RE-AIM at Thomas Nelson Community College: 2018 Final Report

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Executive Summary

To meet regional industry demand for a larger and more skilled workforce, Thomas Nelson Community College (TNCC) offered 8 weeks to 9 months of credit-based instruction and support in workforce training and job preparation, networking, and job placement.

RE-AIM Description and Activities

The Rapid Employment in Advanced Integrated Manufacturing (RE-AIM) program had a strong evidence-based design informed by studies by the Virginia Manufacturers Association (2007), the Peninsula Council for Workforce Development (2012), the National Coalition of Advanced Technology Centers (McAtee & Pierpoint, 2014), and the Council for Adult and Experiential Learning (Klein-Collins, 2012). These reports showed a need for manufacturing and cybersecurity technicians, described competency expectations and requirements for advanced manufacturing programs, and explained the importance of competency-based programs that provide students with fast-paced learning and high program placement.

The RE-AIM career studies certificate (CSC) program structure consisted of three key components: (a) industry-specific workforce classes, (b) employment support, and (c) building workforce/industry support.

TNCC recruited workers eligible for Trade Adjustment Assistance, unemployed or transitioning veterans, dislocated workers, and other adults in Local Workforce Investment Board Area XIV to participate in the program. A total of 483 students enrolled during the grant period. Students were primarily male (75%), and most students identified as Caucasian/White (47%) or African American/Black (34%). Students averaged around 28 years of age.

Evaluation Design Summary

To monitor and improve the RE-AIM program and to determine program outcomes associated with participants' academic performance, employment prospects, and acquisition of skills, TNCC contracted with Magnolia Consulting, LLC, to conduct an external evaluation. The evaluation included an implementation study (i.e., formative evaluation) and an outcome study (i.e., summative evaluation).

Implementation Study Design

The RE-AIM implementation evaluation addressed eight key questions (Figure E1) across two areas: implementation process and structure, and implementation fidelity.

Implementation Process and Structure

(I1) How did RE-AIM program personnel develop the curriculum? What was the program administrative structure? How did specific individuals (e.g., project directors, instructors, career coaches/specialists) each contribute to the program design, development, and implementation (i.e., recruitment, training, placement, management, sustainability, efficient use of available resources)? What factors affected program personnel's involvement or lack thereof?

(I2) Did TNCC conduct an in-depth assessment of participants' abilities, skills, and interests to select or enroll participants in RE-AIM? What assessment tools and processes did TNCC use? Who conducted the

assessments? How were the assessment results used? Were the assessment results useful in determining the appropriate program and course sequence for participants?

(I3) Were employers involved in planning of the RE-AIM program?

(I4) How did RE-AIM students find out about the program?

Implementation Fidelity

(I5) How did RE-AIM program personnel use the curriculum? Which contributions of RE-AIM staff and partners were most critical to the success of RE-AIM? Which contributions had less of an impact?

(I6) Were employers involved in implementation of the RE-AIM program? Did employers believe RE-AIM courses were targeted to workforce needs? Which employer contributions were particularly successful or unsuccessful?

(I7) How did RE-AIM program personnel use grant funding to make improvements during implementation? How was the program delivered to students? What supports or other services were offered to students? Did students receive career guidance? If so, what were the delivery methods?

(I8) What resources did RE-AIM students receive from TNCC? Did students participate in career planning opportunities and other supports offered by TNCC? What were student perceptions of the quality and types of support provided by RE-AIM staff? How engaged were students in the program? What did students view as program strengths and potential areas of improvement?

Figure E1. Formative evaluation questions.

Evaluators developed a program logic model (Appendix A) in collaboration with TNCC stakeholders to document the conceptual framework of the program. Evaluators used this framework to inform development of implementation measures and to document adherence to activities identified in the logic model.

To measure implementation, evaluators used mixed methods, including surveys and focus groups with students, staff, and employers; program artifact review; and documentation of program modifications and revisions through regular informal conversations with project directors, a project liaison, and program faculty. These measures and the implementation analysis supported an understanding of how the U.S. Department of Labor's Trade Adjustment Assistance Community College and Career Training (TAACCCT) funding built the capacity of TNCC to provide workforce-aligned advanced manufacturing and cybersecurity CSC programs.

Outcome Study Design

The outcome evaluation addressed three key questions (Figure E2). Evaluators also examined TNCC performance on the ten Solicitation for Grant Application outcomes articulated in the TNCC proposal to the Department of Labor (DOL).

Outcome Study Design

(O1) Do students who participate in the RE-AIM program self-report gains in workforce content, digital literacy, and workplace etiquette knowledge, as well as career readiness and confidence skills? Do students who participate in the RE-AIM program report changes in their interest in furthering their education? Do gains or changes vary by program type?

(O2) Does TNCC meet RE-AIM program benchmarks in the following areas: (a) the percentage of students pursuing further education after program completion, (b) the percentage of students completing the program, (c) the percentage of students finding employment, and (d) the number of students seeing wage increases after program enrollment? Do percentages vary by program type?

(O3) How does TNCC's RE-AIM program compare to other Virginia Community College System (VCCS) advanced manufacturing and cybersecurity programs on the following benchmarks: (a) the percentage of students completing the program, (b) the percentage of students pursuing further education after program completion, (c) the percentage of students finding long-term employment, and (d) total wages after program completion?

Figure E2. Summative evaluation questions.

Evaluators used mixed methods for the summative evaluation, including end-of-program and retrospective pre–post reflections surveys with students; focus groups with students and staff; the collection of TNCC institutional data on academic and employment outcomes; and the collection of aggregated institutional data from similar programs at demographically similar Virginia Community College System (VCCS) institutions. These data supported an understanding of program outcomes across six areas: knowledge, career readiness, academic completion, further education and academic interest, employment and earnings, and Department of Labor grant benchmarks.

Although a randomized control trial would have been the most rigorous design for the summative evaluation, it was not possible because TNCC did not have an adequate comparison group at the college. TNCC's RE-AIM CSC program was new, and very few TNCC students were enrolled in similar programs at the college. As a result, this study does not permit causal inferences.

To strengthen the design comparing the TNCC RE-AIM program to other advanced manufacturing and cybersecurity programs on various benchmarks, evaluators selected five Virginia community colleges that were programmatically and demographically similar to TNCC to serve as comparison schools. Evaluators then compared aggregated TNCC student outcomes to aggregated student outcomes for comparable advanced manufacturing and cybersecurity programs at demographically similar Virginia community colleges.

Implementation Findings

Study findings pertaining to the implementation evaluation are as follows:

Implementation Process and Structure

- TNCC originally planned for RE-AIM to be a noncredit program and redesigned the program model in early 2015 to offer credit-based courses through the development of new CSCs. TNCC staff developed courses to align with third-party credentialing exams and to better prepare students for future CSCs. Employers were not directly involved in CSC program development (I1, I3).
- The program's administrative structure consisted of a project liaison, two project directors, instructors, a job placement coordinator/career coach, and administrative staff. Each staff member had different levels of involvement in the program (I1; see Table E1).

Table E1. Levels of Program Involvement by RE-AIM Staff

Key RE-AIM Staff Involvement	Project Liaison	Project Directors	Instructors	Job Placement Coordinator/ Career Coach
Achieving program sustainability	☑	☑	✓	☑
Leveraging of resources	☑	☑	✓	×
Program management	☑	☑	✓	✓
Student training	×	×	☑	✓
Recruitment	✓	☑	✓	✓
Curriculum development	☑	✓	☑	×
Program design	☑	✓	✓	×

Note. ☑ = full/high involvement; ✓ = somewhat/limited involvement; × = no involvement

- TNCC did not conduct an in-depth assessment of participants' abilities, skills, and interests to select or enroll participants in RE-AIM. All students who applied were accepted (I2).
- Students primarily heard about the program through TNCC staff, advisors, or on-campus flyers; Google advertisements; job fairs; radio advertisements; or their employer (I4).

Implementation Fidelity

- RE-AIM students received the following core RE-AIM components: workforce courses (100% of students), soft skills instruction (92% of students), tutoring support (as needed; 100% of students), and employment support (75% of students). Employment support for students varied by enrollment date and RE-AIM program (I5, I6, I7).
- Staff and students had positive perceptions about program quality, and some believed the program was delivered effectively. Overall, students and staff commented on several implementation strengths, such as use of a cohort model (for some RE-AIM programs), collaboration with Continental Automotive, knowledgeable instructors who supported student learning, recognition of TNCC as Siemens-certified, recognition by the National Security Agency and the Department of Homeland Security, mechatronics internships for later student cohorts, and dual enrollment programs for mechatronics students (I5, I6, I8).
- Staff and students also highlighted some challenges and areas for improvement, such as the following: a slow curriculum approval process that caused delays in CSC program start dates, difficulties in working with a compressed program time frame, a high degree of staff turnover and communication difficulties among project staff, a lack of direct connections to many regional employers on the credit side of the college (where grant staff were primarily based), limited employer involvement, difficulties in meeting grant benchmarks and tracking students, and an unclear marketing plan and budget (I5, I6, I8).
- Twelve employers supported program planning and implementation. Different employers provided funding for manufacturing technology students, served on faculty search committees, visited labs and donated banners, and supported résumé development. Continental Automotive established a successful partnership with the TNCC machining CSC program and provided several types of assistance to the program, including reviewing the precision machining curriculum and donating lab space, equipment, furniture, and banners to TNCC. A machining classroom and lab space was built at Continental Automotive in late 2017 and made available to TNCC (I6).
- Staff made several course and program modifications throughout the grant period. For example, RE-AIM staff redesigned courses to better align with certification exams and added new CSC programs (e.g., cybersecurity for local area networks [LANs], precision machining) to meet DOL grant benchmarks for program enrollment. TNCC staff funded the majority of staff positions using DOL grant funds and used grant funds to purchase lab equipment. Staff also used funds for marketing and to support faculty professional development (I7).

- Students appreciated peer support and enjoyed learning in a cohort model, but they had mixed perceptions about the benefits of full-time or evening coursework. Students reported being engaged in their RE-AIM coursework (I8).

Participant Outcomes

Study findings pertaining to the outcome evaluation are as follows:

- RE-AIM students generally reported gains in workforce knowledge, digital literacy skills, career readiness, and confidence after participating in the program. However, some students expressed concerns about their ability to find regional employment. Several students expressed an interest in furthering their education, and 69% of program completers pursued additional education at TNCC or other institutions (O1).
- When compared to similar CSC programs at five demographically similar VCCS institutions, TNCC's RE-AIM program evidenced (a) the highest percentage of program completers pursuing additional education, (b) an average employment rate for program completers, (c) the fourth-lowest yearly income rate for program completers, and (d) the fourth-lowest CSC completion rate.
- TNCC exceeded five of the ten project targets articulated in the revised TNCC proposal to DOL. Specifically, TNCC exceeded its targets for total enrollment, completion of credit hours, student retention in RE-AIM or other TNCC programs, and wage increases for enrolled incumbent workers (O2; Table E2).

Table E2. Performance on the Ten Outcomes Articulated in the TNCC DOL Proposal

	Outcome	Target (n)	Achieved (n)	Met or Exceeded Target?
1	Total participants served by RE-AIM	320	483	**Yes**
2	Total number of participants completing RE-AIM	269	68	No
3	Total number of participants still retained in RE-AIM	0	150	**Yes**
4	Total number of participants still retained in other education programs	0	88	**Yes**
5	Total number of RE-AIM participants completing any number of credit hours*	269	408	**Yes**
6	Total number of RE-AIM participants earning credentials	269	68	No
7	Total number of participants enrolled in further education after completing RE-AIM	202	9	No
8	Total number of participants employed after completing RE-AIM	169	7	No
9	Total number of participants retained in employment after RE-AIM program completion (3–9 months later)	157	6	No
10	Total number of RE-AIM participants employed at enrollment who received a wage increase post-enrollment	30	153	**Yes**

Note. This table presents total data across the grant period, with each unique student only counted once across years for each benchmark. For benchmark 5, 408 unique students completed at least one credit hour. However, it should be noted that when students are accounted for more than once across grant years, per DOL guidance, this total is 473.

Conclusions

Over the grant period, RE-AIM staff generally implemented the program with fidelity to the program logic model and revised the model to add new CSC opportunities. The RE-AIM program had mixed results related to student outcomes: students generally reported knowledge gains and increased confidence in certain areas and most student completers also pursued further education. However, only 14% of students completed their program.

The suggestions shared by RE-AIM staff and students during this grant could support TNCC in improving programs and grant management in the future. Based on the study findings, we offer several recommendations and lessons learned for successful implementation of short-duration CSC programs at TNCC and other community colleges:

- Recruit and involve employers in program planning from the beginning.
- Create infrastructure to manage the grant at the beginning of the program.
- Ensure curriculum, materials, and resources are ready before enrolling students.
- Recruit and involve area partners in CSC program recruitment efforts.
- Develop a clear and program-specific marketing plan.
- Consider a wide array of avenues for recruitment.
- Explicitly offer academic and career supports to support student completion.

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Introduction

A shortage of qualified and highly skilled workers in the manufacturing industry (Peters, 2013; Varva, 2011) has contributed to a number of positions going unfilled each year (Giffi et al., 2015; McLeman, 2014; Norwin, 2013). Despite this deficit, the manufacturing sector continues to grow and is projected to create over 3.4 million new jobs during the next decade (Giffi et al., 2015). Without a skilled manufacturing workforce to fill these positions, the gap between available jobs and qualified employees is expected to widen (Peters, 2013; Tupponce, 2013), with an estimated surplus of 2 million unfilled positions over the next 10 years (Giffi et al., 2015).

This scenario is acutely felt in Virginia, where increasing numbers of retirees and a lack of skilled workers have led to hundreds of technical jobs remaining unfilled (Tupponce, 2013). In the Virginia Peninsula region, manufacturing employers reported that 80% of new hires were not fully qualified and lacked essential skills (Peninsula Council for Workforce Development, 2012). With an estimated 11,000 new jobs expected in the region (Peninsula Council for Workforce Development, 2012), there is a need for training programs to produce a larger and more skilled manufacturing workforce.

Similarly, there is heightened demand for cybersecurity employees in the United States. More than 200,000 jobs remain unfilled nationally due to a lack of qualified employees (Virginia Department of Education [VDOE], 2016), and demand is expected to grow in Virginia. The VDOE has noted that "Virginia currently faces an immediate and exciting opportunity to create a pathway to cybersecurity careers" (VDOE, 2016).

In an effort to meet these growing needs, Thomas Nelson Community College (TNCC) developed the Rapid Employment in Advanced Integrated Manufacturing (RE-AIM) program, which offered 8 weeks to 9 months of intense training to regional adults and unemployed workers in advanced manufacturing (i.e., mechatronics, manufacturing technology, precision machining) and cybersecurity for local area networks (LANs). Depending on the career studies certificate (CSC) program, RE-AIM completers received one or more of the following credentials: Virginia Manufacturers Association Manufacturing Technician Level 1 (MT1) Certification; Siemens Mechatronic Systems Certification (Level 1/2); CompTIA Security+, Network+, and A+; and/or an ACT WorkKeys National Career Readiness Certificate. All students who completed the RE-AIM program received a CSC in mechatronics, manufacturing technology, precision machining, or cybersecurity for LANs.

To develop and improve the RE-AIM program and to determine its effects on academic performance, employment prospects, and acquisition of skills, TNCC applied for a 4-year, Round 4 grant from the Department of Labor's Trade Adjustment Assistance Community College and Career Training (TAACCCT) grants program. In 2015, TNCC contracted with Magnolia Consulting, LLC, a small, woman-owned, independent research and evaluation company, to provide an external formative and summative evaluation. This final report addresses program implementation and student outcomes across the entire grant period. It includes the following sections: an overview of the RE-AIM program, a review of the evaluation design, a summary of student demographic information, a discussion of implementation and

outcome findings, and a summary with recommendations for TNCC and other community colleges.

Overview of RE-AIM Program

The RE-AIM program had a strong evidence-based design informed by studies by the Peninsula Council for Workforce Development (2012), the National Coalition of Advanced Technology Centers (McAtee & Pierpoint, 2014), and the Council for Adult and Experiential Learning (Klein-Collins, 2012). These reports detailed a need for manufacturing and cybersecurity technicians, described competency expectations and requirements for advanced manufacturing programs, and explained the importance of competency-based programs that provide students with fast-paced learning and high program placement.

At TNCC, RE-AIM staff sought to provide workers eligible for Trade Adjustment Assistance (TAA), unemployed or transitioning veterans, dislocated workers, and other adults in Local Workforce Investment Board Area XIV with 8 weeks to 9 months of instruction and support in workforce training and job preparation, networking, and placement. The program also aimed to engage local employers in planning and implementation efforts. RE-AIM supported the development of new courses in advanced integrated manufacturing and cybersecurity for LANs and new employment opportunities for TNCC staff and students. By providing the RE-AIM program to students, TNCC aimed to meet Virginia industry demands for a larger and more skilled workforce in advanced integrated manufacturing and cybersecurity.

A program logic model, developed and modified in collaboration with program stakeholders, documents the conceptual framework of RE-AIM (see Appendix A, Figure A1).

Evaluation Design and Data Strategies

This section describes the evaluation design and data strategies, including formative and summative evaluation questions, timelines, analysis procedures, and participant confidentiality procedures.

Evaluation Design

Evaluators conducted a mixed-method, formative and summative evaluation of the RE-AIM program. This final report provides overall findings from the formative and summative evaluations. Evaluators previously provided TNCC with two interim evaluation reports that included recommendations for program improvement (Styers, Shannon, Cosby, & Peery, 2016, 2017).

Formative Evaluation Questions

To understand program implementation, evaluators conducted an implementation study (i.e., formative evaluation) to address several evaluation questions related to two key areas: implementation process and structure, and implementation fidelity (see Figure 1).

Implementation Process and Structure

(1) How did RE-AIM program personnel develop the curriculum? What was the program administrative structure? How did specific individuals (e.g., project directors, instructors, career coaches/specialists) each contribute to the program design, development, and implementation (i.e., recruitment, training, placement, management, sustainability, efficient use of available resources)? What factors affected program personnel's involvement or lack thereof?

(2) Did TNCC conduct an in-depth assessment of participants' abilities, skills, and interests to select or enroll participants in RE-AIM? What assessment tools and processes did TNCC use? Who conducted the assessments? How were the assessment results used? Were the assessment results useful in determining the appropriate program and course sequence for participants?

(3) Were employers involved in planning of the RE-AIM program?

(4) How did RE-AIM students find out about the program?

Implementation Fidelity

(5) How did RE-AIM program personnel use the curriculum? Which contributions of RE-AIM staff and partners were most critical to the success of RE-AIM? Which contributions had less of an impact?

(6) Were employers involved in implementation of the RE-AIM program? Did employers believe RE-AIM courses were targeted to workforce needs? Which employer contributions were particularly successful or unsuccessful?

(7) How did RE-AIM program personnel use grant funding to make improvements during implementation? How was the program delivered to students? What supports or other services were offered to students? Did students receive career guidance? If so, what were the delivery methods?

(8) What resources did RE-AIM students receive from TNCC? Did students participate in career planning opportunities and other supports offered by TNCC? What were student perceptions of the quality and types of support provided by RE-AIM staff? How engaged were students in the program? What did students view as program strengths and potential areas of improvement?

Figure 1. Formative evaluation questions.

Summative Evaluation Questions

Evaluators conducted a summative evaluation (i.e., outcome study) of the RE-AIM program to assess the program's success in meeting its intended outcomes. Summative evaluation activities included a full outcome analysis to examine treatment-only effects of program participation related to academic achievement, long-term employment, and skill-related outcomes. Furthermore, evaluators compared aggregated RE-AIM student outcomes to aggregated outcomes for students participating in similar programs at five demographically similar Virginia community colleges. Summative evaluation questions corresponded to treatment-only findings and to RE-AIM program comparisons to other Virginia Community College System (VCCS) institutions (see Figure 2).

Summative Evaluation

(1) Do students who participate in the RE-AIM program self-report gains in workforce content, digital literacy, and workplace etiquette knowledge, as well as career readiness and confidence skills? Do students who participate in the RE-AIM program report changes in their interest in furthering their education? Do gains or changes vary by program type?

(2) Does TNCC meet RE-AIM grant benchmarks in the following areas: (a) the percentage of students pursuing further education after program completion, (b) the percentage of students completing the program, (c) the percentage of students finding employment, and (d) the number of students seeing wage increases after program enrollment?

(3) How does TNCC's RE-AIM program compare to other VCCS advanced manufacturing and cybersecurity programs on the following benchmarks: (a) the percentage of students completing the program, (b) the percentage of students pursuing further education after program completion, (c) the percentage of students finding long-term employment, and (d) total wages after program completion?

Figure 2. Summative evaluation questions.

For additional information on the summative evaluation, including additional information on comparison VCCS institutions, see Appendix B.

Data Strategies

To evaluate the degree and extent of RE-AIM program development, implementation, and stakeholder engagement, evaluators analyzed data collected through surveys, semiannual in-person meetings, program artifacts, and interviews and focus groups with RE-AIM staff and students. Additional information on specific measures is available in Appendix C.

Data Collection Timeline

Data collection activities occurred from June 2015 through March 2018. This final report includes formative and summative evaluation data for the entire grant period. For more information on program duration and timeline, see Appendix D.

Analysis Procedures

To support data analyses, evaluators utilized ATLAS.ti (qualitative data) and SPSS (quantitative data). Evaluators analyzed qualitative data using the techniques of analytic induction (Erickson, 1986) and calculated descriptive statistics, paired samples *t*-tests, chi-square tests, and ANOVAs for quantitative data. Additional information on specific procedures is in Appendix E.

Participant Confidentiality

Evaluators strongly believe in the importance of human subjects' protection, including maintaining participant confidentiality in data collection and reporting. Thus, evaluators have participated in Family Educational Rights and Privacy Act (FERPA) and National Institutes of Health (NIH) training on protecting human research participants. In compliance with FERPA regulations, evaluators used specific procedures to protect student and staff confidentiality in all data collection activities. For all implementation data, evaluators avoided individual identifiers outside of roles (e.g., project director, instructor, student) and aggregated data so that no individual is identifiable in any report.

Study Participants

Evaluators collected demographic information on all students who enrolled in RE-AIM (see Table 1). Across programs, three quarters of RE-AIM students were male. Nearly half of all students identified as White, and over a third identified as Black or African American. Approximately half (54%) of RE-AIM students were incumbent workers, and 11% of students were veterans. The average age of students was 28.22 years, and students ranged from 16 to 70 years old. Approximately 40% of RE-AIM students had PELL grants. Finally, most of the RE-AIM students were enrolled in the cybersecurity for LANs CSC program (72%), followed by the mechatronics 1 and 2 CSC programs (18% and 11%, respectively), the manufacturing technology CSC program (9%), and the precision machining 1 and 2 CSC programs (3%).

Table 1. RE-AIM Student Characteristics (September 2015–March 2018 (n = 483).

	n	%
Gender		
Male	364	75%
Female	119	25%
Race/Ethnicity		
White	229	47%
Black or African American	163	34%
Asian	17	4%
Hispanic	35	7%
American Indian or Alaska Native	2	0.4%
Native Hawaiian or other Pacific Islander	3	0.6%
2 or more races/Unknown	29	6%
Incumbent status		
Incumbent worker	260	54%
Non-incumbent worker	223	46%
Veteran status		
Veteran	52	11%
Nonveteran	430	89%
PELL grant status		
Received PELL grant	191	40%
Did not receive PELL grant	292	60%
RE-AIM program		
Manufacturing technology	43	9%
Mechatronics Level 1	86	18%
Mechatronics Level 2	55	11%
Precision machining 1/2	14	3%
Cybersecurity for LANs	350	72%
	n	**Mean**
Age	480	28.22

Notes. TNCC did not provide race/ethnicity information for five students or veteran status information for one student. Because students could complete multiple RE-AIM programs, percentages for the RE-AIM program variable do not total 100%.

Evaluators compared RE-AIM student outcomes to aggregated data from students in similar advanced manufacturing and cybersecurity for LANs CSC programs at other Virginia community colleges. Additional information on comparison institutions is in Appendix B.

Implementation Process and Structure

This section provides a detailed overview of how TNCC implemented the RE-AIM program, including the recruitment-to-acceptance process, program administrative structure, and RE-AIM program structure.

Recruitment-to-Acceptance Process

TNCC followed a three-step recruitment-to-acceptance process for the RE-AIM program: (a) RE-AIM recruited students, (b) students applied, and (c) RE-AIM admitted students. Using this process, TNCC began recruiting and enrolling students in the RE-AIM program in August 2015 and continued recruitment through January 2018.

Recruitment was challenging during the grant period. Program staff shared that recruitment primarily occurred through word of mouth and through TNCC-based outreach initiatives (e.g., STEM Saturday, Cyber Saturday). RE-AIM students reported hearing about the program from TNCC staff, advisors, or on-campus flyers; Google advertisements; job fairs; radio advertisements; or their employer. In an effort to increase RE-AIM enrollment numbers, TNCC created and began enrolling for two new CSC programs: cybersecurity for LANs and precision machining in early 2017. Around this time, TNCC also approved the mechatronics Level 2 CSC program and began enrollment. By adding these programs, the RE-AIM team successfully met DOL grant enrollment benchmarks. TNCC staff shared that future enrollment numbers may increase through dual enrollment programs. Staff believed that the dual enrollment programs have been successful in increasing high school students' interest in mechatronics and therefore may open a pipeline of students interested in pursuing advanced manufacturing pathways.

Additional information on the RE-AIM recruitment-to-acceptance process is available in Appendix F.

Program Administrative Structure

The administrative structure for TNCC's RE-AIM staff included two project directors; a project liaison; instructors; a job placement coordinator/career coach; and administrative staff, who supported data collection efforts. The project liaison participated in the first two years of the grant, overseeing grant administration and providing support in working between the credit and noncredit sides of the college. In summer 2017, the project liaison left TNCC, and one project director assumed the previous role of the project liaison. The project director's new duties included leading the RE-AIM team in implementing and revising the RE-AIM program, providing project management support, writing quarterly and annual reports, and coordinating TNCC's response to Department of Labor (DOL) requests.

Additional information on roles and responsibilities of key program staff is available in Appendix F.

RE-AIM Program Structure

The RE-AIM program structure consisted of three key components: (a) industry-specific workforce classes, (b) academic and employment support, and (c) building workforce/industry support (see Table 2).

Table 2. RE-AIM Program Structure

RE-AIM Three-Component Program Structure		
Industry-Specific Workforce Classes	**Academic and Career Support**	**Workforce/ Industry Support**
• Manufacturing technology, mechatronics, precision machining, and cybersecurity for LANs • 8 weeks to 9 months of coursework • Rolling enrollment or cohort	• Tutoring • Basic workplace and soft skills support • Career workshops • Job placement services and support	• Connections fostered with employers • Open houses • Individual meetings with employers

Students participated in industry-specific workforce classes.

Students completed 8 weeks to 9 months of coursework in RE-AIM CSC programs. Manufacturing technology and precision machining students followed a cohort model, in which the same group of students completed identical coursework for 8 weeks to 5 months. By contrast, cybersecurity for LANs and mechatronics students enrolled at different time points and finished their CSC programs in 16 weeks to 9 months. At the end of the manufacturing technology[1] and mechatronics programs, students completed an assessment for MT1 certification or Siemens Level 1/2 certification, respectively.

Students received academic and career support.

Instructors provided various types of academic support, such as tutoring, on an as-needed basis. Students also received career support through their instructors and the job placement coordinator/career coach. The job placement coordinator facilitated job skills workshops, contacted students regarding attendance or course completion issues, and provided explicit job placement services and support to students.

Staff worked to build employer connections and support for RE-AIM.

TNCC project directors and the job placement coordinator/career coach worked to build connections and support for RE-AIM by garnering more attention for a closely related program, AIM.[2] In January 2016, TNCC lobbied for the AIM center to receive funding in the

[1] TNCC ended the manufacturing technology CSC program after the summer of 2017 due to low enrollment.

[2] Students in both programs receive certificates or degrees in advanced manufacturing; however, AIM is academically more intensive than RE-AIM, and unlike RE-AIM students, students who pursue AIM receive an associate degree. TNCC staff noted that RE-AIM still falls under the AIM umbrella.

governor's budget and received letters of support from 11 companies, including Continental, Alcoa, Canon, and Owen's Illinois. However, in April 2016, TNCC determined that it would take another 3 to 5 years to begin building the AIM center. This delay discouraged interested employers early in the grant, as they reported a lack of interest in waiting for trained employees.

The job placement coordinator/career coach began work in May 2016 and concentrated on strengthening employer connections and support for the RE-AIM program, meeting with individual employers to showcase the program and to discuss hiring needs.

Implementation Fidelity

Because implementation fidelity is a multifaceted concept, evaluators used a research-based framework that examines program adherence (i.e., implementation as intended, content received, dosage), while also measuring other variables that could potentially influence implementation fidelity, including quality (i.e., effectiveness of program delivery), participant responsiveness (i.e., level of student engagement and interest), and program adaptations or revisions (Carroll et al., 2007; Pérez et al., 2016). Evaluators used this framework to document implementation fidelity through the collection of several variables, such as the number of industry-specific workforce classes held and the level of student engagement (see Appendix H, Table H1). In general, TNCC implemented the program with fidelity by adhering to the overall program logic model and providing students with adequate program dosage (see Table 3).

Table 3. Summary of Implementation Fidelity Variables and Findings

Implementation Fidelity	
Adherence	• 100% of students received workforce courses, 100% received tutoring support, 93% received soft skills support, and 75% received employment support. • Twelve employers supported program implementation. • Students received 8 weeks to 9 months of instruction. • Students had more one-on-one involvement with instructors than with other staff.
Potential Moderators of Fidelity	
Quality	• The cohort model, hands-on labs, and instructor quality were viewed positively. • The addition of cybersecurity for LANs improved student enrollment. • Grant administration and staff collaboration were difficult.
Participant Responsiveness	• Students worked with other RE-AIM students on projects, discussed courses with family or friends, asked questions during class, and participated in discussions.
Program Adaptations	• TNCC revised the mechatronics and manufacturing technology CSC programs during the grant period. • TNCC added cybersecurity for LANs and precision machining CSC programs in early 2017.

Adherence

To examine program adherence, evaluators explored several variables related to student receipt of core RE-AIM components and employer participation. While participating in the program, RE-AIM students consistently received the following core RE-AIM components: workforce courses (100%), soft skills instruction (92%), and tutoring support (as needed; 100%). Slightly over half of instructors (52%) also reported that RE-AIM students provided tutoring support to each other.

Employment support for students varied by enrollment date and program. The job placement coordinator/career coach was not hired until May 2016, resulting in a lack of support for the first group of student cohorts in manufacturing technology and mechatronics. Furthermore, the job placement coordinator did not provide employment support to cybersecurity students until fall 2017. Students in the cybersecurity for LANs program were difficult to reach because their courses were online, and many did not come to the TNCC campus. To better access cybersecurity and other RE-AIM students, the job placement coordinator created an online portal through Blackboard for networking and information sharing (e.g., soft skills and employability skills resources). The portal was available to all students beginning in October 2017.[3] Overall, 25% of enrolled students did not receive employment support from the job placement coordinator. Across programs, manufacturing technology students (40%) and cybersecurity for LANs students (31%) had the highest percentages of students with no support from the job placement coordinator (compared to 3% of mechatronics students and 0% of precision machining students).

While employment support at TNCC was limited for some students, at least 12 employers supported RE-AIM program planning and implementation. For instance, Alcoa Howmet provided funding for military students, veterans, and their dependents in the manufacturing technology program and served on a RE-AIM faculty search committee. Other employers supported the program by visiting and donating banners to the mechatronics lab and assisting with student résumé development (e.g., résumé writing support from Canon). Continental Automotive established a successful partnership with the precision machining program and provided several types of support, including reviewing the precision machining CSC curriculum and donating lab space, equipment, furniture, and banners to TNCC. A machining classroom and lab space, to which TNCC had access, was built at Continental Automotive in late 2017.

Percentage of enrolled students receiving core RE-AIM components			
Workforce courses	100%	Tutoring support	100%*
Soft skills support	92%	Employment support	75%

At least 12 employers supported program implementation during the grant period	
Alcoa Howmet	Liebherr Mining
Ball Metal	Muhlbauer
Busch Gardens	Newport News Shipbuilding
Canon	Science Technology Corporation
Continental Automotive	Swisslog
Craft Machine	Vision Machine

* Tutoring support was offered to all students on an as-needed basis.
Sources: TNCC institutional data, Program personnel implementation survey, and program artifacts.

[3] TNCC did not provide information on actual use of the Blackboard platform.

Student dosage in RE-AIM varied by program. Specifically, from August 2015 to March 2018, RE-AIM students participated in differing classes for varied periods of time, as follows:

- *Manufacturing technology.* Students enrolled in 8 weeks of courses in industrial technology, world-class manufacturing, and principles of industrial technology for the manufacturing technology CSC program. However, due to low enrollment, RE-AIM ended the program in 2017, with the final cohort finishing in summer 2017.
- *Mechatronics.* Mechatronics Level 1 students participated in an average of 9 months of instruction in programming applications, mechatronics, electrical control systems, mechanisms, digital circuits, pneumatics, hydrostatics, and hydraulics. Beginning in January 2017, students who continued into the mechatronics Level 2 CSC program received an average of 9 months of coursework in instrumentation, microprocessors, logic controller systems, electronic motor drive systems, computer numerical control and mechanic process control, world-class manufacturing, machine design, and human interface systems.
- *Precision machining.* Students participated in 5 months of courses in graphic representation, machine shop, applied technical math, industrial safety, machine blueprint reading, numerical control, computer numerical control programming, machine tool operations, and coordinate measuring machine operations and programming for the precision machining CSC program.
- *Cybersecurity for LANs.* Students participated in one semester of three courses (principles of information systems, Internet and network foundations, and network security basics) for the cybersecurity for LANs CSC program (Appendix H, Table H2).

As one indicator of program dosage, evaluators explored the frequency and type of support received by RE-AIM students (see Table 4). On average, instructors reported that they met with slightly over half of students individually. Instructors largely met with students for academic reasons. Project directors reported that they met with approximately a quarter of students, largely for academic reasons. Finally, the job placement coordinator/career coach reported meeting with nearly a quarter of students individually, primarily for academic, financial, career, and personal reasons.

Table 4. Program Dosage by Individual Meetings with TNCC Staff, 2015–2018

PROGRAM DOSAGE		Instructors*	Project directors/project liaison	Job placement coordinator/career coach*
Average percentage of students met with at least once individually		53%	27%	23%
Primary nature of	Academic	☑	☑	☑
	Financial	☐	☐	☑
	Personal	☐	☐	☑
	Career	☐	☐	☑

* Cybersecurity for LANs instructors met with fewer students individually compared to other instructors. This may have been because the spring and summer 2017 courses were online.
Source: Program personnel implementation survey.

Quality

To understand the quality of RE-AIM implementation, evaluators asked staff and students for their feedback on RE-AIM programs. During focus groups and in surveys, staff and students offered their perceptions of RE-AIM quality, including strengths, weaknesses, and areas for improvement. Student and staff comments fell into five overarching topic areas: (a) program design, structure, and resources; (b) instructor and staff quality; (c) employer contribution and collaboration; (d) Department of Labor grant implementation; and (e) marketing and recruitment (see Table 5).

Table 5. Program Quality Topics

Topics Discussed Related to Program Quality		
Program design, structure, and resources	Instructor and staff quality	Department of Labor grant implementation
	Employer contribution and collaboration	Marketing and recruitment

Program design, structure, and resources

Overall, students viewed the RE-AIM program design and structure positively. Using a scale from 1 (*strongly disagree*) to 5 (*strongly agree*), students rated their agreement with statements about the classes and cohort structure, with students *agreeing* or *strongly agreeing*, on average, that their classmates were supportive and that they enjoyed being in a cohort (see Figure 3).

Students generally appreciated the support of their peers and enjoyed cohorts, and they offered neutral thoughts on full-time courses and class time.

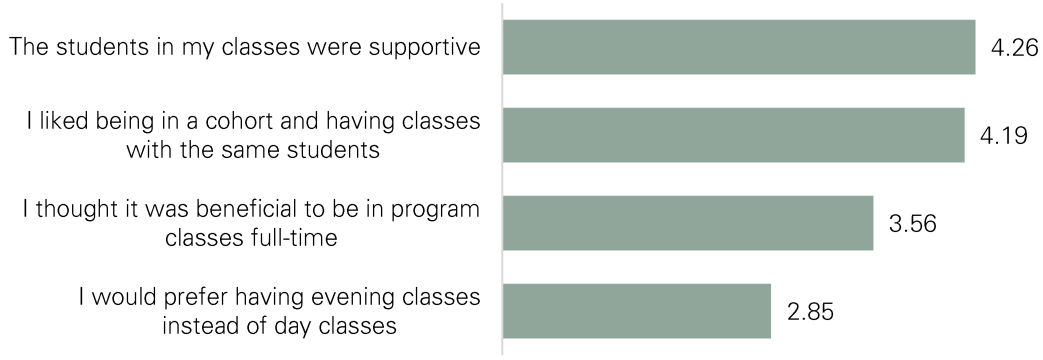

*Figure 3. Students' ratings of RE-AIM classes and cohort structure on a 5-point scale (*n *= 27).*
Source: Student academic experiences survey.

During focus groups, RE-AIM students shared that the cohort model was useful for receiving peer academic and moral support. One student shared:

Being [in a] cohort with other students, it teaches teamwork, communication skills. Also, it allowed us to learn to value each other's expertise in subject matter, which shortened the learning process and built self-confidence. If someone you know acquired understanding of a difficult topic, it gives us peer-to-peer confidence.

Students also continually spoke about the benefits of the hands-on labs. Across multiple years and programs, students requested more opportunities for hands-on lab time, noting that it provided them with additional experience.

"The classes were…too long. Going to class three days a week for four hours a night is too time consuming when you have work and a family."
– RE-AIM student

Staff and students offered mixed perceptions on class scheduling, particularly with regard to preferred enrollment status and the time of day courses were offered (see Figure 3). As an example, staff and students shared that the compressed program time frame could be challenging for full-time students and for instructors, as it (a) required a high level of prerequisite knowledge for students; (b) involved 8-hour instructional days in precision machining, which created extra burdens for the instructor with regard to class preparation; (c) created difficulty for instructors in covering all required content for certification exams (i.e., cybersecurity for LANs); and (d) could feel "rushed" to some students, particularly in 8-week programs. Varied perceptions on scheduling may reflect the different needs, roles, and responsibilities of RE-AIM students.

TNCC staff shared that prerequisite knowledge and scheduling challenges could be addressed in various ways. For example, TNCC staff commented on the benefits of a one-credit boot camp course to provide more foundational knowledge for cybersecurity for LANs students, with the goal of better preparing students for the credentialing exam. For the mechatronics program, the RE-AIM instructors reorganized their courses to ensure that foundational information was taught early in the program. Staff also commented that issues around 8-hour machining days could be resolved by having students participate in hands-on mentoring opportunities for part of the program or instructional day. For example, staff shared that students could be paired with a current machinist at Continental Automotive, where the machining CSC program was hosted.

Finally, the RE-AIM program experienced successes related to obtaining lab supplies, equipment, and resources. First, students and staff noted that having the labs and equipment was critical to providing the hands-on learning experiences that students need. One staff member noted, "When [students] see [the lab], it makes such a huge impact. When you are in there and see the equipment, and you see you will actually be working with these things, it makes a huge difference." For machining in particular, TNCC collaborated with Continental Automotive to develop a machining lab for student use at the Continental facility. The lab was completed in late 2017 and provided needed lab space and resources for machining students.

> *"Equipment was expensive so I understand that they can't get it all in one month, but it wasn't quite ready for students."*
>
> *– RE-AIM student*

However, there were several challenges related to obtaining supplies and resources during the grant, including (a) a lack of mechatronics and machining supplies at the beginning of the program, and later, a lack of cybersecurity supplies, which held up valuable instructional time; (b) delays in finishing the machining lab at Continental Automotive, which caused delays in student enrollment for the precision machining CSC program and delays in the availability of machining completers for employers; (c) a lack of in-class textbooks for every student, resulting in the need to share books; (d) limited or no Internet access at some facilities, which prevented online access to program materials; and (e) a slow curriculum approval process at the college, which delayed implementation start dates for most RE-AIM programs.

Instructor and staff quality

Staff and students offered positive feedback on instructor and staff quality. Using a scale from 1 (*poor*) to 5 (*excellent*), a sample of RE-AIM students generally rated the quality of their interactions with specific staff and other students as *good* or *excellent* (see Figure 4).

On average, students rated the quality of support provided by RE-AIM staff and other students as good or excellent.

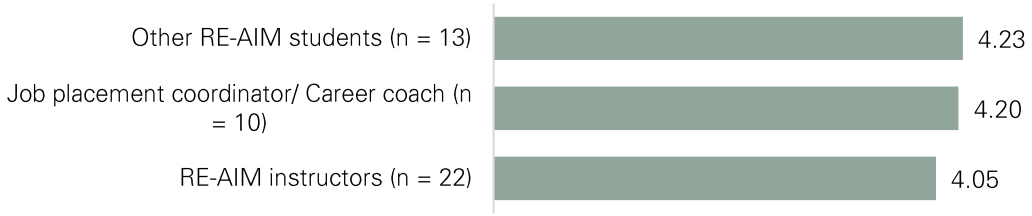

Figure 4. Students' ratings of the quality of support provided by RE-AIM staff and peers on a 5-point scale. Source: Student academic experiences survey.

> *"Amazing teachers, [I] wouldn't have had the motivation to continue without their insight and encouragement. They are fantastic and really stuck with you to make sure you understood everything and worked with you to get your assignments done. Highly recommended!"*
>
> *– RE-AIM student*

Students and staff agreed that instructors were helpful, knowledgeable, and supportive of student learning. Staff indicated that instructors and support staff were genuinely concerned about the well-being of students and focused on relationship building. One staff member noted, "Personally, I haven't seen this level of support for individual students anywhere. They are not just a number or someone who attends the class." Students agreed that instructor support was key to their success. Other students emphasized that instructors regularly went above and beyond to ensure that students were receiving the best learning experience possible. For example, students shared that the mechatronics instructor regularly provided "challenges" outside of the regular curriculum. One student described this, saying, "[The instructor] really wants us to be successful. If you came in an open lab and didn't have to work on anything else, he will give you challenges."

Students also benefited from working with the job placement coordinator/career coach. In focus groups and surveys, students noted that she was an invaluable resource to students as they moved through the program. One student expressed this as, "[the job placement

coordinator/career coach] did a great job. She had a lot of helpful tips to help you obtain a job." Students thought that she could improve her support of students by working with more local employers to support students in securing employment.

There were challenges related to RE-AIM staff quality, primarily because of changes in program leadership and continued staff turnover. There were continual leadership changes during the grant period, resulting in differing perspectives on grant management. Furthermore, staff who were involved for multiple years reported a general lack of project and grant management from the beginning. These staff were unable to recall a clear plan and suggested that a project management plan was never fully developed or implemented. Compounding the leadership issue was a high level of RE-AIM staff and instructor turnover, which contributed to a general lack of knowledge about the program among new staff members. One staff member expressed this sentiment, saying, "We did not have a lot of institutional knowledge of this grant. Most people here now, are six months new." Moving forward, RE-AIM staff suggested that the program should focus on hiring full-time rather than part-time staff to avoid issues around miscommunication and misinformation.

> *"I don't know if we had folks who understood what they were getting into. Complex set of rules. Large grant implementation skills was never a strength of the college. It's hard to find any evidence of a kickoff meeting, organization, divide and conquer. No project management that was implemented."*
>
> *– RE-AIM staff*

Employer contribution and collaboration

Staff offered several examples of successful employer contribution and collaboration during the grant. First, several staff agreed that the partnership with Continental Automotive provided needed lab space and resources and offered the promise of future employment opportunities for students. Second, staff mentioned national and international recognition received by the cybersecurity for LANs and mechatronics programs. The cybersecurity for LANs program at TNCC was recognized nationally as a Center for Academic Excellence by the National Security Administration (NSA) and Department of Homeland Security, and the mechatronics program was recognized internationally as being Siemens certified. Staff noted that few programs in Virginia or nationwide have these recognitions, and they believed these certifications would result in more business partnerships and student opportunities. Finally, students and staff commented on the benefits of RE-AIM partnerships with Muhlbauer and Swisslog in 2018, which resulted in internship opportunities for mechatronics Level 1 completers to pursue Level 2 coursework at no cost.

> *"We need to produce competent students and then employers will be drawn to us. We have the connections established, I think we just need to link it to the students."*
>
> *–RE-AIM staff member*
>
> *"I wish [the program] was able to get with companies that were looking to hire students and have job interviews and hiring sessions geared towards the students."*
>
> *–RE-AIM student*

Staff also highlighted several challenges due to a lack of industry partners and involvement, particularly after the AIM project was not fully funded by the state of Virginia. Staff believed that after the AIM center funding fell through, employer relationships and student employment opportunities were negatively impacted. Some staff also suggested that because industry partners had limited involvement from the beginning, there were (a) limited demand for program graduates, (b) a lack of student internship opportunities, and (c) a mismatch between

what employers wanted to see in potential employees and the experiences afforded by the RE-AIM program. For example, TNCC staff developed the manufacturing technology program based on credentials from the Virginia Manufacturers Association (VMA), but regional industry partners were less interested in these credentials than originally expected, and no manufacturing technology students were hired. To improve employer collaboration and involvement, program staff discussed the importance of strengthening connections between the credit and noncredit (i.e., workforce) sides of TNCC. Given that the workforce program has established industry contacts, staff believed this connection would make it easier for RE-AIM students to have the same access to employers and job opportunities as noncredit students. However, while the credit and noncredit staff commented on this need to collaborate, it never came to fruition during the grant period.

Department of Labor grant administration

RE-AIM staff often reported issues related to grant administration and took various steps to improve overall grant management. Beginning in 2017, RE-AIM staff made improvements to grant administration and tracking. For example, staff began using a Blackboard platform to better assist instructors in collecting and compiling student data. Staff shared that the Blackboard platform offered a more secure and confidential way for students to submit personal information, such as salary data, and would support students in connecting with the job placement coordinator/career coach and finding potential employment opportunities.

> *"How do we vet potential grant opportunities? It's too easy to go after the bright shiny grant, versus, what is the impact on my department, discipline, programs, etc.? What will it do for the morale of people involved? Going through the vetting process up front will help since we know we have to have the project management in place."*
>
> *–RE-AIM staff member*

Even with this improvement, RE-AIM staff encountered several challenges related to the original grant structure. First, staff indicated that it was difficult to understand grant details and necessary deliverables. Staff attributed this confusion to the original grant wording, as it was initially written for TNCC's noncredit, workforce side of the college, making it difficult to translate to for-credit programs. Second, RE-AIM staff reported difficulties with the allocation of various grant funds and resources in the original DOL proposal. This difficulty created issues related to (a) purchasing supplies for the different RE-AIM programs, (b) undercharging of indirect costs in the grant (i.e., capped at 10% when they could have been capped at 40%), and (c) funding of student assessments. Some of these effects trickled down to the cybersecurity for LANs CSC program, which was unable to pay for students' Network + exam fees. Finally, staff encountered challenges when tracking students before they enrolled in RE-AIM. Students in earlier RE-AIM cohorts needed to visit the department to enroll, but students in later cohorts could enroll without visiting the department. As a result, staff reported that it was difficult to track students and obtain their information. Overall, program staff collectively agreed in a fall 2017 staff focus group that it was too late to revise existing DOL grant metrics and that they planned to heed the lessons learned when writing future grants.

Program marketing and recruitment

Program marketing and recruitment efforts were successful in one key area: cybersecurity. The TNCC cybersecurity for LANs CSC program evidenced high enrollment

numbers, and TNCC staff noted that adding the program helped TNCC meet DOL grant enrollment benchmarks. According to staff, cybersecurity outreach events, such as Cyber Saturday and collaborations with local high schools, were beneficial in bringing students into cybersecurity for LANs programs and building an academic pipeline from high school to community college. However, it should be noted that TNCC counted students as being enrolled in the RE-AIM cybersecurity for LANs program if they enrolled in at least one course included in the cybersecurity for LANs CSC, per DOL guidance. Because some of these courses were prerequisites for more advanced cybersecurity degrees, students may have "enrolled" in the CSC but never completed it. Similarly, students may not have been aware of the RE-AIM opportunity. For example, at one focus group with cybersecurity students, these students were unaware of the cybersecurity for LANs CSC or the RE-AIM program.

According to staff, several recruiting challenges continued throughout the entire grant period because of (a) an unclear marketing plan and budget, (b) limited regional job opportunities, (c) a lack of marketing outside of TNCC, and (d) a lack of student screening. First, staff indicated that an unclear marketing plan resulted in confusion around yearly marketing spending, and as a result, the grant ran out of these funds in 2017. Second, staff noted that regional job opportunities were limited, particularly in mechatronics, which resulted in difficulties for student recruitment into RE-AIM programs. Third, staff noted that local workers and individuals outside of the TNCC community were often unaware of the programs and opportunities at TNCC because many marketing efforts were internally focused. TNCC originally planned to partner with outside agencies to recruit students (e.g., One-Stop, Fort Eustis, PluggedInVA), but these partnerships fell through early in the grant and TNCC was unable to recruit in this manner. Finally, some cybersecurity instructors believed that students entered the cybersecurity for LANs program with unrealistic and often idealized program expectations because of a lack of student screening. They suggested that students should receive more information from recruiters on what is involved in cybersecurity for LANs courses and careers.

> *"I think our biggest obstacle is limited marketing budget and the inability to market our programs in the capacity that other local community colleges do, so people don't really know about Thomas Nelson or the RE-AIM programs."*
>
> *–RE-AIM staff member*

In response to the varied recruitment and marketing challenges, students shared several suggestions for improving recruitment and marketing efforts, including (a) highlighting program benefits (e.g., low cost) in marketing materials, (b) advertising on the radio and area interstates, (c) presenting at area high schools and reaching out to guidance counselors about the program, and (d) hanging posters or flyers around the TNCC campus.

Table 6 summarizes strengths and challenges in the implementation of RE-AIM from 2015 to 2018.

Table 6. Summary of Implementation Strengths and Challenges, 2015–2018

	Implementation Strengths	Implementation Challenges
Program design, structure, and resources	• Cohort model • Hands-on labs • Collaboration with Continental Automotive for machining lab	• Slow curriculum approval process • Compressed program time frame • Delays in getting supplies, equipment, and program resources
Instructor and staff quality	• Instructors are knowledgeable and supportive of student learning • Instructors go "above and beyond"	• High degree of staff turnover • Staff communication and collaboration difficulties, particularly

	Implementation Strengths	Implementation Challenges
		across credit and noncredit sides of college
Employer contribution and collaboration	• Machining partnership with Continental Automotive • Cybersecurity for LANs recognized as Center for Academic Excellence by NSA and Department of Homeland Security • Mechatronics recognized as Siemens certified • Mechatronics internships with Muhlbauer and Swisslog	• Limited employer involvement and demand • Lack of connection between credit side of college and employers • Limited regional internship opportunities • Lack of support from curriculum providers
Grant administration	• No key successes noted	• Grant was originally written as a noncredit program • Lack of a formal data collection process • Difficulties in upscaling the program to meet grant enrollment numbers • Difficulties tracking students
Marketing and recruitment	• Adding the cybersecurity for LANs program to the grant • Dual enrollment programs in mechatronics at area high schools	• Unclear marketing plan • Limited marketing budget • Limited external marketing • Lack of student screening

Sources: Staff and student focus groups, student academic experiences survey, and program personnel implementation survey.

Participant Responsiveness

To examine RE-AIM participant responsiveness, evaluators explored staff and student reports of RE-AIM student engagement and interest in coursework through surveys and focus groups. All program instructors acknowledged that students engaged in RE-AIM courses, most often by participating in class discussions (96%); by talking with their instructors after class (78%); or by other ways (13%), including email and phone communications with their instructors, online meetings, and working as a team during labs.

Students' reports of engagement largely varied by the type of activity. For example, using a scale of 1 (*never*), 2 (*rarely*), 3 (*sometimes*), 4 (*often*), and 5 (*very often*), 27 RE-AIM students rated how regularly they engaged in various activities during their RE-AIM program. On average, students *sometimes* or *often* asked questions during class or participated in class discussions, discussed RE-AIM courses with family or friends, and worked with other RE-AIM students on projects during class. Additionally, RE-AIM students, on average, reported that they *sometimes* or *often* talked about grades or assignments with RE-AIM instructors. On average, students indicated that they *sometimes* worked harder than they thought possible and *sometimes* talked with program instructors about assignments or classes outside of class time. Students generally reported that they *rarely* or *sometimes* provided support or tutoring to other RE-AIM students, worked on at least two drafts of an assignment, or worked with other RE-AIM students on projects outside of class. Finally, on average, students reported that they

never or *rarely* came to class without doing the required reading or assignments or skipped class (see Figure 5).

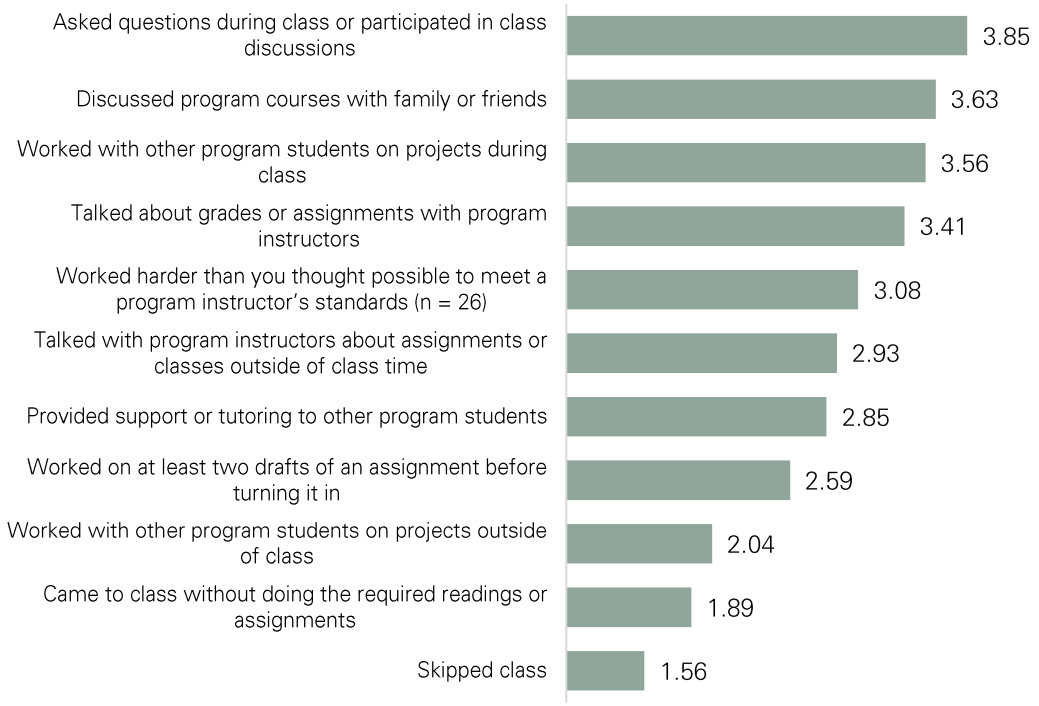

Figure 5. Students' ratings of the frequency and type of their participation during the RE-AIM program, on a 5-point scale (n = 27).

> *"Everything is engaging in this class."*
>
> *–RE-AIM student*
>
> *"I've been sitting behind a desk for several years and I was bored, so I wanted to do something with my hands and my head."*
>
> *–RE-AIM student*

Students also reported being very engaged in their specific RE-AIM program, based on a scale ranging from 1 (*not engaged*) to 10 (*highly engaged*), with a mean of 8.26.

Program staff and students reported that students were excited about and engaged in RE-AIM. Staff shared that students worked as teams during labs, and students regularly commented on the benefits of the hands-on classes and labs in promoting student engagement.

Program Adaptations and Use of Grant Funds

RE-AIM staff stated that they modified some of the course and program content because of changes in program offerings and feedback from RE-AIM staff and students. RE-AIM staff also shared how they used grant funds to make improvements.

Course and program modifications

RE-AIM staff made several program modifications from 2015 to 2018. The following is a detailed list of course and program modifications during the grant period.

2015

Fall

- At the start of the grant, RE-AIM programs were designed to be noncredit, workforce options, but TNCC staff decided that RE-AIM offerings needed to be credit based and, as a result, changed the original program design accordingly. Because of this change to curriculum, staff on the credit side expressed concerns in meeting original DOL grant benchmarks.
- TNCC redesigned the mechatronics program to be a credit-based CSC program, aligned with Siemens Level 1 certification.
- TNCC redesigned the manufacturing technology program to be a credit-based CSC program.

2016

Spring

- TNCC redesigned the manufacturing technology CSC program a second time to include three courses that better aligned with the three MT1 assessment modules. This reduction in the number of courses also reduced the number of credits from 16 to 10. Following these changes, TNCC held manufacturing technology courses over a 7-week period instead of 8 weeks, with one instructor responsible for each course and other instructors serving as tutors, allowing TNCC to offer manufacturing technology courses every 3 to 4 weeks at different times of day.
- TNCC redesigned the mechatronics program a second time to further increase alignment with the Siemens Level 1 exam, to better prepare students for future mechatronics Level 2 coursework, and to allow students to complete the mechatronics CSC program over two semesters (i.e., approximately 6 to 9 months, compared to 6 months previously).
- TNCC hired the job placement coordinator/career coach in late spring (i.e., May 2016). Before this time, students did not receive employment support outside of their classrooms.

Summer

- TNCC staff submitted the mechatronics Level 2 CSC program for curriculum review and approval by college staff.

Fall

- TNCC staff submitted the precision machining CSC and cybersecurity for LANs CSC programs for curriculum review and approval by college staff as new additions to the RE-AIM program.

2017

Spring

- In January 2017, RE-AIM added the cybersecurity for LANs CSC and precision machining CSC programs.

- TNCC delayed the start date of the precision machining CSC program because of delays in completing the precision machining lab at Continental Automotive.

Summer

- Once the precision machining CSC program began, RE-AIM staff condensed one precision machining course, MAC101, from a 16-week course to an 8-week course because Continental Automotive requested that its employees (who were students in the program) participate for the equivalent of a full 8-hour workday.
- In summer 2017, TNCC ended the manufacturing technology CSC program early due to declining student enrollment numbers.

RE-AIM instructors also noted several ways that they regularly modified course content throughout the grant. First, cybersecurity instructors noted that they regularly modified their course content each semester to stay current and provide higher-quality resources (e.g., cybersecurity labs). Other instructors reported adding supplemental videos and online material and adding a virtual factory tour to their lessons during the grant period.

Use of Grant Funds

The following positions were fully or partially funded by DOL grant funds: two project directors, an instructional developer, two mechatronics faculty members, a prior learning assessor/job placement coordinator, and two administrative and fiscal technicians. TNCC also used DOL grant funds to purchase lab equipment to support hands-on learning experiences. There were several changes to the use of grant funds. In April 2016, TNCC changed the mechatronics instructor position from being grant funded to a permanent position fully funded by TNCC. Additionally, in 2017, program staff used DOL grant funds for several reasons, including (a) to develop marketing plans and produce marketing efforts, (b) to provide financial support for faculty professional development, and (c) to hire adjuncts for the different RE-AIM CSC programs.

Throughout the program, TNCC received grants from other organizations. In 2016, the program received funding from the National Science Foundation, which allowed TNCC to build soft skill competencies into the advanced manufacturing curriculum. Additionally, the Alcoa Foundation provided a $40,000 grant that allowed TNCC to support veterans, transitioning military, and their dependents in paying for the manufacturing technology program. Finally, in 2017, RE-AIM received funding from Bank of America to cover certification exam fees for financially needy students in the mechatronics and manufacturing technology CSC programs.

Student Outcomes

This section presents data on RE-AIM student outcomes, including comparisons to DOL grant benchmarks and to other VCCS institutions. Specifically, evaluators present findings related to student knowledge and career readiness, according to surveys and focus groups. Evaluators also present findings related to academic completion, further education and academic interest, and employment and earnings, according to survey, focus group, TNCC institutional, and VCCS data (see Table 7). Evaluators conducted significance tests to examine if there were statistically significant differences in students' retrospective survey ratings. A complete list of findings from statistical significance tests is in Appendix H.

Table 7. Summary of Student Outcome Findings

	Student Outcome Highlights
Knowledge	• A sample of RE-AIM students reported increases in their knowledge of workforce-specific skills and digital literacy skills. These increases were statistically significant.* • In focus groups, RE-AIM students spoke about their workforce and career knowledge gains.
Career Readiness	• RE-AIM students' ratings reflected statistically significant increases in confidence related to communication and workplace skills.* • RE-AIM program completers were career ready but may have lacked regional job opportunities.
Academic Completion	• 14% of students who enrolled in the program completed it, 37% of students left early, and 49% of students were still retained in RE-AIM or other TNCC programs at the end of the grant. • TNCC's RE-AIM completion rate was lower than 4 of the 5 selected VCCS institutions.
Further Education and Academic Interest	• 69% of program completers continued their education at TNCC or other institutions. • TNCC's further education percentage for RE-AIM programs was higher than other VCCS institutions.
Employment and Earnings	• 15 non-incumbent RE-AIM completers found employment within nine months. • 28 of 34 incumbent RE-AIM completers saw a wage increase during the grant period. • Students in RE-AIM fields *could* earn $40,000–$80,000 annually (based on O*Net data). • TNCC's RE-AIM employment rate for student completers was average compared to 5 VCCS institutions.
DOL Grant Benchmarks	• RE-AIM met grant benchmarks for total enrollment, credit hour completion, student retention, and wage increases for enrolled incumbent workers. • Because of the small number of completers, RE-AIM did not meet the further education benchmark.

*Readers should use caution in interpreting findings because of the small sample size on the student retrospective survey.

Knowledge

Over time, RE-AIM students' knowledge increased in multiple areas, according to a sample of RE-AIM students. On a scale ranging from 1 (*no knowledge*) to 10 (*expert*), these students indicated that before taking TNCC courses, they had below-average knowledge in workforce-specific skills, interview and job application skills, and digital literacy skills. After TNCC courses, students retrospectively reported knowledge increases in these three areas. Evaluators conducted three separate paired samples *t*-tests and found that the increases were statistically significant for workforce-specific skills and digital literacy skills, but not for job application and interview skills (see Figure 6).[4]

> *"It's basic knowledge that I can use at home. It helps for problem solving."*
>
> *–RE-AIM student*
>
> *"[The course is a] good start, it gets deeper into stuff we learn about. [The program] impacts you. [You] get… good foundations."*
>
> *—RE-AIM student*
>
> *"The job placement coordinator showed us how job applications work, résumés, the purpose of a cover letter, and how to write a cover letter. I had no idea until she showed us."*
>
> *—RE-AIM student*

Overall, RE-AIM students' knowledge of workforce-specific skills and digital literacy skills increased after TNCC courses, and these increases were statistically significant.

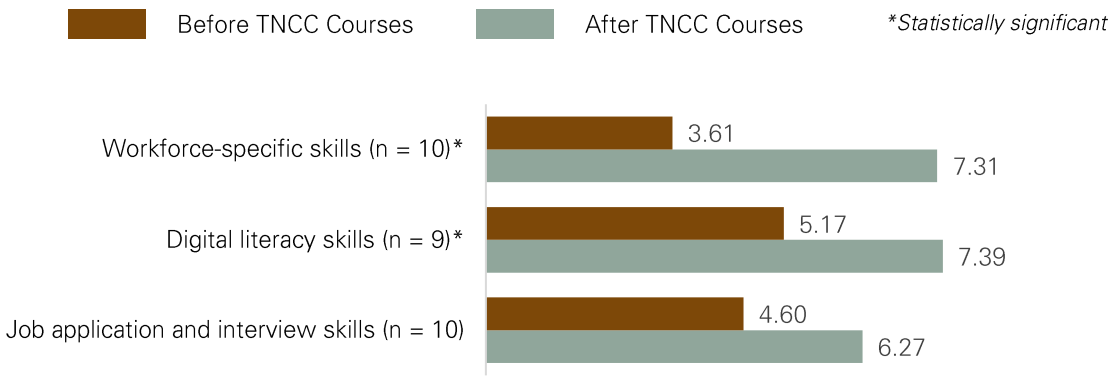

Figure 6. Students' ratings of knowledge of workforce-specific skills, job application and interview skills, and digital literacy skills before and after taking TNCC courses, on a 10-point scale.
Source: Student retrospective survey.
*$p < .05$

In focus groups, students and staff regularly commented on student knowledge gains in RE-AIM programs. Staff noted that by the end of the program, students—including those with previous knowledge or experience—were much more knowledgeable about industry. One staff member shared, "For those already working, it increases their knowledge and gives them the sense that they are furthering their career." In general, staff reported that "[students] are definitely walking out of here having learned something."

Students agreed that the program increased their knowledge in multiple areas, including workforce-specific skills and job application and interview skills. One student shared, "[I] learned a lot in the program. Learned a lot of theory and hands-on that I hope will help me get a nice job." Students also shared that their knowledge gains have the potential to impact both

[4] Because only 10 out of 68 possible RE-AIM students completed the retrospective survey (i.e., 15% response rate), evaluators did not examine knowledge outcomes separately by program type. Due to the small sample size, these findings should be interpreted with caution.

their personal lives and their career futures. One student summed this up, saying, "The hands-on training and instruction give you the skills you will need for a job."

Career Readiness

Across a series of survey questions, RE-AIM students used a scale ranging from 1 (*not confident*) to 10 (*very confident*) to rate their confidence related to job search and interview skills, communication skills, and workplace skills before and after taking TNCC courses. Students' pre- and post-program confidence ratings reflected increases in all three areas (see Figure 7). Paired samples *t*-tests revealed that only the increase in communication skills was statistically significant.[5]

RE-AIM students, on average, reported increased confidence in their communication skills after RE-AIM courses, and this increase was statistically significant.

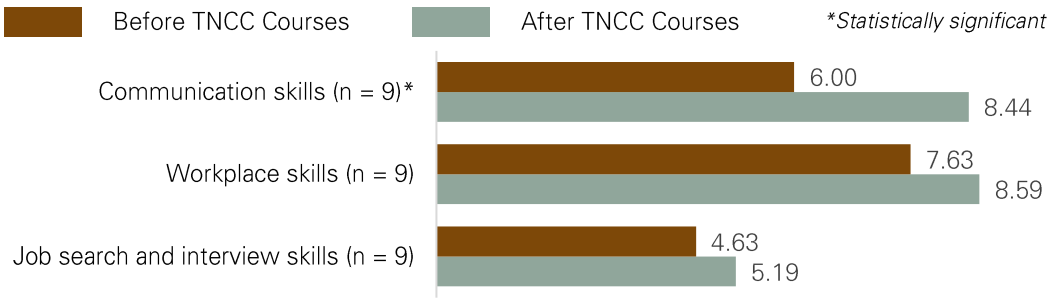

Figure 7. Students' ratings of confidence in job search and interview skills, communication skills, and workplace skills before and after taking TNCC courses, on a 10-point scale.
Source: Student retrospective survey.
*$p < .05$

Moreover, qualitatively, both staff and students expressed how student confidence levels had increased. One staff member shared, "The program gives them the base for a well-rounded foundation, but it also gives them a lot of confidence. When they get out of the program they are floating on cloud nine." Students also reported a sense of accomplishment after they completed the program; as described by one student, "I have confidence in trying something new. I never did anything like this before, and then I got in here and really started to like it."

Immediately after completing the program, students rated their feelings of preparedness for their certification exam and for a career in their RE-AIM program area, using a scale from 1 (*not at all prepared*) to 10 (*very prepared*). Overall, students reported feeling *prepared* for their certification exam and for a career in their program field (see Figure 8). A one-way ANOVA revealed that differences in students' ratings by RE-AIM CSC program were not statistically significant (Appendix H).

[5] Readers should use caution in interpreting findings, due to a small sample size on the student retrospective survey.

Students reported above-average preparedness for careers and certification exams after completing RE-AIM courses. Ratings did not statistically vary by RE-AIM CSC program.

Figure 8. Students' ratings of preparedness for their certification exam and for a career in advanced manufacturing immediately after completing RE-AIM courses, on a 10-point scale (n = 27).
Source: Student academic experiences survey.

> *"This program was started before TNCC established a market for mechatronics. I was told there was a growing need for the field, but there is no jobs available. I feel I wasted my time and money in this course. At this point I am not even confident that an associate degree will land me a decent job."*
>
> *—RE-AIM student*

Most students reported that when they seek employment opportunities, they plan to find a job in their RE-AIM program area (82%) versus outside their program area (19%). In focus groups, some mechatronics students shared that completing the program had increased their career interests, and they expressed confidence in pursuing employment opportunities or in furthering their education. Students who completed surveys, by contrast, offered more divided perceptions regarding their motivation to pursue careers in advanced manufacturing or cybersecurity. Across surveys, on average, career motivation levels remained consistent before and after the program (means = 5.40 and 6.00, respectively), and paired samples *t*-tests revealed that the difference between these means was not statistically significant. However, closer inspection showed that half of these students reported that their motivation had decreased or remained the same. This may be partly due to some students' expressed concerns about finding regional jobs in advanced manufacturing. Several staff agreed that students may be career ready but negatively impacted by a lack of regional job opportunities. One instructor shared this sentiment in a staff focus group, stating, "They are ready, it's just, what are they ready for? Where are they going to work around here? I think we need to start answering that."

Academic Completion

For measures of academic achievement, evaluators first present RE-AIM student completion rates across and within RE-AIM programs, followed by comparisons to student enrollment and completion numbers at demographically similar VCCS institutions.

RE-AIM student enrollment numbers were high, but completion numbers were low

Between August 2015 and March 2018, 37% of enrolled RE-AIM students left TNCC before RE-AIM program completion, and 14% completed their RE-AIM program and received their CSC. The remaining 49% of students were still retained in a RE-AIM program or in other programs at TNCC at the end of the grant. Evaluators were unable to explore academic completion outcomes by program.[6]

[6] Evaluators were unable to disaggregate TNCC institutional data by program area because 53 students enrolled in multiple programs and TNCC provided aggregated academic and employment outcomes across program areas for these 53 students, per DOL guidance. TNCC provided this revised student-level dataset to evaluators in September 2018.

Staff acknowledged that student retention and completion were challenging, largely because of issues related to tracking. For example, some students entered mechatronics or cybersecurity for LANs courses but only completed one or two courses because they were working toward another TNCC degree outside of RE-AIM.[7] However, even with a 14% program completion rate, RE-AIM performed similarly to other programs at TNCC, as reflected in the college-wide graduation rate of 18.8% (Virginia Community College System, 2017).

14% of students completed the RE-AIM program and received a CSC

Meeting DOL grant numbers for program completion was difficult, but staff noted that RE-AIM resources and staff have positively affected other TNCC students, in addition to dual enrollment students. For example, Liebherr enrolled students in a noncredit manufacturing technology program with TNCC RE-AIM instructors in summer 2016, and all Liebherr students passed the final exam. Additionally, in the mechatronics dual enrollment program, high school students used the RE-AIM mechatronics lab and received instruction from grant-funded instructors. In spring 2017, all dual enrollment students passed the program and received their Siemens Level 1 certification. While neither the Liebherr students nor the dual enrollment students could be counted toward grant numbers (because of their noncredit status or age), staff stated that by offering these programs, they are creating an academic pipeline and career pathway for future students. For example, staff believed that Liebherr students could enroll directly in mechatronics with manufacturing technology experience, and dual enrollment high school students could start at TNCC in the Level 2 mechatronics program.

TNCC's RE-AIM completion rate was generally lower compared to similar programs at other VCCS institutions

Using data from the VCCS system, evaluators compared RE-AIM program enrollment and completion numbers to similar CSC programs within five demographically similar VCCS institutions (see Appendix B). Overall, RE-AIM's CSC completion rate was lower than four of the five other VCCS institutions[8] (see Table 8).

TNCC's RE-AIM program completion rate was lower than 4 of the 5 VCCS institutions with similar programs in advanced manufacturing and cybersecurity.

Table 8. Program completion rates by VCCS institution.

VCCS Institution	Program completion rate
TNCC	**14%**
School A	47%
School B	51%
School C	44%
School D	7%
School E	80%

Source: VCCS and TNCC institutional data.

[7] Midway through the grant, per DOL guidance, TNCC began counting students as "enrolled" in the RE-AIM program if they enrolled in any RE-AIM course. However, many of these students were working toward other degrees and may have been unaware of the RE-AIM program or RE-AIM CSC opportunities.
[8] Given that students may not have declared a program before receiving a CSC, VCCS reported that enrollment totals may be slightly off.

Further Education and Academic Interest

To determine students' academic interest and pursuit of further education, evaluators examined the percentage of RE-AIM students who pursued additional education across and within RE-AIM programs. Evaluators also compared the percentage of RE-AIM students pursuing further education to the percentage at similar CSC programs within demographically similar VCCS institutions.

Many RE-AIM completers pursued additional education

Approximately half of surveyed students (*n* = 27) reported an interest in pursuing additional education after completing the RE-AIM program. After finishing the program, several students reported an interest in continuing school to achieve their associate degree (19%) or bachelor's degree (7%), or both (19%) (i.e., combined rate of 44%). According to TNCC institutional data, 69% of students enrolled in further education at TNCC or other higher education institutions after completing RE-AIM. Of the completers who enrolled in further education at TNCC, most enrolled in the Information Systems Technology associate degree program (*n* = 15 students), followed by the Cyber Security for Enterprise CSC program (*n* = 5 students), and the Engineering associate degree program (*n* = 3 students). Evaluators were unable to explore pursuit of further education by RE-AIM program area.[9]

69% of program completers enrolled in further education at TNCC or other higher education institutions

In surveys and focus groups, staff and students reported that students expressed high levels of interest in pursuing additional education. For example, several mechatronics Level 1 students expressed interest in Level 2 classes, and others voiced interest in pursuing their bachelor's degree at a 4-year institution. One student expressed this as:

> *"The Mechatronics program was the best year of schooling I've ever had. The first half of the program pulled me out of the unmotivated hole I dug myself into. the second half pushed me above and beyond. I was learning at such an accelerated rate and it made me want to go to school for my bachelor's degree in mechanical engineering. I wanted to power through and become the best of the best. I learned more outside the school as well because of the motivation increase and the interest increase."*

Cybersecurity for LANs students also indicated that the program increased their interest in learning more about the different educational paths available to them. This higher level of academic interest was partially attributed to RE-AIM's stackable credits, which allowed students to apply credits earned in RE-AIM toward their associate degree. One student shared, "You can stack a lot of certificates and they never expire." One machining student expressed that once a student was in the program, it made sense to continue on with further education, saying, "For me, I was originally going to start here, see how it goes, and then decide whether or not to pursue further education. I don't see any reason not to. It would reinforce the knowledge I've gained and help me retain it."

[9] Evaluators were unable to disaggregate TNCC institutional data by program area because 53 students enrolled in multiple programs and TNCC provided aggregated academic and employment outcomes across program areas for these 53 students, per DOL guidance. TNCC provided this revised student-level dataset to evaluators in September 2018.

The rate of TNCC RE-AIM completers pursuing additional education was higher than the rates of similar programs at other VCCS institutions

Finally, evaluators compared the percentage of program completers who pursued additional education across VCCS institutions. As shown in Figure 9, TNCC had the highest percentage of program completers who pursued additional education when compared to five other VCCS institutions.

The percentage of RE-AIM completers who pursued additional education was higher than the percentage at five VCCS institutions with similar programs in advanced manufacturing and cybersecurity.

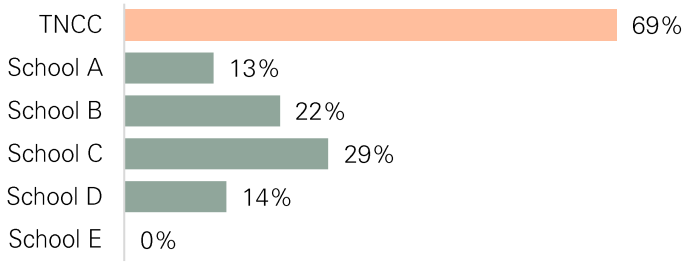

Figure 9. Further education rates for program completers by VCSS institution.
Source: VCCS and TNCC institutional data.

Employment and Earnings

In this section, evaluators examine RE-AIM student completer employment and earnings, in addition to the earning potential of students in RE-AIM fields. Evaluators also examine how RE-AIM completer employment and wages compare to student completers at five demographically similar VCCS institutions.

Some RE-AIM completers found or continued employment

Of RE-AIM completers, 34 were non-incumbent workers and 34 were incumbent workers. Approximately 21% of non-incumbent completers found employment within the first three months following program completion, and 44% were employed within nine months of program completion. Within the incumbent worker group, 82% of student completers received a wage increase during the grant period.

44% of non-incumbent completers found employment within nine months

At the request of TNCC, evaluators examined potential employment and wage outcomes for students who complete credentialing and other short-term programs in advanced manufacturing or cybersecurity. Tables I1 and I2 in Appendix I provide wage data as well as growth and employment projections for several job titles in RE-AIM areas. Within this section, evaluators present wages, projected growth, and projected job openings for the following job titles: manufacturing production technician/engineering technician (i.e., manufacturing technology), industrial machinery mechanic (i.e., mechatronics),

machinist (i.e., precision machining), and computer network support specialist (i.e., cybersecurity for LANs).

Overall, individuals certified in RE-AIM areas could expect to earn a median annual wage of approximately $40,000 to $80,000, depending on the program area, job location, and specific position. Employees with jobs in these areas may also find the highest salaries in the Norfolk–Virginia Beach region compared to statewide and nationally (see Figure 10).

Evaluators also explored projected annual growth and the projected number of annual job openings within Virginia, specific to RE-AIM areas. Overall, industrial machinery mechanics positions (i.e., mechatronics) have the greatest projected annual growth in Virginia (see Figure 11) and the largest number of job openings (n = 360). By contrast, manufacturing production technicians (i.e., manufacturing technology) are seeing decreases in projected annual growth (Figure 11) and have fewer projected annual job openings statewide (n = 80) compared to other RE-AIM areas (i.e., machinist [precision machining, n = 260] and computer network support specialist [cybersecurity for LANs, n = 160]).

Employees in RE-AIM areas could make $40,000 to $80,000 annually based on median 2017 national, state, and local wages in manufacturing technology, mechatronics, precision machining, and cybersecurity for LANs.

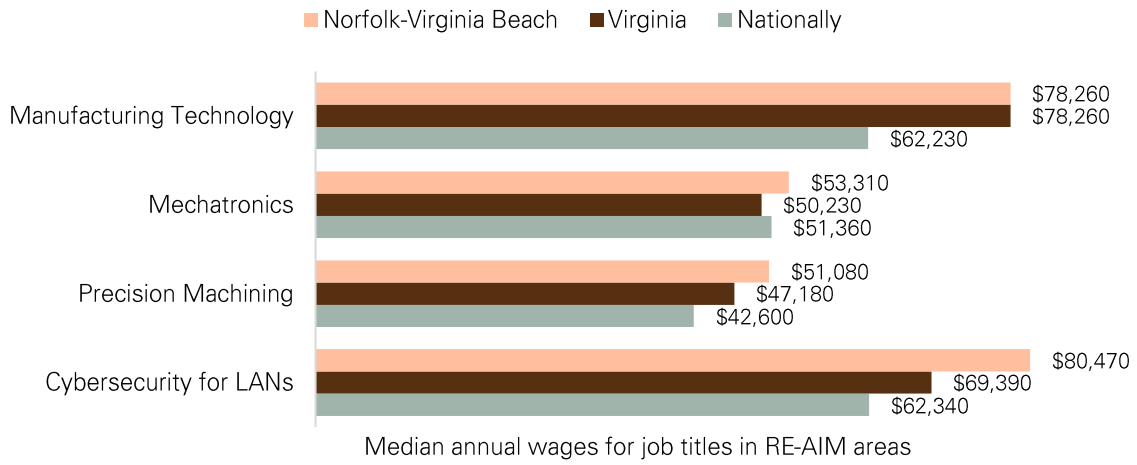

Figure 10. Median annual wages (2017) for manufacturing production technicians (i.e., manufacturing technology), industrial machinery mechanics (i.e., mechatronics), machinists (i.e., precision machining), and computer network support specialists (i.e., cybersecurity for LANs).
Source: O*Net OnLine (n.d.).

Employees in three of the four RE-AIM areas (i.e., all except manufacturing technology) have positive employment prospects in Virginia, based on projected annual growth in the state from 2014 to 2024.

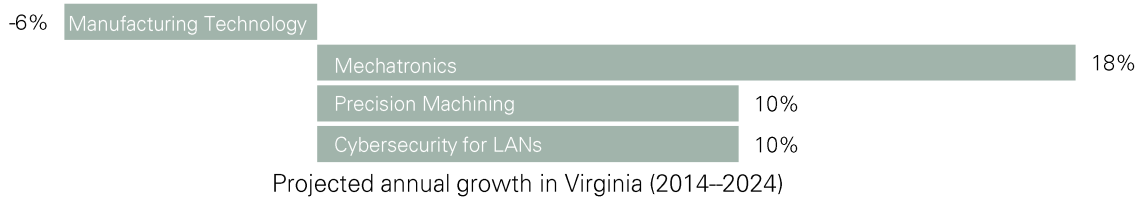

Figure 11. Projected annual growth in Virginia for the following job titles: manufacturing production technicians (i.e., manufacturing technology), industrial machinery mechanics (i.e., mechatronics), machinists (i.e., precision machining), and computer network support specialists (i.e., cybersecurity for LANs).
Source: O*Net OnLine (n.d.).

TNCC's RE-AIM employment rate for program completers was average, and annual income for program completers was average, compared to five other VCCS institutions

Finally, evaluators compared employment rates across VCCS institutions. Overall, TNCC's RE-AIM employment rate for program completers (i.e., percentage of all students employed after program completion) was average when compared to the employment rate of program completers in similar programs at other VCCS institutions (see Figure 12).[10]

TNCC's RE-AIM employment rate for program completers was average when compared to employment rates at five VCCS institutions that have similar programs in advanced manufacturing and cybersecurity.

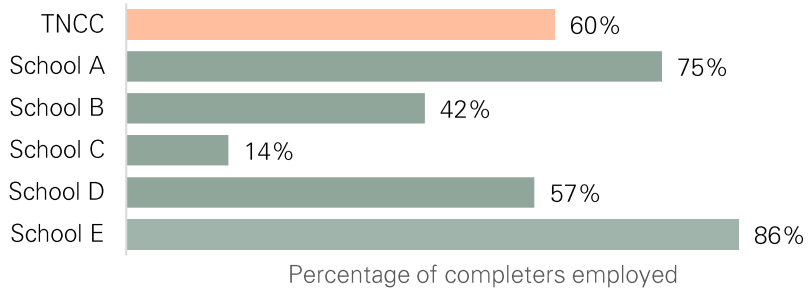

Figure 12. Student employment rates for selected VCSS institutions.
Source: VCCS and TNCC institutional data.

Evaluators also examined data on average yearly earnings for program completers across institutions (see Table 9). The range of annual earnings varied by program area and institution, with TNCC RE-AIM students earning salaries in the lower-than-average range when compared to similar VCCS institutions.

[10] VCCS provided separate and aggregated academic and employment data for TNCC and five comparison institutions. Due to potential missing data, the percentages and numbers reported by TNCC and VCCS may not directly align in all cases.

The average income for RE-AIM completers was lower than four of the five VCCS institutions with similar programs in advanced manufacturing and cybersecurity.

Table 9. Average income for program completers in similar programs across VCCS institutions.

VCCS Institution	Average Annual Income
TNCC	**$21,398**
School A	$17,832
School B	$32,492
School C	$43,720
School D	$66,474
School E	$25,944

Source: VCCS and TNCC institutional data.

DOL Grant Benchmarks

Of the ten metrics articulated in the November 2016 grant modification to DOL, TNCC exceeded project targets on five metrics and did not meet targets on five metrics (see Table 100). TNCC exceeded its target goals for the total number of participants served by RE-AIM, the total number of participants still retained in RE-AIM or other programs, and the total number of enrolled participants who saw wage increases. TNCC did not meet its targets for the number of participants who completed the RE-AIM program, the number of students who earned credentials, and the number of students who enrolled in further education after program completion. TNCC also did not meet its targets for employment metrics.

Table 10. Performance from August 1, 2015, through March 31, 2018, on the Ten Metrics Articulated by TNCC in the November 2016 Department of Labor Grant Modification

Metric	Description	Project Target (*n*)	Achieved (*n*)	Met or Exceeded Target?
1	Total participants served by RE-AIM	320	483	**Yes**
2	Total number of participants completing RE-AIM	269	68	No
3	Total number of participants still retained in RE-AIM	0	150	**Yes**
4	Total number of participants still retained in other education programs	0	88	**Yes**
5	Total number of RE-AIM participants completing any number of credit hours	269	408	**Yes**
6	Total number of RE-AIM participants earning credentials	269	68	No
7	Total number of participants enrolled in further education after completing RE-AIM	202	9	No
8	Total number of participants employed after completing RE-AIM	169	7	No
9	Total number of participants retained in employment after RE-AIM program completion (3–9 months later)	157	6	No
10	Total number of RE-AIM participants employed at enrollment who received a wage increase post-enrollment	30	153	**Yes**

Note. n/a = not available. This table presents total data across the grant period, with each unique student only eligible to be counted once across years for each benchmark. For benchmark 5, 408 unique students completed at least one credit hour. However, it should be noted that when students are accounted for more than once across grant years, per DOL guidance, this total is 473.
Source: TNCC institutional data.

Summary

The purpose of this final report is to support TNCC in understanding RE-AIM program implementation and student outcomes, particularly as they relate to DOL benchmarks and performance in comparison to demographically similar VCCS institutions.

Over the grant period, TNCC staff generally implemented RE-AIM with fidelity to the program logic model and revised the model to add new CSC program opportunities. One area of inconsistency during the grant period related to employment support: the employment specialist was not hired until the middle of the second year, and cybersecurity for LANs students did not receive her support in the first half of 2017. Staff and students highlighted various strengths and areas for improvement related to RE-AIM quality, with many students commenting on the supportive and knowledgeable instructors, and with program staff often highlighting internal issues with communication, collaboration, and grant management.

The RE-AIM program saw mixed results for student outcomes. On a positive note, students generally reported knowledge gains and increased confidence in certain areas, as well as motivation to pursue advanced manufacturing and cybersecurity careers. Additionally, approximately 69% of program completers pursued additional education, and program enrollment numbers were high. However, overall RE-AIM completion rates were low, with only 14% of students (n = 68) completing RE-AIM. Furthermore, 15 non-incumbent completers found employment within nine months and 28 incumbent worker completers saw wage increases. When evaluators compared RE-AIM to similar programs within demographically similar VCCS institutions, RE-AIM had the highest percentage of students pursuing additional education. However, RE-AIM also had the second-lowest CSC completion rate compared to the five other VCCS institutions.

The suggestions shared by RE-AIM staff and students during this grant could support TNCC in improving programs and grant management for future students. Based on the study findings, we offer several recommendations and lessons learned for successful implementation of short-duration CSC programs at TNCC and other community colleges:

- *Recruit and involve employers in program planning from the beginning.* RE-AIM staff requested limited input from employers when developing RE-AIM CSC programs, because program staff noted that RE-AIM was aligned to specific types of licensure (i.e., Siemens Level 1, MT1). As a result, employer investment in RE-AIM was likely low, particularly at grant onset. TNCC was also hindered by the lack of communication between the credit side of the college and area employers. The noncredit side of the college had connections with employers, but despite continued evaluator recommendations for greater collaboration between the two sides, there was limited collaboration and engagement, resulting in a lack of direct connection to area employers on the credit side of the college. To improve these relationships, community colleges could partner with local employers, possibly by establishing a workforce advisory board made up of local employers that would provide input on program and curriculum development, student recruitment, and program delivery for the credit and noncredit sides of the college. Specifically, TNCC could identify regional employers with hiring

needs and a commitment to supporting career development (U.S. Department of Education, 2017). Establishing these connections and requesting continued support from employers could strengthen employers' ties to the program and the college and could increase employers' interest in providing student internships and employment opportunities.

- *Create infrastructure for managing the grant at the beginning of the program*. RE-AIM staff reported a great deal of confusion related to grant management and infrastructure, often because of changes to the leadership structure and the lack of a clearly developed and written plan for program rollout. To improve grant management and understanding of processes, project directors could draft a written plan for grant management, administration, and collaboration during initial meetings. This plan could be shared among grant staff for feedback. Developing a written set of practices and guidelines could also support staff communication efforts, particularly in cases of staff turnover.
- *Ensure that curricula, materials, and resources are ready before enrolling students*. In late 2015 through early 2016, students expressed concerns that TNCC began initial RE-AIM CSC programs before everything was established (e.g., equipment, materials). This same concern resurfaced when the precision machining lab was not complete in early 2017. Before enrolling students in new CSC programs, community colleges should ensure that all materials, resources, equipment, and curricula are ready and that grant-funded positions (e.g., employment coordinator, instructors) are hired.
- *Recruit and involve area partners in CSC program recruitment efforts*. TNCC staff originally planned to involve many other partners, including PluggedInVA staff, One-Stop Centers, and area military bases. When these connections dissolved in late 2015, TNCC lost a number of recruiting opportunities. To foster these connections, community colleges could invite external partners to participate in their initial meetings and could find ways to directly involve them as true partners. For instance, TNCC could consider establishing deeper partnerships with the regional K–12 school systems. The mechatronics CSC program showed the promise and sustainability of dual enrollment pathways, and TNCC could take additional steps to collaborate with regional school systems by actively working together on program and curriculum development, developing shared goals, creating seamless transitions and academic pathways, and recruiting students into community college programs following completion of dual enrollment opportunities (Amey, Eddy, & Campbell, 2010).
- *Develop a clear and program-specific marketing plan*. The RE-AIM team had various ideas for program marketing, but many of these were subsumed into the overarching AIM program, which likely resulted in a lack of direct support and interest in RE-AIM. When marketing and recruiting for new programs, community colleges should ensure that their efforts are program specific, clearly documented, and directly targeted to the population of interest.
- *Consider a wide array of avenues for recruitment*. Another option for improving recruitment might be to examine additional options. For example, community colleges could market academic pipelines through dual credit opportunities, have community

college staff visit area high schools to recruit, and schedule high school counselor visits to view the labs and meet program instructors. Programs could also target older students by offering additional evening and online classes and offering financial aid or scholarships for students (Ruffalo Noel Levitz, 2015).

- *Explicitly offer academic and career supports to promote student completion*. The job placement coordinator/career coach reported meeting one-on-one with nearly a quarter of students to discuss academic, financial, personal, and career-related concerns. Some of these students referred to her support as "invaluable." Given that few students benefited from individual support from the job placement coordinator, TNCC could examine additional ways to promote her role and availability, particularly for students in online courses. Students could benefit from more explicit and ongoing support from the job placement coordinator or another designated individual in a wide variety of areas. For example, previous research suggests the benefits of supporting community college students in building their career goals (Simmons, 1995) and applying for and receiving financial support (Davidson & Petrosko, 2015; Pruett & Absher, 2015), as well as the benefits of actively monitoring individual student progress to identify students who are struggling or falling behind (Capps, 2012).

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Appendix A. RE-AIM Logic Model

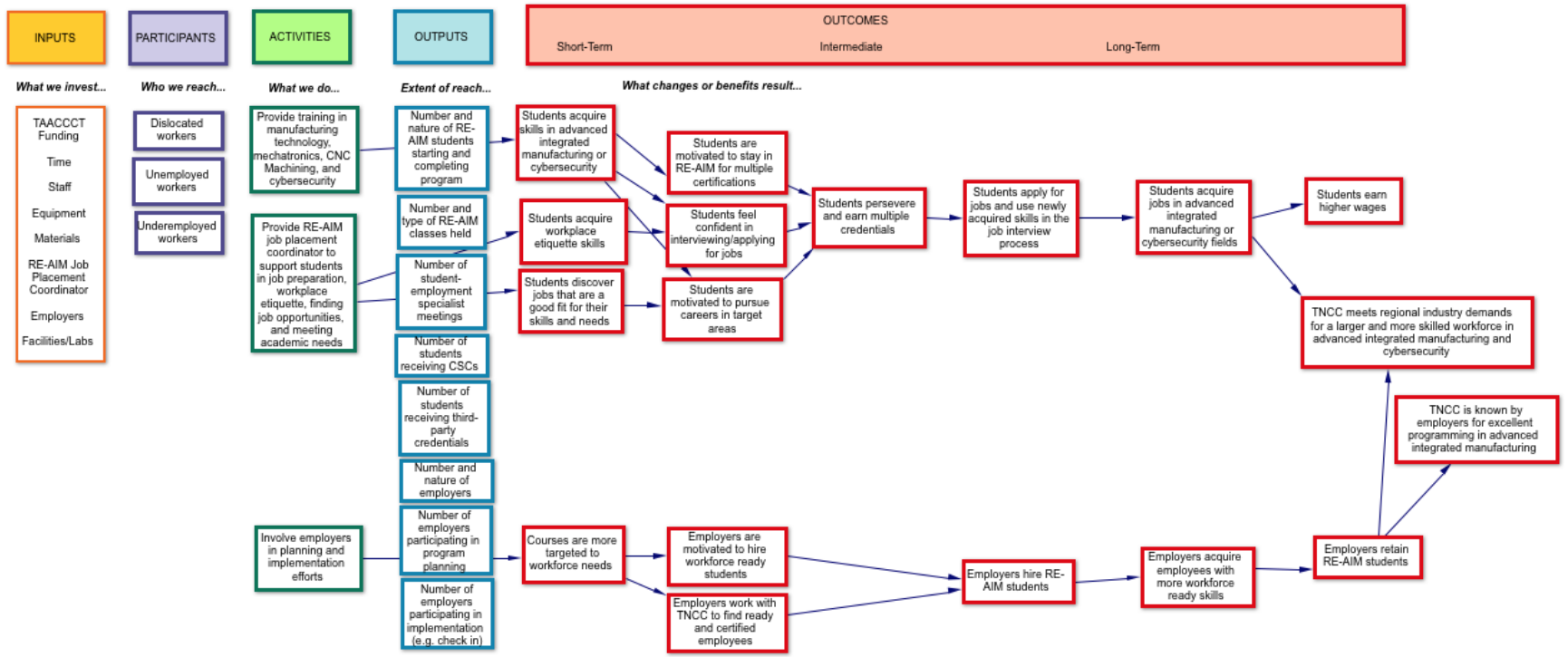

Figure A1. RE-AIM logic model.

Appendix B. Additional Information for Summative Evaluation

Although a randomized controlled trial would be the most rigorous design for the summative evaluation, it was not possible because TNCC did not have an adequate comparison group at the college. TNCC's credit-based advanced manufacturing programs were new, and few TNCC students were enrolled in other manufacturing programs.

To strengthen the design comparing the TNCC RE-AIM program to other advanced manufacturing programs on various benchmarks, evaluators selected five community colleges that were programmatically and demographically similar to TNCC to serve as comparison schools. First, evaluators examined characteristics of advanced manufacturing programs offered by colleges in the Virginia Community College System (VCCS), including program content, number of credits, program model, available certifications, and employment support, as well as whether employment support was offered through the program, etc. Next, for colleges with similar advanced manufacturing programs, evaluators collected data related to college type, setting, size, and tuition, as well as student demographic data. After collecting these data, evaluators compared the colleges to determine those most similar to TNCC. Finally, evaluators examined the VCCS Classification of Instructional Programs (CIP) codes to ensure that the selected colleges offered career studies certificates (CSCs) in advanced manufacturing and cybersecurity that were similar to TNCC's. Based on the data collected, evaluators selected five community colleges that were the most programmatically and demographically similar to TNCC to serve as comparison schools and confirmed these selections with RE-AIM project directors (see Table B1).

Table B1. Thomas Nelson Community College (TNCC) Comparison School Summary

	TNCC	School A	School B	School C	School D	School E
Demographics						
Type	**Public**	Public	Public	Public	Public	Public
Setting	**City**	Town	Rural	Rural	City	City
Size	**Medium**	Medium	Small	Medium	Large	Medium
Total undergraduate students (fall 2017)	**8,897**	3,405	2,481	3,958	23,945	4,145
Average net price (2017)	**$7,694**	$6,283	$6,354	$8,811	$7,126	$6,832
Students receiving federal loans (2016–2017)	**23%**	12%	0%	0%	29%	8%
Students receiving Pell grants (socio-economic diversity measure)	**47%**	36%	50%	33%	40%	30%
First-time, full-time students who return after their first year	**61%**	57%	60%	61%	60%	60%
Overall graduation rate	**19%**	33%	35%	40%	20%	32%
Salary after attending	**$29,900**	$24,700	$22,900	$23,100	$30,400	$26,700
Enrollment status						
Full-time	**30%**	35%	47%	32%	36%	33%
Part-time	**70%**	65%	53%	62%	64%	67%
Race/Ethnicity						
White	**48%**	62%	95%	58%	48%	72%
Black	**34%**	29%	2%	34%	32%	17%
Hispanic	**7%**	4%	1%	2%	8%	3%
Two or more races	**6%**	3%	1%	3%	5%	4%
Asian	**3%**	1%	0%	1%	4%	2%
Unknown	**1%**	0%	0%	1%	1%	1%
American Indian/Alaska Native	**0%**	0%	0%	0%	1%	0%
Native Hawaiian/Pacific Islander	**0%**	0%	0%	0%	1%	0%
Nonresident alien	**0%**	0%	0%	0%	1%	0%
Program						
Comparable CSC programs offered	**Manufacturing technology** **Mechatronics** **Precision machining** **Cybersecurity for LANs**	Manufacturing technician Cybersecurity technician	Industrial maintenance Mechatronics Precision machining Cybersecurity	Precision machining Networking and computer support	Industrial maintenance Cybersecurity	Manufacturing technology Mechatronics Cybersecurity fundamentals

	TNCC	School A	School B	School C	School D	School E
Total credits	**10–19**	28	29	18–25	9–29	18–29
Cohort model?	**Yes (Manufacturing technology, Precision machining) No (Mechatronics, Cybersecurity for LANs)**	Yes	Yes	No	No	Yes
Siemens certified Mechatronics program?	**Yes**	n/a	Yes	n/a	n/a	No
Program duration?	**8 weeks (Manufacturing technology); 9–12 months (Mechatronics); 5–6 months (Machining); 16 weeks (Cybersecurity for LANs)**	16 weeks	6 months	18 weeks	3 semesters (Mechatronics CSC) 2 semesters (precision machining CSC)	3–6 months
Program schedule?	**Full-time (Manufacturing technology, precision machining) Part-time (Mechatronics, Cybersecurity for LANs)**	8 hours daily	3 days a week, 8 hours per day	Varied	Part-time	3 days a week, 3 hours a day
Program-embedded employment support?	**Yes**	Yes	Yes	Yes	No	Yes

Sources: Websites of various VCCS community colleges, 2017; U.S. Department of Education, 2017.

Based on the program logic model (Appendix A) and DOL grant benchmarks, evaluators had the following hypotheses for student changes following RE-AIM participation:

Hypotheses Across Programs

- RE-AIM students will report that their knowledge and skills in advanced integrated manufacturing/cybersecurity content areas, digital literacy, and workplace etiquette increased after participating in the program.
- RE-AIM students will report that their readiness to pursue careers and their confidence in interviewing and applying for jobs increased after participating in the program.
- RE-AIM students will report that their interest in furthering their education changed after participating in the program, as evidenced through new interest in pursuing a higher-level degree or additional certifications. Furthermore, 67 RE-AIM students will pursue additional education after completing the program.
- At least 213 RE-AIM students will complete their program of study, as evidenced by the attainment of a program-specific CSC.
- At least 103 RE-AIM students will acquire jobs in advanced manufacturing or cybersecurity in the first 1 to 3 months after program completion, and 54 of those students who completed the program and were employed will be retained in employment 3 to 9 months later.
- After completing the program, at least 29 students will earn higher wages compared to when they started the program.

Hypotheses by Program Type

- Students will report gains in knowledge and skills in advanced integrated manufacturing/cybersecurity content areas, digital literacy, and workplace etiquette across program types.

Appendix C. RE-AIM Data Strategies

This appendix lists the data strategies and measures used for the formative and summative evaluations. To the extent possible, evaluators triangulated data from multiple measures to understand program implementation and student outcomes across data sources.

Formative Evaluation

Formative evaluation measures included program artifact reviews, focus groups with staff and students, a student academic experiences survey, and a program personnel implementation survey.

Program artifact review

Evaluators examined RE-AIM program artifacts, including program reports, meeting notes, newsletters, and course syllabi. Evaluators examined a total of 92 artifacts from 2015 to 2018.

Focus groups

Evaluators conducted 12 focus groups between 2015 and 2018 to gain a deeper understanding of implementation and to ascertain qualitative perceptions of program outcomes. During each student and staff focus group, evaluators discussed questions related to program implementation and quality, in addition to student outcomes.

Qualitative data from focus groups with program personnel provided information on program development, areas of potential strength or weakness, and program outcomes. The student focus groups offered additional information on how students viewed the RE-AIM program, including information on career support opportunities and student suggestions related to program strengths, weaknesses, and areas for improvement. Student focus groups also provided qualitative support for program outcomes related to career readiness, academic and career interests, and academic achievement.

Across 3 years of data collection, evaluators held seven student focus groups and five staff focus groups, for a total of 12 focus groups. Thirty-one students participated in focus groups, and 41 staff participated in focus groups, resulting in a total of 72 focus group participants across the 3-year study period.

Surveys

Evaluators used two surveys to understand program implementation: a student academic experiences survey and a program personnel implementation survey.

Student academic experiences survey. At the end of RE-AIM courses, evaluators sent an online survey to all enrolled students. Students who confirmed that they had completed their RE-AIM program were invited to complete the survey. The survey included questions for RE-AIM completers about the quality of support received from staff (e.g., instructors, job placement coordinator/career coach) and fellow students, their perceptions of the job placement

coordinator, the program's strengths and areas for improvement, their ratings related to program engagement, their post-program beliefs on career preparedness and plans, and their perceptions of RE-AIM classes (e.g., size, class time, class format, cohort model). This final report includes student academic experiences survey data for 27 RE-AIM program completers out of 68 total (40% response rate).

Program personnel implementation survey. Evaluators surveyed program personnel quarterly to collect additional implementation and program design data related to lesson and course modifications or revisions, perceptions of student engagement for the first eight cohorts, use of grant funds, program involvement, employer involvement, information sharing among staff, program recruitment and training, and general program perceptions. Project directors and a sample of instructors from every program completed the survey at each time point, for a total of 40 staff surveys out of 50 surveys disseminated (80% response rate).

Summative Evaluation

Summative evaluation measures included statewide and TNCC longitudinal data, a student retrospective survey, student and staff focus groups, and a student academic experiences survey (questions related to career plans).

Summative evaluation activities included (a) using focus groups, available state and institutional data, and surveys with students to explore how RE-AIM participation related to career and academic outcomes; (b) examining available state and institutional data to determine the extent to which RE-AIM students completed further education, secured long-term employment, increased their earnings, attained third-party credentials and CSCs, completed the program, were retained in the program, and increased their GPA; (c) examining how TNCC's RE-AIM program compared to other advanced manufacturing and cybersecurity programs on several of the above benchmarks; and (d) tracking RE-AIM progress toward benchmarks from the Solicitation for Grants Application and original TNCC proposal to DOL. Benchmarks relate to student enrollment, CSC completion, and employment outcomes (Table 10).

Statewide employment data and TNCC institutional data

Evaluators used available student-level data from TNCC institutional and statewide employment databases as indicators of student demographics (e.g., race/ethnicity, gender, age), academic outcomes (e.g., whether individual students sought further education, earned credentials, completed credit hours, withdrew from programs, or completed programs), and employment (e.g., average income, job retention, current employment status). TNCC and statewide longitudinal employment data were also used to assess progress toward DOL grant benchmarks. To protect student confidentiality, evaluators used ID numbers instead of student names for tracking purposes. TNCC received approval from DOL on December 14, 2016, to offer two additional CSC programs (i.e., cybersecurity for LANs, precision machining) and to extend program delivery through March 31, 2018. As a result, evaluators present academic outcome and employment data for students who enrolled and completed the program between August 1, 2015 (CSC program start date) and March 31, 2018 (end of CSC program delivery period according to DOL grant modification). This report's presentation of grant metrics 1–10, along with their descriptions and project targets, directly aligns with the information submitted

by TNCC to the Department of Labor in TNCC's November 2016 request to modify the RE-AIM Statement of Work and Budget.

VCCS institutional data

Evaluators worked with VCCS staff to collect aggregated, program-level comparison school data (Schools A–E in Table B1) related to several grant benchmarks, including (a) total students enrolled in programs (based on fall 2015 to spring 2017 data), (b) total students completing programs (based on fall 2015 to spring 2017 data), (c) of those students who completed programs, the total enrolled in further education (based on fall 2016 to fall 2017 data), (d) of those students who completed programs, the total employed (based on June–September 2017 data), and (e) average wage of those students who completed programs (based on June–September 2017 data). VCCS provided program-level data within each VCCS institution for programs that matched the following TNCC RE-AIM program CIP codes: (a) mechatronics (15.0613), (b) precision machining (15.0699), (c) cybersecurity for LANs (15.0303), and (d) manufacturing technology (15.0699). Evaluators then totaled or averaged numbers across programs to determine school-specific performance for the five VCCS comparison schools and for TNCC.

Student retrospective survey

Evaluators surveyed RE-AIM students 3 months after course completion to assess various academic outcomes (e.g., course completion, performance, participation in further education), employment outcomes (e.g., job plans, career self-efficacy, wage increases, retained employment), and skill-related outcomes (e.g., self-efficacy in digital literacy, 21st-century skills). Students who confirmed that they completed RE-AIM courses were invited to complete the survey. This survey included retrospective questions to assess student perceptions of growth in outcome areas over time. Multiple studies suggest that retrospective surveys provide high internal validity and convenience with only one administration period (e.g., Cantrell, 2003; Pratt, McGuigan, & Katzev, 2000). The final report includes data from 10 student completers out of 68 total (15% response rate).

Student and staff focus groups

Evaluators conducted separate focus groups with students and program staff to ascertain qualitative perceptions of program outcomes. Evaluators took several steps to promote reliability and validity, including conducting focus groups with student respondents who had been through at least 75% of the program or staff respondents who had taught RE-AIM students in the previous semester. The lead focus group evaluator was trained to recognize and prevent "groupthink" in participant responses and to effectively moderate focus groups, which includes facilitating whole-group participation and actively working to prevent "groupthink." The lead focus group evaluator also audio recorded focus groups and had an evaluation assistant present in the room to take notes on the group conversation and dynamic. Immediately after each focus group, evaluators created an analytical memo to document observations and support initial data analysis and interpretation (Bazeley, 2013; Chioncel, Van Der Veen, Wildemeersch, & Jarvis, 2003; Ryan, Gandha, Culbertson, & Carlson, 2014). Across 3 years of data collection, evaluators held seven student focus groups and five staff focus groups, for a

total of 12 focus groups. Thirty-one students participated in focus groups, and 41 staff participated, resulting in a total of 72 focus group participants across the 3-year study period.

Student academic experiences survey

Evaluators collected information at the end of RE-AIM courses related to students' career beliefs (e.g., perceptions of career readiness, post-graduation plans). This final report includes student academic experiences survey data for 27 RE-AIM program completers out of 68 total (40% response rate).

Appendix D. Data Collection Timeline

Evaluation milestones and data collection timelines are presented in Table D1.

Table D1. Evaluation Milestones and Data Collection Time Frame

		Evaluation	Manufacturing Technology CSC	Mechatronics CSC	Precision Machining CSC	Cybersecurity for LANs CSC
2015	Jun	*Site visit*				
	July					
	Aug					
	Sept					
	Oct		◎	Mechatronics Level 1 begins		
	Nov	*Focus groups*				
	Dec		◎			
2016	Jan	*Recommendations*				
	Feb	*Staff survey*				
	Mar		◎			
	Apr	*Focus groups*		◎		
	May	*Recommendations*	◎			
	Jun	*Staff survey*		◎		
	Jul		◎			
	Aug					
	Sept	*Institutional data collection point*				
	Oct	*Staff survey*				
	Nov	*Focus groups, Interim report*				
	Dec		◎	◎		
2017	Jan			Mechatronics Level 2 begins		
	Feb					
	Mar					
	Apr	*Focus groups, Staff survey*				
	May	*Recommendations*	◎			◎
	Jun			◎		
	Jul					
	Aug		◎			◎
	Sept	*Staff survey, Institutional data collection point*				
	Oct	*Focus groups*			◎	
	Nov	*Interim report*				
	Dec			◎		◎
2018	Jan					
	Feb					
	Mar	*Focus groups*				◎
	Apr	*VCCS data collection, Institutional data collection*				
	May					
	Jun					
	Jul					
	Aug					
	Sept	*Final report*				

Note. Colors indicate program duration (i.e., start and end dates for the four programs). ◎ = program exit/completion point; students were surveyed at this point and 3 months after completing their program.

Appendix E. Analysis Procedures

To facilitate qualitative analyses, evaluators imported data into Atlas.ti, a qualitative data analysis software. Atlas.ti allows evaluators to divide data into segments, attach codes to the segments, and find and display all instances of similarly coded segments (Miles & Huberman, 1994), allowing evaluators to organize data for more efficient analysis. Evaluators analyzed qualitative data using the techniques of analytic induction (Erickson, 1986). Following a thorough review of the data record from all data sources, evaluators generated a set of preliminary assertions (i.e., statements believed to be true, based on the whole dataset) regarding the evaluation questions. Next, evaluators refined these assertions and established whether each was warranted. Evaluators ensured that excerpts from the data record (i.e., descriptive statistics, nonparametric analysis, and quotes from qualitative data) supported each warranted assertion, and evaluators linked the assertions, themes, and findings in a manner to support analytic generalization (Glaser, 1978). Data segments, such as passages from interviews or descriptive statistics from survey responses, became instances or indicators that were organized and indexed. Particular attention was given to confirming instances generated by mixed data collection methods. This follows the assumption that assertions based on multiple data sources are more robust and persuasive than those based on a sole form of data. In this method, evaluators work toward coherence of data, assertions, and findings.

Following this process, two evaluators were responsible for coding and analyzing data. An evaluation assistant coded all qualitative data in Atlas.ti and held regular calls with a lead evaluator to review existing codes, to discuss emerging codes, and to establish interrater agreement. For each report, a lead evaluator examined the Atlas.ti dataset for common themes related to the implementation analysis evaluation questions (Figure 1. Formative evaluation questions.

To analyze quantitative, implementation-related survey data (i.e., student academic experiences survey, program personnel implementation survey), evaluators imported relevant quantitative data into SPSS and calculated various descriptive statistics, such as frequency counts, ranges, means, and standard deviations. Before conducting quantitative analyses, evaluators conducted thorough data cleansing and preparation procedures, including calculating and examining descriptive statistics, examining data ranges, addressing outliers, and examining quantitative survey data for normality and homogeneity of variance.

Finally, to analyze quantitative outcome data, evaluators calculated descriptive statistics and used paired samples *t*-tests to examine changes in students' ratings before and after the program. Evaluators also used ANOVAs to examine differences in outcomes by program type.

Appendix F. Additional Information on Implementation Process and Structure

This section provides a detailed overview of how TNCC implemented the RE-AIM program, including the recruitment-to-acceptance process and program administrative structure.

Recruitment-to-Acceptance Process

Figure F1 details the recruitment-to-acceptance process.

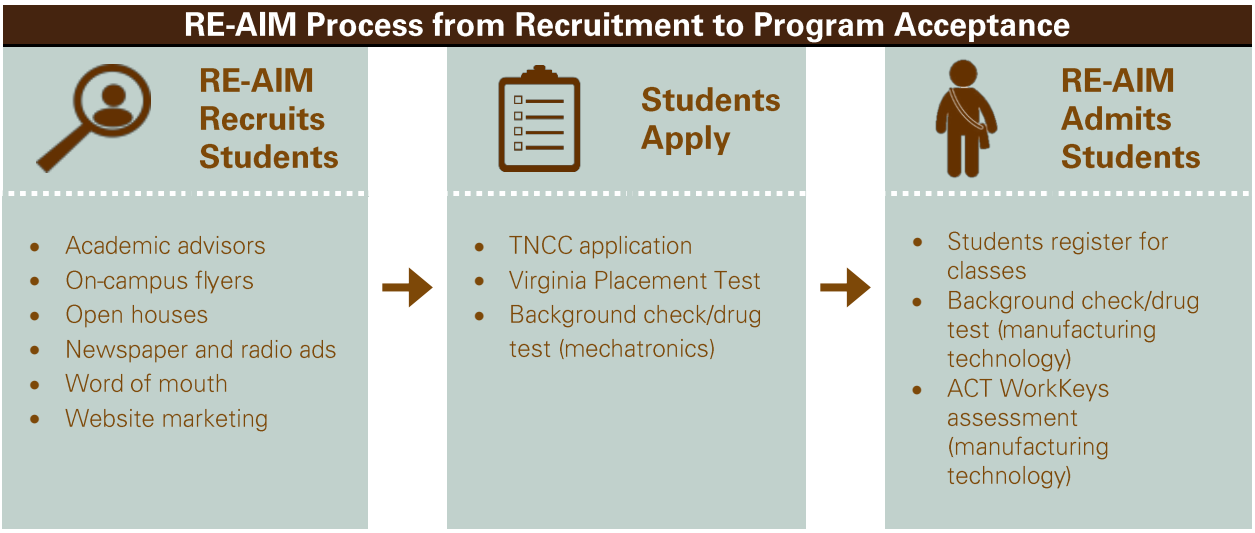

Figure F1. RE-AIM recruitment-to-acceptance process

RE-AIM recruits students

RE-AIM staff attempted to recruit students in a number of ways over the course of the study. In 2015, TNCC began recruitment efforts with on-campus emails and flyers, marketing efforts at local job fairs (e.g., Newport News Shipbuilding, Fort Eustis), and word-of-mouth advertising. At that time, TNCC also initiated recruitment conversations with the Virginia Trade Adjustment Assistance office, PluggedInVA, Fort Eustis, Peninsula Worklink/One-Stop, Eastern Virginia Rapid Response, and the Peninsula Virginia Employment Commission, but these discussions did not yield any additional recruits.

Students apply

Application to the RE-AIM program included completion of a TNCC college admissions application and the Virginia Placement Test. TNCC staff were available to support students in this process. Mechatronics students had to complete a drug test and background check before being admitted to the program. Mechatronics students who failed the drug test were subject to TNCC policy, which could result in disciplinary action and/or participation in a

drug and alcohol abuse prevention program. All students who applied to the program were admitted.

RE-AIM admits students

Once students were accepted for program admission, they were able to register for classes. Students in the manufacturing technology program completed a background check and drug testing shortly after acceptance. To remain in the manufacturing technology program, students needed to pass the online ACT WorkKeys exams, which are National Career Readiness assessments, at the Silver level or higher in the first few weeks of classes.[11] Manufacturing technology students who passed at the Bronze level or lower were dropped from the program.

To clarify roles and responsibilities, evaluators asked key program staff members in 2016 about their levels of program involvement in various areas (see Table F1).

Table F1. Levels of Program Involvement by RE-AIM Staff

KEY RE-AIM STAFF PROGRAM INVOLVEMENT	Project Directors	Instructors	Job Placement Coordinator/ Career Coach
Achieving program sustainability	☑	✓	☑
Leveraging of resources	☑	✓	✗
Program management	☑	✓	✓
Student training	✗	☑	✓
Recruitment	☑	✓	✓
Curriculum development	✓	☑	✗
Program design	✓	✓	✗

Note. ☑ = full/high involvement; ✓ = somewhat/limited involvement; ✗ = no involvement.
Source: Program personnel implementation survey

Administrative Structure

Project Directors

The academic project directors oversaw the credit components of the grant, while the workforce project directors oversaw the noncredit components. Because of changes to the

[11] TNCC set the criteria of a Silver or Gold passing level on the National Career Readiness assessments because of employer feedback on the assessments.

program design, the project directors on the original grant application were replaced with two new project directors in the summer and fall of 2015. In August 2016, the academic project director left her position as the interim dean of science, engineering, and technology and was replaced by the new dean of science, engineering, and technology. Project directors assumed many responsibilities and reported high involvement in achieving program sustainability, leveraging of resources, program management, and recruitment. As examples of their roles in supporting program sustainability, the project directors reported developing sustainable outreach materials and focusing on institutionalizing the advanced manufacturing programs and curriculum. Project directors shared that other evidence of program sustainability would occur when students graduated and employers saw the success of RE-AIM students. Additionally, project directors noted their involvement in leveraging resources, which included working with companies, workforce partners, local industry, and high schools in the area to inform them about the RE-AIM program. Project directors also reported leveraging resources through workforce development grants, Perkins grants, and support around adjunct faculty salaries. For program management, project directors stated that they worked closely with team members to ensure effective management for desired results, while also working on study budgets and supporting quarterly reports to the Department of Labor. Finally, project directors reported involvement in recruitment activities, including searching for new recruiting opportunities, attending career fairs, and holding RE-AIM information sessions.

Instructors

The instructors provided workforce training in advanced manufacturing or cybersecurity to students. Instructors reported high levels of involvement in student training and curriculum development. As examples of student training, instructors reported teaching program content and purchasing course supplies and equipment. For curriculum development, staff developed their respective curricula.

Job Placement Coordinator/Career Coach

The job placement coordinator/career coach directly supported students in meeting their career and academic goals. The job placement coordinator/career coach reported high levels of involvement in program sustainability. Specifically, she stated that she worked to emphasize the importance and benefits of the RE-AIM program to students. She also noted her role in connecting with employers to emphasize the benefits of the program for their workforce and to encourage the hiring of RE-AIM student completers. Additionally, she reported focusing on marketing the RE-AIM program to the public by emphasizing the importance of STEM as a growing field.

Appendix G. Additional Implementation Fidelity Tables

Table G1 describes the implementation fidelity categories and associated variables for this report.

Table G1. Implementation Fidelity Variables

Implementation Fidelity Category	Variable(s)
Adherence	• Number and nature of employers • Number of employers participating in program planning • Number of employers participating in implementation (e.g., involving students in internships) • Receipt of core program components and RE-AIM activities by enrolled students • Number and nature of industry-specific workforce classes held • Number and nature of RE-AIM student-staff individual meetings
Quality	• Staff perceptions of program quality (e.g., strengths, weaknesses) and areas for improvement • Student perceptions of program quality (e.g., strengths, weaknesses) and areas for improvement
Participant responsiveness	• Staff reports of student engagement • Student reports of engagement and interest levels
Program adaptations	• Staff reports of lesson modifications and revisions • Staff reports of grant fund usage, particularly as it relates to program improvements

Table G2 details coursework for RE-AIM CSCs.

Table G2. Program Dosage for RE-AIM Students (Coursework)

	Manufacturing Technology CSC	Mechatronics (Level 1) CSC	Mechatronics (Level 2) CSC	Precision Machining CSC	Cybersecurity for LANs CSC
Number of industry-specific workforce classes held	3	8	9	6	3
Number of credits	10	22	22	19	9
Duration	7 weeks	6–9 months	6–9 months	5 months	16 weeks
Nature of industry-specific workforce classes held	IND 106 Industrial Engineering IND 181 World Class Manufacturing I IND 165 Principles of Industrial Technology I	IND 243 Principles and Applications of Mechatronics ELE 156 Electrical Control Systems ETR 107 Programming Applications for ELE/ETR Calculations ETR 140 Introduction to Mechatronics MEC 155 Mechanisms ETR 168 Digital Circuit Fundamentals ELE 233 Programmable Logic Controller Systems I MEC 161 or 165 Hydraulics, Pneumatics & Hydrostatics	INS 210 Principles of Instrumentation ETR 266 Microprocessor Applications ELE 234 Programmable Logic Controller Systems ETR 246 Electronic Motor Drive Systems MEC 119 Introduction to Basic CNC and CAM ELE 237 Human Machine Interface Systems IND 181 World Class Manufacturing I ETR 230 Mechatronic Process Control MEC 210 Machine Design	CAD 120 Introduction to Graphic Representation MAC 101 Machine Shop 1 MTH 103 Applied Technical Math I SAF 130 Industrial Safety-OSHA 10 DRF 160 Machine Blueprint Reading MAC 121 Numerical Control	ITE 120 Principles of Information Systems ITN 109 Internet and Network Foundations ITN 260 Network Security Basics
Possible certifications/credentials	Manufacturing Technology CSC National Career Readiness Certificate Virginia Manufacturers Association Manufacturing Technician Level 1 (MT1) Certification	Mechatronics Technology CSC Level 1 – Siemens Certified Mechatronics Systems Assistant	Advanced Mechatronics Technology CSC	Precision Machining CNC Technology CSC OSHA 10 Certification	Cybersecurity for LANs CSC

Figure G1–G3 offer additional information on the percentage of students reporting different perceptions regarding the quality of support and RE-AIM class and cohort structure, as well as the frequency of student participation in different activities.

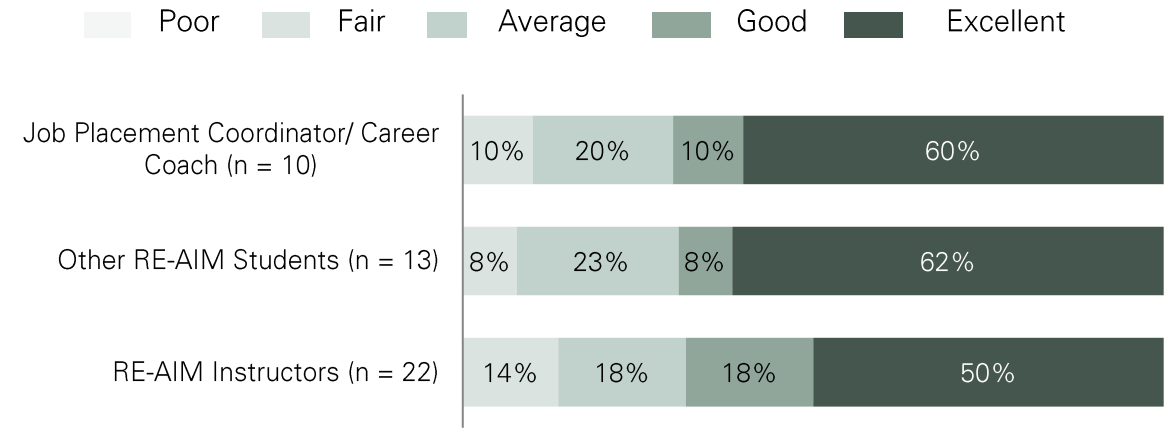

Figure G1. Student perceptions of the quality of support from RE-AIM staff and students.
Source: Student academic experiences survey

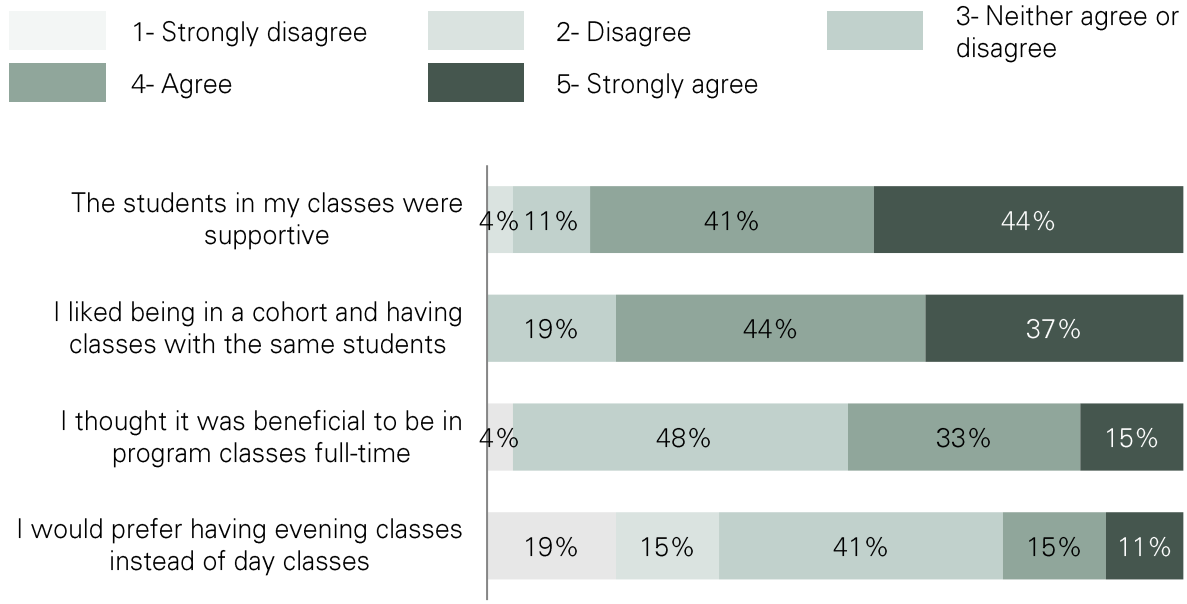

Figure G2. Student perceptions of RE-AIM classes and cohort structure (n = 27).
Source: Student academic experiences survey

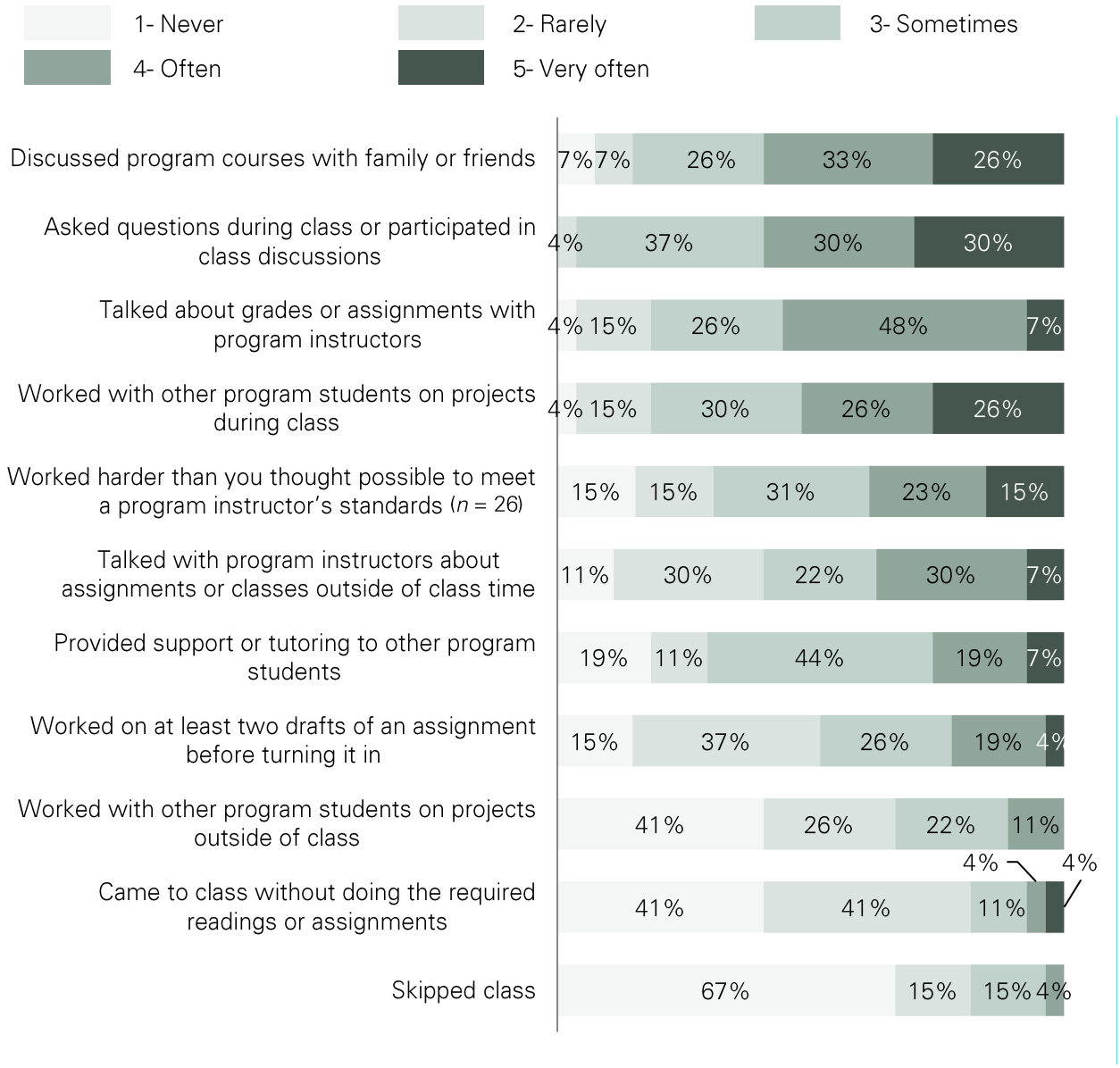

Figure G3. Student frequency of participation in activities during the RE-AIM program (n = 27).
Source: Student academic experiences survey

Appendix H. Statistical Significance Tests and Disaggregated Means for Survey Questions

Appendix H presents information from all statistical significance tests and disaggregated means for survey questions, by topic area.

Statistical Significance Tests

Table H1. Statistical Significance Findings for Retrospective Survey Data (i.e., Knowledge, Confidence, Motivation) and Preparedness Data (Differences by Program Area)

Items	Statistical significance test
Student knowledge (before–after courses)	
Workforce-specific skills	t (9) = 4.47, p = .00*
Job application and interview skills	t (9) = 1.71, p = .12
Digital literacy skills	t (8) = 3.41, p = .01*
Student confidence (before–after courses)	
Job search and interview skills	t (8) = 0.35, p = .74
Communication skills	t (8) = 3.15, p = .01*
Workplace skills	t (8) = 1.27, p = .24
Student motivation (before–after courses)	
Motivation to have a career in workforce area	t (8) = 0.21, p = .84
Student preparedness (differences by program area)	
Certification exam	F (3, 23) = 0.88, p = .46
Career in program area	F (3, 23) = 0.74, p = .54

*$p < .05$

Disaggregated Means for Survey Questions

Table H2. Means for Knowledge Before and After TNCC Courses

Items	Before TNCC courses mean (SD)	After TNCC courses mean (SD)
*Workforce-specific skills**		
Manufacturing technology (n = 5)	3.84 (1.19)	7.00 (2.75)
Mechatronics (n = 4)	2.40 (0.37)	7.20 (2.45)
Cybersecurity for LANs (n = 1)	**	**
Job application and interview skills		
Writing a résumé (n = 10)	4.60 (2.67)	6.50 (2.99)
Searching for relevant job opportunities (After; n = 9)	4.80 (3.29)	5.44 (3.28)
Preparing for job interviews (n = 10)	4.40 (3.27)	6.60 (3.20)
Digital literacy skills (n = 9)		
Communicating through email	6.00 (3.35)	7.67 (2.96)
Using online platforms, such as CoursePark and Blackboard	4.33 (3.16)	7.11 (2.20)

*Because of small sample sizes, evaluators present aggregated means for workforce-specific skills questions (collapsed across program area) to preserve anonymity.
**Cybersecurity for LANs means and standard deviations are hidden to preserve anonymity due to a small sample size.

Table H3. Means for Confidence Before and After TNCC Courses

Items	Before TNCC courses mean (SD)	After TNCC courses mean (SD)
Job search and interview skills (n = 9)		
Finding a job that interests you	4.11 (2.80)	4.22 (3.42)
Writing an effective résumé	4.22 (2.77)	5.67 (3.32)
Having a successful job interview	5.56 (2.96)	5.67 (3.87)
Communication skills (n = 9)		
Communicating through writing	6.67 (3.04)	8.67 (1.73)
Communicating through speaking	5.33 (3.00)	8.22 (2.17)
Workplace skills (n = 9)		
Dressing appropriately for the workplace	7.22 (2.95)	7.67 (3.00)
Arriving on time to the workplace	7.89 (3.37)	8.89 (1.83)
Accepting feedback on your work from your boss or coworkers	7.78 (3.49)	9.22 (1.72)

Table H4. Means for Student Motivation Before and After TNCC Courses

Items	Before TNCC courses mean (SD) (*n* = 10)	After TNCC courses mean (SD) (*n* = 9)
Student motivation		
Motivation to have a career in a workforce-specific area	5.40 (3.44)	6.00 (4.06)

Table H5. Means for Exam and Career Preparedness by Program Area

Items	Mean (SD)
Preparedness for certification exam	
Manufacturing technology (*n* = 9)	6.44 (2.24)
Mechatronics (*n* = 11)	7.55 (3.05)
Cybersecurity for LANs (*n* = 6)	5.50 (2.43)
Precision machining (*n* = 1)	*
Preparedness for career in program area	
Manufacturing technology (*n* = 9)	6.78 (2.44)
Mechatronics (*n* = 11)	7.09 (3.67)
Cybersecurity for LANs (*n* = 6)	5.00 (2.37)
Precision machining (*n* = 1)	*

*All categories were analyzed separately, but the means and standard deviations for precision machining are hidden to preserve anonymity due to a small sample size.

Appendix I. Wages and Projected Employment for Jobs in RE-AIM Fields

Appendix I presents annual wages, current employment, and projected employment nationally and within Virginia for potential job titles associated with RE-AIM program areas.

Table I1. National Wages, Current Employment, Projected Growth, and Projected Number of Openings for Job Titles in RE-AIM Program Areas

Job titles	Median annual wages nationally (2017)	Number of employees nationally (2016)	Projected national growth (2016–2026)	Projected number of annual job openings nationally
Manufacturing Technology				
Manufacturing production technician/engineering technician	$62,230	77,000	Average (5–9%)	7,100
Electrical drafter	$59,690	27,000	Average (5–9%)	2,600
Electro-mechanical technician	$56,740	14,000	Slower than average (2–4%)	1,200
Mechatronics				
Electrical and electronics repairer, commercial and industrial equipment	$57,190	68,000	Slower than average (2–4%)	6,100
Avionics technician	$62,650	18,000	Average (5–9%)	1,500
Electronics engineering technician	$63,660	137,000	Slower than average (2–4%)	12,000
Industrial machinery mechanic	$51,360	347,000	Average (5–9%)	33,000
Precision Machining				
Machinist	$42,600	40,700	Slower than average (2–4%)	40,700
Computer-controlled machine tool operator, metal and plastic	$39,230	146,000	Little or no change (-1–1%)	14,500
Computer numerically controlled machine tool programmer, metal and plastic	$52,550	25,000	Much faster than average (15% or greater)	3,100
Cybersecurity for LANs				
Computer network support specialist	$62,340	199,000	Average (5–9%)	16,500

Note. Information retrieved from O*Net OnLine (n.d.), https://www.onetonline.org.

Table I2. State and Local Wages, Projected Statewide Growth, and Projected Number of Openings (VA) for Job Titles in RE-AIM Areas

Job titles	Annual wages in Virginia (2017)			Annual wages in Virginia Beach–Norfolk (VA) area			Projected annual growth in Virginia (2014–2024)	Projected number of annual job openings in Virginia
	Low (Bottom 10%)	Median	High (Top 10%)	Low (Bottom 10%)	Median	High (Top 10%)		
Manufacturing Technology								
Manufacturing production technician/engineering technician	$49,350	$78,260	$103,830	$54,850	$78,260	$95,260	-6%	80
Electrical drafter	$28,450	$52,720	$97,970	n/a*	n/a*	n/a*	7%	10
Electro-mechanical technician	$39,590	$54,430	$78,410	$39,290	$53,810	$79,000	5%	10
Mechatronics								
Electrical and electronics repairer, commercial and industrial equipment	$40,880	$57,890	$82,080	$37,280	$53,620	$72,390	1%	30
Avionics technician	$45,380	$63,250	$78,990	$55,010	$63,710	$75,690	4%	0
Electronics engineering technician	$43,460	$68,190	$99,910	n/a*	n/a*	n/a*	4%	140
Industrial machinery mechanic	$32,570	$50,230	$72,340	$34,570	$53,310	$73,970	18%	370
Precision Machining								
Machinist	$31,570	$47,180	$64,640	$34,390	$51,080	$63,540	10%	260
Computer-controlled machine tool operator, metal and plastic	$27,870	$39,250	$55,570	$29,960	$45,270	$64,810	20%	70
Computer numerically controlled machine tool programmer, metal and plastic	$32,990	$47,700	$80,190	$37,220	$54,940	$78,720	17%	20
Cybersecurity for LANs								
Computer network support specialist	$41,280	$69,390	$124,110	$48,650	$80,470	$131,650	10%	160

Note. Information retrieved from O*Net OnLine (n.d.), https://www.onetonline.org.
* n/a = not available.