Total Number of (non-incumbent at enrollment) Participants Employed After Program of Study Completion and Exit	97	115
8. Total Number of Participants Retained in Employment After Program of Study Completion and Exit	52	89
9. Total Number of Participants Employed at Enrollment Who Received a Wage Increase Post-Enrollment	54	78

Source: IAM iSTAR TAACCCT Annual Performance Reports

Delivery Methods Evaluation

Workforce Analysis

The Wright State University Evaluation Team used the OLDA to estimate the impact of the treatment by comparing NSCC students in traditional instruction programs to students who participated in the accelerated hybrid 8-week courses. Evaluation of these programs was carried out by comparing historic versus current results rather than in a parallel fashion, due to the fact that the institution could not continue to deliver the same courses in both a traditional and hybrid delivery format. The pre-TAACCCT period

occurred prior to the earliest course conversions that occurred in spring of 2016, with a starting time period of fall 2014. The treatment period begins in spring 2016 and ends spring 2017 because that is the most recent higher education data available in the OLDA.

Results of the analysis of non-incumbent participants show that more students exiting from the traditional program of study found employment in the first quarter after they exited, versus participants exiting from the TAACCCT-funded accelerated hybrid courses. This finding is statistically significant ($p < .01$). The estimated relative risk for finding employment for participants exiting TAACCCT-funded accelerated hybrid courses versus the traditional program was 1.79, with a 95% confidence interval (CI) for the true relative risk of (1.23, 2.54). This means students exiting the TAACCCT-funded courses were 1.79 times as likely to find employment as students exiting the traditional courses were. Following these same participants into their second and third quarters after program exit demonstrates that a higher proportion of participants in the TAACCCT-funded program retained their employment than participants of the traditional course-delivered program. These findings were also significant ($p < .01$ for second quarter results and $p < .05$ for third quarter results). The estimated relative risk for retaining employment until the second quarter after program exit was 1.73, with a 95% CI of (1.13, 2.67). The estimated relative risk for retaining employment until the third quarter after program exit was 1.86, with a 95% CI of (1.17, 2.98).

Studying payroll outcomes for incumbent participants in this delivery methods analysis show that In terms of proportions, 94.6% of incumbent workers in the traditional program received a pay increase at any time since enrollment in the traditional program. Over 86% of incumbent workers in the TAACCCT-funded program received a pay increase any time since their enrollment. Chi square analysis presents a statistically significant association between course delivery format and receiving a pay increase—$p < .001$—indicating a higher likelihood of pay increase for those in the traditional courses versus those who enrolled in the TAACCCT-funded accelerated hybrid courses. The estimated relative risk for receiving a pay increase at any time since enrollment for participants exiting TAACCCT-funded accelerated hybrid courses versus the traditional program was 0.91, with a 95% CI for the true relative risk of (0.87, 0.96). This means students exiting the TAACCCT-funded courses were 9% less likely to receive a pay increase at any time after enrollment as students exiting the traditional courses were. The participants of the traditional program would have had a longer period of time to receive a payroll increase since their enrollment between fall 2014 and fall 2015, as opposed to TAACCCT-funded program participants who enrolled between spring 2016 and fall 2017.

Program of Study Analysis for Fall and Spring Semester

Program of study outcomes of interest for both incumbent and non-incumbent workers include credits attempted, credits completed, and GPA. Participants in this section are NSCC students between summer 2014 and spring 2017 who took any of the courses that eventually became TAACCCT modified. Since the outcomes are the same for incumbent and non-incumbent workers, incumbent and non-incumbent students were analyzed as a whole. Spring and fall semesters were analyzed separately from summer semester, since students tend to take fewer courses in the summer. The following results focus only on spring and fall semesters.

Credit Hours Attempted

Based on a *P*-value of 0.0004, there is strong evidence to suggest there is a significant difference in the mean number of credit hours attempted between the pooled baseline semesters before any courses were modified and spring 2017. On average, NSCC students attempted 0.93 more TAACCCT course credit hours during spring 2017 than in the pooled baseline semesters, with a 95% CI of (0.33, 1.53). Based on a *P*-value of less than 0.0001, there is strong evidence to suggest there is a significant difference in the mean number of credit hours attempted between fall 2016 and spring 2017. On average, NSCC students attempted 1.17 more TAACCCT course credit hours during spring 2017 than spring 2016, with a 95% CI of (0.52, 1.81). No other significant differences were detected.

Credit Hours Completed

Based on a *P*-value of 0.0011, there is strong evidence to suggest there is a significant difference in the mean number of credit hours completed between the pooled baseline semesters before any courses were modified and spring 2017. On average, NSCC students completed 0.84 more TAACCCT course credit hours during spring 2017 than in the pooled baseline semesters, with a 95% CI of (0.26, 1.43). Based on a *P*-value of less than 0.0001, there is strong evidence to suggest there is a significant difference in the mean number of credit hours completed between fall 2016 and spring 2017. On average, NSCC students completed 1.02 more TAACCCT course credit hours during spring 2017 than spring 2016, with a 95% CI of (0.39, 1.65). No other significant differences were detected.

GPA

Based on a P-value of 0.0034, there is strong evidence to suggest there is a significant difference in the mean GPA between the pooled baseline semesters and spring 2016. On average, the GPA of NSCC students was 0.20 points higher in the spring of 2016 than in the pooled baseline semesters, with a 95% CI of (0.05, 0.34). Based on a P-value of 0.0014, there is strong evidence to suggest there is a significant difference in the mean GPA between the pooled baseline semesters and spring 2017. On average, the GPA of NSCC students was 0.27 points higher in the spring of 2017 than in the pooled baseline semesters, with a 95% CI of (0.08, 0.46). Based on a P-value of 0.01, there is strong evidence to suggest there is a significant difference in the mean GPA between fall 2016 and spring 2017. On average, the GPA of NSCC students was 0.30 points higher in spring 2017 than fall 2016, with a 95% CI of (0.04, 0.55). Spring 2016 versus fall 2016 was on the verge of significance with a P-value of 0.0532, but was not quite significant. No other significant differences were detected.

Program of Study Analysis for Summer Semester

Overall, there were no significant differences in academic outcomes when comparing summer semester under the traditional delivery methods versus the TAACCCT modified delivery method.

Impact Evaluation

Results for Non-incumbent Workers—Employment Analysis

Based on a *P*-value of less than 0.01, there is strong evidence to suggest that there is a significant association between treatment group and finding employment within one quarter of exiting a program of study. The estimated relative risk for finding employment for TAACCCT participants versus comparison students was 4.55 with a 95% CI for the true relative risk of (1.23, 16.81). This means TAACCCT participants were around 4.55 times as likely to find employment within one quarter of exiting as comparison students.

Based on a *P*-value of less than 0.01, there is strong evidence to suggest that there is a significant association between treatment group and retaining employment for one consecutive quarter. The estimated relative risk for retaining employment for one consecutive quarter for TAACCCT participants versus comparison students was 7.80 with a 95% CI for the true relative risk of (1.15, 53.03). This means TAACCCT participants were around 7.80 times as likely to retain employment for one consecutive quarter as comparison students.

The same students who were still employed one quarter later were still employed two quarters later, so the results are identical to those above. The *P*-value is less than 0.01 and the estimated relative risk of retaining employment for two consecutive fiscal quarters for TAACCCT participants versus comparison students was 7.80 with a 95% CI for the true relative risk of (1.15, 53.03).

Results for Incumbent Workers—Pay Increase Analysis

Based on a P-value of 0.14, there is not sufficient evidence to suggest there is an association between treatment group and receiving a pay increase. This hypothesis was tested with a chi-square test of independence.

Important Limitations

The analysis and findings underscore several issues that merit review in regard to limitations of the evaluation. In particular, small sample sizes were especially affected by studying outcomes for non-incumbent workers after exit. The period of analysis does not give ample time for participants to reach certificate and degree completion, resulting in small sample sizes for program exiters, which especially affected the sample size from the OLDA data for non-incumbent workers. Furthermore, the Evaluator was not able to study the impact of the full implementation of the TAACCCT grant at NSCC due to the OLDA data not being available through spring 2018.

The UI wage records do not present actual hours worked, so the wage analysis cannot discern whether an increase was due to working more hours or receiving a pay raise. One would assume that those who exit the program may be available to work more hours once they are no longer going to school, which could be the context for increased wages after program of study exit. Also, a wage increase could be the result of picking up a second, third, or fourth job.

For the evaluation of academic outcomes, the higher education data available in the OLDA contained records that were missing GPA points yet had associated credit hours, but there was no coding to explain those missing GPA points such as dropped, withdrew, or incomplete. The OLDA data dictionary did not

address the missing values either. For the analysis, the Evaluator removed the credit hours for courses that had no GPA points associated with them.

Conclusions

Key Lessons

- Contributions to wider learning about topics
    - A larger sample size to measure wage differentials for incumbent workers in intensive hybrid courses should be the focus of future research.
    - A comparison of traditional and intensive hybrid methods, simultaneously delivered, would contribute more to the comparison analysis of the two program of study delivery methods.
    - The NSCC team had a group of innovative, IT-adept faculty and staff to translate traditional courses to the intensive hybrids with technology-enabled supports. Future research could combine a team like this with career coaching in place from day one so that the course transition could be the singular variable to measure.
- Implications for policy and practice
    - The US Department of Labor could utilize the expertise it has galvanized by developing a skunkworks competency-based, interactive technical learning organization. NSCC is poised to share its lessons learned and to coach other community colleges in Ohio. Can there be a similar platform at the national level?
    - The State of Ohio could facilitate a partnership between OMJ offices and community colleges around the use of WorkKeys National Career Readiness Certificate® Assessments. Leveraging ACT WorkKeys solutions is benefiting participants of job training programs in Northeast Ohio in a partnership with Lorain Community College and the OMJ offices, which could be replicated across Ohio.

Implications for future Workforce and Education Research

- Future research questions:
    - What is the impact of student aptitude assessments on proper placement and successful performance in intensive hybrid courses?
    - While there has been analysis from the private sector of the efficacy of internal versus external career coaching, there is a lack of such research in the public sector and for institutions of higher education. What is the efficacy of internally versus externally (i.e., subcontractors) provided career coaching?

Introduction

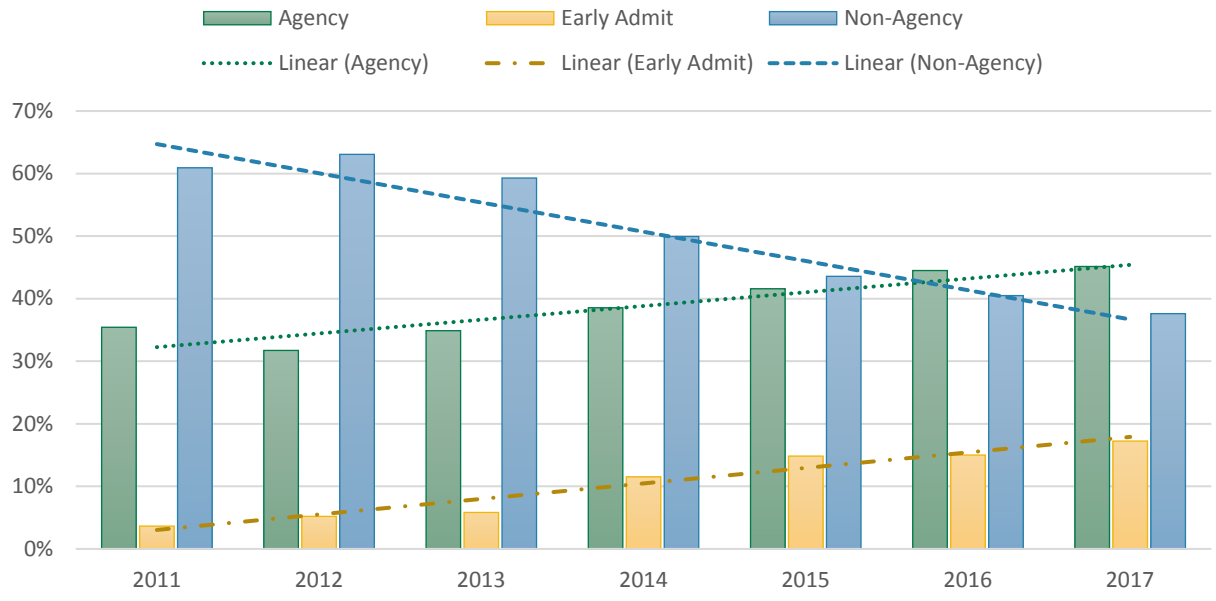
Northwest State Community College Description

Northwest State Community College (NSCC) is located in rural Northwest Ohio, an hour southwest from Toledo Ohio. Its host County is bordered by the State of Indiana on its west and Michigan is a thirty minute drive to the north. The students served by NSCC come from a rural, six-county area dominated by farming, and industrial and small business. All students are commuters and drive an average of fifteen miles to campus, with a substantial percentage driving thirty-five minutes one-way to campus. NSCC's typical student is an adult learner who enrolls part-time, comprising 81% of the student body.

Enrollment Trends[4]

Approximately 80% of students are certificate or degree seeking. The student body includes a large proportion of first-generation college students (30%). Students who are economically disadvantaged are also prevalent at NSCC. In 2015-2016, 72% of degree-seeking students received some form of financial aid. Over the past five years, NSCC has seen a decline in non-agency enrollment while agency enrollment (programs for specific industry / businesses) and early admits (high school students attending college prior to high school graduation) has increased slightly (see Figure 1). The ethnicity of the student population is similar to the general population of the service area. The percentage of the degree-seeking population has remained somewhat constant from fiscal year 2011-2017. The average age of students is 32 years old as of fall 2016.

Figure 1: Percent of Student Body by Student Type and Fiscal Year, 2011-2017



Source: Northwest State Community College Title III Application, 2017

[4] Northwest State Community College Title III Application, 2017

The majority of the student population attends on a part-time basis (Figure 2). Not only has the percentage of part-time students increased, but also the average number of credit hours taken in a term has declined over the past five years (Figure 3). In 2011, students on average took 7.9 credit hours per semester. The average credits had decreased to 6.6 credit hours per semester as of fall 2016.

Figure 2: Student Enrollment Trends, FY2011-FY2016

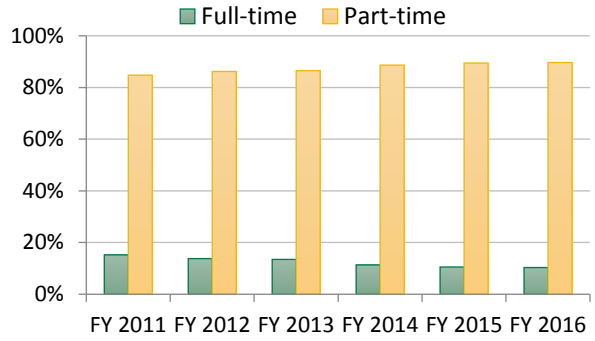
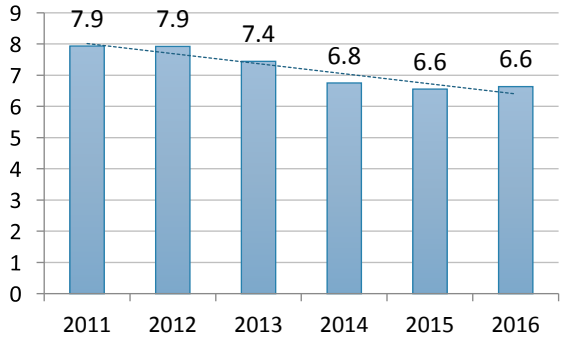


Figure 3: Average Number of Credit Hours Fall Semester, 2011-2016



Source: Northwest State Community College Title III Application, 2017

Manufacturing Situation in Northwest Ohio, in the State, and in the U.S.

There appears to be a manufacturing skills gap, and over the next decade, some sources estimate large numbers of job openings; in one instance 3.4 million manufacturing job openings are forecasted.[5] Due to the talent shortage, some estimate that 60% of these positions are likely to be unfilled.[6] The manufacturing industry is facing serious workforce challenges and is likely to continue to at an increasing rate due to retirements. Across the U.S., 53% of skilled-trade workers are 45 years and older[7]; in Northwest Ohio, 60% of industrial machinery mechanics and machinery maintenance workers are over age 45.

Maintenance technicians, referred to in the Bureau of Labor Statistics Standard Occupational Classification system as "Industrial machinery mechanics and machinery maintenance workers," maintain and repair factory equipment and other industrial machinery, such as conveying systems, production machinery, and packaging equipment.[8] Employment of industrial machinery mechanics, machinery maintenance workers, and millwrights is projected to grow 7% from 2016 to 2026, the average for all occupations. The need to keep increasingly sophisticated machinery functioning and efficient will drive demand for these workers.[9]

While automation eliminates some of the most tedious manufacturing jobs, it is also creating new jobs for a re-trained workforce.[10] "This shift to higher technology will require a new breed of skilled worker: a skilled

[5] Giffi, C., Dollar, B., Gangula, B., and Rodriguez, M. D. "Help Wanted: American Manufacturing Competiveness and the Looming Skills Gap." Deloitte Review, Issue 16, 2015
[6] Giffi, C., Dollar, B. Drew, M., McNelly, J., Carrick, G., Ganula, B. "The skills gap in U.S. manufacturing 2015 and beyond," The Manufacturing Institute and Deloitte, 2015
[7] "Labor Shortages Loom as Most-In-Demand Group of Workers Retire," CareerProfiles.Info, 2018
[8] Industrial Machinery Mechanics, Machinery Maintenance Workers, and Millwrights, US Bureau of Labor Statistics, June 2018
[9] Ibid
[10] Barbier, F. "5 trends for the future of manufacturing," World Economic Forum, 2017

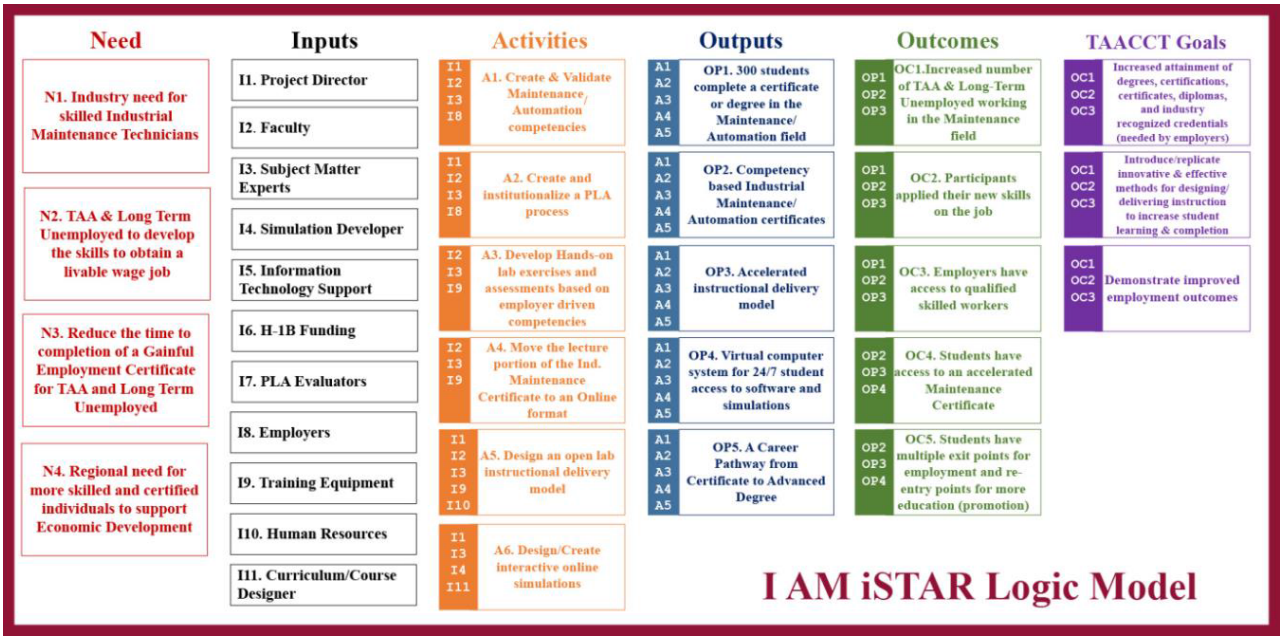
worker able to keep pace with the accelerated changes in automated manufacturing.[11] The worker of tomorrow will need special training and skills; the elite manufacturing multi-skilled technician will be trained in hydraulics, robotics, electrical and computer science."[12]

Overview of the IAM iSTAR TAACCCT-Funded Initiative

The IAM iSTAR initiative sought to achieve a number of outputs and outcomes to impact systems within and across institutions, the manufacturing industry, and for participants. At the systems level, outcomes achieved include enhanced training curricula; new curricula including technical course content delivered online; enhanced support for participants; and meaningful partnerships with educational institutions, industry, and the public workforce system. For the manufacturing industry, results include shortening the time it takes for companies to fill vacant positions with qualified workers and access to training curricula to use with employers' incumbent workers. Finally, participants are expected to earn an increased number of credit hours in a shortened amount of time and therefore be more likely to complete their programs; to obtain industry-recognized credentials; and to secure careers in the manufacturing industry.

The relationship of regional needs, inputs, key strategies, outputs, outcomes, and TAACCCT goals is presented in the NSCC logic model (Figure 4). The logic model provides the framework for this final evaluation report, and informed the development of the National Implementation Research Network (NIRN) stages of implementation analysis[13] performed by the Third-Party Evaluator, Wright State University.

Figure 4: IAM iSTAR Logic Model



Source: IAM iSTAR U.S. Department of Labor Employment and Training Administration Grant Proposal

[11] Taking Control of Today's Skilled Labor Shortage, Industry Week, October 2010
[12] Ibid
[13] Karen Blase, Melissa van Dyke and Dean Fixsen, © 2013

Strategic Intervention Overview

Northwest State Community College proposed a four-part strategy to the U.S. Department of Labor Employment and Training Administration's Round 4 TAACCCT Grants Program (Table 1). The intervention is primarily a technical one, and therefore the evaluation began and concluded with a technical review as described later in the methodology section.

Table 1: Strategic Intervention Overview

Strategy 1: Develop new and modified competency-based curriculum
• **Convert existing industrial based courses to a competency-based model versus a seat time model.** • **Create short-term credit certificate programs in industrial technologies that align with jobs that are in high demand.** • **Collaborate with current funded TAACCCT partner for new certificates and degrees that will address the needs of area employers and take less time for students to complete.** • **Engage Industry Partners to identify competencies and credentials required for their employees.** • **Embed industry-recognized credentials such as the NCRC and NAM into the curriculum.** • **Develop stackable and latticed credentials from assistance with current TAACCCT partner that align with employer needs.**
Strategy 2: Transform the academic process to accelerate student learning and completion
• **Develop a standard model for awarding credit for Prior Learning Assessments (PLA).** • **Allow students to start into a certificate program immediately through the use of "massively open online courses." (MOOC).** • **Build multiple career pathways from Certificate to Associate to Bachelor degree and beyond.** • **Deploy curriculum for individualized or cohort accelerated delivery models that will allow for a faster student completion of a program.**
Strategy 3: Create innovative instructional media and technology to accelerate learning
• **Develop modularized Online Learning Modules for new and modified curriculum to expand student access.** • **Design hands-on training simulators that align with industry standard equipment and machinery.** • **Create hands-on assessments and lab exercises that align directly with the hands-on competencies specified by employer partners.** • **Create and deploy online simulations that align with equipment and processes found in a manufacturing environment.** • **Build a virtual computer farm to give full software access to students on a 24/7 basis.** • **Design a flexible lab-time system that will allow working students to schedule lab times to fit their schedules.**
Strategy 4: Redesign student support services to increase student success[14]
• **Utilize full time Career Coaches to assist students from the start of their program to job placement.** • **Reach out to, and contract with local community-based organization(s) (CBOs) to provide Career Coaching services.** • **Strengthen partnership and existing Workforce Systems and One-Stop Career Centers to better support the needs of the students.** • **Develop opportunities and establish employer sites for work based learning, including apprenticeships, paid internships, co-ops, and OJT.**

Source: IAM iSTAR U.S. Department of Labor Employment and Training Administration Grant Proposal

[14] Forty-two percent of people ages 18 to 24 are enrolled in all of higher education, according to the National Center for Education Statistics, but only 29 percent come from rural areas, compared to nearly 48 percent from cities. The Atlantic, "The Rural Higher Education Crisis," September 27, 2017

Evaluation Design and Questions

The goal of IAM iSTAR's evaluation was to provide Northwest State Community College (NSCC) with regular data collection, information, and guidance for program implementation and measures of effectiveness. (Table 2 presents evaluation milestones.) For ultimate measures of effectiveness, the Third Party Evaluator obtained Wright State University Institutional Review Board (IRB) approval (actually exemption) to utilize de-identified data from the Ohio Longitudinal Data Archive (OLDA) developed and managed by The Ohio State University's Center for Human Resource Research. The OLDA contains Higher Education Information (HEI), which includes demographic information, cumulative credit hours, GPA, year graduated from high school, college/university attended, degree information, major field of study, course information including GPA by course, state residency status, subsidy eligibility, and financial aid information. HEI data in the OLDA are organized at the student-level and are split by year and term. The OLDA data set also includes Unemployment Insurance (UI) wage data at the individual level (indicating worker wages and employment) and these data are associated with the HEI data at the individual level.

The OLDA enabled State of Ohio administrative data to measure the outcomes and impact of NSCC's TAACCCT grant. The annual performance section B participant outcome measures informed by the OLDA data include:

- B.5., total number of credit hours completed
- B.8., total number employed after program of study completion
- B.9., total number retained in employment after program of study completion
- B.10., total number of those employed at enrollment who receive a wage increase post-enrollment

In terms of the impact evaluation, the Third Party Evaluator used OLDA data to establish a comparison group among other public colleges (that have not received a TAACCCT award in the past) located in rural areas of Ohio using propensity score matching. The Evaluator also used historic and current OLDA data to conduct an analysis to compare the outcomes for NSCC students before and after full implementation of IAM iSTAR, the TAACCCT-funded program.

To evaluate program implementation, the Evaluator applied a technical evaluation, in keeping with the technical nature of the NSCC TAACCCT proposal, along with qualitative approaches. The initial technical evaluation was conducted by instructional design experts at Wright State University when NSCC had converted its first course from traditional to intensive hybrid format. These experts used a Quality Matters rubric to assess the new online course, and their guidance enabled modifications that would create a template from which the other sixteen courses could be modeled as they were converted. A total of seventeen courses were converted, with three course conversions funded by an NSF grant and fourteen funded by the TAACCCT grant. At the end of the TAACCCT grant period, experts from Wright State University in engineering and technical training course development reviewed every content aspect of the fourteen revised TAACCCT courses to evaluate the content and the courses' transferability to the public domain.

Qualitative approaches for the implementation analysis included: (1) two stakeholder surveys conducted in the first and last year of the grant; (2) three student focus group sessions and multiple individual student, faculty and staff interviews; (3) analysis of classroom evaluations completed by students; (4) document and

data review; (5) conference calls every two weeks with NSCC throughout the entire grant period; and (6) an initial on-site planning meeting and annual site visits during each of the three years of the grant using the National Implementation Research Network (NIRN) matrix to capture data. The site visits also included tours of employer sites, employer round table engagement, and site visits with the education partners in Toledo and Van Wert, Ohio.

Table 2: IAM iSTAR Evaluation Timeline for Major Milestone Activities

Month/Year	Major Evaluation Activities
February 2015	After grant award announcement in September 2014, program and evaluation team initial meeting via video conference
March 2015	Initial program and evaluation planning and design team meeting onsite at NSCC
June 2015	Round Four Convening in Washington D.C. *Success from the Start* attended by the Evaluator with NSCC Project Team
September 2015	Detailed Evaluation Plan submitted (May 2015) and approved by US DOL
November 2015	Full Evaluation team completes CITI Human Research training, including Human Subjects training
September 2016	Wright State University IRB exemption granted for use of OLDA de-identified higher education and UI data
February 2016	First stakeholder survey conducted
March 2016	Site visit as NSCC, including an employer round table; student classroom focus group, student interviews, and faculty and program staff interviews
March 2016	Interim evaluation submitted to US DOL
August 2016	Wright State University Instructional design expert review of first course converted to online hybrid format
September 2016	Site visits at education partner sites in Toledo and Van Wert, Ohio
November 2016	Evaluator prepares analysis of the University of Toledo's Scott Park as a training partner
March 2017	Classroom evaluations completed by students and analyzed by the evaluator
March 2017	Site visit and employer tour at Chase Brass and Copper; student focus group session; program staff interviews
March 2018	Site visit; student focus group session; program staff interviews; education partners from across Ohio join joint presentation at NSCC to view a demo of their intensive hybrid program
March-July 2018	Technical course content analysis and evaluation conducted by Third Party Evaluation experts in technical and engineering course development
July-August 2018	Second stakeholder survey conducted
2017 and 2018	Outcome and/or impact evaluations of treatment and comparison groups using OLDA wage and higher education completion data

Source: Wright State University, Third Party Evaluator

Implementation Analysis Study Design

For the implementation analysis, Wright State University designed an approach that was both technical – to meet the technical proposal submitted by NSCC and funded by TAACCCT – and qualitative. The qualitative analysis enables the capture of challenges, work-arounds, and evolution of the implementation.

Implementation Analysis Research Questions

The implementation analysis research questions are organized into four major categories: program design, student assessment, stakeholder involvement, and transferability/sustainability.

Program Design Questions

- What is the program's administrative structure?
    - What are the qualifications of program administrators?
- How was the particular curriculum or activity selected, used or created?
- How were programs improved or expanded using grant funds?
    - What delivery methods were offered?
        - To what extent has the project developed new training structures?
    - Do employer or industry assessments identify curriculum needs? To what extent does the curriculum reflect industry needs?

Assessment of Participant Abilities, Skills, and Interests Questions

- How were participants selected for inclusion into their programs of study? How were student support services and work-based learning opportunities improved and perceived?
- Are Prior Learning Assessment policies in place; are they tied to learning outcomes?

Stakeholder Involvement Questions

- To what extent are educators, the community, employers, and workforce development partners involved?
    - What contributions did each of the partners and key stakeholders make toward: program design, curriculum development, recruitment, training, placement, program management, leveraging resources, and commitment to sustainability?
    - What factors affected partner involvement or lack of involvement?
    - Which contributions from partners were most critical to the success of the grant program? And which contributions had less of an impact?

Transferability and Sustainability Questions

- What is the level of fidelity to the program; that is, was the program implemented as planned? If the program deviated, how did changes affect outputs?
- To what extent are components of the program transferable and sustainable?

Implementation Analysis Methodology and Data Collection

Qualitative Study: To guide the implementation analysis, the Evaluator customized a National Implementation Research Network (NIRN) matrix using content from the NSCC IAM iSTAR logic model. (See Appendix A.) The NIRN recommends four-stages of implementation analysis: exploration, installation, initial

implementation, and full-implementation. The Evaluator recorded the evolution of the IAM iSTAR project across all four NIRN stages using categories such as: team qualifications, communication plan, data, target population, employer need, program resources (curriculum, technology, staffing, training, data systems, career coaching), and program support (organizational support, institutional leadership, external partner support). This NIRN matrix enabled a rich documentation of the program. In addition to the matrix, the NIRN recommends that the Evaluator create a "map" of the implementation drivers to identify critical milestone functions of the grant program and describe how those functions are carried out by the grantee. The map and the NIRN matrix were the data collection tools used by the Evaluator to collect information during site visits and interviews, and were the backbone of the qualitative protocol used for the implementation analysis. Site visits were aligned with key meetings which enabled observation of an employer round table session, students in labs, student focus group sessions, an employer tour, and interviews with staff, faculty, and partners. Other data collection tools used were discussion guides developed and used for focus group sessions with students; interview question sets for students, staff, and faculty; guided questions for the employer round table discussion; Qualtrics for online stakeholder surveys; and content analysis of documents utilizing both inductive and deductive content analysis approaches.

Technical Quality Matters review: Quality Matters Higher Education Rubric is designed for use with courses that are delivered fully online or have a significant online component (hybrid and blended courses).[15] The rubric was used to assess the degree to which the initial converted course under IAM iSTAR met Quality Matters (QM) standards and highlighted areas for improvement. (See Appendix B.) Based on the recommendations of Wright State University, NSCC became an institutional member of QM and received organization-wide QM training/professional development, which further enabled future course conversions to meet QM standards.

The QM rubric ensures alignment. Alignment occurs when critical course components work together to optimize student learning outcomes. The eight general standards used by the Instructional Design experts at Wright State University to review the first converted course are:

1. Course Overview and Introduction
2. Learning Objectives (Competencies)
3. Assessment and Measurement
4. Instructional Materials
5. Course Activities and Learner Interaction
6. Course Technology
7. Learner Support
8. Accessibility and Usability

Technical Course Content Review: The engineering and technical training course development experts at Wright State University developed a Microsoft Excel course review tool (Tables 3 and 4) to capture information on the fourteen TAACCCT converted courses using the following rating system. (See Appendix C.)

[15] https://www.qualitymatters.org/qa-resources/rubric-standards/higher-ed-rubric

Table 3: Technical Course Content Review

Term	Definitions for Review Criteria
Exceptional:	Content is ready for implementation. Content is robust and rigorous. Content utilizes "best practices" for instruction.
Effective:	Content is complete with only minor corrections, such as typographical errors, that may need to be made.
Acceptable:	Content is adequate but there are opportunities for improvement.
Developing:	Content is weak and requires significant improvement.
N/A:	Content has not been provided/does not apply for a given section.

Source: Wright State University, Third Party Evaluator

Each course was systematically reviewed and rated for each item listed as "review criteria" in the table below; the table presents just one course as an example. This review required Evaluators to open and assess every Knowledge Assessment Activity (KAA), Hands on Assessment (HOA), learning object, course lecture, syllabus—essentially every item for every converted course. For eleven of the fourteen courses, every review criteria item listed in the table below was rated "exceptional." For the three other courses—Bench Work, Industrial Safety, and Industrial Electricity II—the review criteria items for the syllabus and assessments were rated "exceptional," while the other items were generally rated "effective."

Table 4: Technical Course Review Criteria

Course Number	Course Title	Review Topics	Review Criteria
IND 105	Industrial Safety	Syllabus	Initial course information is easily identifiable • Course includes objectives and/or outcomes that relate to the course and are appropriate for the course • Course objectives and/or outcomes are measureable • Assessment methods are described
		Assignments/ Instructional Materials	Materials relate to course objectives and/or outcomes • Materials are presented in an appropriate format for the learner to understand • Instruction follows a logical format • Instruction and materials reflect direct application to current industry standards and practices • The instruction and materials are appropriately organized and provide clear structure • Provides option(s) for multiple learning styles to engage students
		Modules/ Learning Tasks	Activities clearly support course objectives • Activities utilize various learning styles and provide opportunities for interaction • Activities allow students to connect the content they are learning to real-world application • Activities are easy to understand and follow
		Assessments/ Evaluations	Assessments accurately measure the stated learning objectives and align with course content taught • The assessment instrument used is appropriate to measure student understanding and mastery of concept(s)/skill(s)

Source: Wright State University, Third Party Evaluator

Table 5 presents the interrelationship across the implementation analysis methods.

Table 5: Implementation Analysis Data Collection Crosswalk

Implementation Questions	Outcome	Data Collection Tool	Data Source	Frequency
Program Design: • **What are the program's administrative qualifications and structure?** • **How was the particular curriculum or activity selected, used or created?** • **How were programs improved or expanded using grant funds?**	Program model that accelerates student learning and employment outcomes	Site visits; Document review; Interviews; Quality Matters Rubric; Expert content review of all converted courses	Program students, staff, faculty, and institutional leaders; Quality Matters; Systematic course content analysis	3 site visits and 3 rounds of interviews; 3 student focus group sessions; 1 PLC course reviewed by expert instructional designers; 1 content analysis of the 14 courses
Assessment of Participant Abilities, Skills, and Interests Questions • **How were participants selected for inclusion into their programs of study? How were student support services and work-based learning opportunities improved and perceived?** • **Are Prior Learning Assessment policies in place; are they tied to learning outcomes?**	Program model that accelerates student learning and employment outcomes	Document Review; Interviews; Student focus groups and interviews	Program staff; Students	3 student focus group sessions; Multiple staff interviews in-person and in twice monthly phone conference calls throughout the grant period
Stakeholder Involvement • **To what extent are educators, the community, employers, and workforce development partners involved?** • **What contributions did partners & key stakeholders make to program design, curriculum development, recruitment, training, placement, program management, leveraging resources, and commitment to sustainability?** • **What factors affected partner involvement or lack thereof?** • **Which contributions from partners were most critical to success of the grant program? Which had less?**	New community leadership or systems to increase student learning and employment outcomes	Stakeholder surveys; Document review; Employer and educator interviews	Employer round table; Employers, education partners, and community partners; NSF ATE Evaluator documents	1 employer round table; 2 stakeholder surveys; 2 NSF Evaluator reports; Employer interviews; Multiple faculty interviews
Transferability/Sustainability • **What is the level of fidelity to the program? If the program deviated, how did changes affect outputs?** • **To what extent are components of the program transferable and sustainable?**	Increased institutional capacity, replicability, and sustainability	NIRN; Course content rubric; Document review; Stakeholder interviews & survey; Statistical analysis of OLDA data	Program students, staff, faculty, and institutional leaders; Employers; course content analysis; Title III document; NSF Evaluation Reports; OLDA	Annual NIRN forms; 1 content analysis of the 14 courses; OLDA ongoing data analysis

Source: Wright State University, Third Party Evaluator

Outcomes, Delivery Methods, and Impact Study Design

Outcome Evaluation: The intent of the outcome evaluation is to measure the degree to which IAM iSTAR performance targets for the treatment group are met in terms of the number of participants served, the number completing a TAACCCT-funded program of study, the number retained in their program of study or other TAACCCT-funded program, the number completing credit hours, the number obtaining degrees or certificates in the grant-funded program, the number that enroll in furthering their education, the number employed after grant-funded program of study completion, the number retained in employment, and the number that receive a wage increase post-enrollment. The NSCC Banner System and self-reported data were used for this analysis.

Delivery Methods Evaluation: The intent of the delivery methods evaluation is to measure the degree to which NSCC TAACCCT participants' academic and workforce outcomes exceed the academic and workforce outcomes of NSCC students prior to the TAACCCT grant. State of Ohio administrative Unemployment Insurance (UI) and Higher Education Information (HEI) records, via the Ohio Longitudinal Data Archive (OLDA), were used for this analysis.

Impact Evaluation: The intent of the impact evaluation is to use State of Ohio administrative UI and HEI records via the OLDA to develop an objective analysis that determines whether the wage increase and employment results for the IAM iSTAR participants (i.e., the treatment group) surpass the results for students in the same courses at other rural community colleges in Ohio (i.e., the comparison group), selecting those community colleges that have not participated in any TAACCCT grants for the comparison group.

Outcome, Delivery Methods, and Impact Evaluation Research Questions

- Did the IAM iSTAR TAACCCT-funded program meet and/or exceed the targets it set for the program's annual performance section B participant outcome measures?
- Do NSCC participants in the TAACCCT program of study have better employment, job retention, and wage increase outcomes than students at NSCC prior to the TAACCCT grant?
- Do NSCC participants in the TAACCCT program of study make greater progress and have better program of study completion outcomes (credits attempted, credits completed, GPA) than NSCC students prior to the TAACCCT grant?
- Do participants in the treatment group have better workforce outcomes than students in the comparison group (such as employment, job retention, and wage increases)?

Outcome, Delivery Methods, and Impact Evaluation Methodology and Data Collection

Data collection methods for the outcome and impact evaluations were carried out via the Ohio Longitudinal Data Archive (OLDA) which includes and associates Higher Education Information (HEI) and Unemployment Insurance (UI) records. The evaluator was required to submit a written proposal, reviewed by the Wright State University IRB, to The Ohio State University Center for Human Resource Research (CHRR) which manages this data repository for several State of Ohio agencies. Data access is allowed under restricted conditions to protect the privacy of the records contained in the repository, requiring a data sharing agreement once the Wright State University proposal to use the OLDA was approved. All Wright State

University researchers using the OLDA had to have current Collaborative Institutional Training Initiative (CITI) certificates in place for human research.

The Ohio Longitudinal Data Archive (OLDA) is a project of the Ohio Education Research Center (oerc.osu.edu) and provides researchers with centralized access to administrative data. The OLDA is managed by The Ohio State University's Center for Human Resource Research (chrr.osu.edu) in collaboration with Ohio's state workforce and education agencies (ohioanalytics.gov), with those agencies providing oversight and funding. For information on OLDA sponsors, see http://chrr.osu.edu/projects/ohio-longitudinal-data-archive.

Outcome Evaluation: For the outcome study, Wright State University aggregated the numbers reported in NSCC's IAM iSTAR annual performance reports for Section B. and C. indicators, where appropriate, and compared the actual to targeted outcomes. The self-reported estimates for B. indicators regarding non-incumbent worker participants who entered employment, retained in employment, and incumbent workers earning a wage increase were not comprehensive counts, due to NSCC's challenge in collecting those data and due to the fact that NSCC is continuing to measure those indicators until September 30, 2018. In this way, the analysis using OLDA data augments the outcome data.

Delivery Methods Evaluation: Program of study outcomes of interest for both incumbent and non-incumbent workers include credits attempted, credits completed, and GPA. Since the program of study outcomes focus specifically on the TAACCCT grant-funded courses, and the courses taken by comparison students may not be the same course, even though they might have the same CIP code, academic outcomes were analyzed within NSCC and not via comparison to other community colleges. Participants in this section are NSCC students between summer 2014 and spring 2017 who took any of the courses that eventually became TAACCCT modified. Since the outcomes are the same for incumbent and non-incumbent workers, all students were analyzed as a whole.

The grant-funded courses were gradually introduced between the spring of 2016 and the summer of 2017, so if they have a positive effect on students' academic outcomes, these outcomes should increase as more courses are modified. Specifically, three TAACCCT modified courses were available in spring 2016, six additional courses were modified in fall 2016, and another six courses were modified in spring 2017. The final two courses were modified in summer 2017, but that unfortunately falls outside of the range of available OLDA data.

All semesters prior to any modifications were pooled and treated as a single baseline semester. The summer baseline semester consists of summer 2014 and 2015. The spring and fall baseline semester consists of fall 2014, spring 2015, and fall 2015. In order to account for the fact that students can appear in more than one semester, repeated measures ANOVAs were run to test each of the outcomes of interest. Post-hoc multiple comparisons were made via Tukey's multiple comparison procedure. This procedure controls for a potentially inflated type I error that can arise from making multiple comparisons, and guarantees the overall type I error rate for each ANOVA is at most alpha = 0.05. Because students tend to take fewer courses during summer semesters, summer semesters were analyzed separately. These results focus only on TAACCCT courses.

Impact Evaluation: The method used to study the outcomes of this grant was a quasi-experimental design. The open admissions policy of public community colleges as well as the relatively low number of participants for sample sizes made randomization of students into treatment and control groups impossible. Because participants are neither randomly selected from a well-defined population nor randomly assigned to the two study groups (grant program and comparison group), it is necessary to correct for any confounding that may arise. The evaluator used propensity score matching to match comparison group participants to IAM iSTAR participants. If the comparisons are similar enough, this can reduce or eliminate any potential biases introduced by the lack of randomization and produce more robust and precise results.

Therefore, the Evaluator used the Ohio Longitudinal Data Archive (OLDA) to select comparison study participants for essentially the same programs of study from colleges serving rural areas in Ohio. These rural colleges had no current or previous TAACCCT grant awards. Second, the Evaluator used propensity score matching to identify a matched comparison group and to estimate the impacts of the IAM iSTAR program. The two study groups were compared on six pertinent factors (date of birth, race, sex, the semester start date, credit hours completed, and first college experience) to ensure the two groups are comparable in all important respects except for the program followed. Test results showed that the two groups match well (Table 6). (See Appendix D for more details.)

Table 6: Demonstration of Propensity Matching of Comparison and Treatment Groups

Demonstration of Propensity Matching of Comparison and Treatment Groups for Selected Variables, Incumbent and Non-Incumbent Worker Participants				
Incumbent Workers	**Comparison Group**		**Treatment Group**	
	Frequency	Percent	Frequency	Percent
Female	10	4.3%	<10	Suppressed
Male	223	95.7%	224	Suppressed
Caucasian or White	184	79.0%	176	75.5%
All Minorities	49	21.0%	57	24.5%
First College Enrollment	209	89.7%	210	90.1%
Not First Enrollment	24	10.3%	23	9.9%
Average Year of Birth	1986		1983	
Average Starting Semester	Fall 2016		Fall 2016	
Average # Credit Hours	36		33	
Non-Incumbent Workers	**Comparison Group**		**Treatment Group**	
Female	<10	Suppressed	<10	Suppressed
Male	53	Suppressed	53	Suppressed
Caucasian or White	34	58.6%	37	63.8%
All Minorities	24	41.4%	21	36.2%
First College Enrollment	50	Suppressed	51	Suppressed
Not First Enrollment	<10	Suppressed	<10	Suppressed
Average Year of Birth	1983		1983	
Average Starting Semester	Fall 2016		Fall 2016	
Average # Credit Hours	11		9	

Source: Ohio Longitudinal Data Archive (OLDA)

Once the optimal matches were made, the progress of the comparison group was tracked through the OLDA records and compared with the treatment group in order to draw causal inferences as to the impact of the IAM iSTAR program.

Non-incumbent Workers Methods

For the purposes of the impact analysis, participants are defined as students who have completed at least one course that was modified using TAAACCT grant funds. Participants who are non-incumbent workers are defined as any participants who have zero earnings in the UI Wage record during the quarter in which they enroll in their first TAACCCT grant-funded course. Outcomes of interest for TAACCCT participants who are non-incumbent workers include whether or not they find employment within one quarter of exiting their program of study, whether they are still employed one quarter later, and whether they are still employed two quarters later. Exit was defined by the TAACCCT grantee as one non-consecutive semester of enrollment (excluding summer semester). Finding employment is defined as having earnings in the UI Wage record greater than zero. Retaining employment is defined as continuing to have non-zero earnings in the UI Wage record. Once a participant has zero earnings for a quarter, they are removed from the follow-up counts. Participants are only counted if they have exited. Participants who have yet to exit are not counted toward these outcomes regardless of employment status.

Due to small counts in some cells, Fisher's exact test was used instead of a chi-square test. Significant results are interpreted in terms of relative risk. Relative risk is the probability of an event occurring in one group divided by the probability of the event occurring in another group. All results are phrased in terms of the TAACCCT participants being the reference group. This means relative risks greater than one indicate TAACCCT participants are more likely to find employment within one quarter of exit than comparison students, and relative risks less than one indicate TAACCCT participants are less likely to find employment within one quarter of exit than the comparison students.

Incumbent Worker Methods

Incumbent workers are defined as participants who have greater than zero earnings in the UI Wage record during the quarter in which they enroll in their first TAACCCT grant-funded course. The outcome of interest for TAACCCT participants who are incumbent workers is whether or not they received a pay increase at any point after enrolling in their first TAACCCT grant-funded course. Quarterly earnings are viewed as the total amount of money reported in the UI Wage record for all jobs a participant might have. A pay increase is defined as quarterly earnings in the UI Wage record that are greater than the quarterly earnings at the quarter of enrollment.

Participant Outcome and Impact Findings

Question 1: Did the IAM iSTAR program meet and/or exceed the targets it set for the program's annual performance section B participant outcome measures?

Outcome Evaluation Findings

Table 7 presents the annual performance data submitted by NSCC to the US DOL. It should be noted that the source of these data is the Banner system and self-reported. Later in this section there is a table that presents actual to targeted totals, including an analysis of met and unmet targets.

Table 7: Cumulative Participant Outcomes

CUMULATIVE PARTICIPANT OUTCOMES (ALL PARTICIPANTS)	Year 1	Year 2	Year 3	3-year Total
Unique Participants Enrolled *Total number of individuals who entered any of the grant-funded programs of study offered (including certificate or degree programs or other training activities). Participants are only included once in the year they first enroll, even if they enroll in multiple programs or subsequent years.*	200	174	215	589
Total Number of Participants Who Have Completed a Grant-Funded Program of Study *Number of unique participants having earned all of the credit hours (formal award units) needed for the award of a degree or certificate in any grant-funded program.*	32	97	63	192
a. Total Number of Grant-Funded Program of Study Completers Who Are Incumbent Workers *Total number of incumbent workers (those employed at enrollment) who complete any grant-funded program.*	5	26	37	68
Total Number Still Retained in Their Programs of Study (or Other Grant-Funded Programs) *Number of unique participants enrolled who did not complete and are still enrolled in a grant-funded program of study.*	168	230	345	345[a]
Total Number of Participants Retained in Other Education Programs	0	0	0	0
Total Number of Grant-Funded Credit Hours Completed *Total number of grant-funded credit hours to date that have been completed by all participants in certificate & degree programs during the reporting year, regardless of year in which participants enrolled.*	151	1,905	806	2,862
a. Total Number of Participants Completing Credit Hours *Total number of participants who have completed any number of grant-funded credit hours during the reporting year.*	10	224	120	354
Total Number of Earned Certificates/Degrees *Total number of degrees or certificates earned during the reporting year (includes multiple certificates and degrees earned by the same participant)*	35	135	127	297
a. Total Number of Participants Earning Certificates - less than one year *(participants are counted only once)*	31	114	99	244

CUMULATIVE PARTICIPANT OUTCOMES (ALL PARTICIPANTS)	Year 1	Year 2	Year 3	3-year Total
b. Total Number of Participants Earning Certificates - more than one year *(participants are counted only once)*	2	15	22	39
c. Total Number of Participants Earning Degrees *(participants are counted only once)*	2	6	6	14
Total Number of Participants Enrolled in Further Education After Program of Study Completion and Exit *Total number of participants who entered another program of study after exiting the institution of the number of participants who completed at least one grant-funded program of study*	30	30	25	85
Total Number of Participants Employed After Program of Study Completion and Exit *Number of participants (non-incumbent workers only) who completed a grant-funded program of study entering unsubsidized employment in the quarter after the quarter of program exit*	18	26	53	97
Total Number of Participants Retained in Employment After Program of Study Completion and Exit *Number of participants (non-incumbent workers only) who completed a grant-funded program of study and who entered employment in the quarter after the quarter of program exit who retain employment in the second and third quarters after program exit*	18	19	15	52
Total Number of Participants Employed at Enrollment Who Receive a Wage Increase Post-Enrollment *Total number of participants who are incumbent workers and who enrolled in a grant-funded program of study who received an increase in wages after enrollment.*	10	14	30	54

a. Participants at the end of year 3 only.

Source: Northwest State Community College Banner System and TAACCCT participant-reported data

Participant Demographics

Table 8 presents a demographic profile of the 589 program participants. Nine out of ten participants were male. Assuming that participants reported only one race or ethnicity, 15% of participants provided no information regarding their race or ethnicity, while 69.3% of participants were white, 8.8% were Hispanic, and 5.9% were black or African American. The mean age of participants was 32 years of age. One-quarter (25.1%) of participants were incumbent workers and 1.9% were eligible veterans. Refer to the following table for more demographic characteristics of these participants.

In terms of enrollment, 27.2% of the participants reported full-time student status, while 72.8% reported part-time status. Nearly six percent (5.8%) of the participants were TTA-eligible and 27.3% reported Pell Grant eligibility. Refer to the following table for the enrollment characteristics of these participants.

Table 8: Participant Demographics

DEMOGRAPHIC SUMMARY (ALL GRANT PARTICIPANTS)	Year 1	Year 2	Year 3	3-year Total	
	n	n	n	Sum	Percent
Total Participants	200	174	215	589	N/A
Sex					
Male	189	160	188	537	91.2%
Female	11	14	27	52	8.8%
Race/Ethnicity					
Hispanic/Latino	12	15	25	52	8.8%
American Indian or Alaskan Native	0	0	0	0	0.0%
Asian	0	0	0	0	0.0%
Black or African American	7	11	17	35	5.9%
Native Hawaiian or Other Pacific Islander	0	0	0	0	0.0%
White	162	130	116	408	69.3%
More Than One Race	2	2	2	6	1.0%
Refused					15%
Enrollment Status					
Full-Time Status	52	53	55	160	27.2%
Part-Time Status	148	121	160	429	72.8%
Other					
Incumbent Workers	54	75	19	148	25.1%
Eligible Veterans	2	6	3	11	1.9%
Participant Age (mean)	32	32	33	N/A	32
Persons with a Disability	4	4	5	13	2.2%
Pell-grant eligible	74	58	29	161	27.3%
TAA-eligible	5	24	5	34	5.8%

Source: Northwest State Community College Banner System and TAACCCT participant-reported data

Program Outcomes

Table 9 shows the project's outcomes as compared to the performance targets. The SGA had defined nine outcome measures, while annual performance reporting had ten outcome measures, so the reader should read the definition of the measure. The number of participants recruited was higher than anticipated and the program met or exceeded the performance target outcomes on several key outcome indicators in a numerical way.

- Outcome Indicator #1: 589 participants enrolled in the program compared to the target outcome of 320 participants.
- Outcome Indicator #3: 345 participants were still retained in their programs of study compared to the target of 124 participants.
- Outcome Indicator #4: 354 participants completed credit hours in their program of study, which is 64 participants higher than the target of 290.

- Outcome Indicator #5: 297 participants earned at least one certificate or degree compared to the target of 258 of the participants earning a certificate or degree.
- Outcome Indicator #6: The total number of participants enrolled in further education after program of study completion and exit is twice the target outcome – 85 participants enrolled in further education compared to the target outcome of 41 participants.

Table 9: Program Outcome and Target Outcome Summary

OUTCOME MEASURES	Program Outcomes	Target Outcomes
1. Total Unique Participants Enrolled	589	320
2. Total Number of Participants Who Have Completed a Grant-Funded Program of Study	192	240
3. Total Number Still Retained in Their Programs of Study (or Other Grant-Funded Programs)	345	124
4. Total Number of Participants Completing Credit Hours	354	290
5. Total Number of Participants Earning Certificates/Degrees	297	258
6. Total Number of Participants Enrolled in Further Education After Program of Study Completion and Exit	85	41
7. Total Number of (non-incumbent at enrollment) Participants Employed After Program of Study Completion and Exit	97	115
8. Total Number of Participants Retained in Employment After Program of Study Completion and Exit	52	89
9. Total Number of Participants Employed at Enrollment Who Received a Wage Increase Post-Enrollment	54	78

Source: IAM iSTAR TAACCCT Annual Performance Reports

Four of the program outcomes did not meet the target outcomes during the grant period and are discussed below:

- Outcome Indicator #2: 192 participants completed a grant-funded program of study, which is lower than the target of 240 participants.
- Outcome indicator #7: The targeted number of participants who were not employed at enrollment but who were employed after completion and exit was 115, however, 97 was actually achieved.
- Outcome Indicator #8: 52 of the non-incumbent participants who completed a grant-funded program of study and who entered employment in the first quarter after program exit, retained employment in the second and third quarters after program exit compared to the target of 89 participants.
- Outcome indicator #9: the numeric target was for 78 participants employed at enrollment to receive a wage increase post enrollment, and 54 actual participants reported this.

Question 2: Do NSCC participants in the TAACCCT program of study have better employment, job retention, and wage increase outcomes than students at NSCC prior to the TAACCCT grant?

Delivery Methods Evaluation Findings

Traditional versus Hybrid Workforce Results

The Wright State University Evaluation Team used the Ohio Longitudinal Data Archive (OLDA) to estimate the impact of the treatment by comparing NSCC students in traditional instruction programs to NSCC students who participated in the intensive hybrid eight-week courses. NSCC did not propose development of a new program under this TAACCCT grant, but rather proposed the modification of fourteen existing courses in addition to three other National Science Foundation modified courses – fifteen of the seventeen courses that were modified were included in this analysis, using the most recent data available in the OLDA. Course modification was to enable an intensive hybrid delivery method from a traditional instruction method. Evaluation of these programs was carried out in a before and after-fashion rather than in a parallel fashion, due to the fact that the institution could not continue to deliver the same courses in both a traditional and hybrid format. The pre-TAACCCT period occurred prior to the earliest course conversions that occurred in spring of 2016, with a starting time period of fall 2014. The treatment period begins in spring 2016 and ends spring 2017 because that is the most recent higher education data available in the OLDA.

Recognizing that employment gains and losses change over time, researchers studied unemployment compensation (UC) reports for Lucas County in Ohio from 2014-2017.[16] Unemployment compensation is paid by states to unemployed workers who have lost their jobs due to layoffs or retrenchment. Unemployment compensation initial claims data is considered to be a leading economic indicator. The trend for Lucas County, the largest county in Northwest Ohio, is listed in the table below. The table shows that initial claims for unemployment compensation in Lucas County increased over the study period, indicating an increasing number of workers who have lost their jobs.

Table 10: Claimants Newly Unemployed under Ohio UC Law, Lucas County Ohio

Year	Claimants
2014	18,085
2015	18,170
2016	19,996
2017	21,506

Source: Ohio Labor Market Information,
Ohio Department of Job and Family Services

Labor force outcome measures including employment, retention in employment, and payroll increases were utilized for this analysis, based on the Ohio Longitudinal Data Archive (OLDA), which connects higher

[16] http://ohiolmi.com/asp/uc/OP_RPTS.ASP accessed 8/1/18

education information with employment outcome data (i.e., Unemployment Insurance or UI records). The higher education measure selected was course number by semester.

"Enrollment" is defined as individuals who entered any of the grant-funded programs of study—in this case, existing courses that were modified using TAACCCT funds. NSCC defines an "exit" as any student who does not return in the following semester, not including summer semesters unless the student's trend is to attend in summer semesters. The OLDA data provides course number by semester for each individual enrolled.

Researchers selected participants for this analysis based on their enrollment and exit time period, which also indicated their first quarter after exit for measuring employment and the second and third quarters after exit for measuring employment retention (for the non-incumbent worker students). Determining the enrollment time period enabled researchers to identify pay increases that occurred after enrollment for incumbent workers.

Employment Outcome Results for Non-incumbent workers in this Delivery Methods Analysis

Applying methods to select discreet non-incumbent worker participants for this analysis resulted in the identification of 94 participants for the pre-TAACCCT group receiving traditional instruction, and 28 participants for the treatment group receiving intensive hybrid instruction.

Employed the first quarter after exit. Chi square analysis presents a significant association between the TAACCCT participants and employment—X^2 (1, n = 122) = 7.61, $P < .01$)—indicating a higher likelihood of employment in the first quarter after exit for students who enrolled in the TAACCCT-funded intensive hybrid courses than those in the traditional courses. The estimated relative risk for finding employment for participants exiting TAACCCT-funded hybrid courses versus the traditional program was 1.79, with a 95% confidence interval (CI) for the true relative risk of (1.23, 2.54). This means students exiting the TAACCCT-funded courses were 1.79 times as likely to find employment as students exiting the traditional courses were. Due to small sample size, the table for this analysis is suppressed.

Employed the second quarter after exit. Following these same participants into their second quarter after program exit demonstrates that a higher proportion of participants in the TAACCCT-funded program retained their employment than students in the traditional course delivered program. Chi square analysis presents a significant association between the TAACCCT participants and retaining employment in the second quarter after exit—X^2 (1, n = 122) = 5.319, $P < 0.01$). The estimated relative risk for retaining employment until the second quarter after program exit was 1.73 [95% CI of (1.13, 2.67)]. See Appendix E.

Employed the third quarter after exit. In the third quarter after exit, a higher proportion of participants in the TAACCCT-funded program retained their employment than participants of the traditional course delivery program. Chi square analysis presents a significant association between the TAACCCT participants and retaining employment in the third quarter after exit—X^2 (1, n = 122) = 5.9005, $P < .05$). The estimated relative risk for retaining employment until the third quarter after program exit was 1.86 [95% CI of (1.17, 2.98)]. See Appendix E.

Payroll Outcomes for Incumbent workers in this Delivery Methods Analysis

The UI wage records were used to identify an increase in wages any time after becoming enrolled at NSCC, by studying quarterly payroll data for incumbent-worker participants. The number of incumbent-worker participants in the pre-TAACCCT period is 334 and the number of participants in the treatment group (i.e., TAACCCT participants) is 322. Table 11 presents the proportion of incumbent-worker participants who received a payroll increase any time after enrollment. In terms of proportions, 94.6% of incumbent workers in the traditional program received a pay increase at any time since enrollment in the traditional program, while 86.3% of incumbent workers in the TAACCCT-funded program received a pay increase any time since their enrollment. Chi square analysis presents a significant association between the traditionally trained participants and receiving a pay increase—X^2 (1, n = 656) = 13.1191, $P < .001$)—indicating a higher likelihood of pay increase for those in the traditional courses versus those who enrolled in the TAACCCT-funded hybrid courses. The estimated relative risk for receiving a pay increase at any time since enrollment for participants exiting TAACCCT-funded intensive hybrid courses versus the traditional program was 0.91 [95% CI of (0.87, 0.96)]. This means students exiting the TAACCCT-funded courses were 9% less likely to receive a pay increase at any time after enrollment as students exiting the traditional courses were. The participants of the traditional program would have had a longer period of time to receive a payroll increase since their enrollment which occurred between fall 2014 and fall 2015, as opposed to TAACCCT-funded program participants who enrolled between spring 2016 and fall 2017.

Table 11: Received a Pay Increase any time after Enrollment

Received a Pay Increase any time after Enrollment			
	Pay Increase		
Frequency Row Percent	Yes	No	Total
Pre-TAACCCT	316 94.6%	18 5.4%	334
Treatment	278 86.3%	44 13.7%	322
Total	594	62	656

Statistic	DF	Value	Prob
Chi-Square	1	13.1191	<.001

Source: Ohio Longitudinal Data Archive
Analysis: Wright State University

Question 3: Do NSCC participants in the TAACCCT program of study make greater progress and have better program of study completion outcomes (credits attempted, credits completed, GPA) than NSCC students prior to the TAACCCT grant?

Delivery Methods Evaluation Findings

Traditional versus Hybrid Program of Study Results

Fall and Spring Results

The Wright State University Evaluation Team again used the Ohio Longitudinal Data Archive (OLDA) to estimate the impact of the treatment by comparing NSCC students in traditional instruction programs to NSCC students who participated in the intensive hybrid eight-week courses. Program of study outcomes of interest for both incumbent and non-incumbent workers include credits attempted, credits completed and GPA. Participants in this section are NSCC students between summer 2014 and spring 2017 who took any of the courses that eventually became TAACCCT modified. Since the outcomes are the same for incumbent and non-incumbent workers, incumbent and non-incumbent participants were analyzed as a whole. Table 12 presents the summary findings for this program of study analysis, indicating strong evidence for better academic outcomes for participants in the TAACCCT-modified courses versus students in the traditional courses. Recall that fifteen of the seventeen modified courses were included in this analysis, using the most recent education data available in the OLDA. Table 13 simply presents the numerical improvements from the historical (pre-TAACCCT) to the most recent semester studied. The overall *P*-value indicates evidence of at least one significant difference among all pair-wise comparisons of semesters.

Table 12: Outcomes for the TAACCCT-modified Courses

Outcomes for the TAACCCT-modified courses	Fall 2014, Spring 2015, Fall 2015 (Traditional)	Spring 2016 (after 3 courses were TAACCCT modified)	Fall 2016 (after 9 courses were TAACCCT modified)	Spring 2017 (after 15 courses were TAACCCT modified)	Overall *P*-value
GPA	3.45	3.65	3.42	3.72	< 0.0001
Credit Hours Attempted per Semester	4.17	3.93	4.48	5.10	< 0.0001
Credit Hours Completed per Semester	4.05	3.87	4.16	4.89	0.0004

Source: Ohio Longitudinal Data Archive
Analysis: Wright State University

Table 13: Outcome Improvements for the TAACCCT-modified Courses

Outcomes for the TAACCCT-modified courses	Before modifying courses	After modifying 15 courses	Improvement
Credit Hours Attempted per Semester	4.17	5.10	+0.93
Credit Hours Completed per Semester	4.05	4.89	+0.84
GPA	3.45	3.72	+0.27

Source: Ohio Longitudinal Data Archive
Analysis: Wright State University

Credit Hours Attempted

A repeated measures ANOVA was run to test for significant mean differences in credit hours attempted between semesters. This statistical model accounts for the possibility of the same students showing up in multiple semesters. Based on a *P*-value of less than 0.0001, there is strong evidence to suggest there is a significant difference in credit hours attempted between at least two of the semesters. Tukey's multiple comparison procedure was run to test all pair-wise comparisons of semesters. This procedure adjusts the *P*-values to account for a potentially inflated type I error rate that can occur from performing multiple tests and ensures that the overall type I error rate for the ANOVA is at most alpha = 0.05. The results of Tukey's multiple comparison procedure are given in Table 14.

Table 14: Semester Comparison of Credit Hours Attempted

Differences of Least Squares Means			
Comparison	**Estimate**	**Standard Error**	***P*-value**
Baseline - Spring 2016	0.24	0.18	0.56
Baseline - Fall 2016	-0.31	0.26	0.62
Baseline - Spring 2017	-0.93	0.23	0.0004
Spring 2016 - Fall 2016	-0.55	0.27	0.19
Spring 2016 - Spring 2017	-1.17	0.25	<.0001
Fall 2016 - Spring 2017	-0.62	0.31	0.19

Source: Ohio Longitudinal Data Archive
Analysis: Wright State University

Based on a *P*-value of 0.0004, there is strong evidence to suggest there is a significant difference in the mean number of credit hours attempted between the pooled baseline semesters (before any courses were modified) and spring 2017. On average, NSCC students attempted 0.93 more TAACCCT course credit hours during spring 2017 than in the pooled baseline semesters, with a 95% confidence interval of (0.33, 1.53). Based on a *P*-value of less than 0.0001, there is strong evidence to suggest there is a significant difference

in the mean number of credit hours attempted between fall 2016 and spring 2017. On average, NSCC students attempted 1.17 more TAACCCT course credit hours during spring 2017 than spring 2016, with a 95% confidence interval of (0.52, 1.81). No other significant differences were detected.

Credit Hours Completed

Another repeated measures ANOVA was run for credit hours completed. Based on a *P*-value of 0.0004, there is strong evidence to suggest there is a significant mean difference in credit hours completed between at least two of the semesters. The results of Tukey's multiple comparison procedure are given in Table 15.

Table 15: Semester Credit Hour Comparison

Differences of Least Squares Means			
Comparison	**Estimate**	**Standard Error**	***P*-value**
Baseline - Spring 2016	0.18	0.18	0.75
Baseline - Fall 2016	-0.11	0.25	0.97
Baseline - Spring 2017	-0.84	0.23	0.0011
Spring 2016 - Fall 2016	-0.29	0.27	0.70
Spring 2016 - Spring 2017	-1.02	0.25	.0002
Fall 2016 - Spring 2017	-0.74	0.30	0.07

Source: Ohio Longitudinal Data Archive
Analysis: Wright State University

Based on a *P*-value of 0.0011, there is strong evidence to suggest there is a significant difference in the mean number of credit hours completed between the pooled baseline semesters (before any courses were modified) and spring 2017. On average, NSCC students completed 0.84 more TAACCCT course credit hours during spring 2017 than in the pooled baseline semesters, with a 95% confidence interval of (0.26, 1.43). Based on a *P*-value of less than 0.0001, there is strong evidence to suggest there is a significant difference in the mean number of credit hours completed between fall 2016 and spring 2017. On average, NSCC students completed 1.02 more TAACCCT course credit hours during spring 2017 than spring 2016, with a 95% confidence interval of (0.39, 1.65). No other significant differences were detected.

GPA

A final repeated measures ANOVA was run for GPA. Based on a *P*-value of less than 0.0001, there is strong evidence to suggest there is a significant mean difference in GPA between at least two of the semesters. The results of Tukey's multiple comparison procedure are given in Table 16.

Table 16: Semester GPA Comparison

Differences of Least Squares Means			
Comparison	**Estimate**	**Standard Error**	***P*-value**
Baseline - Spring 2016	-0.20	0.06	0.0034
Baseline - Fall 2016	0.03	0.08	0.99
Baseline - Spring 2017	-0.27	0.07	0.0014
Spring 2016 - Fall 2016	0.22	0.09	0.05
Spring 2016 - Spring 2017	-0.075	0.08	0.79
Fall 2016 - Spring 2017	-0.30	0.10	0.01

Source: Ohio Longitudinal Data Archive
Analysis: Wright State University

Based on a *P*-value of 0.0034, there is strong evidence to suggest there is a significant difference in the mean GPA between the pooled baseline semesters (before any courses were modified) and spring 2016. On average, the GPA of NSCC students was 0.20 points higher in the spring of 2016 than in the pooled baseline semesters, with a 95% confidence interval of (0.05, 0.34). Based on a *P*-value of 0.0014, there is strong evidence to suggest there is a significant difference in the mean GPA between the pooled baseline semesters and spring 2017. On average, the GPA of NSCC students was 0.27 points higher in the spring of 2017 than in the pooled baseline semesters, with a 95% confidence interval of (0.08, 0.46). Based on a *P*-value of 0.01, there is strong evidence to suggest there is a significant difference in the mean GPA between fall 2016 and spring 2017. On average, the GPA of NSCC students was 0.30 points higher in spring 2017 than fall 2016, with a 95% confidence interval of (0.04, 0.55). Spring 2016 versus fall 2016 was on the verge of significance with a *P*-value of 0.0532, but was not quite significant. No other significant differences were detected.

In general, there appears to be an upward trend in credit hours attempted and credit hours completed as time goes on and more courses become "TAACCCCT-modified" or hybridized. Spring 2017, which was the final semester where data sets were available, had significantly more mean credit hours attempted and completed than both the baseline semesters and spring 2016. Similarly, the GPA for spring 2017 was significantly higher than both the baseline semesters and fall 2016. Spring 2016 was also higher than the baseline semesters for mean GPA.

Summer Results

Overall, there were no significant differences in academic outcomes when comparing summer semester under the traditional delivery methods versus the TAACCCT modified delivery method (see Table 17).

Table 17: Summer Semester Outcome Summary Table

Outcome	Summer 2014 and 2015 (Traditional)	Summer 2016 (after 3 courses were TAACCCT modified)	Improvement	*P*-value
Credit Hours Attempted per Semester	5.34	5.79	+0.45	0.50
Credit Hours Completed per Semester	5.23	5.69	+0.46	0.49
GPA	3.53	3.70	+0.17	0.21

Source: Ohio Longitudinal Data Archive
Analysis: Wright State University

Credit Hours Attempted

Based on a *P*-value of 0.50, there is not sufficient evidence to suggest there is a significant difference in credit hours attempted between the baseline summer semesters and summer 2016.

Credit Hours Completed

Based on a *P*-value of 0.49, there is not sufficient evidence to suggest there is a significant difference in credit hours completed between the baseline summer semesters and summer 2016.

GPA

Based on a *P*-value of 0.21, there is not sufficient evidence to suggest there is a significant difference in credit hours completed between the baseline summer semesters and summer 2016.

It is not surprising there were no significant results for the summer comparisons, because there were only three courses that had been modified by summer 2016, which is the final summer for which OLDA data sets were available. Additionally, the summer semesters had smaller sample sizes than the spring and fall semesters.

Question 4: Do participants in the treatment group have better workforce outcomes than students in the comparison group (such as employment, job retention, and wage increases)?

Impact Evaluation Findings

Quasi-Experimental Design Analysis

Overall, based on *P*-values of less than 0.01, there is strong evidence to suggest that there is a significant association between non-incumbent workers in the treatment group and finding employment within one quarter of exiting a program of study, as well as in retaining employment (Table 18). For incumbent workers, the *P*-value does not provide sufficient evidence to suggest there is an association between treatment group and receiving a pay increase (Table 19).

Table 18: Non-incumbent Worker Participant Employment Impact Evaluation Findings

Outcome	TAACCCT Participants	Comparison Students	*P*-value
Non-incumbent workers who found employment within one quarter of program exit	14	<10	< 0.01
Non-incumbent workers who retained employment for one quarter	12	< 10	< 0.01
Non-incumbent workers who retained employment for two quarters	12	< 10	< 0.01

Source: Ohio Longitudinal Data Archive
Analysis: Wright State University

Table 19: Incumbent Worker Participant Employment Impact Evaluation Findings

Outcome	TAACCCT Participants	Comparison Students	*P*-value
Incumbent workers who received a wage increase at any point post-enrollment	200 (86.2%)	188 (82.5%)	0.14

Source: Ohio Longitudinal Data Archive
Analysis: Wright State University

Non-Incumbent Worker Results

Based on a *P*-value of less than 0.01, there is strong evidence to suggest that there is a significant association between treatment group and finding employment within one quarter of exiting a program of study. The estimated relative risk for finding employment for TAACCCT participants versus comparison students was 4.55 with a 95% confidence interval for the true relative risk of (1.23, 16.81). This means TAACCCT participants were around 4.55 times as likely to find employment within one quarter of exiting as comparison students.

Based on a *P*-value of less than 0.01, there is strong evidence to suggest that there is a significant association between treatment group and retaining employment for one consecutive quarter. The estimated relative risk for retaining employment for one consecutive quarter for TAACCCT participants versus comparison students was 7.80 [95% CI of (1.15, 53.03)]. This means TAACCCT participants were around 7.80 times as likely to retain employment for one consecutive quarter as comparison students.

The same students who were still employed one quarter later were still employed two quarters later, so the results are identical to those above. The *P*-value is less than 0.01 and the estimated relative risk of retaining employment for two consecutive fiscal quarters for TAACCCT participants versus comparison students was 7.80 [95% CI of (1.15, 53.03)].

Incumbent Worker Results

This hypothesis was tested with a chi-square test of independence. Based on a *P*-value of 0.14, there is not sufficient evidence to suggest there is an association between treatment group and receiving a pay increase.

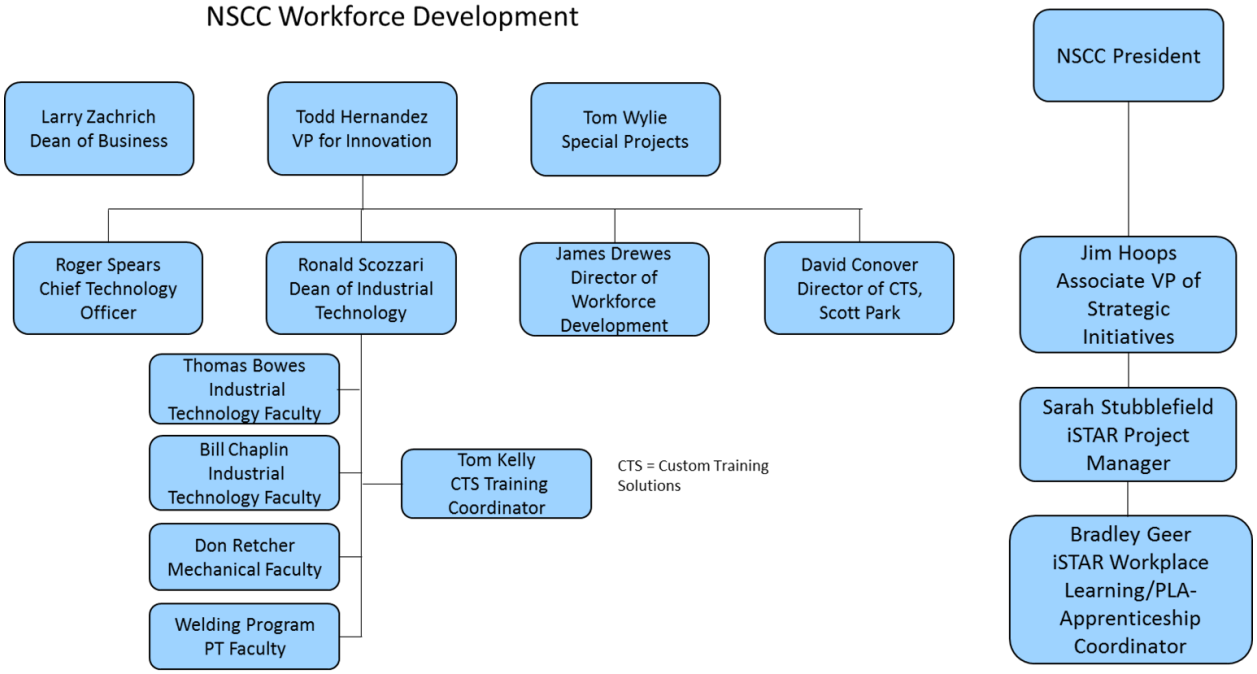
Implementation Study Findings

Question 1: What is the program's administrative structure? What are the qualifications of program administrators?

The IAM iSTAR core management team is housed in the Workforce Development Office at Northwest State Community College (NSCC) called Custom Training Solutions (CTS). NSCC has affiliate arrangements at Scott Park Campus of Energy and Innovation at the University of Toledo, and at Vantage Career Center in Van Wert, Ohio where NSCC faculty travel to these sites to teach or NSCC faculty teach the IAM iSTAR courses remotely. Tom Kelly of NSCC managed and coordinated classroom set up and resources to support these sites in collaboration with faculty and staff at the satellite facilities. At these sites, there is either another instructor or technically competent lab assistant to help facilitate the remote learning environment. Ron Scozzari, Dean of Industrial Technology at NSCC, is also the Dean over the satellite courses.

Figure 5 presents the organizational chart providing the big picture of the relationship between the IAM iSTAR initiative and the NSCC Workforce Development office (inclusive of Custom Training Solutions).

Figure 5: NSCC Workforce Development



Source: Northwest State Community College

Grant Personnel Evolution and Personnel Contributions that had the Greatest Influence

Grant Personnel Evolution

From the onset of the TAACCCT grant, the program administrators had assigned a strong team and had an Associate Vice President with a direct reporting line to the college President for continuous support of the program. The grant leaders at day one remained the grant leaders at the end of the grant, also providing program stability. The grant's core leadership team had a track record of delivering college-based custom training to major companies like Campbell Soup prior to the TAACCCT grant; in short, they had strong academic and practitioner experience. Expectations for technology-proficient training delivery from global companies meant that the grant leadership team had the talent to convert traditional courses to intensive hybrid courses. They hired an Instructional Designer to help translate traditional courses to an online venue. As the transition to the intensive hybrid format ramped up, however, some faculty members were resistant to the change. Early on, the team had some personnel challenges such as filling a faculty position in industrial technologies on the mechanical side. NSCC reached out to the evaluator to determine if the resistance from faculty was the norm. An Inside Higher Education 2014 survey of faculty showed that, "Faculty are reserved about the quality of online courses compared with in-person courses; 83 percent of faculty say that online courses are of lower quality than in-person courses with respect to interaction with students."[17] So it was not a surprise when some faculty left NSCC to be able to teach in a traditional setting. Faculty members who remained at NSCC were provided with one-on-one support to translate their lectures to work in an online setting, and these faculty members reported satisfaction—during third-party evaluator faculty interviews on March 1, 2016—with the new model which actually enabled more interactive faculty-to-student teaching and learning mainly in the lab setting.

Program Administration Contributions that had the Greatest Influence

Tom Wylie, Leader of Special Projects for NSCC and Conceptual Framework and Course Developer for the Grant: Education—two Associate degrees in industrial electricity and electronics, Bachelor of Science degree in industrial technology, and a Master's degree in Career and Technology Education. Mr. Wylie articulated the conceptual framework for the project. Not only conceptualizing the big picture, he provided course content expertise, developing course overview and summary sheets to use in the DACUM processes (Developing a Curriculum) with employers. He developed dozens of hands-on assessments and served as the developer of learning objects (he even carried out the production of private YouTube videos to aid student learning). He also worked with the Instructional Designer and coached the faculty in how to translate lectures into an online format.

Todd Hernandez, Vice President of Innovation at NSCC—Simulations Leader for the Grant: Education/Experience—licensed professional engineer and a Bachelor's of Science in Electrical Engineering Technologies. He has worked as a nuclear trained US Naval Officer, a controls engineer, software developer, and Vice President of Product Development for a software OEM. He is skilled in a variety of different PLC families and specializes in data collection and visualization. When the commercial-off-the shelf options for

[17] The 2014 Inside Higher Ed Survey of Faculty Attitudes on Technology, Conducted by Gallup, Scott Jaschik & Doug Lederman Editors

simulators and simulations were deemed to be outdated and insufficient, Mr. Hernandez's expertise provided supervision of custom simulation development.

Jim Hoops, Associate Vice President of Strategic Initiatives—Grant Project Liaison: Mr. Hoops had previously served in the Ohio House of Representatives from 1999 to 2006, and was called back to serve a vacant seat in March 2018. His connections to community leaders as well as his direct report to the NSCC President gave the project a consistent place of importance.

Ron Scozzari, Dean of the Industrial Technologies Division—Grant Project Leader: Bachelor of Science and Master's degrees in industrial technology. His critical roles included strategic thinking, risk management, and compromise as he enabled the industrial technologies area to be redesigned as an intensive hybrid program.

Jim Drewes, Director of Workforce Development - Custom Training Solutions: Education—Associate of Science Degree - Electrical Engineering and Electro-Mechanical Engineering. Mr. Drewes has a demonstrated history of collaboration in public/private partnerships. He is responsible for connecting future workforce with business and industry clients, and is accountable for incumbent worker training programs on the client site, meeting the off shift and credit/non-credit needs of employers.

Sarah Stubblefield—TAACCCT Project Manager: Education—Bachelor's Degree in Psychology. Ms. Stubblefield's role was to serve as the lynchpin of the project, interfacing with College administration, the US DOL, faculty, students, subcontractors, employers, school partners, other TAACCCT Round 4 grantees, equipment vendors, and more. Her previous work experience in another US DOL grant along with having served as a career coach resulted in her knowing how to make the inner workings of the project successful.

Jim Lammy, Adjunct Faculty—Simulations Developer: Education—Associate's Degree in Database Programming and Bachelor of Science in Mechanical Engineering. Mr. Lammy wrote the computer code, under Mr. Hernandez's guidance, for the PLC and trainer simulations.

Bradley Geer--Workplace Learning/PLA - Apprenticeship Coordinator: Education—Associate in Applied Sciences in Alternative Energy, Bachelor's degree in Electro-Mechanical Engineering, Master's degree in Instructional Design and Technology. Mr. Geer ramped up the work-based learning opportunities for students, increasing placed internships from 16 to 62 in about one year. He coordinated the PLA policy and program enhancements, resulting in an increase in PLA credits from 162 in 2017 to 1,380 in 2018 (to date).

Grant-related Faculty

Bill Chaplin: Bill has worked in the Industrial Controls industry for the past 25 years. He has focused primarily on automation components such as PLCs, Inverters, networks and HMI components. Bill has an Associate in Applied Sciences degree and a Computer Systems Bachelor's degree. For the past fifteen years Bill has worked at NSCC in the Engineering Technologies and Workforce Development Divisions.

Tom Bowes: Industrial Technology Faculty with over 40 years of industry experience. He focuses on electrical and PLCs. He has an Associate's degree and a Bachelor of Science degree.

Don Retcher: Industrial Technology Faculty with a focus on Mechanical. He has is an Associate in Applied Sciences degree in Engineering Technology, Mechanical Engineering/Mechanical Technology/Technician.

Tom Wylie: Described above also serves as adjunct faculty

Question 2: How was the particular curriculum or activity selected, used, or created?

Create short-term credit certificate programs in industrial technologies that align with jobs in high demand: In March 2015, Northwest State Community College selected fourteen traditional semester courses to be modified to intensive hybrid courses under this round 4 TAACCCT grant. These fourteen courses, along with three other course modifications funded by an NSF grant (courses piloted in March 2016), translate as the core set of courses for the TAACCCT-funded AAS in Industrial Technologies as well as for four certificates:

1. Industrial Automation Maintenance (IAM) Certificate—29 credit hours
2. Industrial Maintenance Certificate—37 credit hours
3. Programmable Logic Controller (PLC) Certificate—32 credit hours
4. Industrial Electrical Certificate—35 credit hours

This degree and the courses were selected due to the high demand for industrial maintenance technicians in Northwest Ohio, in the State, and in the nation's Midwest in general. Modification of the courses was intended to be fueled by commercial curriculum products, but the products reviewed in December of 2014 and followed by a site visit on April 7, 2015 to review e-learning and e-assessment software were found not a good fit for NSCC. Therefore, grant personnel involved employers in curriculum redesign. Since many employers run 24/7 manufacturing plants and have multiple work shifts, the hybrid online course format provides flexibility for their employees to take classes, allowing apprentices to take courses no matter which shift they may work. In terms of its focus on jobs in high demand, one employer stated, "There are no unemployed maintenance technicians in Northwest Ohio." The certificates in Industrial Automation Maintenance, Industrial Maintenance, Programmable Controller, and Industrial Electrical are linked to multiple occupations such as: 49-2091 Avionics Technicians; 49-2093 Electrical and Electronics Installers and Repairers, Transportation Equipment; 49-2094 Electrical and Electronics Repairers; Commercial and Industrial Equipment; and 49-2096 Electronic Equipment Installers and Repairers, Motor Vehicles. Core occupations include 49-9041 Industrial Machinery Mechanics and 49-9043 Maintenance Workers Machinery. The Northwest Ohio region has outpaced the national growth rate for these occupations every year since 2016 and that is projected to continue to 2028. As of 2017, Northwest Ohio employed 3,618 workers in these occupations, with a growth rate of 5.8% (versus the national rate of 3.9%), and median hourly earnings of $24.37.

The accelerated delivery model modified TAACCCT-funded (and NSF-funded) courses from 16 to 8 week courses, resulting in students being able to complete the certificate in Industrial Automation Maintenance in three 8-week semesters. See more about the accelerated model under "Deploy curriculum for individualized or cohort accelerated delivery models."

Convert existing industrial based courses to a CBE model: Students think that the internships plus course competencies translated to a job description have made the biggest difference in their workforce readiness, as described in focus group sessions facilitated by the Evaluator. (See Appendix F for the TAACCCT Participant Focus Group Discussion Guide.) As mentioned below, employers are involved in validating the skills needed for maintenance technicians. Employers are already using internal online learning systems for their workforce training, and they want students who don't only "learn by lecture."

Beyond employer engagement to translate courses to a competency-based model was to develop forty hands-on assessments based on those competencies. The assessments are deployed through the Learning Management System (LMS) to the virtual farm. Having all of the assessments online provides data intelligence about participant knowledge gains and challenges. In response to participant learning challenges, program developers create new learning objects—such as YouTube videos and simulations, as well as practice quizzes to prepare for assessments, to aid student learning; and learning objects are key to accelerated learning. This online learning environment enables the ***continuous quality improvement cycle – Plan Do Study Act (PDSA)*** to occur in real time by NSCC. Student surveys have shown a high level of satisfaction with the intensive hybrid courses. The students like the ability to learn at their own pace and many students are completing the eight-week course in less than 8 weeks. Based on student survey responses, students especially like the incorporation of instructor-created videos that prepare them for laboratory activities, thereby making their time in the lab more efficient since they have already been introduced to the equipment.

The course conversion schedule is presented below (Table 20). It demonstrates the timing of course conversions. The initial courses converted were reviewed with student users to capture insights as the NSCC Industrial Technologies division began the movement away from traditional courses to the hybrid format. The first three courses were modified in spring 2016, with the last two courses being converted in summer 2017 (beyond the time period of higher education data updates in the OLDA).

Table 20: Course Conversion Schedule

Course #	Spring 2016	Fall 2016	Spring 2017	Summer/Fall 2017
IND223	Motors and Controls*	Motors and Controls*	Motors and Controls*	Motors and Controls*
PLC200	PLC I*	PLC I*	PLC I*	PLC I*
PLC230	Servo and Robotics*	Servo and Robotics*	Servo and Robotics*	Servo and Robotics*
IND105	Industrial Safety (MSSC CPT 1)	Industrial Safety (MSSC CPT 1)	Industrial Safety (MSSC CPT 1)	Industrial Safety (MSSC CPT 1)
IND100	Precision Measurement (MSSC CPT 2)	Precision Measurement (MSSC CPT 2)	Precision Measurement (MSSC CPT 2)	Precision Measurement (MSSC CPT 2)
IND120	Industrial Electric I	Industrial Electric I	Industrial Electric I	Industrial Electric I
IND121	Industrial Electric II	Industrial Electric II	Industrial Electric II	Industrial Electric II
IND132	Bench Work	Bench Work	Bench Work	Bench Work
IND232	Machine Repair	Machine Repair	Machine Repair	Machine Repair
IND134	Industrial Fluid Power	Industrial Fluid Power	Industrial Fluid Power	Industrial Fluid Power
IND131	Industrial Pipefitting	Industrial Pipefitting	Industrial Pipefitting	Industrial Pipefitting
PLC210	PLC 2	PLC 2	PLC 2	PLC 2
PLC220	PLC 3	PLC 3	PLC 3	PLC 3
IND140	Principles of Machining	Principles of Machining	Principles of Machining	Principles of Machining
CIS195	Networking Essentials	Networking Essentials	Networking Essentials	Networking Essentials
IND110	Industrial Computing	Industrial Computing	Industrial Computing	Industrial Computing
IND122	Industrial Wiring	Industrial Wiring	Industrial Wiring	Industrial Wiring

*These three classes were funded through the National Science Foundation and used to develop the process for course conversions under the TAACCCT grant.

	Course Conversion Complete
	Course Conversion in Progress
	Course Conversion not Started

Source: IAM iSTAR

Collaborate with TAACCCT partner for updated certificates and new degrees that will address the needs of area employers and take less time for students to complete: TAACCCT-funded Robeson Community College mentored NSCC as they ventured into simulation development. In the early days of the grant, Todd Hernandez moved to the position of Vice President for Innovation at NSCC. Mr. Hernandez is a licensed professional engineer, and worked as a Vice President for Product Development for a software OEM. Under his supervision, Adjunct Faculty member, Jim Lammy, (AS database programming and BS Mechanical Engineering) programmed simulations such as a PLC simulation, Allen Bradley trainers, and Siemens trainers, which students can access through an emailed link in the LMS that launches via the virtual farm onto students' virtual machines.

Question 3: How were programs improved or expanded using grant funds? What delivery methods were offered?

Installation of Equipment: The NSCC IAM iSTAR program invested in updated equipment and software on three different campuses across Ohio. Figure 6 below presents a trainer purchased for the NSCC campus by another grant but for use with the IAM iSTAR participants, demonstrating the leverage of capital improvement grant dollars from the State of Ohio. The Pressure, Flow, Level, and Temperature Process Training System features two workstations: the Process Workstation and the Instrumentation Workstation. The workstations can accommodate a single team of students for the temperature experiments and up to two teams for the pressure, flow, and level experiments (if the second-team add-on is used). The Pressure, Flow, Level, and Temperature Process Training Systems introduce students to a wide range of industrial processes, as well as to their instruments and control devices. The modularity of these energy-efficient process control training systems allows the instructor to select specific equipment as a function of the training objectives.

Figure 6: Lab Volt 3531 Pressure, Flow, Level, and Temperature Process Training System Purchased for IAM iSTAR Program

Source: http://aetlabs.com/product/lab-volt-dc-fundamentals-91001-2/

Scott Park at the University of Toledo has multiple manufacturing labs—a robotics lab, a PLC lab, two mechatronics labs, two mechanical labs, two electricity labs, and two computer labs. Figure 7 below presents four of these labs. The IAM iSTAR initiative updated equipment for use at all three partner sites—Vantage Career Center, Scott Park, and the NSCC main campus.

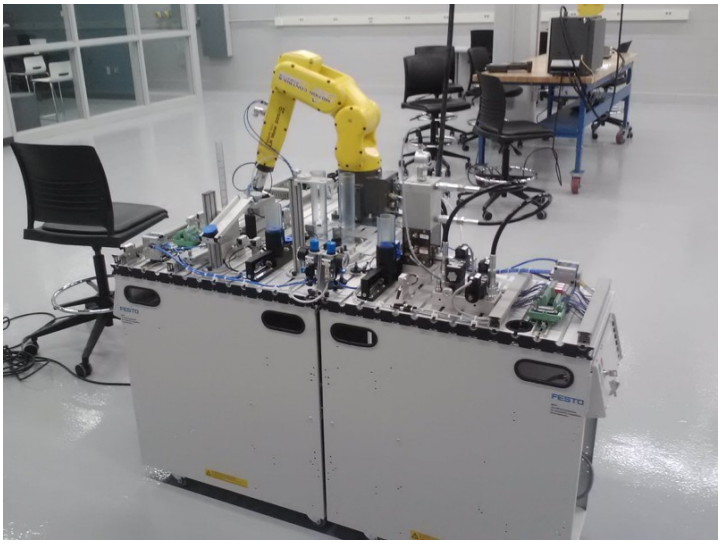
Figure 7: Example of Labs at Scott Park, University of Toledo

Electricity Lab 1

Electricity Lab 2

Mechatronics Lab 1

Mechatronics Lab 2



Source: **IAM iSTAR**

Engage Industry Partners to identify competencies and credentials required for their employees: NSCC used a DACUM process to redesign the courses and validate the skills needed by local employers for maintenance technicians. DACUM is an acronym for Developing a Curriculum. DACUM is a process that incorporates the use of a focus group in a facilitated storyboarding process to capture the major duties and related tasks included in an occupation, as well as the necessary knowledge, skills, and traits. NSCC quickly determined that to engage employers, a course overview sheet followed by a list of competencies, was needed to streamline the DACUM industry feedback process. Figure 8 presents an example of a course overview sheet and list of competencies.

Figure 8: Overview for: PLC200 Programmable Controller I, 3 Credit Hour, 4/11/17

Course Description:
The course is a study of the installation, programming and troubleshooting of programmable controlled systems currently used in an industrial environment. The focus will be on Installation, Programming, Engineering and Maintenance tasks performed with PLC systems. The primary PLC used for this class will be the Allen Bradley SLC-500 and CompactLogix, using RSLogix 500, RSLogix5000 and RSLinx software. The topics presented will be learned through online instructional material, and hands on labs.

This course will consist of 9 competencies (Objectives):
1. Explain the function of a PLC in an industrial environment
2. Set up communications between a PLC and a programming panel
3. Configure and program an Allen Bradley SLC-500 system.
4. Install and maintain basic control system based on the SLC-500
5. Troubleshoot an Allen Bradley SLC-500 system.
6. Configure and Program Allen Bradley CompactLogix with RSLogix5000
7. Interpret the basic instruction set of Allen Bradley CompactLogix system
8. Interpret AB PLC-5 hardware addressing & block transfer instructions
9. Explain the operation of an Allen Bradley Sequencer Output instruction

This course will consist of the following 8 Modules:
Module #1: Basic Allen Bradley SLC-500 operation
Module #2: RSLogix500 and the SLC-500 basic instruction set
Module #3: Allen Bradley SLC-500 timer & counter instructions
Module #4: Allen Bradley SLC-500 intermediate instruction set
Module #5: Maintain & Troubleshoot an AB SLC-500 system
Module #6: Basic Allen Bradley CompactLogix operation
Module #7: AB CompactLogix: Data Types, Timer & Counter Instructions
Module #8: Specialized Allen Bradley instructions & equipment

Module 1: Basic Allen Bradley SLC-500 operation: Hands-On Assessment Tasks:
1. Identify the processor, power supply, discrete input and output modules, and analog I/O module on an SLC-500 system
2. Identify the power supply, discrete input and discrete output modules on an electrical print and correlate to the SLC-500
3. Find an output on the electrical print and corresponding address as specified by the instructor (i.e. coolant valve).
4. Identify the communication ports on the processor, on the computer, and what cabling would be required
5. Interpret the diagnostic indicators on the SLC-500 processor and I/O module
6. Setup an RSLinx driver to communicate between the processor and program panel with RS-232

Module 2: RSLogix500 and the SLC-500 basic instruction set: Hands-On Assessment Tasks:
1. Create a new project in RSLogix500, and download to the processor
2. Go online to the processor and change the mode of the processor (run or program)
3. Explain the operation of the basic relay instructions
4. Interpret and explain the I/O addressing of the SLC-500 system
5. Toggle the instruction descriptions and symbols on/off in RSLogix500
6. Setup the Emulator in the Virtual Machine and run the same program as done with hardware in the PLC lab

Module 3: Allen Bradley SLC-500 timer & counter instructions: Hands-On Assessment Tasks:
1. Create multiple program files and enter ladder logic into each with RSLogix500
2. Interpret the operation of the AB timer instruction, and their status bits
3. Interpret the operation of the AB timer instruction, and their status bits
4. Create PLC programs with timer & counter instructions and load into the PLC processor
5. Navigate through the RSLogix500 project with search cross reference commands
6. Explain to the instructor how a PLC program operates that contains timers, counters and relay instructions

Module 4: Allen Bradley SLC-500 intermediate instruction set: Hands-On Assessment Tasks:
1. Interpret the operation of the AB basic compare instructions (LES, GRT, EQU, LEQ, GEQ, NEQ)
2. Interpret the operation of the AB limit test instruction (LIM), including circular & non-circular
3. Interpret the operation of the AB MOV and MVM instruction, with students setting up masking data
4. Interpret the hardware electrical prints of an AB SLC-500 based system
5. Predict the operation of a program that includes compare and move instructions

Module 5: Maintain & Troubleshoot an AB SLC-500 system: Hands-On Assessment Tasks:
1. Wire a PLC systems with at least 5 inputs and 3 outputs. Create the program to run a specific operation
2. Manipulate I/O with force commands (On, Off, Remove), as well as interpreting the Force indicator light
3. Modify a ladder program while online to the SLC-500 (online programming)
4. Utilize search commands to find instructions throughout a large program using RSLogix500
5. Troubleshoot a PLC system with an injected fault, using the software and hardware print
6. Upload a modified online program, back to the default directory
7. Determine why the user does not have address descriptions when going online to a PLC with RSLogix500

Module 6: Basic Allen Bradley CompactLogix operation: Hands-On Assessment Tasks:
1. Create an Ethernet driver, and an Ethernet IP driver in RSLinx for communication with a CompactLogix processor
2. Identify and explain all communication ports on the CompactLogix processor
3. Create a new project in RSLogix5000, by configuring the I/O, and creating the alias tags in the Controller Tags settings.
4. Create a 4 rung program in a new project with the relay and timer instructions, using RSLogix5000
5. Use RSLogix5000 to do basic program functions (Download, go online, go offline, and upload)
6. Interpret the diagnostic indicators on the CompactLogix processor

Module 7: AB CompactLogix: Data Types, Timer & Counter Instructions: Hands-On Assessment Tasks:
1. Explain the difference between timer and counter data types, as well as Integer, Signed Integer and Double Integer
2. Interpret the operation of the AB timer instruction, and their status bits on a CompactLogix system
3. Interpret the operation of the AB timer instruction, and their status bits on a CompactLogix system
4. Create PLC programs with timer & counter instructions and load into the PLC processor
5. Navigate through the RSLogix5000 project with search cross reference commands
6. Explain to the instructor how a PLC program operates that contains timers, counters and relay instructions

Module 8: Specialized Allen Bradley instructions & equipment: Hands-On Assessment Tasks:
(This module satisfies the Ohio CTag requirement for University Transfer of this course)
1. Create a project in RSLogix500, with a Sequencer Output instruction to control the outputs on an SLC-500 simulator
2. Configure the Mask word in the Sequencer Output instruction
3. Load the file Integer file with data for the status of the output in the sequence
4. Create a PDF report of the ladder program and the cross reference report.
5. Interpret octal addressing on a PLC-5 PLC
6. Explain the purpose of a block transfer instruction on a PLC-5 system

Source: **IAM iSTAR**

In the first stakeholder survey carried out in January and February of 2016, six of twenty partners indicated that they assisted with curriculum redesign and development to ensure that the training would align with industry needs. In the second stakeholder survey, conducted in July/August of 2018, only one of four employers provided this response. The employers in the second survey defined their role primarily as providing work-based opportunities to students, and articulating required skills and competencies for curriculum development. NSCC also recruited employers to participate in industry roundtables. Involving about four employers at once for different aspects of curriculum change worked optimally. NSCC also visited employer sites to gather targeted feedback, especially on the competencies required. This input was the first step in converting existing industrial courses to a competency-based model versus a traditional seat

time model. In an ongoing fashion, the internship and apprenticeship programs have provided continuous communication between hiring managers and instructors. Figure 9 presents employer feedback as an example.

Figure 9: Employer Feedback on the Online, Hybrid Courses

Employer feedback on the online, hybrid courses: (sample of comments from industry representatives captured by the NSF Evaluator)

- Mark Ryan, Sauder Manufacturing: Liked the layout and content. Wanted to insure that legacy type PLCs were covered in the curriculum since that is what they primarily have running. Excited about the online coursework since many of their employees are trying to balance work with school. Was relieved that NSCC did not intend to ask him to come up with the curriculum. More than willing to vet the course to make sure that the competencies are relevant and in-line with industry needs.
- Mike Tiscovic, Chase Brass and Copper Company: Felt the content was good, but wanted to accelerate the development and deployment of the online content so that NSCC could respond to needs of their employees sooner. Stated that he would have wanted this done a year ago.
- Nate Killion, ConAgra Foods: Requested that more troubleshooting be taught in the PLC and VGD areas. Faculty told him that troubleshooting would be part of most of the modules in PLC200 and IND223. Was particularly excited about the virtual farm.
- Scott Davis, Spangler Candy Company: Liked the new instructional model but wanted to make sure that OSHA safety standards on Robotic installation and operation be added to PLC 230.
- Thomas Stierwalt, Siemens Corporation: Really liked the competency-based educational model. Recommended that NSCC continually review and align the curriculum every twelve months or less, simply due to the field of automation changing so fast. The college will be setting up a continuous improvement course review model.

Source: Northwest State Community College HOME4TECHS Project. National Science Foundation ATE Project Evaluation Report, June 1, 2016

Embed industry-recognized credentials such as the NCRC and NAM into the curriculum: NSCC researched options to embed industry-recognized credentials into the program, and found early support from ConAgra Foods for the Manufacturing Skill Standards Council (MSSC) Certified Production Technician (CPT) program. MSSC describes itself:

> "As the leading certifying body for the nation's front-line manufacturing production and supply chain logistics workers, MSSC's two certification programs allow students and workers to document their knowledge." "The purpose of the Certified Production Technician (CPT) program is to recognize, through certification, individuals who demonstrate mastery of the core competencies of manufacturing production at the front-line (entry-level through front-line supervisor) through successful completion of the certification assessments. The goal of the CPT certification program is to raise the level of performance of production workers both to assist the individuals in finding higher-wage jobs and to help employers ensure their workforce increases the company's productivity and competitiveness.
>
> The CPT program consists of five individual certificate modules: 1. Safety; 2. Quality Practices & Measurement; 3. Manufacturing Processes & Production; 4. Maintenance Awareness and 5.

> Green Production. Candidates must earn the first four certificates to receive the full CPT certification."

NSCC moved forward with the MSSC's CPT creating a new course for Industrial Safety (CPT 1) and for Precision Measurement (CPT 2), while embedding course content into existing courses for the MSSC CPT 3 and 4. NSCC is offering the MSSC at the Scott Park location but not on the main campus of NSCC, but is moving toward offering the MSSC on campus. Of course, the CPT content is integrated into the previously identified courses taught at the main campus. At an Implementation Analysis site visit on March 23, 2018, leadership stated, "We need to have a rapid certification that will showcase student skills and highlight their dedication to training."

Besides the CPT, students of the PLC robotics course conclude that course with a "practice test" to prepare them for the FANUC certification test held at an official testing center.

Develop stackable and latticed credentials from assistance with current TAACCCT partner that align with employer needs: NSCC organized a new associate's degree called an Associate of Industrial Technologies and submitted it to academic affairs (NSCC's governance process) on May 13, 2015. This new degree was approved for offering through academic affairs on November 12, 2015. The degree has been articulated to Bowling Green State University and to the University of Toledo. Fourteen students were awarded this degree during the TAACCCT program years up to the time of this report. This degree focuses on learning experiences that will prepare students with the technical skills to work within diverse technological fields in manufacturing and industrial environments. Students can obtain a generalist degree and have the opportunity to specialize in areas such as Industrial Electrical, Machining/CNC Programming, and Maintenance/Mechatronics.

Movement from one of the TAACCCT-funded short-term certificates to the degree was made easy, transparent, and promoted as was employer reimbursement for continuing education. The MSSC CPT 1 and 2 are the earliest levels of the stackable certificates, offered as IND 105 and IND 100. Latticing creates horizontal pathways so that certain classes can be applied to several certificates, as is evidenced by the linear X patterns in Table 21.

Table 21: Stackable Certificates and TAACCCT Converted Courses

Converted Courses						
		Ind. Automation Maintenance	PLC Certificate	Industrial Electrical Certificate	Industrial Maintenance Certificate	Industrial Technologies Associate Degree
Course #	**Course Name**					
IND110	**Industrial Computing**				X	X
IND120	**Industrial Electricity I**	X	X	X	X	**
IND121	**Industrial Electricity II**	X	X	X	X	**
IND223	**Motors & Controls**	X	X	X	X	**
PLC200	**PLC I**	X	X	X	X	**
PLC230	**Servo & Robotics**	X	X	X	X	**
IND132	**Bench work (embed MSSC CPT4)**	X				**
IND134	**Industrial Fluid Power**	X				**
IND131	**Industrial Pipefitting**	X				**
IND232	**Machine Repair (embed MSSC CPT4)**	X				**
PLC210	**PLC2**		X			**
PLC220	**PLC3**		X			**
IND122	**Industrial Wiring (NEC)**			X		**
IND140	**Principles of Machining (optional/elective)**					**
CIS195	**Networking Essentials (optional/elective)**					
IND105	**Industrial Safety (MSSC CPT1)**	Stacked Credential				X
IND100	**Precision Measurement (MSSC CPT2)**	Stacked Credential				
	Note: MSSC CPT3 Manufacturing Processes & Production is embedded in multiple courses) *Blue shading indicates courses converted via NSF funds* ***Technical elective concentration areas of the associate's degree*					

Source: IAM iSTAR

Analysis: Wright State University, Third Party Evaluator

Allow students to start into a certificate program immediately through the use of "massively open online courses." (MOOC): The intensive hybrid courses provide students flexibility, and many students complete the 8-week courses in less than 8 weeks. For those finishing early, instructors provide three open learning modules for the next course to allow students to audit future courses prior to semester start, and all hands-on assessments are open for the course. Students who register for the next semester (semesters are eight

weeks long) cannot see the knowledge assessments. Due to financial aid stipulations – "federal student aid is designed to fund education occurring within structured, discrete time periods (e.g., courses within semesters, hours instead of learning, and timed academic terms)"[18] – the full set of eight learning modules cannot be opened until the following semester. The MOOC is what enables the open learning modules. The second Sakai server purchased under this TAACCCT grant hosts the MOOC, which is also a means of non-registered student access to course materials.

Build multiple career pathways from Certificate to Associate to Bachelor degree and beyond: The figure above which presents the stackable and latticed credentials developed by NSCC under this TAACCCT grant demonstrate the multiple career pathways that can be pursued. While the work-based learning opportunities created under the NSCC TAACCCT grant will be described later, it should be noted that work-based learning is also part of the career pathway.

1. The MSSC Certified Production Technician certificate that can be pursued through NSCC's modified courses "demonstrates mastery of the core competencies of manufacturing production at the front line (entry-level through front-line supervisor) through successful completion of the certification assessments."[19]
2. The certificates in Industrial Automation Maintenance, Industrial Maintenance, Programmable Controller, and Industrial Electrical demonstrate mastery (via the hands-on assessments that require mastery at NSCC) and are linked to multiple occupations such as: 49-2091 Avionics Technicians; 49-2093 Electrical and Electronics Installers and Repairers, Transportation Equipment; 49-2094 Electrical and Electronics Repairers; Commercial and Industrial Equipment; 49-2096 Electronic Equipment Installers and Repairers, Motor Vehicles.[20]
3. The AAS in Industrial Technologies is a generalist degree that provides the opportunity for students to specialize in areas such as Industrial Electrical, Machining/CNC Programming, and Maintenance/Mechatronics.

Deploy curriculum for individualized or cohort accelerated delivery models that will allow for faster student completion of a program*:* The traditional sixteen-week courses that were modified to intensive hybrid eight-week courses under this NSCC TAACCCT-grant accelerate completion. A student can take about three courses in each eight-week semester and finish their certificate in three semesters, or twenty-four weeks of education, with 29 credit hours to earn the Industrial Automation Maintenance (IAM) certificate. Students in the hybrid courses are required to earn a grade of A or B on the knowledge assessments and 100% mastery is required on all hands-on assessments.

In interviews with employers, Sauder Woodworking indicated that there is a 0% unemployment rate for maintenance technicians, so they have developed a two-year path for apprentices. The plant runs 24/7 and has three shifts, so apprentices need an accessible school schedule and the hybrid courses are working well for their apprentices. Chase Brass and Copper, another employer, cannot find enough skilled maintenance

[18] Porter, S. R. "Competency-Based Education and Federal Student Aid, *"Journal of Student Financial Aid*: Vol. 46: Iss. 3, Article 2. (2016)

[19] https://www.msscusa.org/certification/production-certification-cpt/ accessed 7/5/2018

[20] Economic Development and Employer Planning System (EDEPS), https://www.edeps.org, accessed 7/5/2018 2018

technicians. They have worked with NSCC for the last forty years. About seven years ago, they experienced a shortage of maintenance technicians and needed to ramp up their apprenticeship program. Over the years of the TAACCCT grant, Chase Brass and Copper has been vocal about the need for a flexible class schedule to fit their shift schedules.

Students' perspectives about the conversion to intensive hybrid courses were captured via focus group sessions with the evaluator and classroom surveys. (See Appendix G for the TAACCCT Participant Course Assessment Questionnaire.) Most students prefer the hybrid (eight week) classes to the regular (sixteen week) classes. Students that prefer the hybrid classes cite that they can complete the program faster; it is easy to access, especially with a busy schedule; they can work at their own pace; and it saves travel time. "I was involved in the first hybrid classes they had and have noticed improvements since the earliest hybrid courses. I think I'm getting the same amount of training in half the time."

Those who do not prefer the hybrid classes cite that it is easier to procrastinate and there is less interaction with the instructor to discuss questions. "Hybrids seem like they miss that faculty interaction." Some students were in the middle saying it depends on the class. "It depends on the class. There are some math courses that I would not want to take in just eight weeks. But areas where you have aptitude, sixteen weeks is way too long."

As mentioned above, in a 2014 Gallup survey, faculty were reserved about the quality of online courses compared with in-person courses. As part of the TAACCCT third-party evaluator role, both an instructional design evaluation and a technical analysis of the new hybrid course content was conducted, to verify the quality. The instructional design evaluation was conducted with Quality Matter (QM) experts Sheri Stover, Ph.D., who is an Assistant Professor in Instructional Design. She is the Program Director for the Instructional Design for Digital Learning (IDDL) graduate program at Wright State University and also the Educational Technology for Health Professions. Stover's Ph.D. is in Instructional Design in Online Learning. She has several Quality Matters certifications including Applying the QM Rubric (APPQMR), QM Peer Reviewer Higher Education, QM Face-to-Face Facilitator, QM Peer Reviewer K-12 and K-12 Publisher Reviewer. Noah Schroeder, Ph.D., is an Associate Professor of Educational Technology and Instructional Design. His research interests are focused on how to design and use innovative technology tools to improve teaching and learning in STEM and medical fields.

The Instructional Design/Quality Matters evaluation was conducted with the first course that was modified from a traditional to hybrid format—PLC 200, with results provided August 12, 2016. According to the Evaluation Team's Instructional Design experts, "Overall, the course is well organized and easy to navigate. The consistent design will make it easy for students to proceed through the modules. The consistent format from module to module aids readability and comprehension. The variety of instructional materials are well organized." Other recommendations were made pertaining to Quality Matters standards that can be reviewed in Appendix B.

The technical content evaluation was conducted from March-July 2018. The qualifications of the technical reviewers follow. Dennis Hance has served as a military officer in a variety of positions, and has performed technical training in military and civilian engineering courses. He developed five new engineering courses for Howard Community College, redesigned and implemented three new courses for Wright State

University, and two courses for Edison Community College. He currently serves as the Director, Lake Engineering Program for Wright State University Lake Campus. He has owned a professional services company providing engineering technical training and services in multiple states. He has served on various curriculum review committees for universities and the Ohio Department of Higher Education. He has worked in manufacturing and engineering facilities for more than thirty years as a consultant or employee. As such, his extensive knowledge in manufacturing and engineering product development aid his abilities in developing curriculum, instructional products, and assessment materials.

- Masters of Science in Electrical Engineering, Air Force Institute of Technology
- Graduate Engineering Coursework, National Cryptologic School, Department of Defense
- Graduate Coursework in Vocational Education, Wright State University
- Graduate Coursework in Vocational Education, University of Dayton
- Bachelors of Science in Systems Engineering, Wright State University
- Project Lead the Way Certification in Engineering Design & Documentation, Introduction to
- Engineering Design, Digital Electronics, Introduction to Principles of Engineering
- United States Air Force Cryptologic School, Goodfellow Air Force Base
- Cryptologic Linguist Education, Defense Language Institute Foreign Language Division

Kelsey Fruchey has worked for over five years in increasingly more demanding manufacturing and engineering roles. She has served as project manager for facilities upgrades, manufacturing line redesign, implementation of new product lines, and all related design activities. Also, she has served as an adjunct engineering faculty member at Wright State University for several years. As an undergraduate and graduate engineering student, she assisted in the development and implementation of new undergraduate curriculum for three fundamental engineering courses.

- Masters of Science Degree in Mechanical Engineering, Wright State University
- Bachelors of Science Degree in Mechanical Engineering, Wright State University
- Honda Engineering Training Program

Mr. Hance, Ms. Fruchey, and her team reviewed fourteen online courses featuring state-of-the-art learning objects and custom-developed simulations. Specific details of each course reviewed include the syllabus, competencies, resources, instructional materials, modules or learning tasks, assessment items and the supporting criteria, and instructional videos. Each pdf-file format document was opened, the link validated, the content reviewed for instructional purposes, and, where necessary, minor errors were reported to the course originator. Each instructional video was opened to validate the source and ease-of-access for remote students.

Each Knowledge Assessment Activity (KAA) quiz or practice quiz was activated, evaluated, and documented. The Evaluator verified that students are evaluated on content presented in the courses, and considers these assessment vehicles to be exceptional. Each item reviewed had a sourced learning module within the online course. The practice quizzes are well structured and tailored to the different learning styles for modern students.

Of particular note are the Programmable Logic Controller courses. These exceptional courses provide state-of-the-art content, training exercises, evaluation materials, and offer students the ability to work at home

using online simulators not found at many universities in the United States. According to the technical evaluation team, these courses will prepare students for immediate employment in industrial companies upon completion of this program.

One item of note is the parent source for each video is the commercial Youtube.com website. A recommendation was made to have a redundant back-up link for remote users in case the Youtube.com web service is not available.

In summary, evaluators found all fourteen TAACCCT-funded courses ready for immediate implementation in higher education programs. Evaluators find these courses to reflect the best practices of the most advanced industrial technical training available today, and recommend immediate implementation of all the courses.

Develop modularized Online Learning Modules for new and modified curriculum to expand student access: NSCC organized all but one of the TAACCCT courses into eight modules, or organizational units used to organize the components of the course. The one course not organized into eight modules is CIS 195 which has been organized to be completed in four or eight weeks. Each module includes learning objectives, required resources, in some cases simulators and/or simulations, learning objects (including YouTube videos) and activities (including practice quizzes), and Knowledge Assessment Activity (KAA's). The continuous quality improvement design of the online system enables faculty to immediately identify student learning challenges. As such, faculty have already created practice quizzes as learning activities to improve results. In the Third-Party Evaluator technical review of the course design, the fourteen courses were reviewed within four topical areas and sixteen items associated with those topical areas, and rated on a five-point scale. See Appendix C for more information.

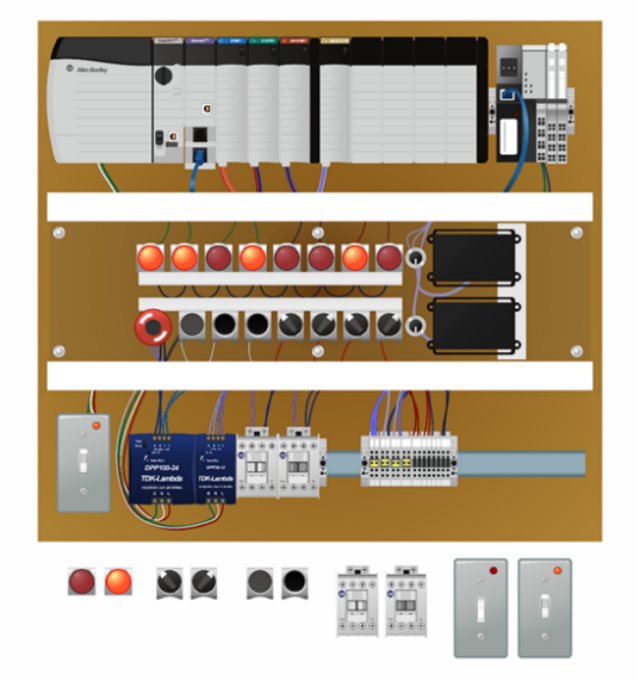
All aspects for eleven of the fourteen courses were rated as "exceptional," meaning that the "Content is ready for implementation. Content is robust and rigorous. Content utilizes "best practices" for instruction." For three of the courses—Bench Work (IND132), Industrial Electricity II (IND121), and Industrial Safety (IND105) – the actual modules were rated as "effective." The modules, therefore, are assessed as having "Content that is complete with only minor corrections, such as typographical errors, that may need to be made."

Design hands-on training simulators that align with industry standard equipment and machinery: The NSCC created simulators for the five courses targeted for simulators under this grant. Third-party Evaluator content experts who reviewed the fourteen courses' content noted that the Programmable Logic Controller courses are particularly exceptional. These courses provide state-of-the-art content, training exercises, evaluation materials, and offer students the ability to work at home using online simulators not found at many colleges or universities in the United States.

NSCC programmed a PLC simulator so students can practice programming online before coming to the laboratory to take their hands-on assessment. Students can access the expensive software through the 24/7 virtual farm. Here they can program the PLC so that indicators in the lab simulation turn off and on per instructions. The online PLC trainer replicates the look and feel of the actual PLC trainer. Students are able to save the programming that they write for the virtual PLC and build on it to take their "hands on" test in

the lab on campus. This lack of duplication saves time for the student and accelerates instruction (see Figure 10).

Figure 10: PLC Training Simulator

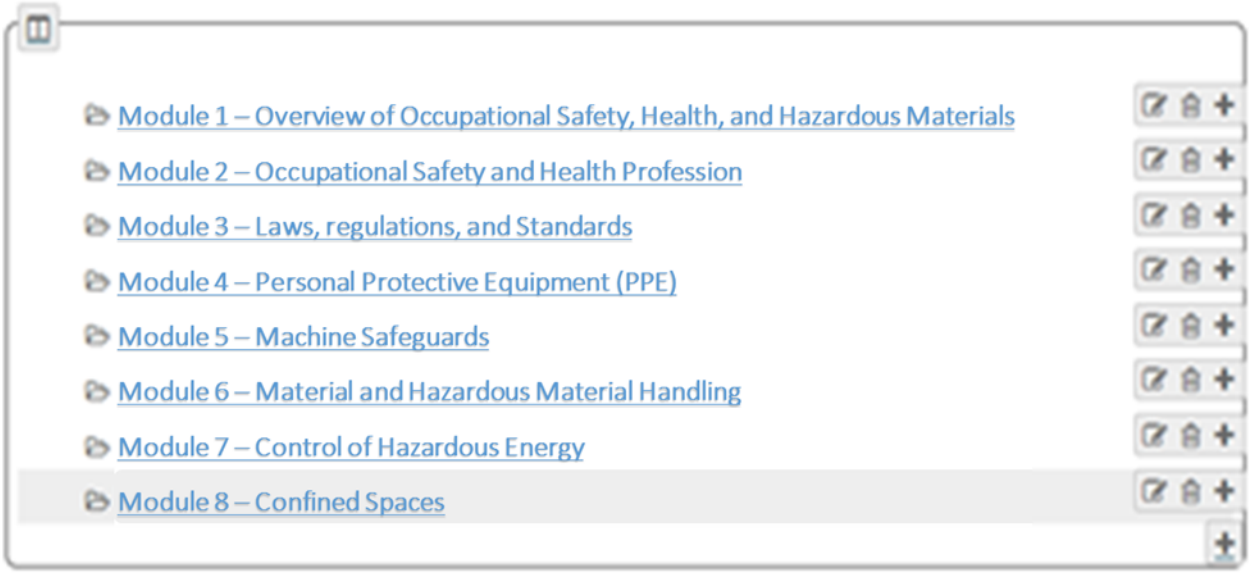


Source: IAM iSTAR

Create hands-on assessments and lab exercises that align directly with the hands-on competencies specified by employer partners: NSCC developed forty hands-on assessments as well as lab exercises in concert with simulations based on employer-specified competencies for the modified courses. The assessments are deployed through the Learning Management System (LMS) to the virtual farm, and therefore data intelligence about knowledge gains and challenges for students are readily known. In response to student learning challenges, program developers create new learning objects—such as YouTube videos and simulations, as well as practice quizzes, to prepare students for assessments and aid student learning. The hands-on assessments have the added benefit of providing clarity to the award of PLA credits at NSCC. In the last year of the TAACCCT, PLA credit awards, enabled by the hands-on assessments, led to a 750% increase in PLA credits awarded at NSCC.

How the hands-on assessments work: At the completion of each assignment, students complete the corresponding online Practice Knowledge Assessment Activity (KAA) and the online Knowledge Assessment Activity (KAA) to validate and verify student learning. In some courses, these are augmented with Hand-on Assessment Activities (HOA). Figure 11 provides a 'snapshot' of the modular assignments students will complete. In this course on safety, students will complete the following eight modules.

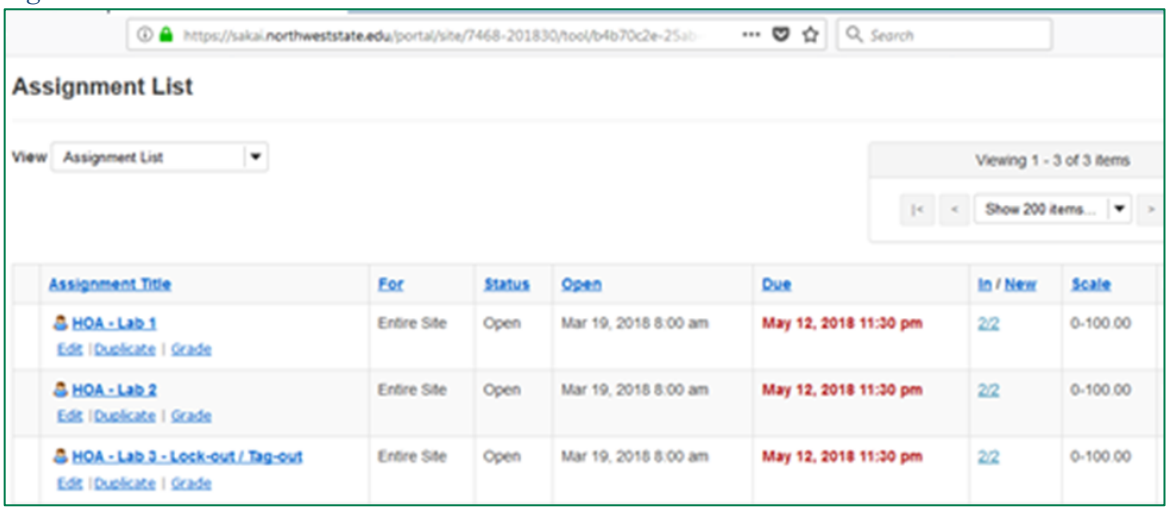
Figure 11: Example Figure 5:Hands-On Assessment Online Student Assignment Modules



Source: Wright State University, Third Party Evaluator

Students are expected to complete the Hand-on Assessments at the college in the presence of the course instructor within a required time period. Figure 12 shows the list of three expected HOA activities for the Industrial Safety Course.

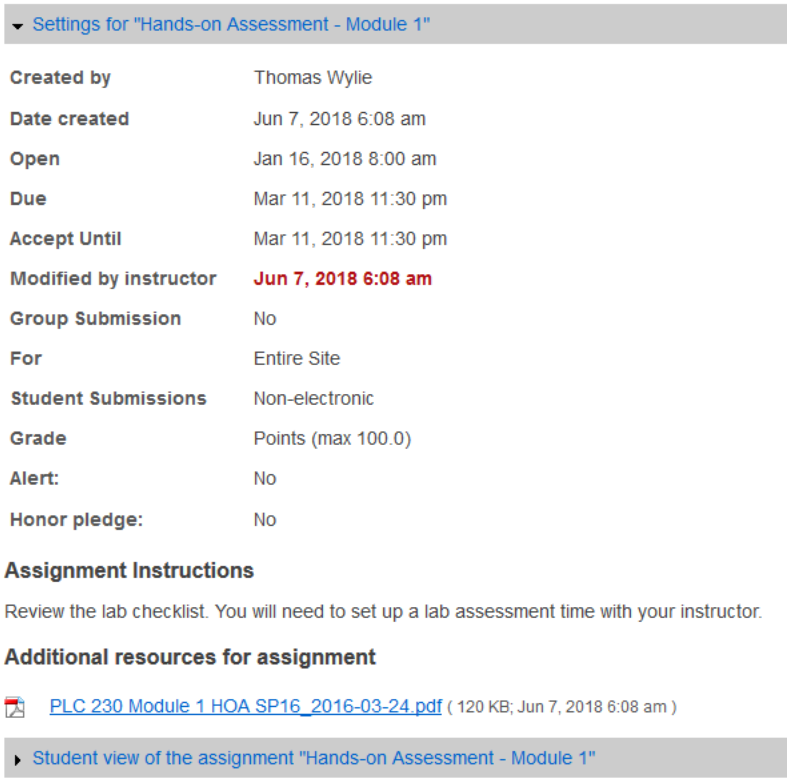
Figure 12:Hands-On Assessment Activities



Source: Wright State University, Third Party Evaluator

Every HOA has a pdf-file with the skills students are expected to complete and demonstrate to the course instructor. The pdf-files are available to students prior to their beginning the HOA activity. The pdf files provide the student time to review the course content and to prepare for the HOA activity. Figure 13 illustrates what students will see when they access a specific HOA. This HOA is for Module 1 of the PLC 230 Programmable Logic Controller course.

Figure 13: Accessing and Hands-On Assessment



Source: Wright State University, Third Party Evaluator

Figure 14 shows the expectations a student must satisfy in the presence of the course instructor to pass this specific HOA for Module 1 of the PLC 230 Programmable Logic Controller course. The instructor records a grade and signs their name at the left-hand side of this sheet documenting a student's performance of each task. This provides students with immediate feedback of their performance.

Figure 14: Example Hands-On Assessment Student Expectations

Northwest State Community College

HOME4TECHS, 2/3/16
PLC230 Module 1, Hands-On Assessment

Student Name: _____ N# _____ Date: _____

Directions:

1. This Hands-On Assessment (HOA) requires you to demonstrate 100% mastery of the following. You will not be able to take the next module's HOA without successfully completing this assessment.
2. Prior to taking this assessment, you must pass (minimum of 80%) the Knowledge and Application Assessment (KAA).
3. Print this assessment and hand it to the lab instructor who will document your performance on each of the following skills.

Check	#	Skills Task
_____	1.	Demonstrate the lock out and power up procedure for the Fanuc Cert system.
_____	2.	Identify and explain the five major components on the Fanuc system.
_____	3.	Explain the function of each component on the Fanuc controller.
_____	4.	Jog all 6 axis of the Fanuc robot in Joint Jog mode.
_____	5.	Jog all 6 axis of the Fanuc robot in World Jog mode.
_____	6.	Display positional data on the screen for Joint and World motion types.
_____	7.	Explain the right hand rule in conjunction with jogging the robot in Joint.
_____	8.	Explain the status indicators on the teach pendant display.
_____	9.	Reset any faults in manual mode.

Source: Wright State University, Third Party Evaluator

Third Party Evaluator content experts found each HOA activity to be thorough, well documented, and covering material presented only in the specific course under review.

Create and deploy online simulations that align with equipment and processes found in a manufacturing environment: Due to NSCC's success in developing highly technical online simulations, NSCC was asked by TAACCCT to mentor Central Community College (CCC) in Nebraska as that college sought to develop simulations. CCC Nebraska was successful in creating simulations, but not to the "gold standard" that NSCC achieved (email from CCC Nebraska dated April 16, 2018). At NSCC, it took a lot of personnel time to make the simulations available via the MOOCs; and this requires continuous debugging. These simulations allow students access to 15% more content, while coming to campus half the time of a traditional course model.

NSCC created 15 interactive simulation objects as well as virtual trainers: The simulations – PLC simulation, Allen Bradley trainers, and Siemens trainers and fluid power simulations--enable student access through an emailed link in the LMS that launches via the virtual farm onto students' virtual machines. Such learning objects greatly accelerate student learning. At a rural college, these simulations also save student travel

time to the labs. At an average of thirty-five miles one-way for NSCC workforce development students, this time savings can be reinvested back into student learning.

The Evaluator noted that ideally institutions seeking to replicate the NSCC curriculum should provide access to equipment similar to the training equipment used at NSCC. However, at a minimum, implementation of all online simulation tools developed by NSCC could substitute for the equipment, if fiscal resources are restricted. The online simulation tools are effective and will provide sufficient technical training to provide students with an entry-level knowledge-set to obtain employment in their manufacturing and industrial communities.

The Evaluator content experts also reviewed all instructional materials for the TAACCCT courses. The items evaluated were:

- Materials relate to course objectives and/or outcomes
- Materials are presented in an appropriate format for the learner to understand
- Instruction follows a logical format
- Instruction and materials reflect direct application to current industry standards and practices
- The instruction and materials are appropriately organized and provide clear structure
- Provides option(s) for multiple learning styles in order to engage students

Again, for eleven of the fourteen courses, every item above was rated "exceptional." For the Bench Work, Industrial Electricity II, and Industrial Safety courses, the items were generally rated "effective."

Build a virtual computer farm to give full software access to students on a 24/7 basis: NSCC successfully implemented the virtual farm, resulting in substantial software cost savings for students as well as accelerating student learning. The following paragraph elucidates the role of the virtual farm in accelerating student learning at NSCC.

> "Current market requirements in the industrial sector have motivated the development and adoption of digital manufacturing software tools for control systems design, training, and process optimization to validate and ensure the production system´s programming control and automation equipment. This practice, known as Virtual Commissioning, emulates the real process behavior in a computer software environment. This technology represents an opportunity for education where the virtual emulation of real processes can be used to equip Control and Automation laboratories where students can test, validate, and debug their control and automation strategies, contributing to student formation and solving the need of having costly, real industrial machinery to reinforce the understanding of classroom theory, with practice."[21]

Access to simulations via the virtual farm is made easy—students can click on a link to the simulations via email on Sakai and open the simulation on the student's virtual machine. Another major advantage to each student having their own virtual machine (computer), is that they will have 24/7 remote access to the proprietary software that they would typically have to come to the college campus to access.

[21] Alfredo R. Izaguirre, Manuel E. Macías. Virtual Reality Machines to improve training in Control and Automation. Conference for Industry and Education Collaboration, American Society for Engineering Education February 2011.

Design a flexible lab-time system that will allow working students to schedule lab times to fit their schedules: NSCC initially experienced several challenges with their effort to create an open lab. Early on, NSCC tried offering time blocks that students could sign up for, but it was poorly communicated (according to students in focus group sessions). At this point, students are expecting communications related to their courses to come to them via software and through the LMS. So an NSCC faculty member developed software for open lab scheduling, called "NSCC Lab Sites." The software has been fully deployed and now links directly to the LMS. NSCC continues to make improvements to increase performance and end-user experience. Students are able to take labs that would have been cancelled previously due to low enrollment, and this use of labs is leading to higher student completion rates, per staff interviews conducted March 2018.

Summary of Student Perspectives on Program Changes

NSCC conducted student evaluations in the classroom and shared the de-identified data with the Evaluator. Students in four classrooms were involved in the survey: IND120 (evening class), IND121 (evening), IND223 (evening), and IND223 (day). Across all four classes, 87% of students prefer the hybrid courses over traditional courses, but proportionately more students in the day-time class prefer traditional courses. The 87% of students who prefer hybrids, cite the benefits of “learning at your own pace,” access to material at any time, and “I learn more quickly with hands-on and visual.”

Other comments to elucidate student sentiment who prefer the hybrids:

- “First time in college. Love it. It’s at my hands at all times. Working two jobs plus a family. I still can complete the courses.”
- “The instructors are knowledgeable and they have experience. The videos, PDFs and textbooks are laid out easy to read and understand. Sakai is very friendly to use.”
- “The KAA study guide is helpful in what is to be read and how long to study. The communications from the instructor in Sakai is great. I don't have to wait for traditional class to ask a question.”
- “I post on the forum and everybody sees it and can respond, or see what the instructor has to say.”
- “I think if all classes were hybrid, graduation would be sooner, cost would be more affordable.”

Tables 22 and 23 present the aggregate results of student interviews, demonstrating that most students like the hands-on learning for lab exercises and rate the quality of hands-on assessments (HOA’s) highly. They perceive high quality for the KAA testing as compared to traditional tests, the value of practice quizzes on the LMS, and the quality of lab exercises.

Table 22: Methods of Study and Assignments that Work Best for Participant Learning

Rate the methods of study and assignments that work the best for your learning:	
Reading assignments in the textbook	66%
Instructor created PDF informational documents	81%
Instructor created videos	85%
Reading of manufacturer equipment cut sheets	74%
YouTube videos the instructor put into Sakai	85%
Hands-on learning from the lab exercises	90%

Table 23: Course Component and Material Quality Rating by Participants

Rate the quality of the following parts of the course (presents the percentage for positive response to the quality):	
The quality and effectiveness of the textbook	68%
Quality of the lab exercises in the course	85%
Quality of the lab equipment in the course	77%
Value of the KAA study guides	76%
Value of the practice quizzes in Sakai	87%
KAA testing, as compared to traditional tests	88%
Quality of the HOAs	87%

Source: IAM iSTAR TAACCCT Participants

Analysis: Wright State University, Third Party Evaluator

Question 4: Are in-depth assessments of participant abilities, skills, and interests conducted to enroll individuals into programs? How were student support services and work-based learning opportunities improved? Was career guidance provided?

Utilize full time Career Coaches to assist students from the start of their program to job placement including assessment for determining inclusion into their programs of study: The NSCC proposal said that "career coaches will help address each participant's unique situation. Assessments (e.g., COMPASS, TABE, WorkKeys, Barriers to Success Inventory (BESI), KeyTrain) conducted will identify and assist individuals in prioritizing their studies, plan for success, and resolve potential barriers."

Career coaches: Coaches provided student supports such as referring students for tutoring, assisting with resumes, and setting up interviews for graduates. NSCC had a rocky career coach situation. The nonprofit organization called WSOS Community Action Commission was contracted on May 13, 2015 to provide career coach services to NSCC students. The position experienced multiple workforce turnovers as coaches served

for brief periods and then moved to other jobs, or, in one case, the career coach passed away unexpectedly leaving NSCC without a career coach for six months in 2017. Intermittent coaching services led to students in focus group sessions reporting that they had seen the coach only at enrollment, or only one time after enrollment. Many of the incumbent worker students stated that they had little interest in career coaching services. It took time for career coaches to gain the support of faculty to permit them to make classroom presentations to students. In August 2017, Brad Geer was hired as the Workplace Learning/PLA - Apprenticeship Coordinator. Mr. Geer brought continuity of coaching services to NSCC, and was immediately successful. As a previous faculty member at NSCC, Mr. Geer had immediate rapport with NSCC faculty, and getting in front of participants while they are in the classroom is an essential means of connecting with them. Private sector companies are finding that internal coaches have better results than contracting for such services externally.[22] The Third-Party Evaluator had included in its plan to quantitatively measure the impact of career coaching on students; however, with so much interruption in career coaching services, it was not possible to conduct a quantitative analysis of the career coaching on student performance. Future research should consider evaluating the efficacy of internal versus external career coaching.

NSCC learned a lot from its earlier failed attempt at contracting out for the career coach services, and is using its Title III grant to establish a student advising center. The primary lesson learned under the TAACCCT grant is that career coaching has a positive impact, and must be a continuous institutional student service. The Community College Survey of Student Engagement (CCSSE) is a well-established student survey that helps institutions focus on good educational practice and identify areas in which they can improve their programs and services for students. Even though NSCC showed improvement in academic advising from 2011 to 2015 based on the CCSSE survey, NSCC scored below the 2015 CCSSE cohort on support for student learners and student-faculty interaction, placing the college in the 20th percentile for its cohort.[23] NSCC students ranked academic advising as the most important student service out of the ten services identified in the CCSSE survey, yet scored (1.75 out of 3.0) below the CCSSE cohort (1.83) on the frequency of utilizing advising services.[24]

When Ohio's funding formula for community colleges shifted in 2013 and 2014 to a performance-based model, NSCC's lack of institutional data impacted data-informed decision-making. A new position to the college, vice president for institutional effectiveness & student success, was created in January 2017. The goal is to increase student success through improved advising by: (1) creating a centralized advising center, (2) employing professional advisors, (3) providing student success-focused professional development, (4) establishing a data warehouse, and (5) defining, adopting and using key performance indicators (KPI's) to drive institutional decisions.

Establishing a centralized student advising center is intended to help students develop (a) the knowledge required to identify (or confirm) their educational goals, (b) an appropriate educational plan, and (c) self-monitor with advisor support their progress toward achieving those goals. The "Entry" segment includes the point at which a student is ready for academic advising and enrollment and concludes with the end of

[22] Gurchiek, K. "Should your organization use internal coaches?" SHRM, September 19, 2016
[23] Northwest State Community College Title III Proposal, 2018
[24] Ibid

the entry semester. Students will meet with their assigned professional advisors and further develop their relationship with and connection to NSCC. Students will use assessment and placement tools by answering a series of questions and completing an open-ended, self-assessment worksheet that help the advisor provide prescriptive and intrusive advising for the student. The questions and worksheet help the student consider factors that exist that influence their progression and completion and allow the advisor to identify supportive services targeted toward the students' needs.

Aptitude Assessment: In the technical proposal to the US DOL, NSCC proposed to assess students for determining inclusion into their programs of study using COMPASS, TABE, WorkKeys, Barriers to Success Inventory, or KeyTrain. The COMPASS tests were used by NSCC at the beginning of its Round 4 TAACCCT grant, which includes modules in reading, writing skills, essay writing, math and English as a Second Language (ESL). A typical college placement assessment was found not to work effectively with candidate students in the Industrial Technology division. In the end, NSCC did not install a candidate assessment tool. In focus group sessions with NSCC students, students indicated in spring 2016 and again in spring 2018 that they believed an aptitude assessment to evaluate incoming students' aptitude in industrial technology should have been available, because participants' perceptions were that some individuals in the program lacked the aptitude. At NSCC, there was program interest but not institutional support to use WorkKeys—assessments that measure foundational skills required for success in the workplace. The Third-Party Evaluator had planned to conduct an analysis of the ability of the assessment to appropriately guide student placement, based on student performance; however, because no assessment was used by NSCC, no evaluation could be conducted.

Reach out to, and contract with local community-based organization(s) (CBOs) to provide Career Coaching services: As stated in the previous section, the nonprofit organization called WSOS Community Action Commission was contracted on May 13, 2015 to provide career coach services to NSCC students. The position experienced multiple workforce turnovers as coaches served for brief periods and then moved to other jobs, or, in one case, the career coach passed away unexpectedly, which left NSCC without a career coach for six months in 2017. In August 2017, NSCC hired an internal candidate to provide career coaching services, primarily coaching in job readiness skills (given the near conclusion of the grant). This internal career coach was immediately successful. In the spring 2018 student focus group session, students underscored the excellent support of the career coach, and especially cited the success of the internship program, ramped up by the career coach, as having an exceptional impact on student workplace and career learning.

Strengthen partnership and existing Workforce Systems and One-Stop Career Centers to better support the needs of the students: There is a partnership between NSCC and the Ohio Means Jobs (OMJ) offices in Northwest Ohio, particularly with Henry, Fulton, Williams, and Defiance counties' OMJ offices. Jim Drewes, NSCC's Director of Workforce Development - Custom Training Solutions, sits on the Workforce Investment Board for Henry County; while the President of NSCC, Dr. Thomas Stuckey, who served as President up until the end of the TAACCCT grant, served on the Area 7 Workforce Development Board.

NSCC has recently announced a new partnership program between Job and Family Services (JFS) and Custom Training Solutions (CTS). The program is designed to assist individuals aged 14-24 who need jobs and use county services. It provides innovative training and increases opportunities for career pathways that offer

family-sustaining wages. JFS offices in Auglaize, Defiance, Henry, Paulding, Williams and Wood Counties in Ohio are already onboard. This program is referred to as CCMEP in Ohio. Comprehensive Case Management and Employment Program (CCMEP) provides employment and training services to eligible, low-income individuals based on a comprehensive assessment of employment and training needs, as well as a basic skills assessment. Participants are provided services to support goals outlined in their individual opportunity plan, which may include support to obtain a high school diploma, job placement, work experience, and other supportive services such as child care and transportation.

In addition to this involvement with Job and Family Services and OMJ offices, in its IAM iSTAR program, NSCC involved five Trade Adjustment Assistance (TAA) eligible students in year 1 of the TAACCCT grant, twenty-four in year 2, and five in year 3. In an interview with NSCC grant staff, the Evaluator asked about the increase in involvement by TAA eligible students in year 2 of the grant. There was one company that received a TAA contract in year 2 of the grant, which impacted those numbers.

The Evaluator also interviewed NSCC grant staff at a March 2016 site visit about the number of veterans served by NSCC's TAACCCT grant and continued to recommend targeted recruitment efforts working with Veterans Service Commissions in each County as well as veterans organizations. NSCC used its career coaches to conduct recruiting efforts, as well as other grant staff. On June 20 and 28, 2017 and on January 5, 2018, NSCC visited Veterans Association offices in Napoleon, Williams County, and Defiance County, respectively, to share program information and marketing materials to recruit veterans to the IAM iSTAR program.

Over the course of the TAACCCT grant, NSCC served eleven veterans-- two veterans in year 1, six in year 2, and three in year 3. Veterans self-identify on the NSCC college application form. Local research on veterans conducted by Wright State University shows that there is a trend of younger veterans not seeking out veterans' services and not self-identifying as veterans.[25] The Montgomery County Ohio Veterans Service Commissioners said, "If Veterans cannot get a job at Wright-Patterson Air Force Base (WPAFB), they're really lost; they're like orphans." This quote indicates the single strategy mentality of many veterans. In a survey conducted of veterans in Montgomery County Ohio (where WPAFB is located), 70% of veterans were unaware of the Veterans Service Commission (VSC). VSC service officers are the most qualified to describe veterans' services and benefits, and so a lack of awareness of county-based VSC's leads to a lack of access to veterans benefits. The Montgomery County VSC established a set of strategies to reach out to new military recruits and work with families of soldiers to ensure they come to the Veterans Service Commission after they conclude their military service. It is an ongoing challenge in Montgomery County and, apparently, in Northwest Ohio.

Develop opportunities and establish employer sites for work-based learning, including apprenticeships, paid internships, co-ops, and OJT: NSCC has institutionalized the workplace learning supports that it developed under the TAACCCT grant by placing the grant-funded Workplace Learning/PLA - Apprenticeship Coordinator on the college budget and by adding a "completion" focus to the new student advising center. The "Completion" section includes the time through graduation or transfer-out. The faculty advisor remains

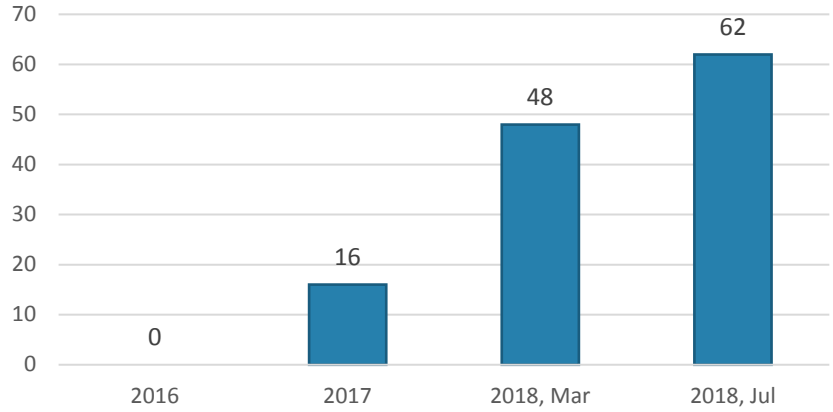
[25]Dockery, J. "Montgomery County Veterans Service Commission Strategy Session," February 10, 2016

the student's advisor throughout the program to completion. The frequency and content of advising sessions will shift from academic success to work-based preparation, transfer, or both.

Faculty advisors will connect students with area employers and the career and activities coordinator as students prepare to make the transition from graduation to the workplace. The career services coordinator will help students build on workplace readiness skills and transfer preparation developed through the academic program course work and prescriptive and intrusive advising from their faculty advisor. The career coordinator will help students effectively prepare for the job search process, including resume development, professional attire, and interview practice. Students will use their career portfolio and participate in a job fair (on-campus or off). This career portfolio may also aid students as they meet with the institution to which they intend to transfer.

Internships: NSCC's internship program has experienced a large growth rate over the period of the TAACCCT grant, and the TAACCCT grant and the grant staff are attributed the credit for this success. (See Figure 15.) In the earliest years of the TAACCCT grant, NSCC basically had no institution-wide internship program, while an occasional placement of an intern might have occurred with individual faculty brokering the relationship. In spring of 2017, NSCC had sixteens students placed in internships with eight students at Allied Moulded, two students at Spangler Candy Company, and six students at Sauder Woodworking.[26] On March 9, 2018, the TAACCCT Third Party Evaluator requested an update on the internship program, and found 105 NSCC students in the internship program with forty-eight placed as interns working with area employers with the remainder receiving intensive job readiness supports such as resume development and job interviewing support. Of the 105 students, 30 were female. It should be noted that NSCC involves both incumbent worker and non-incumbent worker students in its internship program. For incumbent worker students, NSCC explains to employers the need for them to be flexible and allow interns who are also their employees to participate in the internship program. Twenty-six (26) incumbent worker participants have reported advancement in their careers due to the internship program.

Figure 15: Northwest State Community College Interns



Source: Northwest State Community College

[26] Hata, D. M. "Northwest State Community College HOME4TECHS Project, National Science Foundation ATE Project Evaluation Report," May 1 2017

In mid-July 2018, the internship program grew to 117 students in the internship program with 50 students placed at employer sites. Mr. Geer, who coordinates the internship program at NSCC ascribes some of the success of the program to a very tight labor market. According to Mr. Geer, "Regionally, the biggest demand from employers is for students in industrial and engineering programs. But the aim is to get all of the College's divisions involved. This is capacity building at the institutional level."

Institutionalization of the internship program at NSCC has also formalized the way students provide input about what skills employers are expecting, and employers provide feedback on the students every two weeks.

By the end of July 2018, Mr. Geer reported 140 students in the NSCC internship program, with 62 placed at 50 different employer sites. The other students are receiving career management services such as resume development and job search support.

The Third Party Evaluator asked, "What have been the critical elements behind the success in the growth of internships at NSCC?" Mr. Geer responded, "Having a dedicated person to market the internship program, and encouraging students to get credit for the program. Word of mouth has also increased enrollment. The critical element is listening to employers and the students." The Evaluator then asked, "What will it take to continue to sustain the internship program that has been grown at NSCC?" NSCC has institutionalized Mr. Geer's position, moving him from a grant-funded employee to the college budget, and NSCC has committed to have Mr. Geer spend half of his time face-to-face in the community meeting potential employers for the internship program. Furthermore, the internship program is part of NSCC's Title III grant outcomes. One example of Mr. Geer's recent success in working with employers follows. In 2018, NSCC established a new relationship with Silgan Can Containers located in Napoleon, Ohio and headquartered in California. NSCC staff invested about 24 hours of time in developing this relationship. As a result, Silgan has committed to one CTS training, one engineering intern placed, one manufacturing intern placed, one electrical intern in the interview process, one graduate hired full time, four new part-time students hired (with full tuition reimbursement), and a long-term working relationship between Silgan and NSCC. Mr. Geer points out the very positive return on his and his NSCC associates' time investment with this company.

Workplace Tours: "A workplace tour is a highly-structured career awareness activity in which students visit a workplace, learn about the business, meet employees, ask questions and observe work in progress."[27] "More than a simple field trip or site visit, a Workplace Tour is designed and structured to meet specific learning outcomes, be educationally rich, and build awareness of the business, its industry sector, its role in the economy and the career options it provides."[28] During the first and second years of the TAACCCT grant, grant staff recorded in their smart sheet each of the workplace tours that they coordinated as listed below. Recordkeeping for this fell off in the third year of the grant; however, grant staff report that workplace tours continue at the same rate and that employers are motivated to continue to provide these opportunities. In a March 23, 2018 site visit, the Third Party Evaluator also was hosted at a tour of the Chase Brass and Copper Company. The company's Chief Operating Officer (COO) recognized that manufacturers have to be active partners with NSCC so that programs are aligned with employer needs. The COO also discussed how NSCC

[27] New York City Department of Education http://wbltoolkit.cte.nyc/workplace-tour/
[28] Ibid

might engage other mid-sized manufacturers to engage as TAACCCT partners. A barrier to involvement is protecting the employers from liability when students come on site. The COO is also a proponent of capstone courses, the culminating and usually integrative experience of an educational program.

- GT Technologies 11/13/15 "LEAN Manufacturing"
- Lubrizol 12/4/15 "Growth within a Company"
- Fulton Industries 1/22/16 "Process"
- Allied Moulded 2/17/16 "PLC Automation"
- Archbold Container 2/23/16 "Process"
- 20/20 Plastics 3/22/16 – no topic listed
- GT Technologies 3/18/16 "Lean Manufacturing and PLC"

Question 5: Are Prior Learning Assessment policies in place; are they tied to learning outcomes?

Develop a standard model for awarding credit for Prior Learning Assessments (PLA): NSCC modified its PLA policy under this TAACCCT grant. Modifications to the policy include:

- Addition of the phrasing pertaining to credit for military service—transfer credit will be given to those students who have successfully completed educational experience through the military services as evaluated in the American Council on Education Guide (ACE) or "Military Transfer Assurance Guides (MTAGs) as maintained by the Ohio Department of Higher Education."
- Under the subtitle *Proficiency Examination,* the language has been changed to accommodate the accelerated 8-week sessions.
- Under the subtitle *Credit by Documentation*, the guidelines include multiple changes pertaining to clarifying the role of the student, academic dean, faculty member, and coordinator in pursuing PLA credit.
- Under a new section, a *One Year Option (OYO)* is described as: the OYO was established by House Bill 59 and allows a graduate from an approved Ohio Technical Center program to earn a block of technical credit toward an Associates of Technical Studies degree.

NSCC PLA marketing materials state that, "The review of prior learning is consistent with processes promoted by the Council for Adult and Experiential Learning (CAEL). Several staff members on campus are certified by CAEL." The Vice President for Institutional Effectiveness and Student Success verified that NSCC uses the rubric developed by the Ohio Department of Higher Education standards that are based on CAEL standards, yet go further by making explicit the PLA details. The framework has four elements that are covered in detail at https://www.ohiohighered.org/pla-framework:

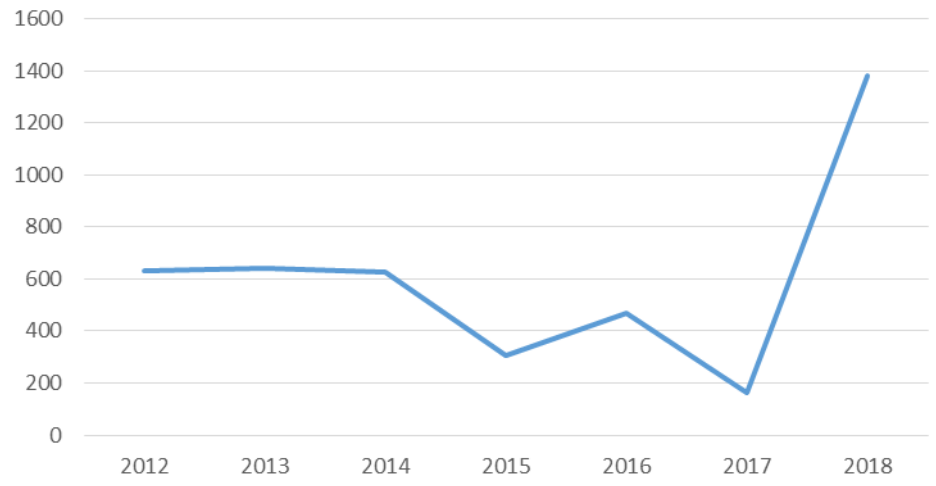
1. Element 1: Ensures student-centered, faculty-driven practices
2. Element 2: Ensures consistency
3. Element 3: Maintains academic integrity within, across and among institutions
4. Element 4: Improves the portability of credit earned

NSCC struggled to move the PLA policies forward that would enhance the industrial technology degrees and certificates until mid-2017 when, under the TAACCCT grant, NSCC hired a Workplace Learning/PLA-Apprenticeship Coordinator. While NSCC already had a PLA policy in place, under the TAACCCT grant NSCC has institutionalized a competency-based PLA policy that works for the industrial technology division. The forty hands-on assessments developed under the TAACCCT grant enable faculty to carry out the competency-based prior learning assessments.

A big part of implementing a successful PLA program is marketing and communications. A content analysis of the current versus the previous PLA brochure demonstrates that NSCC is simplifying its message and not presenting it as a list of "to-do's" for the student, but rather provides sufficient information to initiate the process, and then the staff coordinate the process with the student.

A 6.5 year trend in PLA credits awarded is presented in Figure 16. From calendar year 2012 to 2014, an average of 632 PLA credits were awarded each year. In the 2014/2015 academic year, the Ohio Board of Regents required Ohio public institutions to reduce the credit hour totals for their programs where programs could accommodate that, and so colleges in Ohio aimed to cap associate degree credit requirements to 60 to ensure degrees can be completed on time and to improve credit mobility for community college transfer students. At NSCC, among other data sources, PLA credits were used to identify which credits could be eliminated from programs to condense them. Therefore, the figure below shows a sharp decline from 2015 through 2017. In 2018, using the PLA credits as a recruiting tool, NSCC marketed its PLA program to students as well as to small businesses. Small businesses have been aggressively marketing the experience they provide to workers as an education benefit that can be translated to free academic credit. In a July 2018 interview, the PLA Coordinator also attributed extreme growth in PLA credits to conversations with students that help them relate their experience to credit. In one example, the Coordinator described a military veteran who worked in computer-based anti-terrorism for four years, which resulted in credit for a cyber-security course.

Figure 16: NSCC Prior Learning Assessment Credits Awarded



Source: Northwest State Community College

Question 6: What contributions did each of the partners and other key stakeholders make? What factors affected partner involvement? Which contributions from partners were most critical to success?

Role and Support Services provided by each partner category

***Educators**:* The role of the NSCC grant team was a leadership role that ensured the success of this project. The team's content and grant expertise, jump-starting the TAACCCT grant with an NSF ATE grant, along with its IT acumen, inventiveness, and innovation, contributed the most to the grant's success. Top administrators at NSCC have expressed a commitment to continue to convert the remaining industrial technology courses to the intensive hybrid format, even if the institution has to use hard budget dollars to accomplish this. The school partners at the beginning of the TAACCCT grant have remained the same throughout the project—NSCC, Vantage Career Center, and University of Toledo Scott Park. The roles have remained the same as well, with NSCC providing faculty to teach the TAACCCT courses at all three locations, while a coordinator at each site schedules classroom space, lab time, etc. At Scott Park, the MSSC certification has been made available, resulting in partnerships in the Toledo area with the JFS offices, Goodwill, and others to recruit candidates to the MSSC program and thus recruiting them to the manufacturing industry. Beyond these original roles, the NSCC partnership is also involved with Ohio TechNet (OTN), the consortia round 4 TAACCCT grant team in Ohio, which is seeking sustainability via philanthropic and State of Ohio support. More details are provided in the sustainability section.

Community: In the first two years of the grant, a key role of WSOS, a community-based organization, was to provide career coaching services at NSCC for the IAM iSTAR program. The primary role of community partners in the last year of the grant and ongoing is to serve as points of participant recruitment. NSCC continues an ambitious schedule of recruitment across the region, partnering with Veterans Services and veterans organizations (6 visits in 2017/2018), Ohio Means Jobs offices (30 visits), social service agencies (65 visits), churches (44 visits), businesses (35 visits), libraries (49 visits), laundry mats (64 visits), apartment complexes and rental properties (34 visits), and about 10 visits to stores, the mall, counseling centers, and courthouses. NSCC also continues to partner with WSOS Community Action Commission on its US DOL Ready to Work grant, acting as a key training provider in support of that grant.

***Employers**:* The TAACCCT grant has changed the interaction between NSCC and employers, wherein NSCC is recognized for its efforts to align program content and delivery with employer needs for a trained workforce *now*. As previously noted, the internship program has grown from 16 to 62 students placed at employer work sites in about one year's time. Employers recognize the need to continue to convert traditional courses to the intensive hybrid format, and they recognize course conversion requires employer participation in updating course content and competencies. Employers continue to provide workplace tours as part of the student learning process, with one tour planned for each month of the fall 2018 semester as reported in staff interviews conducted July 2018. Regarding apprenticeships and OJT's, there is some reluctance by manufacturing employers to establish state-registered apprenticeship programs and to use OJT's as an incentive.

***Workforce Development**:* The role of JFS offices is to provide leadership and vision for the TAACCCT courses, with top NSCC administrators serving on WIBs and the Area 7 WDB, and having key JFS staff on campus regularly to coordinate the training and recruitment partnership they have with NSCC. The role of OMJ offices is primarily recruitment of candidates to the TAACCCT courses and the MSSC training in the Toledo area. NSCC is also now a partner with Ohio TechNet's efforts to make all of the Ohio TAACCCT schools part of Ohio's Advanced Manufacturing workforce development system.

Stakeholder Survey Results

Table 24 presents the results of the first stakeholder survey question, showing that most ***employers*** see their contributions as providing work-based learning opportunities and identifying needed workforce skills and competencies. Most ***educators*** see their role as providing equipment and facilities and educating/training participants. Besides these contributions, others were made as listed in the table. See Appendix H for the stakeholder questionnaire.

Table 24: Stakeholder Contributions

Is your role as part of this partnership to?	**Employer (*n=4*)**	**Educational Institution (*n=7*)**	**Faith-based Organization (*n=1*)**
Guide program design	1	2	0
Identify needed skills and competencies	3	1	0
Co-develop or inform/validate the curriculum	0	2	0
Recruit student participants	2	2	0
Provide student support services (e.g., individualized counseling for personal support, tutoring, and mentoring programs)	0	2	0
Educate/Train student participants	0	4	0
Provide work-based learning opportunities like internships, co-ops, on-the-job training, etc.	4	2	0
Assist in preparing student training completers for jobs (e.g., mock interviews)	1	0	0
Assist in placing student training completers in jobs/hire qualified participants	1	1	0
Provide use or access to equipment and facilities	1	4	1
Contribute resources such as supplies, materials, funding	0	0	1
Other (Please specify): One employer reported providing facility space & equipment for an electricity class, another mentioned time, one invested in a program, and another said "employment opportunities." Educators provided: student referrals, education remediation if needed; time; access to equipment and materials, expertise; setting up opportunities to create, design, then pitch concepts to on-campus clients, and set up a 30-minute meeting with two design consultants; time, materials and equipment (2 responses).	0	1	0

Source: Stakeholder Survey conducted by Wright State University

Partnership Collaboration Factors

One means of assessing program operation was via the stakeholder online survey. In a series of questions, the survey probed stakeholders about nine collaborative partnership characteristics, using the Collaboration Factors Inventory and the Coalition Effectiveness Inventory. In February 2016, early into the grant, the twenty-three stakeholders responding to the survey showed varying degrees of uncertainty about the program for all nine of the factors. In 2018, with twelve respondents (four employers, seven educators, and one faith-based organization), confidence in the partnership had grown; however, the lower number of responses could indicate less buy-in from stakeholders who did not respond (see table 25).

Table 25: Stakeholder Collaboration Factors

Stakeholder Collaboration Factors	Before Implementation 2016	After Implementation 2018
The organizations that are partnering on this IAM iSTAR effort have a history of working together.	80%	100%
My organization will benefit from being involved in this partnership.	90%	100%
Partners in this group have a clear sense of their roles and responsibilities.	65%	92%
I have a clear sense of my organization's roles and responsibilities on this initiative.	65%	92%
So far, this group is effective in making decisions and getting the work done.	65%	83%
This group is able to adapt to changing conditions such as less funds than expected or change in leadership.	45%	92%
This group has adequate funds to accomplish what it needs to do.	45%	50%
This group has adequate "people power" to accomplish what it needs to do.	45%	75%
This group has a good track record of getting the resources it needs to get a job done.	60%	83%

Source: Stakeholder Survey conducted by Wright State University

Factors that Affected Partner Involvement

Three other questions on the stakeholder survey addressed the factors that affected partner involvement and results are presented in the following three tables. The main advantages that affected employer involvement were: (1) improved image with clients, employers, and the community, (2) the ability to offer a wider range of services, (3) increased knowledge and communication across agency staff, and (4) increased efficiency and cost savings through elimination of duplicative efforts. For educators, the main advantages were: (1) the ability to offer a wider range of services; and (2) improved image with clients, employers, and the community. See Table 26.

Table 26: Advantages Experienced from the IAM iSTAR Partnership

What advantages have arisen from the IAM iSTAR partnership for Industrial Technologies training and education?	**Employer (*n=4*)**	**Educational Institution (*n=7*)**	**Faith-based Organization (*n=1*)**
Access to additional resources (additional public funding)	2	3	0
Greater flexibility in using funds	2	1	0
Ability to offer a wider range of services	3	5	0
Agencies able to specialize in areas of expertise	2	2	0
Better tracking of services received by participants across agencies	1	1	0
Enhanced ability to place student participants in jobs	1	4	0
Increased knowledge/communication across agency staff	3	4	0
Improved image with clients, employers, and the community	4	5	1
Changing the way I do my own job (becoming more reflective about what & how I do my work)	2	3	0
Enhanced performance outcomes	2	4	0
Increased efficiency and cost savings through elimination of duplicative efforts	3	2	0
Improved hiring and reduced time to hire	2	1	0
Productivity improvements due to trained employees/interns	1	4	0
Other	0	0	0

Source: Stakeholder Survey conducted by Wright State University

Disadvantages that affected one employer's experience as a partner was the time and effort involved in planning and sustaining coordination; the need to resolve interagency conflicts/turf battles; the need to maintain or create new operational procedures, client flows, and information systems; and the difficulties of having out-stationed staff (e.g., having your personnel assigned to work at the Community College). For two educators, the main disadvantage was the need to maintain or create new operational procedures, client flows, and information systems. See Table 27.

Table 27: Disadvantages Experienced from the IAM iSTAR Partnership

What disadvantages have arisen from the IAM iSTAR partnership?	**Employer (*n=4*)**	**Educational Institution (*n=7*)**	**Faith-based Organization (*n=1*)**
Time and effort involved in planning/sustaining coordination	1	1	0
Potential loss of autonomy in decision making	0	0	0
Need to resolve interagency conflicts/turf battles	1	0	0
Need to maintain or create new operational procedures, client flows, and information systems	1	2	0
Difficulties of having out-stationed staff (e.g., having your personnel assigned to work at the Community College)	1	1	0
Other	0	1	0

Source: Stakeholder Survey conducted by Wright State University

Getting to the main challenge to partner involvement and non-involvement shows that for most employers it is about time constraints, and for most educators it is a lack of resources. See Table 28.

Table 28: Most Important Challenges for Partners to Participate in IAM iSTAR

In your opinion, what have been the most important challenges for partners to participate in IAM iSTAR?	**Employer (*n=4*)**	**Educational Institution (*n=7*)**	**Faith-based Organization (*n=1*)**
Lack of time	3	1	0
Don't understand community college's policies, procedures, or challenges	2	1	0
Politics, regulations, and bureaucracy get in the way	1	1	0
Lack of resources (such as business personnel shortages or lack of funding)	0	4	0
Access channels (such as who to contact)	0	1	0
We don't know how best to help	0	1	0
Other (Please specify)	0	0	0

Source: Stakeholder Survey conducted by Wright State University

Critical to the Success of the Grant Program

The next question in the stakeholder survey addresses the extent to which the program has impacted how organizations operate. Among the four employers in the survey, two report that the IAM iSTAR credential receives special consideration at their company; two report that their company has modified its requirements for entry level hires due to the IAM iSTAR program; and two companies now regularly communicate with those involved in workforce development. The educator responses follow, with most indicating system change and improvement due to the IAM iSTAR program. See Table 29.

Table 29: How the IAM iStar Program Changed the Way the Organization Operates

How has this program changed the way your organization operates?	**Yes**	**No**
<u>For Employers:</u>		
The training or certifications are a preferred criterion for entry into jobs with our company	1	3
The credential receives special consideration with our company	2	2
Earning the credential becomes part of the promotion practice, meaning scheduled pay increases are impacted by having the certification, or the hourly rates are increased at our company	0	4
The company has modified its requirements for entry level hires due to the training program	2	2
We regularly communicate with organizations involved in workforce development	2	2
<u>For Education Institutions (6 respondents):</u>		
We have changed how we teach and how we deliver education	5	1
We have expanded the support services we offer to job seekers and students	5	1
We have increased awareness among faculty about student support services	6	0
We promote training and career pathways in new ways to students and employers	6	0
We regularly communicate with organizations involved in workforce development	5	1
We connect industries' workforce needs to curriculum and training programs	5	1

Source: Stakeholder Survey conducted by Wright State University

Question 7: What is the level of fidelity to the program; that is, was the program implemented as planned? If the program deviated, how did changes affect the output?

NSCC proposed a technical set of strategies—to convert traditional courses in the Industrial Technology program to intensive hybrid courses. The technical know-how to implement the grant came from internal talent. In several instances, the intent was to purchase commercial off the shelf products, such as curriculum content and competencies, simulators, and simulations. The commercial products were considered to be outdated, and so the internal technical team created the products themselves. Translating technical course material for a hybrid format is not commonly done and certainly is not a common service delivered by community colleges, to the extent that was accomplished by NSCC. And the technical tasks were the ones most readily accomplished. Tasks that involved policy change, such as PLA policy change, and the delivery of consistent student support services took longer to implement.

Where the program diverted from the proposed program was in terms of career coaching and student aptitude assessment. NSCC is using its currently awarded Title III funding to stand up a centralized student advising center as it moves from its traditional focus on enrollment to a focus on student success, necessitated by demographic changes affecting most of Ohio's institutions of higher education and also by Ohio's performance-based funding of community colleges. NSCC tried, under the TAACCCT grant, to use an external subcontractor to implement career coaching services, but learned that such services are better delivered when they are part of the institution's internal core services. In the last year of the TAACCCT grant, when the external career coaching position turned over for the fourth time, the NSCC project manager identified an internal expert to lead the career coaching. He is a former NSCC faculty member and therefore had a ready alliance with faculty to get in front of students during classroom time to market the career coaching services. He also transitioned the focus to career readiness, placement, and advancement, making the services relevant to incumbent worker and non-incumbent worker students alike. For example, internships are available to incumbent worker students, too, and have already led to career advancement for some students. In the year three student focus group session, students expressed a high level of satisfaction with the student support services and even more so with the internship program.

The student aptitude test was not carried out to fidelity during the TAACCCT grant. While grant staff wanted to implement WorkKeys, there was not institutional support. However, under the Title III grant, the advising model is intended to provide student assessment.

To address the need for a student assessment, the new student advising center will help students (a) develop the knowledge required to identify (or confirm) their educational goals, (b) develop an appropriate educational plan, and (c) self-monitor with advisor support their progress toward achieving those goals. The "Entry" segment of the advising center will enable students to meet with their assigned professional advisors and further develop their relationship with and connection to NSCC. Students will be asked a series of questions and complete an open-ended, self-assessment worksheet that helps the advisor provide prescriptive and intrusive advising for the student. The questions and worksheet help the student consider factors that exist that influence their progression and completion and allow the advisor to identify supportive services targeted toward the students' needs. Students, staff, and faculty of the IAM iSTAR

program agree that a suitable assessment is needed to assess participant abilities, skills, and interests. The new NSCC assessment process needs to be relevant to the Workforce Development Office as well as for the institution overall.

Question 8: To what extent are components of the program transferable and sustainable?

Transferability

Continuing Intensive Hybrid Course Conversion: Within NSCC, there is a need to hybridize all the courses in the industrial technologies program including all courses in the Associate's degree so students do not have to shift from online intensive hybrid 8-week courses to traditional sixteen-week courses. NSCC's top administration has articulated a commitment to course conversion, using college budget dollars, if not grant funding.

Sharing NSCC Know-how with Ohio TechNet: The Ohio TechNet initiative will focus on assembly of resources to support colleges in:

- Employer engagement
- Expansion of work-based learning
- Integration of models for accelerating student learning and completion, including competency-based education, prior learning assessment, modularization/stackable credentials
- Integration of models for student supportive services such as career navigation

The activities that NSCC will implement as an Ohio TechNet consortium member are to:

1. Engage employers to determine their skills and employment needs.
2. Expand work-based learning through the Apprenticeship and "High School to Manufacturing" initiatives.
3. Develop acceleration strategies that will enhance the student learning experience and get them to employment at a faster pace.
4. Further develop coursework based on intensive hybrid instructional model.
5. Assist other colleges in the consortium to convert their courses to a hybrid model.
6. Develop OER material for Ohio Colleges.

Third Party Evaluator: The engineering and technical experts at Wright State University plan to use the content that NSCC will place on Skills Commons to upgrade courses at the Wright State University Lake Campus. Therefore, one "transfer" of the IAM iSTAR program to another institution of higher education is already planned.

Sustainability Plan

The Evaluator interviewed project staff on an ongoing basis via conference calls every two weeks and via annual site visits throughout the performance period to gain a better understanding of the project's plans and approach to support sustainability. The design of the IAM iSTAR program from the outset, as well as information gathered throughout the grant years, demonstrates that project staff designed and implemented the IAM iSTAR program with sustainability in mind. The TAACCCT grant increased the capacity of NSCC and the Ohio TechNet consortium TAACCCT grant, which NSCC has joined, to sustain the programs of study that have been supported by grant funding.

Short-term sustainability of the IAM iSTAR program is ensured because TAACCCT grant funding was used to convert an existing program at NSCC, as opposed to creating a new program, while there is consistent and growing employer demand for a skilled maintenance technician workforce. Longer-term sustainability is the challenge that the core team at NSCC is wrestling with. Consistent equipment, project management, and participant navigation investments are necessary to sustain the implementation of the IAM iSTAR program to fidelity. NSCC has already become an important partner of Ohio TechNet. Ohio TechNet has developed a budget to continue the conversion of advanced manufacturing courses and has requested statewide investment in the intensive hybrid course format, supported by virtual trainers, open labs, and student advising and navigation services as the cornerstone of a statewide advanced manufacturing sector strategy and a statewide consortium for workforce development. The sustainability framework, used in Table 30 to present NSCC's sustainability position, was a joint development between NSF ATE Centers and the TAACCCT Learning Network.[29]

[29] Elaine Craft, Jennifer Freeman. "Planning for Sustainability presentation," slide 14, July 29, 2016.

Table 30: Sustainability Framework

Innovations to Sustain	Priorities they Align with	Data to Show Success	Mechanism to Sustain the Innovation
Instructional methods: • intensive hybrid • flipped courses • virtual trainers • open labs	College-wide goal: • Program model that accelerates student learning and employment outcomes	Student retention & completion: • Sakai LMS provides data intelligence for program CQI to improve student success	Formalized partnerships: • IAM iSTAR is now a formal member of Ohio TechNet
Employer partnerships: • Ongoing DACUM process with small groups of employers	Regional economic development initiatives: • IAM iSTAR within Ohio TechNet proposing to serve as a workforce development system for Ohio's Advanced Manufacturing Sector	Employer testimonials: • Sauder: "Excited about the online coursework since many employees balance work with school." • Siemens: "Really like the competency-based educational model" • Chase Brass: Wanted this done a year ago	College or statewide policy: • At NSCC, the new student advising center policies, PLA policies, the continued commitment to convert courses to the intensive hybrid format, CCMEP involvement with Ohio Means Jobs
Career planning services: • New student advising center • Entry segment with assessment & placement • Completion segment with job readiness services	Statewide higher education policies: • Ohio Performance-based Model for Higher Education and its funding	Job placements: • Statistically significantly higher percentage of job placements under IAM iSTAR • NSCC has institutionalized job readiness & placement support	Professional development (PD): • Quality Matters membership & PD • Faculty to faculty mentorship to flip & hybridize courses • PD for the new student advising center

Source: Wright State University, Third Party Evaluator

Organizational Capacity to Support a Sustained Program

Specifically, during staff and partner interviews, interviewees were asked to share how the IAM iSTAR project increased NSCC's capacity in the domains of human capacity, institutional capacity, structural capacity, and material capacity. Interview highlights follow.

Human capacity (i.e., knowledge, expertise, and understanding, as well as the will and commitment, of personnel charged with implementing the targeted change):

- Project staff shared that the TAACCCT grant has cultivated a level of expertise in the industrial technology program and the engagement of industry, workforce, and community partners.

- Top NSCC administrators have articulated their commitment to continue to convert traditional courses to the intensive hybrid format, using hard budget dollars, if grant funding is not identified.
- NSCC still needs to articulate a succession plan for the core faculty talent team of the TAACCCT grant, which was recommended by the Evaluator at the time of the Interim Evaluation. Some progress has been made on this through faculty hires.

Institutional capacity (i.e., the interaction, collaboration, and communication among members of the organization):

- The institution has created a new position within the student advising center to retain the Workplace Learning/PLA - Apprenticeship Coordinator previously funded under the TAACCCT grant. This position will ensure that the work-based learning opportunities—including the Internship Program, job readiness, and job placement activities developed under the TAACCCT grant—are scaled up to and supported by the institution. This position will spend half time off campus to continue to cultivate employer partnering for work-based opportunities.
- Furthermore, NSCC has hired the TAACCCT project manager who will coordinate NSCC's Industrial Technologies department so that knowledge gains under TAACCCT continue to benefit the college.
- Quality Matters professional development will continue to build institutional capacity for converting courses to the intensive hybrid format.
- NSCC's membership in Ohio TechNet will increase transferability of NSCC's expertise in converting traditional courses to hybrid courses across the State of Ohio.

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):

- At NSCC, the new student advising center policies, PLA policies, the continued commitment to convert courses to the intensive hybrid format, Comprehensive Case Management and Employment Program (CCMEP) involvement with Ohio Means Jobs, and NSCC's membership in Ohio TechNet are critical structural changes that occurred at NSCC due to the TAACCCT grant.
- The NSCC procurement process was improved under the TAACCCT grant and that will continue to benefit the college.

Material capacity (i.e., the fiscal resources, materials, and equipment that the organization uses to meet its needs and to implement targeted change):

- Ohio TechNet has developed a one-year budget of $154,000 for continuing to convert and deliver intensive hybrid courses in industrial technology. NSCC has a critical role in this strategy as it has committed to share its know-how across all Ohio TechNet colleges. No request for equipment funds has been made given the recent equipment upgrades made under the TAACCCT grant.

Major Findings and Key Lessons

Major Findings

IAM iSTAR accelerates participant employment. Data from the delivery methods analysis using administrative data from the Ohio Longitudinal Data Archive (OLDA),[30] which associates student higher education data and UI wage records at the individual student record, provides statistically significant evidence of a higher percentage of IAM iSTAR-TAACCCT participants getting jobs by the first quarter after exit as compared to students in the year prior to the IAM iSTAR-TAACCCT program being implemented.

The OLDA data were also used in a quasi-experimental design to compare NSCC IAM iSTAR participant outcomes to other rural Ohio college student outcomes. Analysis shows a statistically significantly higher likelihood of IAM iSTAR students in jobs by the first quarter after exit as compared to other rural Ohio college students.

IAM iSTAR participants demonstrate a statistically significantly higher likelihood of job retention. The delivery methods analysis used State of Ohio administrative records in the OLDA dataset to objectively compare student outcomes from the traditional program at NSCC (prior to TAACCCT) to the intensive hybrid program at NSCC (TAACCCT) and found a statistically significant higher likelihood of participants still employed in the second and third quarters after exit.

The OLDA data were also used in a quasi-experimental design to compare NSCC IAM iSTAR participant outcomes to other rural Ohio college student outcomes. Analysis shows again that IAM iSTAR participants are more likely to be retained in employment the second and third quarters after exit.

A similar percentage of incumbent-worker IAM iSTAR participants and traditionally trained incumbent-worker students experienced a wage increase sometime after enrollment, but there was a statistically significantly higher likelihood of a pay increase with the traditionally trained students. In terms of proportions, 94.6% of incumbent workers in the traditional program received a pay increase at any time since enrollment in the traditional program, while 86.3% of incumbent workers in the TAACCCT-funded program received a pay increase any time since their enrollment. Chi square analysis presents a significant association between course delivery format and receiving a pay increase—X^2 (1, n = 656) = 13.1191, P < .001)—indicating a higher likelihood of receiving a pay increase for those in the traditional courses versus those who enrolled in the TAACCCT-funded hybrid courses. The participants of the traditional program would have had a longer period of time to receive a pay increase since their enrollment between fall 2014 and fall 2015, as opposed to TAACCCT-funded program participants who enrolled between spring 2016 and fall 2017.

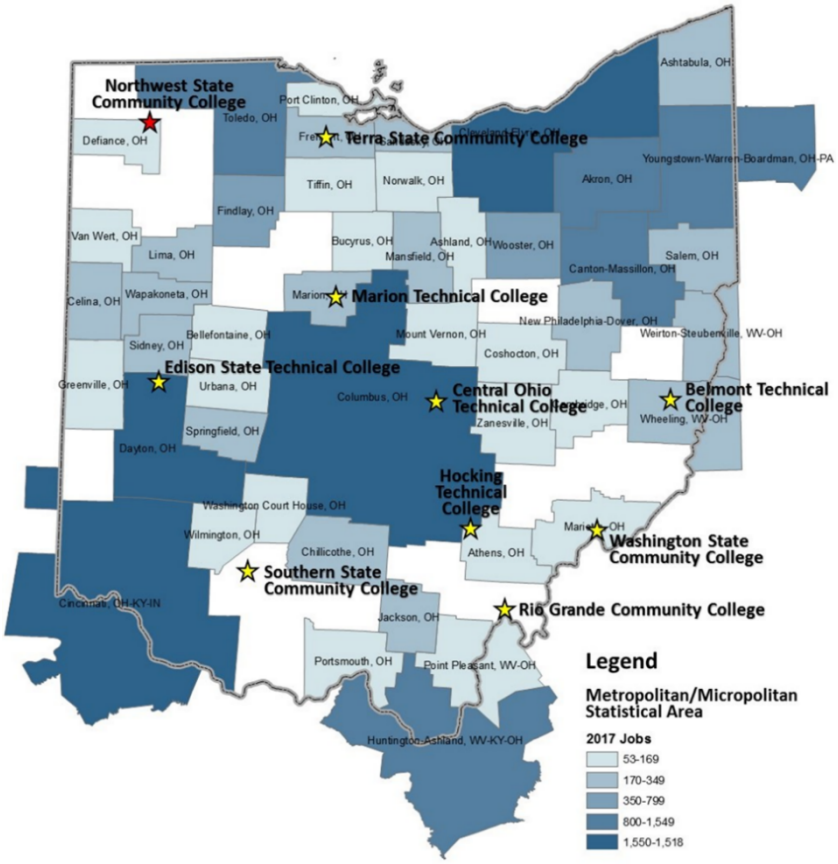
[30] The OLDA includes demographic information, cumulative credit hours, GPA, year graduated from high school, college/university attended, degree information, major field of study, course information including GPA by course, state residency status, subsidy eligibility, and financial aid information. HEI data in the OLDA are organized at the student-level and are split by year and term. The OLDA data set also includes UI wage data at the individual level (worker wages and employment) and these data are associated with the HEI data at the individual level.

A greater percentage of incumbent-worker IAM iSTAR participants received a pay increase after enrollment compared to students at other rural Ohio colleges, but the difference was not statistically significant. In the quasi-experimental design of incumbent workers, there were 233 participants in the IAM iSTAR TAACCCT-funded program and 233 students in the comparison group. The results show that 85.8% of the IAM iSTAR incumbent worker participants received a pay increase after enrollment versus 80.7% of the comparison group incumbent worker students. While this percent difference may be considered substantial in terms of real world impact, analysis identified no statistically significant difference. According to Economic Modeling Specialists International (EMSI), Ohio employs over 27,500 industrial technicians in its Metro areas and they earn $23.73 per hour on average. Industrial technicians include:

- Industrial Machinery Mechanics
- Electrical and Electronics Repairers, Commercial and Industrial Equipment
- Avionics Technicians
- Maintenance Workers, Machinery
- Electronic Equipment Installers and Repairers, Motor Vehicles
- Electrical and Electronics Installers and Repairers, Transportation Equipment

Employment opportunities for industrial technicians are primarily in the major Metropolitan Statistical Areas (MSA's) of Cincinnati, Cleveland, Columbus, Toledo, and Dayton. See Figure 17.

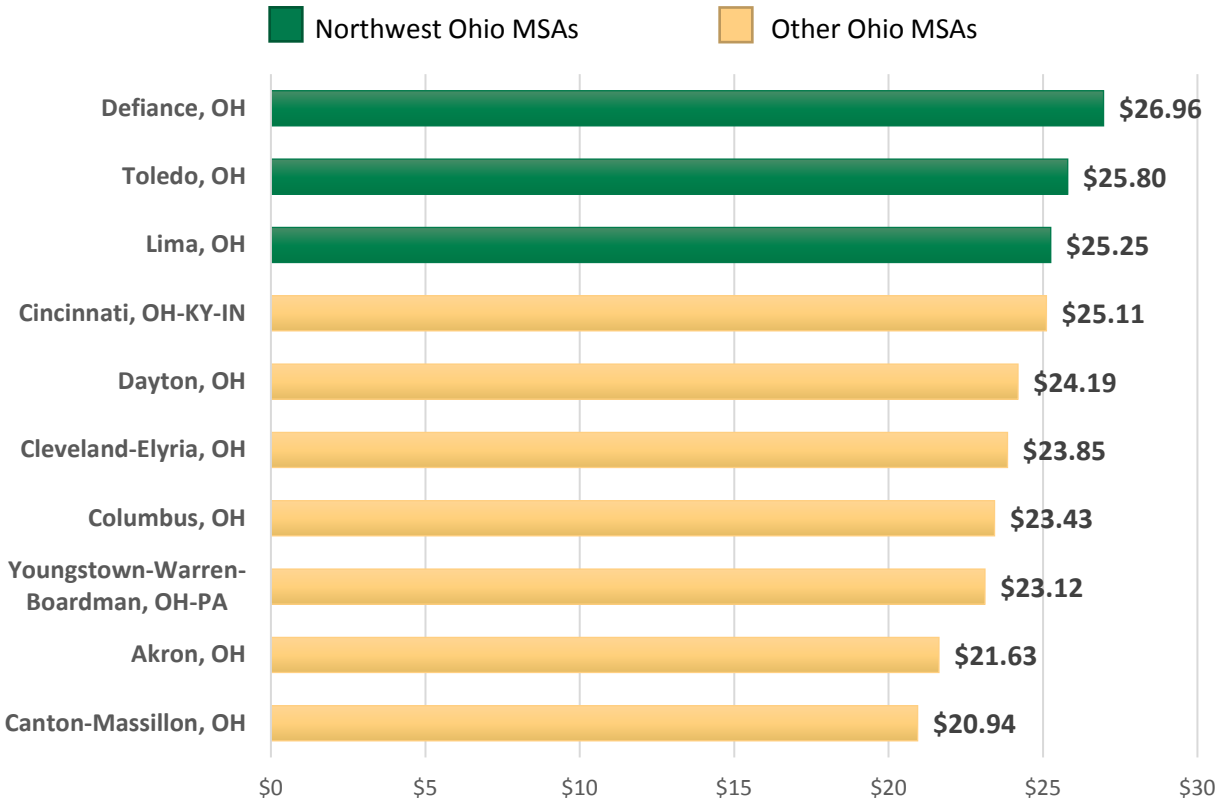
Figure 17: Industrial Technician Jobs, 2017



Source: Economic Modeling Specialists International Q3 2018 Data Set
Analysis: Wright State University Third Party Evaluator

Earnings potential for workers depends on many variables such as unionized versus non-unionized plants, supply, and demand. Rural areas in Ohio are less likely to have wide prevalence of unionized plants. But among Ohio's Metropolitan Statistical Areas, hourly earnings for these industrial technician occupations are highest in Northwest Ohio. See Figure 18 below where Defiance County MSA (where NSCC is located), Toledo MSA, and Lima MSA have the highest median hourly earnings. One employer involved with the NSCC IAM iSTAR program said, "There are no unemployed maintenance technicians in Northwest Ohio." Higher demand can increase wages for occupations.

Figure 18: Ohio Metro Area Industrial Technician Median Hourly Earnings



Source: Economic Modeling Specialists International Q3 2018 Data Set
Analysis: Wright State University Third Party Evaluator

Open lab access with on-demand access to equipment, instructors, and software is critical to easing student transition from traditional to intensive hybrid formats. Participant surveys indicate that 87% of all IAM iSTAR students – both those who enroll as incumbent workers and those who enroll as non-incumbent workers—prefer the intensive hybrid courses over traditional courses. They cite the benefits of learning at their own pace, access to material at any time, and learning more quickly with hands-on and visuals. NSCC has measured that students learn 10-15% more content in half the time now as compared to traditional course learning. Technology used to accelerate learning such as virtual trainers and simulations allow students to learn course objectives anytime, anywhere. Blending the online and intensive in-person formats is how *intensive hybrid* formats are defined. NSCC Faculty have found that time spent with students is more

in the form of one-on-one or small group-on-one, as opposed to a lack of student interfacing which they had feared by the shift away from traditional course delivery methods. The IAM iSTAR project proves that community colleges can translate traditional maintenance technician courses to intensive online hybrid courses, given the right mix of internal advanced manufacturing and IT staff and faculty talent working together. It was wise to initiate the implementation of intensive hybrid courses by translating traditional courses where the curricula was already understood rather than having to develop curricula for courses that have never been taught. This is a challenge cited in other TAACCCT grant funded projects (see McREL Advanced Manufacturing Education (AME) Alliance Evaluation: Final Evaluation Report, p. 70, 2016).

Key Lessons

Implications for Future Workforce and Education Research

- Contributions to wider learning about topics
    - A larger sample size to measure wage differentials for incumbent workers in intensive hybrid courses should be the focus of future research.
    - A comparison of traditional and intensive hybrid formats simultaneously delivered would contribute more to the comparison analysis of the two delivery formats.
    - The NSCC team had a group of innovative, IT adept faculty and staff to translate traditional courses to the intensive hybrids with all the technology-enabled supports. Future research could combine a team like this with consistent career coaching from day one so that the course transition could be the singular variable to measure.
- Implications for policy and practice
    - The US Department of Labor could utilize the expertise it has galvanized by developing a skunkworks competency-based, interactive technical learning organization. NSCC is poised to share its lessons learned and to coach other community colleges in Ohio. Can there be a similar platform at the national level?
    - The State of Ohio could facilitate a partnership between OMJ offices and community colleges around the use of WorkKeys National Career Readiness Certificate® Assessments. Leveraging ACT WorkKeys solutions is benefiting participants of job training programs in Northeast Ohio in a partnership with Lorain Community College and the OMJ offices, and that type of partnership could scale up.
- Future research questions:
    - What is the impact of student aptitude assessments on proper placement and successful performance in advanced manufacturing-related intensive hybrid courses?
    - While there has been analysis from the private sector of the efficacy of internal versus external career coaching, there is a lack of such research in the public sector and for institutions of higher education. What is the efficacy of internally versus externally (i.e., subcontractors) provided career coaching in higher education?
    - Recognizing the time lag of UI wage information, the evaluations of programs like TAACCCT need a longer time horizon in order to capture impacts. The NSCC TAACCCT grant was not fully implemented until fall 2017, and the most recent UI data are for summer 2017.

- Challenges
    - NSCC experienced challenges with the MOOC; the open lab scheduling (which ultimately was solved via the creation of scheduling software); the lack of updated technical curriculum, simulators, and simulations available via commercial products. In each case, NSCC thought that external experts and external products would solve these technical challenges. Yet in every case the team rallied to create its own technical solutions, with all of the technical course-related solutions being considered highly effective by the Evaluator's technical content experts.
    - NSCC had challenges with the career coaching intervention, due to multiple staff turnovers. A future research question listed above pertains to externally provided career coaches.
    - NSCC had challenges instituting a relevant abilities, skills, and interests participant assessment, because common assessment tools at community colleges are less viable for workforce development programs. NSCC will be implementing a new student assessment process with its Title III funding, and it would be appropriate to test and ensure its positive impact on Workforce Development students.

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Appendices

Appendix A: National Implementation Research Network (NIRN) Stages of Implementation Analysis

Exploration: How are activities mapped to student and stakeholder needs? The intent is to understand the enabling and limiting aspects of the context in which the grant is occurring. As of March 1, 2015	In Place (2)	Initiated or Partially in Place (1)	Net Yet in Place (0)	Evidence for "In Place" or "Initiated or Partially in Place" Components
Qualified Team	2			Industrial Technologies Mechanical Faculty member added
Communication plan (for internal and external groups)		1		Website needs work; outreach to Veterans and TAA eligible needs to be further developed.
Data: how NSCC initially quantified the need for the program and later, is new data informing the program		1		The CRM that was developed is not working as well as hoped.
Program is reaching the targeted population		1		Outreach to Veterans and TAA needs improvement; identify the Vet education benefits & connect to that
Program fits the employer need, workforce development need, and other needs	2			Training delivery changes are well received by partners
Program resourced at baseline:				
a. **Curriculum**	1.5			Having the instructional designer on the team is standardizing online curriculum
b. **Technology**	2			NSCC invested $3.5 million in tech upgrades from 2011-14
c. **Staffing (e.g., obtaining instructional designer)**		1		See above
d. **Training (e.g., staff professional development)**	1.5			Faculty requested PD on working with lower income students
e. **Data systems**		1		Data system doesn't identify TAA eligible students; procurement process is a challenge; custom changes to Banner will be needed
f. **Coaching**	2			WSOS ongoing partnership
g. **Admin**		1		Still need a grant accountant; TAACCCT grant is pushing changes in the procurement process—

Exploration: How are activities mapped to student and stakeholder needs? The intent is to understand the enabling and limiting aspects of the context in which the grant is occurring. As of March 1, 2015	In Place (2)	Initiated or Partially in Place (1)	Net Yet in Place (0)	Evidence for "In Place" or "Initiated or Partially in Place" Components
				there is a process in place, but its articulation is lacking.
Program has written operational definitions of essential functions	2			See the project Smart Sheet
Program has competent staff		1		Staff desire more professional development to increase their competence. More quality matters training is one example.
Program has organizational support	1.5			Under the previous US DOL grant, the program was considered outside of the campus process such as the admissions process. TAACCCT is part of the mainstream organization. Conversely, the institution supported the change from 16 to 8-week courses but the concept of moving to 4-week courses was met with skepticism.
Program has leadership support	2			The College President took a hands-on role at the March 1, 2016 partners breakfast meeting and is a champion for iSTAR
Program has buy-in of external partners	1.5			Few employers & other partners are playing a substantive role. There is still a struggle on how best to engage them.
Total:	18	7		
Overall Score:	25/32			

EXPLORATION STAGE ACTION PLANNING

What are the enabling and limiting aspects for this initiative?

Enabling Factors: Talented team, embedded program, College leadership, previous capital investments, employer demand, Partner

- Talented core team with academic and practitioner experience
- Core team has track record of delivering custom training to major companies like Campbell Soup
- The grant program will modify existing courses rather than creating a new program, and this makes it sustainable and embedded into existing College systems
- The College President is a champion for the program
- The College was awarded $3.5 million for capital and technology upgrades the 3 years prior to the TAACCCT grant
- Employers are in need of a skilled labor force as demand in manufacturing leads industry recovery out of the great recession. U.S. manufacturing output grew 38% by mid-2014, adding 646,000 jobs and recruiting to fill another 243,000
- The WSOS partnership for career coaching was already strong due to a previous US DOL grant

Limiting Factors: Personnel, Commercial Curriculum, Partners, and Data Systems

- Personnel challenges included hiring an Industrial Technologies Mechanical Faculty member and the team had to defend the hiring of an instructional designer to lead the transition to an online format
- Commercial curriculum was to be purchased, however, it was found to be outdated
- The Public workforce development system is overwhelmed due to WIOA being enacted on July 22, 2014, thus making them limited partners
- The Banner system was not designed to identify TAA students and even veterans were not easily identifiable with Banner
- The College procurement process needs improvement

A comparison between the enabling and limiting factors indicates that NSCC has a strong foundation from which to address limiting factors that are primarily process and timing challenges.

Installation: What are the structural and functional changes needed to support this program—funding, HR, policy development (like PLA), recruitment mechanisms. The degree to which the institution is aligned for staffing, hiring, space, technology. Acquire and/or repurpose resources needed. As of Fall 2016	In Place (2)	Initiated or Partially in Place (1)	Net Yet in Place (0)	Evidence for "In Place" or "Initiated or Partially in Place" Components
Identify structural and functional changes needed (e.g. policies, communication, re-allocation of roles and responsibilities, new positions needed, staff training)				
Make Structural and functional changes needed to initiate the program.				
a. **For NSCC & other colleges UT/Scott Park and Vantage**	2			
b. **For stakeholders—efforts with MEP; difficulty attracting sufficient # of SME's**		1		
c. **At the regional level—efforts with TAA rep, VA associations, OMJ offices**		1		
d. **New policies**				
1. **PLA efforts**			0	
e. **Role reallocation—IT support provided internally (Jim Lammy)**	2			
f. **New positions—Instructional Designer**	2			
g. **Staff training—regular TAACCCT conference attendance, Quality Matters college-wide training**	2			
Resource changes due to need since baseline review				
a. **Curriculum – developed August 2016**	2			
1. **Add MSSC**	2			
2. **Faculty developing online course content and supports.**		1		
b. **Technology/Equipment budget $380,308 as of 3/31/16; Equipment quote $387,205.68 as of 4/26/16**				
1. **Virtual farm up by 1/16 for PLC courses**	2			
2. **Setting up new Sakai for non-credit MOOCs**	2			
3. **8 laptops for open lab**	2			
4. **Wireless overage in open tech labs**	2			
c. **Software License $38,000 as of 3/31/16; software related activities**				
1. **Siemens S7 to work on virtual farm**	2			
2. **Sakai and iPad mini communication method**	2			
3. **Write into Sakai instantly for hands on assessments**	2			
4. **Open lab scheduling software application for student self-schedule**	2			

Installation: What are the structural and functional changes needed to support this program—funding, HR, policy development (like PLA), recruitment mechanisms. The degree to which the institution is aligned for staffing, hiring, space, technology. Acquire and/or repurpose resources needed. As of Fall 2016	In Place (2)	Initiated or Partially in Place (1)	Net Yet in Place (0)	Evidence for "In Place" or "Initiated or Partially in Place" Components
5. **Automate the virtual farm allocation/assignment**	2			
d. **Staffing -- Industrial Technologies Mechanical Faculty member added**	2			
e. **Data Systems**				
1. **Student ID scanning for open tech lab**	2			
f. **Coaching**				
1. **New WSOS member**	2			
g. **Admin**				
Analyze and problem solve around the sustainability of staffing, training, coaching, technology and data systems.	2			Ongoing
Establish and improve communications to guide the initial implementation phases	2			Ongoing
Total:	45			
Overall Score:	45/50			

Initial Implementation: Try out the program and gain lessons learned at the practice level, the organization level, and the systems level As of Spring 2017	In Place (2)	Initiated or Partially in Place (1)	Net Yet in Place (0)	Evidence for "In Place" or "Initiated or Partially in Place" Components
Communication plan(s) developed to inform stakeholders of activities (school-business communications, workforce development and other stakeholder communications, etc.)		1		Ongoing communication w/businesses, school partners, etc. Still need to find meaningful way to partner w/public workforce development
Communication protocols developed for identifying barriers and adaptive challenges and problem solving	2			Organized as work group meetings vs. staff meetings to optimize on-topic engagement: faculty, IT, PLA, quarterly reporting
Leadership develops support plan to promote ongoing efforts.	2			Strong leadership support; VP, Dean involvement
Participant assessment in place (of abilities, skills & interests)				
a. **What tools are used**			0	NSCC has not identified an effective abilities/ skills/interests assessment tool. Students asked for this during evaluator interview.
b. **Who conducted the assessments**				NA
c. **How were assessment results used (e.g. used for program and course sequencing).**				NA
PLA Assessment in place				Hired a grant-funded employee in a one-year appointment to lead the effort to change PLA policy. Addressing how to incentivize instructors such as an independent study contract and scheduling while instructors are in the lab.
a. **What tools were used?**		1		
b. **How were assessment results used (e.g. used for program and course sequencing)**				NA
Coaching system (personnel, communications, sequence of activities/support)	2			WSOS ongoing working relationship. Students indicate they interact with Coach at the beginning of their education.

Initial Implementation: Try out the program and gain lessons learned at the practice level, the organization level, and the systems level As of Spring 2017	In Place (2)	Initiated or Partially in Place (1)	Net Yet in Place (0)	Evidence for "In Place" or "Initiated or Partially in Place" Components
There is a written coaching plan	2			The plan is more focused on financials & personal needs
Student support services are in place (individualized counseling, tutoring and mentoring)		1		NSCC is preparing a new Study area for veterans. Generally, students turn to their advisor for guidance; students are requesting additional f-2-f instructor tutoring/ support. Opportunities must be widely, clearly communicated.
Revisions recommended based on these "pilot" results:				
a) **Recruitment and selection**	2			Not sustainable yet without Sarah
b) **Training of staff & participants**		1		Sometimes there is a breakdown in supervision or accountability due to many position changes. 190 position changes in the last 5 years among 140 employees.
c) **Coaching processes**	2			Integrated as orientation in each class
d) **Outcome data measures**	2			In the movement from 16 to 8 week courses the Banner system does not indicate non-degree seeking students and this affects performance metrics
e) **Policy changes**		1		PLA perspectives differ between faculty & CTS
f) **Leadership support strategies**	2			NSCC allocated a VP to the TAACCCT initiative; other leaders are involved as well.
Level of fidelity of program model				
a. **Is the program deviating? If yes, why? How did changes affect outputs?**				The grant implementation follows multiple evidence based models--the core model to this intervention is the hybrid model of education delivery. The 8 week courses are rolling out according to plan, yet it has "created culture shock." The hybrids are preferred by students and employers;

Initial Implementation: **Try out the program and gain lessons learned at the practice level, the organization level, and the systems level** **As of Spring 2017**	**In Place (2)**	**Initiated or Partially in Place (1)**	**Net Yet in Place (0)**	**Evidence for "In Place" or "Initiated or Partially in Place" Components**
				however, faculty are adjusting. It is not unusual to experience some faculty resistance. (See article from Inside Higher Education.) It is commonly true that faculty who experience online learning are more favorable to it. Supports are needed and recommendations from the evaluator have been provided.
Total:	16	5		
Overall Score:	21/28			

INITIAL IMPLEMENTATION STAGE ACTION PLANNING

What should we do to further strengthen our Initial Implementation Process? Are there Initial Implementation Activities we need to revisit? What are the "next right steps" to engage in or revisit Initial Implementation Activities?

- Initial implementation challenges:
  - Communicating open lab times—developing software so that students can see when open labs are. Standard communication to students works best through the LMS. Other forms of communication such as institutional email to students are not as successful.
  - Communicating additional instructor or lab tech help times.
  - Transition to 8-week hybrid classes is mainly a big winner with students, but there is some faculty concern.
  - How to get access to the next course for students who complete courses early; how to communicate the impact of financial aid as the reason to only opening up 3 lessons into the next course.
  - Great quality equipment, but insufficient quantity.
  - In Robotics, the quantity problem leads to access problems. At times, multiple students have to watch as one student interacts with the equipment.
  - PLA is a work in progress.
  - Participant assessment (of abilities, skills & interests) deemed necessary by student peers and is a best practice component of workforce development plans, but NSCC administration still using standard college assessment which does not meet the needs of TAACCCT participants.
  - Time to hone in on sustainability

Full Implementation: Fully operational, fully staffed, full participant load; recruitment flourishing; staff including consultants are carrying activities out with all the training they need; managers & administrators are supporting and facilitating program success; community embraces program. As of Spring 2018	In Place (2)	Initiated or Partially in Place (1)	Net Yet in Place (0)	Evidence for "In Place" or "Initiated or Partially in Place" Components
Monitoring and support systems				
a. **Recruitment and Selection**	2			In 2017 the career coach (CC) died suddenly, and there was no CC for 6 months. This affected data collection for the outcome evaluation as well as individual student plans, and career readiness support. PLA/Apprenticeship coordinator took over.
b. **Candidate assessment (skills, abilities, interests)**			0	NSCC did not install a candidate assessment tool. There is program interest but not institutional support for Work Keys
c. **PLA assessment**	2			PLA/Apprenticeship Coordinator was hired 8/2017. PLA policies approved by College cabinet, which is a combination of portfolio and hands on assessment.
d. **Student support services**	2			Individualized plans, referrals to tutoring, resume assistance, and career management skills training were provided
e. **Training of staff**	2			Instructor training & adjustment to intensive hybrid environment via QM. Instructors who could not adjust moved on to other colleges or traditional programs
f. **Training of Participants**	2			Students learning 10% more content in ½ the time via virtual trainers & simulations

Full Implementation: **Fully operational, fully staffed, full participant load; recruitment flourishing; staff including consultants are carrying activities out with all the training they need; managers & administrators are supporting and facilitating program success; community embraces program.** **As of Spring 2018**	**In Place (2)**	**Initiated or Partially in Place (1)**	**Net Yet in Place (0)**	**Evidence for "In Place" or "Initiated or Partially in Place" Components**
g. **Coaching processes/career guidance**	2			PLA/Apprenticeship coordinator provided job prep & placement guidance; internships became centralized, increasing from 16 internships in spring 2017 to 117 with 50 placements in spring 2018
h. **Outcome data measures**		1		Students reticent to share employment & pay information. NSCC still has not submitted request to JFS for the data. Wright State data sharing arrangement being used instead
i. **Policy changes**	2			Quality Matters—established guidelines for course conversion to online formats; PLA—hands on PLA option available and marketed to all non-credit custom training students; CCMEP involvement with 6 county WIB offices; Open lab scheduling enables collaborative and mutually enriching connections among students and faculty; Articulation to bachelor's programs; Work with Ohio TechNet to establish a statewide sector strategy and a statewide consortium for workforce development.
j. **Leadership support strategies**	2			Make presentations to leadership to demonstrate the future of education; work with the statewide

Full Implementation: Fully operational, fully staffed, full participant load; recruitment flourishing; staff including consultants are carrying activities out with all the training they need; managers & administrators are supporting and facilitating program success; community embraces program. As of Spring 2018	In Place (2)	Initiated or Partially in Place (1)	Net Yet in Place (0)	Evidence for "In Place" or "Initiated or Partially in Place" Components
				consortium to deliver the TAACCCT funded programs as a workforce development model in support of Ohio's Manufacturing industry
Feedback processes (stakeholders, students, employers).	2			NSCC holds industry round tables to obtain continuous curriculum feedback from employers; NSCC uses LMS to identify student struggles with content to inform the development of new learning objects to aid learning
Impact data are reported and used to make decisions.	2			Collect impact data on the MOOC, simulations
Improvement processes are employed	2			Course content delivery is improved immediately in response to knowledge and hands-on assessment results
Fidelity to the program model is sustained.	2			The program model was developed to be sustainable in that new programs were not developed, but rather existing courses were modified to an intensive hybrid format, with virtual trainers, open labs, & career coaching
a. **Is the program deviating? If yes, why? How did changes affect outputs?**				Equipment/IT based innovations are to be sustained via a proposal with Ohio TechNet to philanthropists and ultimately the State. In the near term, the more vulnerable investment is in project management to ensure

Full Implementation: **Fully operational, fully staffed, full participant load; recruitment flourishing; staff including consultants are carrying activities out with all the training they need; managers & administrators are supporting and facilitating program success; community embraces program.** **As of Spring 2018**	**In Place (2)**	**Initiated or Partially in Place (1)**	**Net Yet in Place (0)**	**Evidence for "In Place" or "Initiated or Partially in Place" Components**
				ongoing fidelity and career coaching (i.e., personnel)
Total:	24	1	0	
Average % in Each Category-Strength of Exploration Score:				
Overall Score:	25/28			

FULL IMPLEMENTATION STAGE ACTION PLANNING

What should we do to further strengthen our Full Implementation Process? Are there activities we need to revisit? What are the "next right steps"?

NSCC leveraged its talented core team to make this TAACCCT grant successful in out-performing most of its proposed outcomes. This team updated the curriculum with employer input and feedback, having found the commercial curriculum to be out of date. Faculty organized course summaries and a list of course competencies for employers to react to, to streamline employer involvement.

Faculty again turned to commercial options for simulators, but simulators and simulations were also found to be outdated. Faculty designed and programmed their own simulators and simulations. This capability and success raised NSCC to national visibility, as TAACCCT requested NSCC to mentor another college in Nebraska that was pursuing development of simulations.

Now that the NSCC program is an intensive hybrid format, the Sakai system provides data intelligence to the faculty leadership team so that they know immediately where students struggle. Faculty then create learning objects, including YouTube videos, in response to student needs, and then chart student performance via 40 new knowledge and hands-on assessments.

CCMEP involvement with 6 county WIB offices is a solid step toward a true partnership with public workforce development. NSCC is also working with Ohio TechNet to establish PLA links in the Ohio Means Jobs portal. Up until now, the partnership with public workforce development has impacted the NSCC TAACCCT grant outcomes in less substantive ways, save for partnering for participant recruitment.

The Partnership with WSOS to provide career coaching was originally thought to be a strength of the NSCC TAACCCT grant, but due to regular staff turnover, such as a career coach passing away unexpectedly, the impact of the career coaching was affected. NSCC's recent Title III grant award will invest in a centralized advising center including initial and regular student assessment, in response to lessons learned under the TAACCCT grant among other experiences.

Short-term sustainability of the program as-is is ensured because the grant updated an existing program at NSCC as opposed to creating a new program, where there is consistent and growing employer demand for a skilled workforce. Longer-term sustainability is the challenge that the Core Team is wrestling with. Consistent equipment, project management, and career coaching investments are necessary to sustain the implementation of this program to fidelity. NSCC has already become an important partner of Ohio TechNet, providing a budget for statewide investment in this intensive hybrid format, supported by virtual trainers, open labs, and career coaching as the cornerstone of a statewide manufacturing sector strategy and a statewide consortium for workforce development.

Appendix B: Quality Matters Results

Northwest State Community College

PLC200-020 Evaluation

August 2016

OVERALL FEEDBACK

The course is well organized and easy to navigate. The consistent design will make it easy for students to proceed through the modules. Here are some suggestions you might want to consider to make some improvements:

GENERAL STANDARD 1

COURSE OVERVIEW AND INTRODUCTION

1.1 Instructions make clear how to get started and where to find various course components.

- POSITIVES:
  1) There is a general course overview included on the home page.
  2) The "NSCC Industrial Technologies Hybrid Learning Environment.pdf" includes a depiction table that shows the relationship between the online and face-to-face portions of the class.
- SUGGESTIONS:
  1) I would recommend moving the "Start Here" to the top of your menu on the left side so that it is the first item students see above the "Syllabus".
  2) I would recommend including more information in your "Start Here" such as directing them to the syllabus, instructor contact information, technical help information, and important aspects of the class to review.
  3) Are there any drivers that your students need to download or update to be able to complete the course (ex- watching videos or completing simulations)? If so, this information should be included in the "Start Here".
  4) I would recommend including the instructor introduction in the "Start Here" area. New students to the class need to form an immediate connection to the instructor and need to know the instructor contact information if questions or issues come up, so it should be one of the first things students see. I would also recommend including a short video of introduction in the "Start Here" area giving a short overview of the "big ideas" of the class and maybe some personal information about the instructor.
  5) I would include instructions for the students that they need to purchase the textbook Introduction to the ControlLogix Programmable Automation Controller by Gary Dunning. I would also include this in the syllabus as currently it says that no textbook is required.

1.2 Learners are introduced to the purpose and structure of the course.

- POSITIVES:
  1) The "Start Here" did a good job at giving students information about their flexible learning options so they know they are not limited by the weekly format.
- SUGGESTIONS:
  1) I would recommend including a course calendar that includes a summary of all course activity. It should include online quizzes, face-to-face exams, and any other requirements they have while enrolled in the course. This might be a "Suggested Schedule" since students have flexible learning options.
  2) I would also recommend coming up with a firm schedule that outlines a weekly schedule that has firm deadlines. Students should be able to work ahead if they have some work conflicts and certainly instructors can grant extensions if needed. By having a firm schedule with specified dates, students will be working on the same information and practicing the same skills. This will allow students to build a stronger sense of community if they are going through the course at the same pace. It is not uncommon for students to procrastinate and try to wait to complete course activities until the last minute. The students might be able to successfully do a couple of crash sessions to complete the course, but this does not give them the time to reflect and process information and work collaboratively with their classmates.

1.3 Etiquette expectations (sometimes called "netiquette") for online discussions, email, and other forms of communication are clearly stated.

- POSITIVES:
  1) The "Syllabus" included explicit information about how the instructor will communicate with the class and also outlined the communication expectations of the student.
- SUGGESTIONS:
  1) I would recommend including a "Statement of Professional Conduct" that outlines the behaviors expected by your students while in the program. Information about cultural differences, civility, or other expected behaviors. EXAMPLE: Students in the [Put name here] program are expected to maintain the highest levels of professional conduct throughout their study and subsequently in their professional careers. All students are expected to support and contribute to a collegial environment within the program and extend that collegial work to partners and affiliating organizations. Students are expected to attend to their own personal wellbeing, conduct themselves as reflective practitioners, display integrity, and align their actions in accordance with the ethical standards of the profession. Questions regarding the educational statement of professional conduct should be directed to your academic advisor or to the program director. Students should treat all members of our learning community with respect, dignity, and courtesy. Students in this program should:
     - Display a positive, cooperative, and cordial attitude.
     - Be prepared for and actively participate in class discussions and

activities.

- Avoid engaging in negative, disparaging, or potentially harmful communication regarding others.
- Avoid any activity which may tend to bring discredit to oneself, the university, the department, or the program.
- Avoid academic misconduct and impropriety.
- Comply with all university, department, and program regulations and policies.

1.4 Course and/or institutional policies with which the learner is expected to comply are clearly stated, or a link to current policies is provided.

- POSITIVES:
  1) The "Start Here" includes a "Shop Safety Agreement" that thoroughly outlines the regulations that students need to follow in the lab. It also requires students to download and sign the form to provide evidence they have read and understand the agreement. The name for these shop safety regulations is listed as the document name. I would recommend changing the posted name of this document to something more meaningful for the students to something like "Shop Safety Regulations" instead of "ShopSafetyRegs-Groups.docx".
- SUGGESTIONS:
  1) I would recommend including information about other policies such as Academic integrity (what happens if they are caught cheating), lack of logging onto the system, lack of attendance to face-to-face exams, student grievance and grade appeal procedures, technology policy, what happens if students get an incomplete, what happens if student has personal emergency, etc. Students could even take an "honor code" quiz agreeing to the course/program policies. This could be done in the first class if the policies are the same for every class in the program.

1.5 Minimum technology requirements are clearly stated and instructions for use provided.

- POSITIVES:
  1) The "Sakai Student Guide" includes information about recommended browsers, how to contact the Distance Learning Office and how to contact the help desk.
- SUGGESTIONS:
  1) I would recommend including a list (with links) to any drivers that students need to download to watch videos or run simulations for this class.
  2) There are two links to the Sakai Student Guide listed close to each other in the "Start Here". I would recommend removing one.

1.6 Prerequisite knowledge in the discipline and/or any required competencies are clearly stated.

- POSITIVES:
  1) The Prerequisite class (IND 120 Industrial Electricity I) is listed in the "Syllabus".
- SUGGESTIONS:
  1) No recommended changes.

1.7 Minimum technical skills expected of the learner are clearly stated.

- POSITIVES:
  1) In the "Syllabus", the general expectations of the student list that students are expected to log-in to the course on at least 5 different days and check Announcements, Messages, and Forums.
- SUGGESTIONS:
  1) Are there minimum computer requirements to run the simulation or videos? If so, these should be listed.

1.8 The self-introduction by the instructor is appropriate and is available online.

- POSITIVES:
  1) The course "Syllabus" includes the instructor's name, office, phone, and email.
  2) The instructor has posted an introduction in the "Forums" area.
- SUGGESTIONS:
  1) I would also recommend having the instructor include a short video that welcomes students to the class. The instructor introduction information should be included in the "Start Here" page.

1.9 Learners are asked to introduce themselves to the class.

- POSITIVES:
  1) There is a posting in the "Forums" that asks students to introduce themselves to the class.
- SUGGESTIONS:
  1) I would recommend adding a list of specific activities students need to complete in the "Start Here". One of the activities should be to go to the "Forums" and post an introduction. I didn't see the students directed to complete this activity anywhere in the class.

GENDERAL STANDARD 2
LEARNING OBJECTIVES (COMPETENCIES

2.1 The course learning objectives, or course/program competencies, describe outcomes that are measurable.

- POSITIVES:
  1) The course objectives are listed in the "Syllabus" document. They are written using measurable verbs and are also written in terms that are easily understandable by the students.
- SUGGESTIONS:
  1) No recommended changes.

2.2 The module/unit learning objectives or competencies describe outcomes that are measurable and consistent with the course-level objectives or competencies.

- POSITIVES:
  1)
- SUGGESTIONS:
  1) There are not module/unit objectives listed for each of the modules. The module objectives should align with the course objectives and be more specific than the course objectives. The module learning objectives should describe the students' objectives in specific terms for what they should complete for that specific module.

2.3 All learning objectives or competencies are stated clearly and written from the learner's perspective.

- POSITIVES:
  1) The course objectives are clearly stated and written in a format that students will easily understand.
- SUGGESTIONS:
  1) The course should have competencies for each module that align with the course objectives and are targeted to that specific module.

2.4 The relationship between learning objectives or competencies and course activities is clearly stated.

- POSITIVES:
  1) The course activities align with the course competencies.
- SUGGESTIONS:
  1) The course needs module learning objectives.

2.5 The learning objectives or competencies are suited to the level of the course.

- POSITIVES:
  1) This is a 200 level course that is designed to study the installation, programming, and troubleshooting of programmable controlled system. The course objectives are suited to this level student and also suited to meet the "big idea" of the course.
- SUGGESTIONS:
  1) No recommended changes to the course learning objectives. My only recommendation would be to add module learning objectives.

GENERAL STANDARD 3
ASSESSMENT AND MEASUREMENT

3.1. The assessments measure the stated learning objectives or competencies.

- POSITIVES:
  1) The assessments do a good job measuring the stated course learning objectives.
- SUGGESTIONS:
  1) No recommended changes for the course learning objectives as the course learning objectives are measured by the assessment. However, there are no module learning objectives, so these need to be added.

3.2. The course grading policy is stated clearly.

- POSITIVES:
  1) The course grading policy is listed in the "Syllabus".
  2) The course includes a list of all tests and activities that students must complete in the "Course Content"/ Module.
- SUGGESTIONS:
  1) I would recommend adding more detailed assessment and measurement policies. For example, what happens if the student doesn't pass one of the hands-on assessments at 100% as the syllabus states? Is the student permitted to retake the hands-on assessment? This needs to be clarified. Also, you don't mention if students are permitted to work together while taking quizzes or practicing in the lab. This should be clarified. Also, what happens if students are caught cheating. An academic integrity policy should be included.

3.3. Specific and descriptive criteria are provided for the evaluation of learners' work and are tied to the course grading policy.

- POSITIVES:
  1) There is a KAA Study guide that gives students a study guide to help them know what they will be quizzed on for each module.
  2) There is a "Skills Task" that is listed for each Hands-on Assessment that will service as a rubric for students to let them know the criteria for their hands-on assessments.
- SUGGESTIONS:
  1) No recommended changes.

3.4. The assessment instruments selected are sequenced, varied, and suited to the learner work being assessed.

- POSITIVES:
  1) The assessments are adequately sequenced, varied, and suited to the learning work being assessed. The "hands-on" assessment measures to make sure that students can meet the course learning objectives where students need to be able to install, program, and troubleshoot a PCS. A multiple-choice

test simply would not measure this and the "hands-on" assessments require students to demonstrate their mastery of this course learning objective. The multiple-choice quizzes allow students to demonstrate their mastery of the PLC vocabulary.

- SUGGESTIONS:
  1) No recommended changes on the assessments themselves. My only recommendation would be to include a link for the multiple-choice quiz in the list of module activities found in the "Course Content".

3.5. The course provides learners with multiple opportunities to track their learning progress.

- POSITIVES:
  1) Module Knowledge & Application Assessments:
     Students are given a study guide to allow them to independently check their content knowledge before taking the KAA quiz.
  2) I am assuming that the KAA quizzes give students immediate feedback since they are posted in the learning management system. If this is an incorrect assumption, I would recommend activating the quiz feedback tool to give students robust feedback.
  3) Hands-On Assessments:
     Students complete lab assignment to prepare themselves for the hands-on assessment. This gives them an opportunity to track their learning progress. Students also have a check list of the skills they will be required to demonstrate during the "hands-on" assessment. Therefore, students can independently complete the "hands-on" activities as many times as they wish to check their own learning progress before taking the "hands-on" assessment.
- SUGGESTIONS:
  1) No recommended changes

GENERAL STANDARD 4
INSTRUCTIONAL MATERIALS

4.1. The instructional materials contribute to the achievement of the stated course and module/unit learning objectives or competencies.

- POSITIVES:
  1) The instructional materials align well to help students master the course objectives.
- SUGGESTIONS:
  1) There needs to be module learning objectives added to the course.

4.2. Both the purpose of instructional materials and how the materials are to be used for learning activities are clearly explained.

- POSITIVES:
  1) The class is designed with a consistent structure, so students can easily find the instructional materials for the course (except for the information about setting up the virtual machine).
- SUGGESTIONS:
  1) Setting Up Your Virtual Machine:
     I would recommend including the information about setting up your virtual machine for PLC200 in the Module #1 area. It was too easy to miss this information in the "Announcements" area.

4.3. All instructional materials used in the course are appropriately cited.

- POSITIVES:
  1) The textbook (Introduction to the ControlLogix Programmable Automation Controller) is properly cited with author and publisher.
  2) The link to the vendor material from Allen Bradley is properly cited.
- SUGGESTIONS:
  1) No suggested changes. 4.4.

The instructional materials are current.

- POSITIVES:
  1) Textbook is the most current edition.
- SUGGESTIONS:
  1) The Allen-Bradley SLC 500 Instruction Set has a publication date of September 2001. I went online and found another one published with 2008 date (http://literature.rockwellautomation.com/idc/groups/literature/documents/rm/ 1747-rm001_-en-p.pdf). Is there a reason why the older publication is used?

4.5. A variety of instructional materials is used in the course.

- POSITIVES:
  1) Videos, books, manuals, simulations, and other material give students a variety of instructional materials to help master the learning objectives.

- SUGGESTIONS:
    1) No recommended changes.

4.6.The distinction between required and optional materials is clearly explained.

- POSITIVES:
    1) It is clear that the KAA quizzes and hands-on assessments are mandatory assignments.
- SUGGESTIONS:
    1) The syllabus states that there is no required textbook. However in Module #6, Module #7, students are directed to read several chapters from the textbook, Introduction to the ControlLogix Programmable Automation Controller by Gary Dunning to have the knowledge and skills to pass the KAA quiz. You need to clarify if the readings from the textbook are required or optional. If the readings are required, you should include instructions for the students that they need to purchase the textbook in the "Start Here". The syllabus needs to be updated to include the textbook also.
    2) I don't see anywhere in the course where students are directed to use the Virtual Machine. Is this required or optional?

GENERAL STANDARD 5

COURSE ACTIVITIES AND LEARNER INTERACTION

5.1. The learning activities promote the achievement of the stated learning objectives or competencies.

- POSITIVES:
  1) The learning activities require students to have quizzes to demonstrate their knowledge and also hands-on assessments to demonstrate their mastery. These activities align to promote students achieve the stated learning objectives.
- SUGGESTIONS:
  1) No recommended changes.

5.2. Learning activities provide opportunities for interaction that support active learning.

- POSITIVES:
  1) This course is designed so students have consistent activities throughout the course. However, since students have a mix of "book" learning and hands-on, there is enough variety to keep them engaged but enough consistency to keep it easy for students to complete.
- SUGGESTIONS:
  1) No recommended changes

5.3. The instructor's plan for classroom response time and feedback on assignments is clearly stated.

- POSITIVES:
  1) In the syllabus, the instructor lists his general expectations as posting the HOA grade within 24 hours of student completion. This is a reasonable time for students to expect to receive their grades. The KAA quizzes are automatically graded, so students get these grades automatically.
- SUGGESTIONS:
  1) No recommended changes.

5.4. The requirements for learner interaction are clearly stated.

- POSITIVES:
  1) Clear expectations for learner interaction with log-in is posted.
  2) Clear expectations for how learners post all assignments is posted.
  3) Clear expectation for how learners complete assignments.
- SUGGESTIONS:
  1) The learners are currently given the flexibility to complete the KAA quizzes and Hands-on assignments when they wish. While there is a suggested schedule, I would recommend firming up this schedule as it provides student a clear expectation how learners interact with course assignments. Having all students working on the same assignments throughout the class will encourage stronger interaction and community

between the learners as they will be working on the same content and have opportunities to collaborate.

2) Forum Discussions: The syllabus states that there is a separate handout that discusses student responsibility for student discussion. Students are asked to post and initial response to a discussion prompt and then comment or analyze responses from other students. Students are asked to post their responses over a span or risk penalization if the posts are done in one day. This is an excellent way to encourage learner-learner interaction. However, I don't see where the discussion topics are posted.

GENERAL STANDARD 6
COURSE TECHNOLOGY

6.1.The tools used in the course support the learning objectives and competencies.

- POSITIVES:
    1) The design of the online course within the Sakai learning management system is well laid out and will help support the learning objectives.
    2) The quizzes, virtual machine, videos and other technologies used will help support the learners mastery of the learning objectives.
- SUGGESTIONS:
    1) No recommended changes.

6.2.Course tools promote learner engagement and active learning.

- POSITIVES:
    1) The technology and course tools require students to independently complete the course material which requires them to become active learners.
- SUGGESTIONS:
    1) No recommended changes. 6.3.

Technologies required in the course are readily obtainable.

- POSITIVES:
    1) The technologies used were readily obtainable.
- SUGGESTIONS:
    1) No recommended changes.

6.4. The course technologies are current.

- POSITIVES:
    1) The course technologies were current.
- SUGGESTIONS:
    1) No recommended changes.

6.5.Links are provided to privacy policies for all external tools required in the course.

- POSITIVES:
    1) All links successfully launched to the intended sites and information.
- SUGGESTIONS:
    1) No recommended changes.

GENERAL STANDARD 7
LEARNER SUPPORT

7.1. The course instructions articulate or link to a clear description of the technical support offered and how to obtain it.

- POSITIVES:
  1) In the Sakai Student Guide, there is information about how to contact the Distance Learning Office and also the Technology Help Desk.
- SUGGESTIONS:
  1) I would recommend putting the information about how to contact the Distance Learning Office and the Technology Help Desk in the syllabus and also the "Start Here". This is information you want students to have readily available to them so they can get support when they need help.

7.2. Course instructions articulate or link to the institution's accessibility policies and services.

- POSITIVES:
  1) The course syllabus includes information about accessibility policies and how the learners can contact accessibility services.
- SUGGESTIONS:
  1) No recommended changes.

7.3. Course instructions articulate or link to an explanation of how the institution's academic support services and resources can help learners succeed in the course and how learners can obtain them.

- POSITIVES:
  1) The contact information for the instructor is listed in the syllabus.
  2) There is information about how students find the lab each week.
  3) There is information about the mini-group learning sessions.
- SUGGESTIONS:
  1) The course says that the instructor will have office hours and is available to take phone calls, do a webinar, or video through Google Hangouts. The times for his office hours are not posted anywhere in the class.

7.4. Course instructions articulate or link to an explanation of how the institution's student services and resources can help learners succeed and how learners can obtain them.

- POSITIVES:
  1) In the Sakai Student Guide, there is information about how to contact the Distance Learning Office and also the Technology Help Desk.
- SUGGESTIONS:
  1) I would recommend creating a page that can be added to all online classes that outlines the support services available for students. Students are not always aware of the support that is available to them (especially working online students). I would recommend including information such as links to the academic calendar, campus bookstore, bursar, career services, standards and student conduct policies, counseling center, legal services,

library support, police support, Registrar, Student Services, Student Support, campus ID card, parking, and any other student services that might be important for students to know about. You can list the offices, give a short description, phone, email, and web site.

GENERAL STANDARD 8
ACCESSIBILITY AND USABILITY

8.1. Course navigation facilitates ease of use.

- POSITIVES:
  1) Course navigation is easy to use and well laid out.
- SUGGESTIONS:
  1) I would recommend moving the "Start Here" to the top above the "Syllabus". The "Start Here" needs to include more robust information that the students' needs to know to be immediately successful in the class.

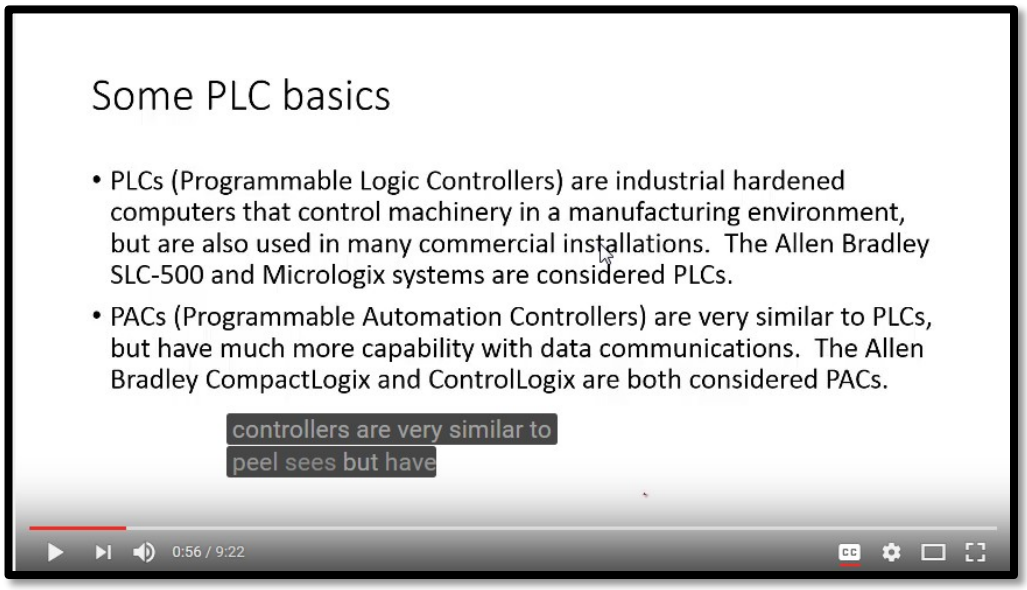
8.2. Information is provided about the accessibility of all technologies required in course.

- POSITIVES:
  1) Information about how to contact the office of disabilities is included in the syllabus.
- SUGGESTIONS:
  1) How would students with physical disabilities complete the hands-on assignments? Is this something you need to consider?
  2) Have you checked to see if the virtual machine is accessible for students with disabilities? If it is not, do you have an equal and equivalent activity? Is this something that needs to be considered?

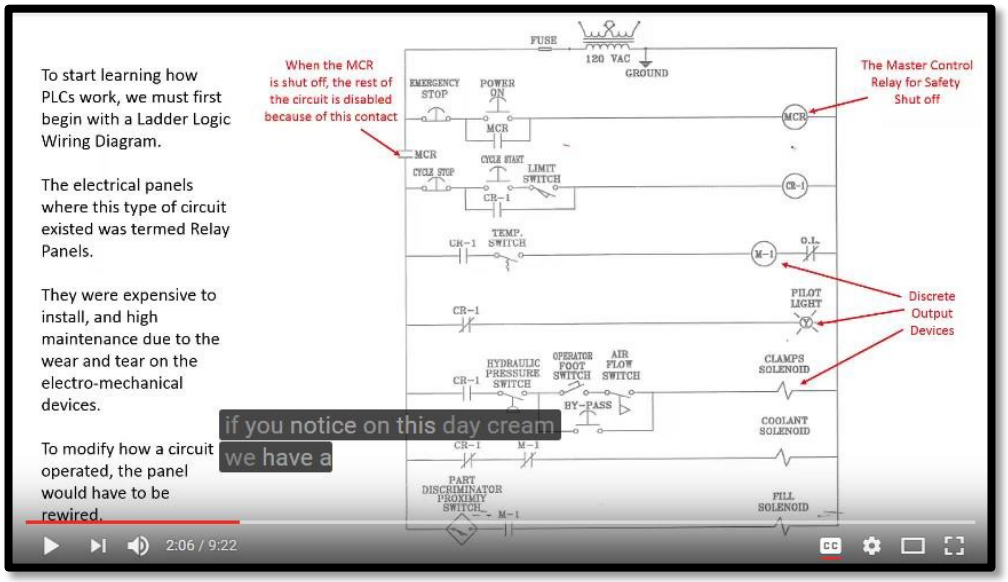
8.3. The course provides alternative means of access to course materials in formats that meet the needs of diverse learners.

- POSITIVES:
  1) The Sakai LMS is well laid out and meets the needs of diverse learners.
- SUGGESTIONS:
  1) There are some YouTube videos that were created by others outside your institution that is using the "auto generate" tool that is not accurate enough. I would recommend typing up the transcript and including a document with the transcript audio narration.
  2) The closed captioning for the videos appears to have utilized the "auto generated" YouTube feature. You can tell that the "auto generated" tool was used because you can turn on the closed captioning for the video and the phrase "English (auto generated) appears in the upper left corner. The YouTube closed captioning is not entirely accurate. Your captioning should be updated to exactly match what the speaker is saying. Here is a video that explains how to do this in Camtasia (see below) https://www.youtube.com/watch?t=1&v=lLcJKZKeFRs. I have include three examples from the Module #1 Part 1 video.

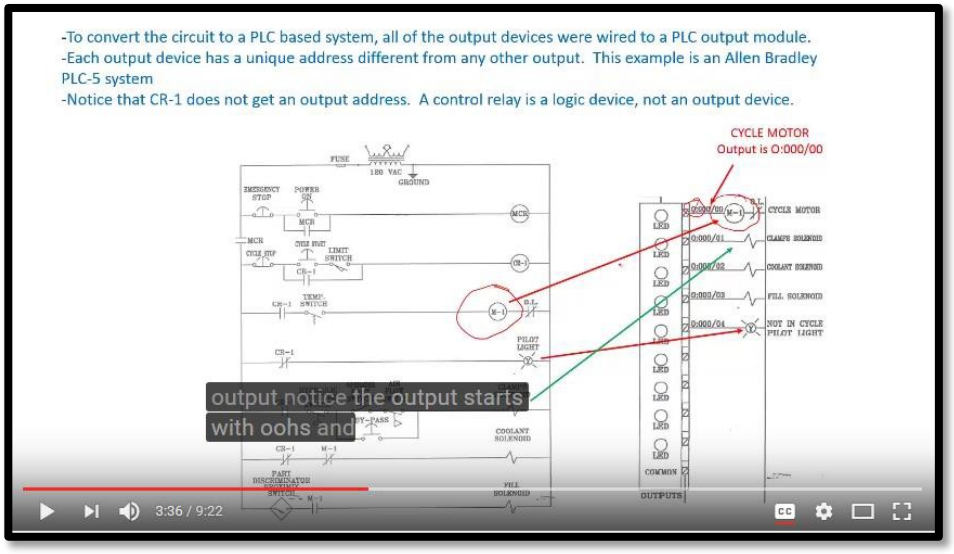
Example #1:
Author is saying the word “PLCs” and the captioning says “peel sees”



Example #2:
Author is saying “if you notice on this diagram” and the captioning says “on this day cream”.



Example #3:
Author is saying “notice the output starts with 0s” and the captioning says, “notice the output starts with oohs”.



8.4.The course design facilitates readability.

- POSITIVES:
  1) The course structure is well designed and facilitates readability
- SUGGESTIONS:
  1) No recommended changes. 8.5.

Course multimedia facilitate ease of use.

- POSITIVES:
  1) The multimedia is incorporated well and is easy to use.
- SUGGESTIONS:
  1) No recommended changes.

Appendix C: Technical Course Content Review

	Course Number	IND 105	IND 110	IND 120	IND 121	IND 122	IND 131	IND 132	IND 134	IND 223	IND 232	PLC 200	PLC 210	PLC 220	PLC 230
		Rating 1=Exceptional; 2=Effective; 3=Acceptable; 4=Developing; 5=N/A													
Syllabus	Initial course information is easily identifiable	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Course includes objectives and/or outcomes that relate to the course and are appropriate for the course	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Course objectives and/or outcomes are measureable	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Assessment methods are described	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Assignments/ Instructional Materials	Materials relate to course objectives and/ or outcomes	1	1	1	2	1	1	2	1	1	1	1	1	1	1
	Materials are presented in an appropriate format for the learner to understand	2	1	1	2	1	1	2	1	1	1	1	1	1	1
	Instruction follows a logical format.	2	1	1	2	1	1	2	1	1	1	1	1	1	1
	Instruction and materials reflect direct application to current industry standards and practices	2	1	1	2	1	1	2	1	1	1	1	1	1	1
	The instruction and materials are appropriately organized and provide clear structure.	2	1	1	2	1	1	2	1	1	1	1	1	1	1
	Provides option(s) for multiple learning styles in order to engage students	2	1	1	2	1	1	2	1	1	1	1	1	1	1
Modules/ Learning Tasks	Activities clearly support course objectives	1	1	1	2	1	1	2	1	1	1	1	1	1	1

	Course Number	IND 105	IND 110	IND 120	IND 121	IND 122	IND 131	IND 132	IND 134	IND 223	IND 232	PLC 200	PLC 210	PLC 220	PLC 230
		Rating 1=Exceptional; 2=Effective; 3=Acceptable; 4=Developing; 5=N/A													
	Activities utilize various learning styles and provide opportunities for interaction	2	1	1	2	1	1	2	1	1	1	1	1	1	1
	Activities allow students to connect the content they are learning to real-world application	2	1	1	2	1	1	2	1	1	1	1	1	1	1
	Activities are easy to understand and follow	2	1	1	2	1	1	2	1	1	1	1	1	1	1
Assessments & Evaluations	Assessments accurately measure the stated learning objectives and align with course content taught	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Assessment instrument used is appropriate to measure student understanding & mastery of concept(s)/skill(s)	1	1	1	1	1	1	1	1	1	1	1	1	1	1

DEFINITIONS FOR REVIEW CRITERIA

Term	Definition
Exceptional:	Content is ready for implementation. Content is robust and rigorous. Content utilizes "best practices" for instruction.
Effective:	Content is complete with only minor corrections, such as typographical errors, that may need to be made.
Acceptable:	Content is adequate but there are opportunities for improvement.
Developing:	Content is weak and requires significant improvement.
N/A:	Content has not been provided/does not apply for a given section.

Appendix D: Propensity Score Matching

Since students are neither randomly selected from a well-defined population nor randomly assigned to the two study groups (NSCC TAACCCT participants and comparison students), it is necessary to correct for any confounding that may arise. One quasi-experimental technique that attempts to minimize and potentially eliminate any biases is propensity score matching[31] (PSM). PSM uses baseline characteristics such as age and gender to estimate the probability of assignment to the treatment group. It then takes these probabilities and matches treatment subjects with comparison students who have similar probabilities of assignment to the treatment group. The R "MatchIt" package with a one-to-one nearest neighbor matching method was used for all propensity score matching.

Treatment and Comparison Groups

For this analysis, treatment subjects are defined as any Northwest State Community College (NSCC) student who took at least one class after it was modified using TAACCCT funding. The first courses were modified in the spring of 2016 and the final courses were modified in the summer of 2017. Academic and wage data were accessed via the Ohio Longitudinal Data Archive. The Ohio Longitudinal Data Archive is a project of the Ohio Education Research Center (oerc.osu.edu) and provides researchers with centralized access to administrative data. The OLDA is managed by The Ohio State University's Center for Human Resource Research (chrr.osu.edu) in collaboration with Ohio's state workforce and education agencies (ohioanalytics.gov), with those agencies providing oversight and funding. For information on OLDA sponsors, see http://chrr.osu.edu/projects/ohio-longitudinal-data-archive.

The academic data sets only extend to the spring of 2017, so courses that were not TAACCCT modified until the summer of 2017 (IND 110, Industrial Computing I, and IND 122, Industrial Wiring) are not included in this analysis. Additionally, fully open labs were not available by the spring of 2017, so any impact from that aspect of the TAACCCT grant cannot be assessed with the available data.

Comparison students are defined as students from colleges in Ohio that are similar to NSCC TAACCCT participants who took at least one course at any point between the summer of 2014 and the spring of 2017 with the same Classification of Instructional Programs (CIP) code as an NSCC course that eventually became modified with TAACCCT funding. The following nine colleges were considered similar to NSCC and used to generate the pool of potential comparison students:

- Belmont Technical Center
- Central Ohio Technical College
- Edison State Technical College
- Hocking Technical College
- Marion Technical College

[31] Rosenbaum, P. and Rubin, D. "The central role of the propensity score in the observational studies for causal effects." *Biometrika*. 1983. Volume 70, Issue 1.

- Rio Grande Community College
- Southern State Community College
- Washington State Community College
- Terra State Community College

Once the prospective treatment and comparison students had been identified, any NSCC students who had also attended one of the comparison colleges and taken a TAACCCT equivalent course there were removed from the analysis. Additionally, any high school students and students under the age of 18 were removed from the analysis. High school status was based on the "year graduated high school" variable available in the OLDA. All students were assumed to have graduated high school in the spring, so students over the age of 18 who took any courses in the summer of the year they graduated from high school or later were deemed eligible for inclusion. When there was a missing value for "year graduated high school" for a student, the student's age was used as a surrogate. The maximum age allowed in high school in Ohio is 22, so anyone with a missing high school graduation year that was under the age of 23 was removed from the analysis. Students with missing high school graduation years and missing ages were also removed. SAS version 9.4 (SAS Institute, Inc., Cary, NC) and RStudio version 1.1.453 (RStudio, Inc.) were used for participant extraction and data cleaning.

Propensity Score Matching Details

Baseline characteristics considered for propensity score matching include:
Semester started
Credit hours at start
Year of birth
Year graduated high school
Gender
Ethnicity

- First college enrollment

"Semester started" is the first semester in which a student took a TAACCCT modified or equivalent course. The first semester in the data set is summer 2014, which was coded as 1, followed by fall 2014, which was coded as 2, all the way to spring 2017 which was coded as 9.

"Credit hours at start" is the number of credit hours a student has already completed when they take their first TAACCCT modified or equivalent course.

Since ages change over the course of the experiment, "year of birth" was used so as to enable constancy.

"Year graduated high school" was extremely highly correlated with "year of birth" ($r = 0.98$), because most students graduated when they were 18 years old. Highly correlated independent variables can have deleterious effects on statistical models, so this variable was excluded from the matching process.

"Gender" was treated as categorical with two levels, male and female.

Due to small counts in certain ethnicities, the "ethnicity" variable was coded as having three levels, Caucasian, African American, and other.

"First college enrollment" was treated as categorical with two levels, "yes" if it is the student's first college enrollment and "no" if the student has at least one prior enrollment.

Since many of the outcomes are employment-based and differ for incumbent and non-incumbent workers, the students were separated into incumbent workers and non-incumbent workers and propensity score matching was done for each of these groups separately. For the purposes of the impact analysis, incumbent workers are defined as students who have earnings greater than zero in the quarter in which they took their first TAACCCT modified or equivalent course. Spring semester was considered quarter one, summer quarter two, and fall was considered quarters three and four. Conversely, for this analysis, non-incumbent workers had earnings of zero for the quarter in which they took their first TAACCCT modified or equivalent course.

After comparison students were matched with NSCC TAACCCT participants, the validity of the matches was assessed via calculating standardized differences and inspecting histograms and boxplots. Standardized differences are the number of pooled standard deviations the group means (or proportions) are from each other. Standardized differences are preferred to doing a statistical test of significance because the sample size plays no role in the standardized difference, while statistical significance, or lack thereof, between two groups is highly dependent on the sample size. Lower standardized differences indicate better balance between groups. While there is no agreed upon cutoff for the magnitude of a standardized difference that would indicate imbalance, a standardized difference of 0.25 has been suggested as the upper bound for what would be considered negligible imbalance[32] and therefore was used in this analysis.

Baseline Characteristics and PSM Results

Descriptive statistics for the PSM predictor variables after matching are given below along with the standardized differences before and after matching. Continuous variables are expressed as means and standard deviations, while categorical variables are expressed as proportions. Standardized differences were calculated with the "stddiff" R package. Categories with counts fewer than ten have been suppressed to ensure privacy of the research subjects.

[32] Harder, V., Stuart, E., Anthony, J. "Propensity score techniques and the assessment of measured covariate balance to test causal associations in psychological research." *Psychol Methods.* 2010. 15(3): 234-239.

Non-incumbent workers

Variable	Matched Comparison Students	NSCC TAACCCT Participants	Standardized Difference before Matching	Standardized Difference after Matching
Semester Started[a]	7.90 (1.47)	8.14 (1.07)	1.68	0.19
Credit Hours at Start	16.41 (16.10)	14.70 (15.53)	0.59	0.11
Year of Birth	1983.09 (12.72)	1983.48 (9.82)	0.54	0.04
Gender	Suppressed	Suppressed	0.21	0.00
Ethnicity **-Caucasian** **-African American** **-Other**	 0.59 Suppressed Suppressed	 0.64 Suppressed Suppressed	0.53	0.12
First College Enrollment	Suppressed	Suppressed	0.02	0.05

a. The semesters are coded 1-9 where 1 is summer 2014, 8 is fall 2016, and 9 is spring 2017

Prior to matching, "Semester Started", "Credit Hours at Start", "Year of Birth", and "Ethnicity" all had standardized differences greater than 0.25 and would therefore be considered out of balance for non-incumbent workers. After matching, all variables for non-incumbent workers have standardized differences less than 0.25 and therefore any differences in these baseline characteristics would be considered negligible.

Incumbent workers

Variable	Matched Comparison Students	NSCC TAACCCT Participants	Standardized Difference before Matching	Standardized Difference after Matching
Semester Started[a]	7.80 (1.58)	7.71 (1.37)	1.19	0.06
Credit Hours at Start	36.18 (29.53)	33.08 (29.42)	0.19	0.11
Year of Birth	1985.63 (10.66)	1983.02 (9.24)	0.69	0.26
Gender **-Male** **-Female**	 0.96 0.04	 Suppressed Suppressed	0.33	0.02
Ethnicity **-Caucasian** **-African American** **-Other**	 0.79 Suppressed Suppressed	 0.76 0.04 0.20	0.36	0.08
First College Enrollment	0.90	0.90	0.13	0.01

a. The semesters are coded 1-9 where 1 is summer 2014, 8 is fall 2016, and 9 is spring 2017

Prior to matching, "Semester Started," "Year of Birth," "Gender," and "Ethnicity" all had standardized differences greater than 0.25 and would therefore be considered out of balance for incumbent workers. After matching, "Semester Started," "Credit Hours at Start," "Gender," "Ethnicity," and "First College

Enrollment" all have standardized differences less than 0.25 and therefore any differences in these baseline characteristics would be considered negligible. "Year of birth" was just above this threshold at 0.26. The average year of birth for NSCC TAACCCT participants was 1983.02 while the average year of birth for comparison students was 1985.63, making the average year of birth 2.61 years earlier for NSCC TAACCCT participants.

Appendix E: Statistical Tables

Northwest State Community College (NSCC) Delivery Methods Employment Analysis

Frequency Table of Group by *Found Employment* suppressed due to small sample size.

Statistic	DF	Value	Prob
Chi-Square	1	7.6137	<0.01

Fisher's Exact Test	
Cell (1,1) Frequency (F)	36
Left-sided Pr <= F	0.0054
Right-sided Pr >= F	0.9986
Table Probability (P)	<0.01
Two-sided Pr <= P	<0.01

Table of Group by Still Employed One Quarter Later			
Group	Still Employed One Quarter Later		
Frequency Row Pct	Yes	No	Total
Pre-TAACCCT	31 32.98	63 67.02	94
Treatment	16 57.14	12 42.86	28
Total	47	75	122

Statistic	DF	Value	Prob
Chi-Square	1	5.3190	<0.01

Fisher's Exact Test	
Cell (1,1) Frequency (F)	31
Left-sided Pr <= F	0.0193
Right-sided Pr >= F	0.9939
Table Probability (P)	0.0132
Two-sided Pr <= P	0.0273

Table of Group by Still Employed Two Quarters Later			
Group	Still Employed Two Quarters Later		
Frequency Row Pct	Yes	No	Total
Pre-TAACCCT	27 28.72	67 71.28	94
Treatment	15 53.57	13 46.43	28
Total	42	80	122

Statistic	DF	Value	Prob
Chi-Square	1	5.9005	<0.05

Fisher's Exact Test	
Cell (1,1) Frequency (F)	27
Left-sided Pr <= F	0.0149
Right-sided Pr >= F	0.9955
Table Probability (P)	0.0104
Two-sided Pr <= P	0.0227

Table of Group by Pay Increase			
Group	**Pay Increase**		
Frequency Row Pct	**Yes**	**No**	**Total**
Pre-TAACCCT	316 94.61	18 5.39	334
Treatment	278 86.34	44 13.66	322
Total	594	62	656

Statistic	DF	Value	Prob
Chi-Square	1	13.1191	<0.001

Northwest State Community College Delivery Methods Academic Outcomes Analysis

Time	Variable	N	Mean	Std Dev	Minimum	Maximum
Combined Su14/Su15	Attempted Hours	77	5.34	3.08	2.00	11.00
	GPA	77	3.53	0.88	0.00	4.00
	Completed Hours	77	5.23	3.22	0.00	11.00
Su16	Attempted Hours	61	5.79	4.55	2.00	15.00
	GPA	61	3.70	0.66	0.00	4.00
	Completed Hours	61	5.69	4.61	0.00	15.00

Time	Variable	N	Mean	Std Dev	Minimum	Maximum
Combined F14/Sp15/F15	Attempted_Hours	582	4.17	2.59	2.00	17.00
	GPA	582	3.45	0.87	0.00	4.00
	Completed_Hours	582	4.05	2.57	0.00	17.00
Sp16	Attempted_Hours	325	3.93	2.42	2.00	15.00
	GPA	325	3.65	0.67	0.00	4.00
	Completed_Hours	325	3.87	2.32	0.00	15.00
F16	Attempted_Hours	125	4.48	2.44	2.00	11.00
	GPA	125	3.42	1.10	0.00	4.00
	Completed_Hours	126	4.16	2.54	0.00	11.00
Sp17	Attempted_Hours	160	5.10	3.07	2.00	18.00
	GPA	160	3.72	0.71	0.00	4.00
	Completed_Hours	160	4.89	2.85	0.00	15.00

Summer Results

Attempted Hours

Type 3 Tests of Fixed Effects				
Effect	Num DF	Den DF	F Value	Pr > F
Time	1	136	0.46	0.4977

GPA

Type 3 Tests of Fixed Effects				
Effect	Num DF	Den DF	F Value	Pr > F
Time	1	136	1.58	0.2104

Completed Hours

Type 3 Tests of Fixed Effects				
Effect	Num DF	Den DF	F Value	Pr > F
Time	1	136	0.48	0.4908

Spring/Fall Results

Attempted Hours

Type 3 Tests of Fixed Effects				
Effect	Num DF	Den DF	F Value	Pr > F
Time	3	1188	7.83	<.0001

Differences of Least Squares Means												
Effect	Time	_Time	Estimate	Standard Error	DF	t Value	Pr > |t|	Adjustment	Adj P	Alpha	Adj Lower	Adj Upper
Time	1	2	0.2355	0.1801	1188	1.31	0.1912	Tukey-Kramer	0.5582	0.05	-0.2278	0.6988
Time	1	3	-0.3122	0.2564	1188	-1.22	0.2236	Tukey-Kramer	0.6157	0.05	-0.9718	0.3474
Time	1	4	-0.9322	0.2322	1188	-4.02	<.0001	Tukey-Kramer	0.0004	0.05	-1.5294	-0.3349
Time	2	3	-0.5477	0.2737	1188	-2.00	0.0456	Tukey-Kramer	0.1882	0.05	-1.2519	0.1565
Time	2	4	-1.1677	0.2512	1188	-4.65	<.0001	Tukey-Kramer	<.0001	0.05	-1.8139	-0.5215
Time	3	4	-0.6200	0.3105	1188	-2.00	0.0461	Tukey-Kramer	0.1896	0.05	-1.4187	0.1787

GPA

Type 3 Tests of Fixed Effects				
Effect	Num DF	Den DF	F Value	Pr > F
Time	3	1188	7.49	<.0001

Differences of Least Squares Means												
Effect	Time	_Time	Estimate	Standard Error	DF	t Value	Pr > |t|	Adjustment	Adj P	Alpha	Adj Lower	Adj Upper
Time	1	2	-0.1970	0.05727	1188	-3.44	0.0006	Tukey-Kramer	0.0034	0.05	-0.3443	-0.04963
Time	1	3	0.02488	0.08153	1188	0.31	0.7603	Tukey-Kramer	0.9901	0.05	-0.1849	0.2346
Time	1	4	-0.2718	0.07383	1188	-3.68	0.0002	Tukey-Kramer	0.0014	0.05	-0.4617	-0.08186
Time	2	3	0.2219	0.08705	1188	2.55	0.0109	Tukey-Kramer	0.0532	0.05	-0.00208	0.4458
Time	2	4	-0.07482	0.07988	1188	-0.94	0.3491	Tukey-Kramer	0.7851	0.05	-0.2803	0.1307
Time	3	4	-0.2967	0.09873	1188	-3.00	0.0027	Tukey-Kramer	0.0144	0.05	-0.5507	-0.04269

Completed Hours

Type 3 Tests of Fixed Effects				
Effect	Num DF	Den DF	F Value	Pr > F
Time	3	1189	6.15	0.0004

Differences of Least Squares Means												
Effect	Time	_Time	Estimate	Standard Error	DF	t Value	Pr > |t|	Adjustment	Adj P	Alpha	Adj Lower	Adj Upper
Time	1	2	0.1759	0.1761	1189	1.00	0.3180	Tukey-Kramer	0.7500	0.05	-0.2771	0.6289
Time	1	3	-0.1121	0.2499	1189	-0.45	0.6539	Tukey-Kramer	0.9699	0.05	-0.7549	0.5308
Time	1	4	-0.8471	0.2270	1189	-3.73	0.0002	Tukey-Kramer	0.0011	0.05	-1.4311	-0.2631
Time	2	3	-0.2880	0.2669	1189	-1.08	0.2808	Tukey-Kramer	0.7025	0.05	-0.9746	0.3986
Time	2	4	-1.0230	0.2456	1189	-4.17	<.0001	Tukey-Kramer	0.0002	0.05	-1.6548	-0.3911
Time	3	4	-0.7350	0.3029	1189	-2.43	0.0154	Tukey-Kramer	0.0727	0.05	-1.5143	0.04423

Impact Evaluation Analysis

Non-Incumbent Worker Results

Table of Group by Found_Employment			
Group(Group)	Found_Employment(Found Employment)		
Frequency Row Pct	Yes	No	Total
Comparison	<10	11	<21
TAACCCT	14	<10	<24
Total	<24	<21	<45

Statistic	DF	Value	Prob
Chi-Square	1	9.4091	<0.01

Fisher's Exact Test	
Cell (1,1) Frequency (F)	2
Left-sided Pr <= F	0.0028
Right-sided Pr >= F	0.9998
Table Probability (P)	<0.01
Two-sided Pr <= P	<0.01

Common Odds Ratio and Relative Risks				
Statistic	Method	Value	95% Confidence Limits	
Odds Ratio	Mantel-Haenszel	0.0779	0.0131	0.4642
	Logit	0.0779	0.0131	0.4642
Relative Risk (Column 1)	Mantel-Haenszel	0.2198	0.0595	0.8119
	Logit	0.2198	0.0595	0.8119
Relative Risk (Column 2)	Mantel-Haenszel	2.8205	1.3888	5.7280
	Logit	2.8205	1.3888	5.7280

Note: Relative Risks presented in table are in reference to comparison group

Table of Group by Still_employed_1_Q_later			
Group(Group)	Still_employed_1_Q_later(Still Employed One Quarter Later)		
Frequency Row Pct	Yes	No	Total
Comparison	<10	12	<22
TAACCCT	12	<10	<22
Total	<22	<22	<44

Statistic	DF	Value	Prob
Chi-Square	1	9.0291	<0.01

Fisher's Exact Test	
Cell (1,1) Frequency (F)	1
Left-sided Pr <= F	0.0030
Right-sided Pr >= F	0.9999
Table Probability (P)	<0.01
Two-sided Pr <= P	<0.01

Common Odds Ratio and Relative Risks				
Statistic	**Method**	**Value**	**95% Confidence Limits**	
Odds Ratio	Mantel-Haenszel	0.0556	0.0060	0.5154
	Logit	0.0556	0.0060	0.5154
Relative Risk (Column 1)	Mantel-Haenszel	0.1282	0.0189	0.8717
	Logit	0.1282	0.0189	0.8717
Relative Risk (Column 2)	Mantel-Haenszel	2.3077	1.3192	4.0369
	Logit	2.3077	1.3192	4.0369

Note: Relative Risks presented in table are in reference to comparison group

Table of Group by Still_employed_2_Q_later			
Group(Group)	**Still_employed_2_Q_later(Still Employed Two Quarters Later)**		
Frequency Row Pct	**Yes**	**No**	**Total**
Comparison	<10	12	<22
TAACCCT	12	<10	<22
Total	<22	<22	<44

Statistic	DF	Value	Prob
Chi-Square	1	9.0291	<0.01

Fisher's Exact Test	
Cell (1,1) Frequency (F)	1
Left-sided Pr <= F	0.0030
Right-sided Pr >= F	0.9999
Table Probability (P)	<0.01
Two-sided Pr <= P	<0.01

Common Odds Ratio and Relative Risks				
Statistic	**Method**	**Value**	**95% Confidence Limits**	
Odds Ratio	Mantel-Haenszel	0.0556	0.0060	0.5154
	Logit	0.0556	0.0060	0.5154
Relative Risk (Column 1)	Mantel-Haenszel	0.1282	0.0189	0.8717
	Logit	0.1282	0.0189	0.8717
Relative Risk (Column 2)	Mantel-Haenszel	2.3077	1.3192	4.0369
	Logit	2.3077	1.3192	4.0369

Note: Relative Risks presented in table are in reference to comparison group

Incumbent Worker Results

Table of Group by Pay_Increase			
Group(Group)	**Pay_Increase(Wage Increase)**		
Frequency Row Pct	**Yes**	**No**	**Total**
Comparison	188 80.69	45 19.31	233
TAACCCT	200 85.84	33 14.16	233
Total	388	78	466

Statistic	DF	Value	Prob
Chi-Square	1	2.2173	0.1365

Propensity Score Matching (PSM) Descriptive Statistics

PSM Incumbent Worker Variables

Group	*Variable*	*N*	*Mean*	*Std Dev*	*Minimum*	*Maximum*
Comparison	Total GPA	228	2.95	1.15	0.00	4.00
	Hours per Semester	233	8.47	4.65	0.00	21.00
	Courses Passed per Semester	233	2.71	1.74	0.00	8.00
	Credit Hours at Start	233	36.18	29.53	0.00	131.67
	Birth Date	233	1985.63	10.66	1951.00	1998.00
	Start	233	7.80	1.58	1.00	9.00
	Total Wages 2014 Q2	<10	*	*	*	*
	Total Wages 2014 Q3	<10	*	*	*	*
	Total Wages 2014 Q4	<10	*	*	*	*
	Total Wages 2015 Q1	<10	*	*	*	*
	Total Wages 2015 Q2	12	8222.67	5408.45	1428.00	18877.00
	Total Wages 2015 Q3	22	8130.68	3928.67	203.00	16180.00
	Total Wages 2015 Q4	22	9121.73	4524.93	0.00	19877.00
	Total Wages 2016 Q1	43	9754.30	5511.25	0.00	23068.00
	Total Wages 2016 Q2	58	8870.86	5545.25	0.00	23364.00
	Total Wages 2016 Q3	134	8711.54	5554.27	26.00	21660.00
	Total Wages 2016 Q4	134	8536.68	5946.32	0.00	24686.00
	Total Wages 2017 Q1	233	7774.86	6013.76	0.00	28533.00
	Total Wages 2017 Q2	233	8257.70	5957.02	0.00	28435.00
	Total Wages 2017 Q3	233	8335.41	5719.08	0.00	23778.00
	Total Wages 2017 Q4	233	9130.23	6994.07	0.00	42807.00
TAACCCT	Total GPA	232	3.62	0.73	0.00	4.00
	Hours per Semester	233	5.79	3.63	0.00	21.00
	Courses Passed per Semester	233	2.01	1.11	0.00	6.00
	Credit Hours at Start	233	33.08	29.42	1.00	121.00
	Birth Date	233	1983.02	9.24	1958.00	1997.00
	Start	233	7.71	1.37	6.00	9.00
	Total Wages 2014 Q2	0	.	.	.	.
	Total Wages 2014 Q3	0	.	.	.	.
	Total Wages 2014 Q4	0	.	.	.	.
	Total Wages 2015 Q1	0	.	.	.	.
	Total Wages 2015 Q2	0	.	.	.	.
	Total Wages 2015 Q3	0	.	.	.	.
	Total Wages 2015 Q4	0	.	.	.	.
	Total Wages 2016 Q1	84	14214.14	5183.85	902.00	38685.00
	Total Wages 2016 Q2	95	13447.69	5999.74	0.00	31502.00
	Total Wages 2016 Q3	122	14983.90	6544.73	0.00	29107.00
	Total Wages 2016 Q4	122	15025.89	6899.43	0.00	29593.00
	Total Wages 2017 Q1	233	12852.57	6963.85	0.00	38251.00
	Total Wages 2017 Q2	233	13968.14	7673.13	0.00	39065.00
	Total Wages 2017 Q3	233	14703.03	7567.75	0.00	45966.00
	Total Wages 2017 Q4	233	14673.49	6993.56	0.00	30431.00

Comparison Students

Gender

Gender	*Frequency*	*Percent*	*Cumulative Frequency*	*Cumulative Percent*
Female	10	4.29	10	4.29
Male	223	95.71	233	100.00

Race

Race	*Frequency*	*Percent*	*Cumulative Frequency*	*Cumulative Percent*
White	184	78.97	184	78.97
All Minorities	49	21.03	233	100.00

First College Enrollment

First College Enrollment	*Frequency*	*Percent*	*Cumulative Frequency*	*Cumulative Percent*
Yes	209	89.70	209	89.70
No	24	10.30	233	100.00

NSCC Students

- Gender results are suppressed due to small sample sizes.

Race				
Race	*Frequency*	*Percent*	*Cumulative Frequency*	*Cumulative Percent*
White	176	75.54	176	75.54
All Minorities	57	24.46	233	100.00

First College Enrollment				
First College Enrollment	*Frequency*	*Percent*	*Cumulative Frequency*	*Cumulative Percent*
Yes	210	90.13	210	90.13
No	23	9.87	233	100.00

PSM Non-incumbent Worker

Group	Variable	N	Mean	Std Dev	Minimum	Maximum
Comparison	Credit Hours at Start	58	16.41	16.10	0.00	69.98
	Birth Date	58	1983.09	12.72	1946.00	1998.00
	Start	58	7.90	1.47	2.00	9.00
	Total GPA	56	2.57	1.31	0.00	4.00
	Hours per Semester	58	10.94	5.17	0.00	21.00
TAACCCT	Credit Hours at Start	58	14.70	15.53	1.00	73.00
	Birth Date	58	1983.48	9.82	1960.00	1998.00
	Start	58	8.14	1.07	6.00	9.00
	Total GPA	58	3.26	1.08	0.00	4.00
	Hours per Semester	58	9.04	4.31	2.00	17.00

Comparison Students

- Gender and first enrollment results are suppressed due to small sample sizes.

Race				
Race	Frequency	Percent	Cumulative Frequency	Cumulative Percent
White	34	58.62	34	58.62
Non-White	24	41.38	58	100.00

NSCC Students

- Gender and first enrollment results are suppressed due to small sample sizes.

Race				
Race	Frequency	Percent	Cumulative Frequency	Cumulative Percent
White	37	63.79	37	63.79
Non-White	21	36.21	58	100.00

Appendix F: TAACCCT Participant Focus Group Guide

TAACCCT Participant Focus Group Sessions
Discussion Guide

Welcome

Welcome and thank you for volunteering to take part in this focus group [interview].

Introduction

You have been invited to participate in this focus group session as part of Northwest State Community College efforts to modify its Industrial Automation Maintenance courses from a traditional delivery method to an intensive hybrid delivery method. I am part of a team evaluating NSCC's efforts, and I will be asking you a set of questions about your experiences and perceptions of the "hybrids." We will go around the room so that all have the opportunity to participate. I ask that only one person speaks at a time. You do not have to answer any question that you do not wish to. No person's name will be associated with responses. Does anyone have questions for me? Let's begin.

Guiding Questions

1. Describe how the "hybrids" have affected you.
2. How do you compare in-class lecture type classes (traditional delivery) to the hybrid classes?
3. How satisfied are you with the quality and quantity of lab equipment?
4. What are your perceptions of the competency of fellow students?
    a. [Probe if not freely mentioned] Do you believe some sort of pre-assessment to test student aptitude should be done before students begin the hybrids?
5. Have you received any Prior Learning Assessment credits? What are your thoughts about the process for receiving PLA credit?
6. How have the job placement services affected you? Career Coaching?
7. What is your employer's perception of the education you are receiving here?
8. Has your education here affected your being hired, receiving a pay increase, or other?
    a. How has this hands-on program affected your work skills or level of competency?

Conclusion

Thank you for participating. Your experiences and perceptions that you have shared here today will be a valuable asset to our study. If you have any concerns, you may speak to me after the session. If you would like a copy of the results of this discussion, you may request a copy from Sarah Stubblefield here at NSCC.

Appendix G: TAACCCT Participant Course Assessment Questionnaire

Student Course Assessment Questions

Please rate each question's items on a scale from 1-5, where 1 is poor, 2 is fair, 3 is average, 4 is good, and 5 is excellent.

1. Rate the methods of study and assignments that work the best for your learning:
   a. Reading assignments in the textbook
   b. Instructor created PDF informational documents
   c. Instructor created videos
   d. Reading of manufacturer equipment cut sheets
   e. YouTube videos the instructor put into Sakai
   f. Virtual Machine (PLC200 Students only)
   g. Hands-on learning from the lab exercises

2. Rate the quality of the following parts of the course:
   a. The quality and effectiveness of the textbook
   b. Quality of the lab exercises in the course
   c. Quality of the lab equipment in the course
   d. Value of the KAA study guides
   e. Value of the practice quizzes in Sakai
   f. KAA testing, as compared to traditional tests
   g. Quality of the HOAs
   h. Instructor's communication in Sakai or Forums in Sakai (if applicable)
   i. Instructor's communication in Sakai

Please respond to the following open-ended questions.

3. How does your learning in this new hybrid model, compare to traditionally scheduled courses?

4. What advantage does the hybrid course provide as compared to traditional courses?

5. Do you feel you have enough lab time to do the lab exercises & HOA?

6. Does the course schedule work for you?

7. Do you have any other comments you would like to add?

Appendix H: Stakeholder Questionnaire

You are receiving this survey because you have been identified by Northwest State Community College (NSCC) as an organization that is partnering on the new hybrid classes in Industrial Technologies, called the IAM iSTAR program, to train and place students in Advanced Manufacturing jobs. Please take 5-10 minutes to complete this survey. Thank you! Please respond by Wednesday, July 27, 2018.

1. **Indicate the type of Partner Organization you represent** *(Select only one response)*
   - ❍ Employer
   - ❍ Workforce Development System
   - ❍ Industry Trade Association (an organization founded and funded by businesses that operate in a specific industry)
   - ❍ Chamber of Commerce
   - ❍ Nonprofit Organization
   - ❍ Faith-based Organization
   - ❍ Educational Institution
   - ❍ Other *(Please specify)* _____

2. **Is your role as part of this partnership to** *(Select all that apply)***:**
   - ❍ Guide program design
   - ❍ Identify needed skills and competencies
   - ❍ Co-develop or inform/validate the curriculum
   - ❍ Recruit student participants
   - ❍ Provide student support services (e.g., individualized counseling for personal support, tutoring, and mentoring programs)
   - ❍ Educate/Train student participants
   - ❍ Provide work-based learning opportunities like internships, co-ops, on-the-job training, etc.
   - ❍ Assist in preparing student training completers for jobs (e.g., mock interviews)
   - ❍ Assist in placing student training completers in jobs/hire qualified participants
   - ❍ Provide use or access to equipment and facilities
   - ❍ Contribute resources such as supplies, materials, funding
   - ❍ Other *(Please specify)* _____

Display this question if "Is your role as part of this partnership to: = Co-develop or inform/validate the curriculum"

3. **To what extent does the curriculum reflect industry needs**
   - ❍ Great extent
   - ❍ Moderate extent
   - ❍ Small extent
   - ❍ Not at all

Please list what your organization or you have contributed to this partnership (time, materials, equipment, expertise, etc.).

4. **Indicate your level of agreement with the following statements.**

	Strongly agree	Agree	Neutral/No Opinion	Disagree	Strongly disagree
The organizations that are partnering on this IAM iSTAR effort have a history of working together.	❍	❍	❍	❍	❍
My organization will benefit from being involved in this partnership.	❍	❍	❍	❍	❍
Partners in this group have a clear sense of their roles and responsibilities.	❍	❍	❍	❍	❍
I have a clear sense of my organization's roles and responsibilities on this initiative.	❍	❍	❍	❍	❍
So far, this group is effective in making decisions and getting the work done.	❍	❍	❍	❍	❍
This group is able to adapt to changing conditions such as less funds than expected or change in leadership.	❍	❍	❍	❍	❍
This group has adequate funds to accomplish what it needs to do.	❍	❍	❍	❍	❍
This group has adequate "people power" to accomplish what it needs to do.	❍	❍	❍	❍	❍
This group has a good track record of getting the resources it needs to get a job done.	❍	❍	❍	❍	❍

5. **What advantages have arisen from the IAM iSTAR partnership for Industrial Technologies training and education?** *(Select all that apply)*
   - ❒ Access to additional resources (additional public funding)
   - ❒ Greater flexibility in using funds
   - ❒ Ability to offer a wider range of services
   - ❒ Agencies able to specialize in areas of expertise
   - ❒ Better tracking of services received by participants across agencies
   - ❒ Enhanced ability to place student participants in jobs
   - ❒ Increased knowledge/communication across agency staff
   - ❒ Improved image with clients, employers, and the community
   - ❒ Changing the way I do my own job (becoming more reflective about what & how I do my work)
   - ❒ Enhanced performance outcomes
   - ❒ Increased efficiency and cost savings through elimination of duplicative efforts
   - ❒ Improved hiring and reduced time to hire
   - ❒ Productivity improvements due to trained employees/interns
   - ❒ Other *(Please specify)* _____

6. **What disadvantages have arisen from the IAM iSTAR partnership?** *(Select all that apply)*
   - ❒ Time and effort involved in planning/sustaining coordination
   - ❒ Potential loss of autonomy in decision making
   - ❒ Need to resolve interagency conflicts/turf battles
   - ❒ Need to maintain or create new operational procedures, client flows, and information systems
   - ❒ Difficulties of having out-stationed staff (e.g., having your personnel assigned to work at the Community College)
   - ❒ Other *(Please specify)* _____

7. **In your opinion, what have been the most important challenges for partners to participate in IAM iSTAR?** *(Select all that apply)*
   - ❒ Lack of time
   - ❒ Don't understand community college's policies, procedures, or challenges
   - ❒ Politics, regulations, and bureaucracy get in the way
   - ❒ Lack of resources (such as business personnel shortages or lack of funding)
   - ❒ Access channels (such as who to contact)
   - ❒ We don't know how best to help
   - ❒ Other *(Please specify)* _____

8. **What are your plans for continued involvement with Northwest State Community College after this grant ends?**
   - ❍ Extremely likely to continue involvement
   - ❍ Likely to continue involvement
   - ❍ Unlikely to continue involvement
   - ❍ Extremely unlikely to continue involvement

*Display this question if, "What are your plans for continued involvement with Northwest State Community College after this... = Unlikely to continue involvement" o*r "*What are your plans for continued involvement with Northwest State Community College after this g... = Extremely unlikely to continue involvement"*

9. **Why do you feel that way? (Please specify)**

Display this question If, "Indicate the type of Partner Organization you represent (Select only one response) = Nonprofit Organization" or "Indicate the type of Partner Organization you represent (Select only one response) = Faith-based Organization"

10. **How has this IAM iSTAR program changed the way your organization operates?**

	Yes	No
We have expanded the support services we offer to job seekers and students	❍	❍
We promote support services to job seekers and students in new ways	❍	❍
We regularly communicate with organizations involved in workforce development	❍	❍
We refer job seekers to the IAM iStar program	❍	❍

Display this question if, "Indicate the type of Partner Organization you represent (Select only one response) = Workforce Development System"

11. How has this IAM iSTAR program changed the way your organization operates?

	Yes	No
We promote training and career pathways in new ways to job seekers and employers	❍	❍
We regularly communicate with organizations involved in workforce development	❍	❍
We better connect employers with workforce programs and services	❍	❍

Display this question if, "Indicate the type of Partner Organization you represent (Select only one response) = Industry Trade Association (an organization founded and funded by businesses that operate in a specific industry)" or "Indicate the type of Partner Organization you represent (Select only one response) = Chamber of Commerce"

12. How has this IAM iSTAR program changed the way your organization operates?

	Yes	No
We regularly assess industries' workforce needs	❍	❍
We try to connect industries' workforce needs with workforce development partners such as education partners and OMJ offices	❍	❍
We regularly communicate with organizations involved in workforce development	❍	❍
We connect individuals to jobs and to learning opportunities	❍	❍

Display this question if, "Indicate the type of Partner Organization you represent (Select only one response) = Employer"

13. How has this IAM iSTAR program changed the way your organization operates?

	Yes	No
The IAM iStar training or certifications are a preferred criterion for entry into jobs with our company	❍	❍
The IAM iStar credential receives special consideration with our company	❍	❍
Earning the IAM iStar credential becomes part of the promotion practice, meaning scheduled pay increases are impacted by having the certification, or the hourly rates are increased at our company	❍	❍
The company has modified its requirements for entry level hires due to the training program	❍	❍
We regularly communicate with organizations involved in workforce development	❍	❍

Display this question if, "If Indicate the type of Partner Organization you represent (Select only one response) = Educational Institution"

14. How has this IAM iSTAR program changed the way your organization operates?

	Yes	No
We have changed how we teach and how we deliver education	❍	❍
We have expanded the support services we offer to job seekers and students	❍	❍
We have increased awareness among faculty about student support services	❍	❍
We promote training and career pathways in new ways to students and employers	❍	❍
We regularly communicate with organizations involved in workforce development	❍	❍
We connect industries' workforce needs to curriculum and training programs	❍	❍

Display this question if, "Indicate the type of Partner Organization you represent (Select only one response) = Employer" or "Indicate the type of Partner Organization you represent (Select only one response) = Educational Institution"

15. **Did your organization offer internship opportunities to any Northwest State Community College (NSCC) student interns?**
    - ❍ Yes
    - ❍ No *(Skip to Q20)*

Display this question if, "Indicate the type of Partner Organization you represent (Select only one response) = Employer" or "Indicate the type of Partner Organization you represent (Select only one response) = Educational Institution"

16. **Was it more than 1?**
    - ❍ Yes
    - ❍ No

Display this question if, "Indicate the type of Partner Organization you represent (Select only one response) = Employer" or "Indicate the type of Partner Organization you represent (Select only one response) = Educational Institution"

17. **Did the internship lead to employing the intern(s) as a full-time or part-time employee with your organization?**
    - ❍ Yes
    - ❍ No *(Skip to Q19)*

Display this question if, "Indicate the type of Partner Organization you represent (Select only one response) = Employer" or "Indicate the type of Partner Organization you represent (Select only one response) = Educational Institution"

18. **Was that a permanent/temporary/seasonal employed position?**
    - ❍ Permanent
    - ❍ Temporary
    - ❍ Seasonal

Display this question if, "Indicate the type of Partner Organization you represent (Select only one response) = Employer" or "Indicate the type of Partner Organization you represent (Select only one response) = Educational Institution"

19. **Do you plan to recruit future NSCC interns as a source of possible candidates for permanent employment with your organization?**
    - ❍ Yes *(Skip to "Thank you")*
    - ❍ No

Display this question if, "Indicate the type of Partner Organization you represent (Select only one response) = Employer" or "Indicate the type of Partner Organization you represent (Select only one response) = Educational Institution"

20. **Are interested in participating in the NSCC internship program?**
    - ❍ Yes
    - ❍ No

Thank you for partnering on this important project and for your response!

This survey was informed by the following sources:
National TAACCCT Evaluation: Evaluating Partnerships in TAACCCT—National and Local Perspectives (December 2014)
The Coalition Effectiveness Inventory
The Collaboration Factors Inventory