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MECHATRONICS

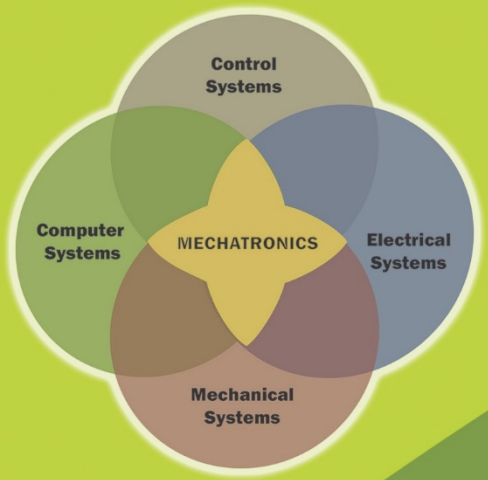
technology combining electronics and mechanical engineering

CONNECTING COMPETENCIES TO EMPLOYERS (C2E)

ROUND 4 TAACCCT GRANT

Final Report

September 20, 2018



CLOVER PARK TECHNICAL COLLEGE

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Connecting Competencies to Employers (C2E) Round 4 TAACCCT Grant: Clover Park Technical College, Lakewood, Washington

Final Evaluation Report

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September 20, 2018

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Executive Summary

In September 2014, Clover Park Technical College (CPTC) in Lakewood, Washington received a $2.49 million four-year grant from the U.S. Department of Labor (DOL) under Round 4 of the Trade Adjustment Assistance Community College Career Training (TAACCCT) grant program to implement its Connecting Competencies to Employers (C2E) Project. The stated goals of the initiative were to develop a new associate degree program in Mechatronics and prepare students for high-paying mid-level skilled jobs in advanced manufacturing. The Mechatronics Program was designed to teach the skills students would need to install, maintain, and repair the various electronic, mechanical, pneumatic, and computer systems used to control production machinery in the aeronautics, food processing, and IT sectors of the regional advanced manufacturing economy.

The C2E Project had five key objectives:

- establish a new quarter-long Fundamental Skills for Manufacturing and Engineering (FSME) certificate;
- develop a new seven-quarter-long Mechatronics Associate Degree (AAS-T) program, which has, as its required first quarter, the FSME certificate curriculum;
- create a dynamic lab space for advanced manufacturing, made possible by the purchase and installation of new equipment;
- provide students with robust and effective supports that help them successfully complete the program; and
- build a Smartmatching Competency Database System that matches the skills mastered by individual program students to the competencies needed by manufacturing employers for different manufacturing jobs.

Taken together, these five objectives were intended to build a robust mechatronics training system at CPTC to serve students and regional manufacturing employers.

Study Methods

As required by DOL, CPTC sought the services of a third-party evaluator to conduct an evaluation of C2E; in June 2015, the college selected Social Policy Research Associates (SPR) as its external evaluator. The evaluation included an implementation component and an outcome component. A planned net impact component was eliminated from the study design because the low numbers of students that had exited from the program would have prevented the researchers from identifying any impacts with confidence.

The objectives of the implementation study included documenting the key features of the C2E program, identifying how CPTC addressed the challenges of designing and launching a new

academic program under the grant, and providing feedback to CPTC on the strengths and weaknesses of program design and implementation so it could make mid-course corrections. The implementation study also described the gradual maturation of the program, providing an important context for understanding the variation in outcomes across different entry cohorts.

The implementation study methods included three site visits to the program that included interviews with key college administrators, faculty, and grant staff, observations of program operations, focus groups with current students, and telephone discussions with employer representatives. In addition, the researchers conducted online surveys with current students in two rounds and a small number of in-depth interviews with students who had completed the associate degree and had left the program at least six months before the interview took place.

The outcome study design called for a descriptive study of program outcomes including student retention, completion of academic credentials, and post-training employment and earnings over the four calendar quarters after each student exited the program. To document these outcomes, the research team collected and analyzed individual-level demographic data and administrative data from college academic records on all enrolled students. In addition, for all program exiters, CPTC obtained individual level data on quarterly employment and earnings from the state's UI system, and provided the evaluator with aggregate data on quarterly earnings for three distinct subgroups of C2E participants: those who completed the Mechatronics Associate Degree, those who completed only the FSME quarter-long certificate program, and enrolled students who left the program without completing any academic credential (degree or certificate).

Implementation Study Findings

Implementation Challenges

During the initial six to nine months of program operations, the C2E program did not have in place the administrative staff members needed to effectively lead program operations and development and provide student support services. In addition, due to the absence of experienced instructors strongly committed to program success, students who entered in the first cohort experienced shortcomings in the curriculum, the available technology, and the quality of instruction. Even after the first full-time faculty member was hired for the new program, some student survey respondents expressed dissatisfaction with instructional quality (although students valued the services available from the Career Navigator). Despite strong recruitment efforts, the number of enrolled students did not increase as quickly as had been hoped.

Eventually, after energetic and qualified instructors were hired and several large flexible manufacturing training systems were purchased, program quality improved markedly. Word of

mouth started spreading the news among potential students and interested employers that CPTC had a Mechatronics Associate Degree program that offered valuable training. At this point, enrollment increased and ultimately reached the point at which the program could be self-sustaining with student tuition fees. Throughout the difficult start-up, both the Grant Manager and the college dean responsible for overseeing the program kept their focus on the goal of building a high-quality program with strong employer engagement and long-term viability. By the end of the grant it appeared that this steadfast commitment to continuous improvement had paid off.

Because of low enrollment during the first 18 months of the grant, the program fell somewhat short of the original enrollment objective of 220 students. Only 158 students were enrolled during the grant period.

Implementation Successes

Ultimately, CPTC was successful in realizing each of the five objectives of the C2E grant. The college established the academic credential programs, instructional curriculum, and physical facility and equipment needed to prepare students for employment in the emerging mechatronics field, provided services to support students in successfully completing training, and developed and launched a Smartmatching Competency Database System that will enable employers to define the competencies they need from candidates for new job openings and assess the competencies achieved by program completers. This competency database system, though not completely implemented, has been received with substantial interest by local employers and is being considered for adoption by other programs within CPTC and elsewhere within the state's community and technical college system. As intended, realization of the five objectives has indeed built the capacity of CPTC to offer a high-quality mechatronics training system at CPTC, which in turn has become one of the key programs within a larger School of Advanced Manufacturing at the college.

Among the best practices that helped the program mature into a leading program for CPTC are the following:

- C2E grant money was used to purchase simulated work stations for laboratory instruction, giving the program what students and employers thought of as a "state of the art" facility for instruction and practice.
- Instructors capable of providing academic leadership in the development of the program curriculum were ultimately secured.
- Active outreach to high schools and community organizations—far beyond the on-campus "information sessions" typically held for interested prospective students—brought information about the program out into the community.

- Business representatives were continuously involved in various stages of the program design and implementation.

The Student Perspective

Focus groups with students conducted early in the grant period revealed that students were frustrated by the lack of a well-developed curriculum and stable group of instructors. The students expressed concern about the high rate of turnover of instructors, the lack of an established curriculum or written texts, and the absence of enough equipment to give them adequate "hands-on" time in the lab sessions.

However, when students were surveyed during the 2nd and 3rd years of the grant, most students expressed a significantly higher level of satisfaction with most features of the program. These survey results were undoubtedly influenced by the substantial progress that had been made toward overcoming the initial challenges. Over 85 percent of the students surveyed in spring of 2016 and the fall of 2017 reported being very satisfied or somewhat satisfied with training and instruction and with the support services they had received from the Career Navigator. A total of 90 percent of students believed that they were receiving training that was preparing them for employment in the advanced manufacturing field. The final student focus groups also provided evidence that, by the end of the study period, students were increasingly aware of the career options available to them and were excited about developing careers in the mechatronics field. Students had developed a variety of specific career objectives, which they planned to pursue by gaining work experience in the field or completing further education and training.

Detailed interviews with a small sample of associate degree program completers who had been out of the program for at least six months suggested that program graduates were optimistic about the mechatronics career path, because the mechatronics field was expected to have a strong demand for workers into the future and offered opportunities to move up a career ladder to manufacturing management and/or engineering technical specializations.

Findings from the Outcome Study

Student Characteristics

Enrollees varied broadly in age, ethnicity, educational level, and work experience. The age of students ranged from 18 to 64, with a mean age of 30 years. About sixty percent of students were non-traditional in terms of age: twenty percent were between 25 and 29, thirty percent were between 30 and 39, and about 15 percent over 40.

For about one-third of all students, the Mechatronics Program was the first exposure to college-level course work. However, over half of all enrollees had some previous college experience and 14 percent of students already held an associate or higher degree.

Fifty-one percent of enrolled students were white non-Hispanic, 12 percent African-American, and 10 percent Hispanic/Latino. Although most students were male, the Grant Manager was proud of the fact that the C2E program had enrolled 12 females. Thirty percent of all enrollees were veterans, some of whom had recently left military service. Only 14 percent of participants had any experience working in the manufacturing sector before enrolling in the Mechatronics Program.

Completion of Academic Outcomes

As noted above, 158 students enrolled in C2E during the study period from the fall quarter of 2014 through the winter quarter of 2018; all were participants in the study. By the end of the study period, 125 students had exited the program (where "exit" is defined as either graduating with a certificate or a degree, or leaving the program before obtaining any credential), while 33 were still active students partway through the associate degree. The exited students were members of three mutually exclusive outcome groups:

- Outcome Group 1: The 24 students who completed the Mechatronics Associate Degree before exiting the program.[1]
- Outcome Group 2: The 74 students who completed only the FSME degree before exiting the program. (Thirty-six of these students had begun the 2nd quarter of the associate degree program but had exited before completing the degree.)
- Outcome Group 3: The 27 students who did not complete any academic credential at CPTC before exiting the program.

Employment and Earnings Outcomes

For each of the three outcome groups, we obtained aggregate data on employment and earnings from the state's quarterly earnings records maintained as a part of the unemployment insurance system. (Because of a ruling by the Washington State Employment Security Department, which maintains the UI earnings records, we were not allowed access to quarterly earnings records at the individual level.) For each outcome group, we obtained aggregate outcome data for the four quarters prior to each individual student's enrollment in the program and the four quarters after each student exited the program. Outcomes of interest included the number and percentage of outcome group members who were employed during the quarter

[1] One of these students completed a mechatronics certificate, rather than the full mechatronics associate degree.

(had non-zero earnings) and the mean quarterly earnings for each outcome group during each study quarter.

The outcome study documents some very interesting trends. The aggregated outcomes for the small number of students who completed the associate degree program during the study period are encouraging though not conclusive. They show that the students who completed the associate degree worked more frequently and, as a group, earned more than they did before entering the program and were more likely to be employed and have higher earnings than other program enrollees who did not complete this credential. This suggests that regional employers valued the skills students gained in the Mechatronics Program, and, as the program logic model posited, were interested in hiring and paying relatively high wages to individuals who had completed the Mechatronics Degree.

Conclusion

By the end of the grant period, the Mechatronics Program was not only well-established at CPTC, but it had exercised a positive influence on the growth and development of other manufacturing programs at the college. College administrators no longer had to wonder whether the Mechatronics Program would be sustainable after the end of the grant. For the 2018-2019 academic year, the CPTC administration has established a School of Manufacturing that brings together previously separate associate degree and certificate programs in Manufacturing Technologies, Nondestructive Testing, Advanced Composites, and Mechatronics in a new Advanced Manufacturing Center facility on the CPTC campus funded by the State of Washington. The Mechatronics Program will have a major footprint in the new center.

To confirm the hypothesis that participation in the Mechatronics Program improved market outcomes for students, it will be necessary to conduct an evaluation that follows a larger number of students who complete the Mechatronics Associate Degree for a longer post-program period and to collect individual-level data that will allow the analysis to more adequately assess the employment and earnings benefits gained by different types of participants. To assess the net impacts, it will also be necessary to implement an evaluation design that enables researchers to compare individual-level outcomes for program enrollees to outcomes for a matched set of individuals who did not participate in the associate degree program.

I. Introduction

Introduction

In September 2014, Clover Park Technical College (CPTC) in Lakewood, Washington received a $2.49 million four-year grant from the U.S. Department of Labor (DOL) under Round 4 of the Trade Adjustment Assistance Community College Career Training (TAACCCT) grant program to implement its Connecting Competencies to Employers (C2E) Project. The stated goals of the initiative were to develop a new associate degree program in Mechatronics and prepare students for high-paying mid-level skilled jobs in advanced manufacturing. The Mechatronics Program was designed to teach the skills students would need to install, maintain, and repair the various electronic, mechanical, pneumatic, and computer systems used to control production machinery in the aeronautics, food processing, and IT sectors of the regional advanced manufacturing economy.

In the proposal it submitted to DOL for the TAACCCT funding, CPTC described five key objectives for the C2E Project:

- establishing a new quarter-long Fundamental Skills for Manufacturing and Engineering (FSME) certificate;
- developing a new seven-quarter-long Mechatronics Associate Degree (AAS-T) program, which has, as its required first quarter, the FSME certificate curriculum;
- creating a dynamic lab space for advanced manufacturing, made possible by the purchase and installation of new equipment;
- providing students with robust and effective supports that help them successfully complete the program; and
- building a competency database that matches the skills mastered by individual program students to the competencies needed by manufacturing employers for different manufacturing jobs.

As required by DOL, CPTC sought the services of a third-party evaluator to conduct an evaluation of C2E; in June 2015, the college selected Social Policy Research Associates (SPR) as its external evaluator. The Evaluation Plan submitted by SPR in October 2015 called for an implementation study, an outcomes study, and a net impact study using the quasi-experimental method of identifying a group of individuals similar to the group that enrolled in the C2E grant and to which the latter could be compared. As the project evolved, it became clear that the net impact study would not be feasible and a revised study design eliminated it from the evaluation.

At the time the grant was awarded by DOL, it was anticipated that the C2E program would operate during the first 36 months of the grant period—from fall 2014 through summer 2017

and that the final year of the grant period would be used to track participant outcomes, close out the grant, and complete the evaluation. However, because CPTC was slower than had been anticipated in recruiting and enrolling students into the Mechatronics Program, the college secured DOL approval to continue enrolling Mechatronics students under the grant through the winter quarter of 2018. This *Final Report* describes program implementation and operations through winter quarter 2018 (the final site visit occurred during the fall quarter of 2017) and tracks participants' employment and earnings through the end of the fourth calendar quarter of 2017.

Evaluation Objectives and Methods

Implementation Study

The objectives of the implementation study included documenting the key features of the C2E program and how CPTC addressed the challenges of designing and launching a new academic program under the grant. The implementation study was designed to provide feedback to CPTC on the strengths and weaknesses of program implementation, so it could make mid-course corrections. The implementation study also described the gradual maturation of the program, providing an important context for understanding the variation in outcomes across different entry cohorts. The research questions addressed by the implementation study are summarized below.

As part of the implementation study, the research team conducted three rounds of site visits to CPTC during the fall academic quarters of 2015, 2016, and 2017. During each site visit, the research team observed program operations, conducted focus groups with participating students, and interviewed key college stakeholders (the CPTC Dean of Instruction, C2E curriculum developers, and program instructors) and project staff members supported by the TACCCT grant (Grant Manager, Career Navigator, Employer Engagement Coordinator, and Grant Assistant).

In addition to the annual site visits, the research team conducted monthly telephone calls with the Grant Manager and other key staff members to get updates on implementation progress and ask about project accomplishments and challenges. To document the student perspective, the research team designed a survey to collect data on how the students perceived the Mechatronics Program and worked with CPTC to administer the survey to current students in the spring of 2016 and in the fall of 2017.[2] Appendix A reproduces the survey instrument and summarizes the aggregate responses across both rounds of the survey.

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[2] The survey of current students was administered the first time via a paper and pencil survey instrument. Completed surveys were sent to SPR for data entry and analysis. The survey of current students was

The researchers also conducted individual telephone interviews with program completers to collect detailed descriptive information on their post-program experiences. During the summer and fall of 2017, the research team attempted to reach all students who had completed the Mechatronics Associate Degree at least six months previously. We were able to complete a total of six detailed telephone interviews with program completers from a possible pool of twelve. These discussions covered completers' job search experiences, their employment status and earnings at the time we talked with them, and their progress in developing their desired career paths using the skills they had learned in the program. The findings from the discussions with program completers provide more detailed descriptive information about the experiences of students who exited from the C2E program. However, because of the small sample size and the fact that we reached only 50 percent of the eligible completers, data from these interviews cannot be generalized to all participants and should be used only to put together illustrative examples of student experiences after leaving the program.

- **How did contextual factors influence the implementation of the initiative?**
  - What contextual challenges did the C2E project face and how did it address those challenges?
  - What factors were perceived as contributing to the success of the grant initiative overall?
- **What organizational structures and administrative procedures were developed to guide the C2E project?**
  - Who participated in the decision to apply for the TAACCCT grant and what influenced the design of the proposed project?
  - What was the program's administrative and leadership structure? At what level were decisions about program design and operation made?
  - What role did partners (workforce partners, employers, non-profit organizations, etc.) play in supporting the project, with or without grant funding? What roles did partners play in program design, curriculum development, recruitment, training, placement, program management, leveraging of resources, and program sustainability?
  - What factors contributed to partners' involvement or lack of involvement in project efforts?
- **What was the nature of outreach to and assessment of potential enrollees?**
  - To what extent did the project have a goal of recruiting students from specific target groups (e.g. veterans, TAA-eligible individuals, dislocated workers)?
  - What strategies did the project use to recruit eligible participants?
  - What were the characteristics of enrollees in the FSME certificate program?
- **How were the individual courses supported under the grant developed and launched?**

administered the second time via an online survey site controlled by the SPR research team. Both administrations of the survey were anonymous, to ensure that students felt comfortable assessing the quality of the program.

- **What support services did the Career Navigator or other individuals provide to enrolled students, and how were these services received by students?**
- **How successful was the project in achieving its stated goals for number of students enrolled? For number and percentage of enrollees completing intended certificates and degrees?**
    - What challenges did the project encounter in achieving its desired outcomes and how did it address these challenges?
    - How adequate are program databases for documenting student status and progress through the program and services received?
- **How satisfied were stakeholders and students with the implementation and outcomes of the C2E project? What improvements would they recommend?**

Outcome Study and Proposed Net Impact Study

The outcome study design called for a descriptive study of program outcomes (student retention, completion of academic credentials) and post-training participant outcomes (employment and earnings over the year after training completion).

The key questions to be addressed by the outcome study included the following:

- **What were the enrollment outcomes of C2E programs?**
    - How many students were enrolled in the C2E training program?
    - How many participants completed their programs during the study period? How many completed the required number of credits and sequences of courses?
    - How many individuals discontinued their studies before program completion?
- **What were the educational outcomes of C2E participants?**
    - How many participants earned the FSME credential?
    - How many earned the associate degree?
    - How many C2E completers enrolled in further education during the study period or planned to enroll in further education?
- **What were the employment outcomes of C2E participants?**
    - How many C2E participants were employed after program completion?
    - What were the average quarterly earnings of C2E participants after enrolling in the program?
    - How do quarterly earnings during the 12 months prior to program enrollment compare to the quarterly earnings after exiting the program?

As noted above, SPR initially proposed an assessment of net program impacts to accompany the outcomes study. This net impact study would have compared outcomes for students enrolled in the program to outcomes for those in a matched comparison group (such as students participating in another manufacturing-related program already in place at the college). Several developments during the study period made the implementation of the net

impact study infeasible. The most important problem was the inadequate statistical power that would have resulted from the smaller-than-expected sample sizes of program entrants and exiters. Although a total of 158 individuals enrolled in the grant-funded C2E program during the study period, only 125 students had exited from the program during the study period. Of these, only 44 were enrolled in the seven-quarter-long associate degree program early enough in the study period to have been able to complete the associate degree and have had at least six months of post-program job search/employment experience during the study period; only 29 students were enrolled early enough to have had at least 12 months of post-program job search/employment experience during the study period. [3] With these sample sizes, minimum detectable impacts on binary outcomes would have had to exceed 20 percentage points on every outcome and would have to approach or exceed 30 percentage points when measuring impacts on 12-month post-program employment outcomes for the mechatronic degree students. Because of this exceptionally high bar for detecting effects, we determined that it would be unlikely for us to discover any net program impacts, even if they did exist.[4]

A secondary barrier to carrying out the net impact study was logistical difficulty in identifying an appropriate pool of students from which to select members of a comparison group and securing outcome information for those students. Our objective was to estimate how outcomes for the FSME and Mechatronics students differed from the outcomes they might have experienced if the Mechatronics Program had not existed. Although we had considered selecting a comparison group of similar individuals who enrolled in other programs at CPTC—e.g. Aviation Maintenance, Networking/IT, Composites, Nondestructive Testing, and HVAC—these programs did not have sufficient numbers of students enrolled during the study period to provide an effective comparison group, and, further, students in these programs had not signed informed consent forms giving permission for the study to collect data on their employment and earnings outcomes.

The final barrier to completing the net impact study was that the Washington State Employment Security Department (WSESD)—the public entity that maintains and controls access to employer reports of quarterly earnings data—decided in November of 2016 that community colleges could not share individual-level data from quarterly employment and earnings records with external TAACCCT evaluation contractors, even if all individual student

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[3] Another 56 students who intended to complete only the one-quarter long FSME certificate would also have had the opportunity to complete their certificate and have at least six months of post-program job search/employment experience during the study period, but these certificate seekers were not appropriate for inclusion in the net impact study because they were never expected meet the grant objective of gaining employment in high-paying mid-skill mechatronics jobs.

[4] Kogan D., and D'Amico R., Updated Outcome Study Design: Connecting Competencies to Employers (C2E) Round 4 TAACCCT Grant, Social Policy Research Associates, April 20, 2017, pp. 2 – 3.

identifiers were removed. This decision invalidated a previous data exchange agreement that had been negotiated between the Washington State Community and Technical College Board and Social Policy Research in June of 2016 for delivery of client-level employment and earnings data to inform the C2E evaluation. This ruling reduced the usefulness of using students in comparable programs as a comparison group in a net impact study because key employment and earnings outcomes for these students would not be available to the evaluation team at the individual level. It also limited the analyses of employment and earnings outcomes that the evaluation team could perform for the C2E participants themselves in the outcome study.

An updated study design[5] for the outcome study submitted in April of 2017 eliminated the net-impact study and redesigned the outcome study to use aggregate earnings data for the grant-funded students.

Following the updated outcome study design, the research team collected and analyzed the data described below.

- **Demographic and academic data.** The research team obtained individual student-level data from CPTC academic administrative records on the characteristics of all 158 C2E enrollees at enrollment and on the academic outcomes of all 125 students who had exited the program during the study period. The academic outcomes studied included both the total number of credits completed and the academic credentials earned. Using these data, the research team examined how different factors such as student characteristics and entry cohort influenced the academic outcomes for students enrolled in the TAACCCT grant-funded program.
- **Employment and earnings data.** The research team obtained aggregate data for 115 of the 125 program exiters, compiled by CPTC's institutional research department from the individual-level records on employment and earnings in Washington State's Employment Security database.[6] CPTC provided aggregate data for three distinct subgroups of C2E participants: those who completed the Mechatronics Associate Degree, those who completed only the FSME quarter-long certificate program, and enrolled students who left the program without completing any academic credential (degree or certificate).
    - For each of these three groups of program completers, CPTC provided aggregate statistics on (a) the number of student records for which data matches had been completed, (b) the total earnings for the subgroup, (c) the number of individuals

[5] Kogan D., and D'Amico R., *Updated Outcome Study Design: Connecting Competencies to Employers (C2E) Round 4 TAACCCT Grant*, Social Policy Research Associates, April 20, 2017.

[6] CPTC had secured informed consent to use social security numbers in tracking student outcomes from 115 of the 125 students who exited the program during the study period.

from the subgroup with reported non-zero earnings, and (d) the mean and median quarterly earnings.

- Each of these data measures was computed for four calendar quarters prior to program enrollment and four calendar quarters after program exit.

Guide to the Remainder of the Report

The remainder of this report is organized as follows:

- **Chapter II, "Addressing Implementation Challenges,"** is a detailed description of how the C2E grant program was designed and implemented and the extent to which the C2E program met its stated goals. This chapter describes the successes and challenges experienced in implementing the project at CPTC.
- **Chapter III, "Completion of C2E Grant Objectives,"** describes the system-level program outcomes and assesses the likelihood that the grant accomplishments will be sustained after the end of the grant.
- **Chapter IV, "The Student Perspective,"** presents information about how students perceived the program, based on data from the structured surveys completed by students active in the program as well as the student focus groups conducted during the three rounds of site visits
- **Chapter V, "Findings from the Outcome Study,"** describes the characteristics of the students who enrolled in the grant and summarizes findings on academic outcomes (from individual-level data) and employment and earnings outcomes (from aggregate data provided for several subgroups of participants). This chapter also uses information from detailed interviews with selected program completers to provide profiles of typical program experiences.
- **Chapter VI, "The C2E Program Experience and Its Lessons,"** summarizes what lessons have been learned from the evaluation's implementation and outcome studies about how to avoid implementation pitfalls, and how to develop a new academic program that meets the needs of local employers and prepares students for high-paying jobs and opportunities for career advancement.

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II. Addressing Implementation Challenges

This chapter describes the implementation of the C2E grant, focusing on the challenges experienced during the first grant year and the subsequent evolution and maturation of the Mechatronics Associate Degree program.

Prior to the TAACCCT grant award, CPTC's curriculum review committee had approved the development of a new 108-credit seven-quarter-long Mechatronics Associate Degree program at the college, with an imbedded 18-credit Fundamental Skills in Manufacturing and Engineering (FSME) certificate as the first quarter of the program. However, the curriculum had not yet been designed in detail, the college had not yet hired instructors or a tenured faculty member to run the new degree program, and there was no administrative staff in place to oversee the design and launching of the new program. Thus, CPTC faced many challenges in implementing the TAACCCT grant. It had to

- create an effective grant management and leadership structure,
- develop a relevant curriculum and assign high-quality faculty to deliver program instruction,
- engage regional manufacturing employers as key program partners,
- reach the targets set for student enrollment, and
- support enrolled students and guide them to successful program completion.

Below we describe how CPTC addressed each of these tasks and confronted the challenges inherent in them.

The early grant implementation period was difficult because the program was brand new and without any existing reputation in the local community. In addition, the college was not adequately prepared to start enrolling and instructing students during the first nine months of the grant. However, after a full-time Grant Manager came on board at about 18 months into the grant period and began to provide strong leadership, the maturing program overcame the early challenges and developed a good reputation among employers and potential students.

Providing Grant Management and Program Leadership

CPTC faced grant management and leadership challenges during the first grant year because of hiring delays and turnover in administrative personnel. The C2E project was launched at CPTC in the fall quarter of 2014, soon after the notification of the federal grant award. The acting Grant Manager during the first 12 months of the grant was an individual from the college's development office who had prepared the grant proposal and oversaw grant development on a

part-time basis. In addition, due to delays in the hiring process, a Career Navigator was not hired until the spring quarter of 2015. Thus, during the first two quarters of the grant, the first cohort of TAACCCT-funded Mechatronics students did not have access to a full-time Grant Manager or a Career Navigator to offer career guidance, enrollment support, financial aid advice, assistance with accessing social services, or support seeking employment.[7] Further, there was no one to offer prospective students advice about whether the program was appropriate to their needs and interests.

In October 2015, the acting Grant Manager left CPTC to take a job at another community college in the region. After his departure, the Career Navigator filled in as acting Grant Manager during the two months the grant manager position was empty, essentially fulfilling the responsibilities of two positions. A permanent Grant Manager was hired using grant administrative funds in early 2016.

Finally, by mid-2016, a strong grant management team was in place. This team consisted of the new full-time Grant Manager, a full-time Career Navigator, a full-time Administrative Assistant, and a part-time Fiscal Specialist. After the second site visit in October of 2016, the SPR site visitor observed that the grant team seemed to be well organized and focused on ensuring that students were recruited into the program and were supported in completing it.

During the last two years of the grant, as the needs of the project changed, staffing changes occurred without any negative effects on quality of overall project administration. During the spring of 2017, the original Career Navigator left the project to take another position at CPTC and an experienced Career Navigator who had worked on another TAACCCT grant at CPTC took her place. As the grant entered its final year, the Career Navigator began to shift his focus from recruitment and intake of new students to engaging employers and placing students in training-related jobs. To reflect this change in focus, he took on the new title of Employer Engagement Coordinator. In addition, an Instructional Designer was added to the project administrative team in the final grant year to complete the design and implementation of the competency database that documents student mastery of the skills sought by local employers.

Throughout the grant period, the C2E project benefitted greatly from the strong oversight and guidance of CPTC's Dean of Instruction, who was interested in building the strength of the college's Advanced Manufacturing programs and was grateful that the TAACCCT grant resources made it possible to establish the Mechatronics Program as an innovative growth center for advanced manufacturing within the college.

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[7] About half of the individuals participating in the first cohort of C2E had access to these types of services from another program, because they were individuals exiting the military from nearby Joint Base Lewis McCord. These individuals were referred to the one quarter-long FSME training as part of a separate "Camo to Commerce" program which provided them with case management, tuition support, and placement support from a contractor funded under a separate federal grant.

Developing A High-Quality Curriculum Taught by Qualified Instructors

When the Mechatronics Program was launched in the fall of 2014 and the first cohort of students was recruited and enrolled, the Mechatronics Associate Degree program curriculum had been approved in concept, but its details had not yet been fleshed out. Much of the seven-quarter curriculum did not yet have detailed lesson plans, identified textbooks, or developed assessment tests. Further, a permanent full-time faculty member to head the program had not yet been hired. The part-time instructors hired to teach the FSME certificate courses and the classes offered during the early quarters of the Mechatronics curriculum had not been involved in the development of the grant proposal, had limited work experience in a manufacturing workplace, and had only a limited stake in ensuring the program's success. Interviews with grant administrators indicated that these instructors received limited guidance or oversight in rolling out the program curriculum. The absence of permanent faculty also delayed the purchase of the new equipment needed to provide an up-to-date lab environment in which students could learn and practice key skills. In retrospect, it probably would have made sense for the college to delay program startup by one or two quarters to allow time for completing curriculum development, hiring a tenure-track faculty member, and developing an up-to-date lab environment. However, a delay was not seriously considered because CPTC administrators were eager to start enrolling students in the new program.

Because of the early startup, during the first nine months of the program—the fall of 2014 and the winter and spring of 2015—enrolled students were taught by part-time instructors who lacked relevant industry experience and were substantially less prepared than the subsequently hired faculty. These students did not receive training and services that were consistent with the more mature program that had evolved by the second year of the grant. As discussed in Chapter V, these differences in students' experience have made it difficult to assess the effectiveness of the mature program.

By the fourth quarter of the grant, key program elements began to settle into place. Training machinery for the program labs had been ordered and was beginning to arrive. A new full-time instructor had been hired to teach the FSME curriculum. This individual turned out to be a good fit for the one-quarter-long certificate program, which gave all participants a solid foundation of hands-on skills to prepare them for success in the Mechatronics Associate Degree program. A permanent full-time faculty member had also been hired in the spring of 2015 for the Mechatronics Associate Degree program. This individual had prior experience teaching in a mechatronics program in another state; he worked hard to complete the curriculum and began teaching courses during the summer of 2015.

Although the program appeared to have completed staffing up its instructional team by the fall of 2015, more hiring challenges were in the offing. The new faculty member's vision for the Mechatronics Program was to prepare students within 18 months for employment as

mechatronics technicians; this would be accomplished by shortening the AAS-T degree program from seven quarters to six and simplifying the math and physics curriculum to make the content more accessible to students.[8] This vision, based on the instructor's experience with another mechatronics technician program that had emphasized getting students prepared as quickly as possible for employment as technicians, was in tension with the earlier C2E grant writers' vision of the Mechatronics Associate Degree program as an in-depth program that would take seven academic quarters to prepare students for jobs as mid-level-skill mechatronics workers who could advance to more skilled jobs over time. In addition, it was part of CPTC's vision for the program to support students who wanted to transition to a 4-year advanced manufacturing degree program after completion of the Mechatronics Associate Degree.

Ultimately, the performance of the full-time mechatronics faculty member became an issue as well. Students were not satisfied with the quality of his classroom instruction; administrators heard reports that he was having difficulties getting along with students; and the program was not generating a sufficient flow of new student enrollees over time to help the program reach "take-off velocity" (the level of enrollment at which the program could become self-supporting). After discussions with college administrators late in the spring quarter of 2017, the mechatronics instructor left his job at the college to take another position.

At this point, the Grant Manager, asserting strong leadership, resolved to locate and hire new program instructors who could keep the program on track. Working closely with a college search committee and the college's Dean of Instruction, the Grant Manager recommended hiring two individuals who could share the responsibilities for designing and teaching the Mechatronics Associate Degree program courses. Both these individuals had relevant experience—one was an experienced college instructor with a specialty in robotics; the other was an entrepreneur and engineer with business experience and a degree in production management. They were subsequently hired. During the final study site visit in the fall of 2017, administrators reported that these new faculty members had complementary technical skills and worked well together.

After joining the program, the new instructors once again revamped and reorganized the Mechatronics curriculum to improve the integration between the concepts described in lectures and the hands-on practice. They also created a new sequence of courses that made use of natural connections between courses taught at the same time and expanded opportunities for applying theoretical knowledge in applied courses. The online survey of students conducted

[8] The college curriculum committee, however, decided to retain the requirement for enrollees to complete physics before entering the program or to complete physics sometime during the first two quarters of the Mechatronics Program. A simplified curriculum was ultimately adopted as the framework for a shorter mechatronics certificate program that was approved as another option for interested students; one of the students in the outcome study completed this mechatronics certificate rather than the associate degree.

in the fall of 2017 as part of the evaluation revealed that students were well satisfied with the quality of instruction provided by the new instructors. (The responses to this survey question are reported in Chapter IV). Among the new highlights of the curriculum was a capstone course focused on undertaking a project for an actual firm in the local area (e.g. ideally in connection with an internship) rather than a theoretical project.

Developing Partnerships with Industry Representatives and the Public Workforce System

Industry engagement was a priority goal of the C2E project throughout the grant period. The project initiated a Business Advisory Board with representation from seven companies and convened the advisory board for its first face-to-face meeting during 2016 to inform members about the project and its objectives and to open channels for industry input into the design of the curriculum. In addition, the program has tried to develop effective relationships with local public workforce training system providers.

Industry Engagement

Initially, the C2E project determined that the best way to provide employers with appropriately trained workers would be to organize the mechatronics curriculum around national industry-recognized credentials. The C2E initiative selected as its curriculum framework the Automotive Manufacturing Technical Education Council (AMTEC) certification system developed by an NSF-funded collaborative of community colleges and auto-related manufacturing plants.

At the time of the third site visit, the Grant Manager and instructors indicated that they have backed away somewhat from a strong link to the AMTEC credentialing system. Because the credentialing tests were expensive and did not necessarily match the specific skills required by local employers, instructors did not encourage students to complete the AMTEC credentials testing. Instead, they recommended that students complete discrete certificates that are lower cost while providing potentially greater value for them as graduates seeking employment in advanced manufacturing in the Puget Sound region. These include an OSHA safety certificate, a first aid certificate, and the college's own FSME certificate, plus industry credentials that are granted when students take third-party exams testing their knowledge, skills, and abilities in subjects specifically covered in the curriculum. Examples of these third-party certifications are the Certified SolidWorks Associate, demonstrating Computer Assisted Design (CAD) proficiency; the Society of Manufacturing Engineers Bronze Lean Certification, demonstrating understanding of lean and quality assurance principles and practices; and a certification granted by the firm FANUC, demonstrating skill and safety with a specific robotic arm manufactured by the company.

As part of his new focus on encouraging employer engagement with the C2E program, the current Career Navigator/Employer Engagement Coordinator has also reached out to local manufacturing companies to participate in a National Manufacturing Day event held at CPTC, which is targeted to high school students as well as current CPTC students. A total of seven companies attended a recent Manufacturing Day session, hosted by the Mechatronics Program and a student "Club Mech," and more than ten companies indicated interest in using the competency database developed as a key component of the grant (described in Chapter III).

Throughout the project, C2E grant administrators have also worked closely with a local association of small and medium-sized manufacturing employers—the Center for Advanced Manufacturing Puget Sound (CAMPS)—funded under a U.S. Department of Labor grant to link individuals exiting military service at Joint Base Lewis-McChord (JBLM) to the C2E program.[9] Since the end of the Camo2Commerce grant, the college has maintained its working relationship with CAMPS as a way to reach out to local manufacturing employers and encourage them to be involved with the program.

College administrators anticipate that employer awareness of and interest in the program will continue to increase as larger numbers of students complete the CPTC Mechatronics Associate Degree. An employer representative interviewed during the third site visit commented that "there is still only a trickle of program completers coming out of this program." Recent efforts to engage business representatives in the project have included providing information to business associations and employers about the Mechatronics Associate Degree program and the skills of program completers, inviting business representatives to speak to students about their products and opportunities for employment, and encouraging employers to consider CPTC students for internships and job openings.

As an indicator that employers recognize the value of the CPTC Mechatronics Associate Degree, C2E staff members reported that several graduates have obtained jobs with local manufacturing firms that pay at least $26.00 per hour. Program staff members were also delighted that several of their Mechatronics students have been selected by the local Boeing plant to participate in summer internships during each of the last few summers. In addition, the college noted with approval that the Boeing Company has created a new job title ("mechatronic technician") to correspond to the competencies of the students who complete the Mechatronics Associate Degree program.

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[9] CAMPS was funded under a DOL National Emergency Grant (NEG) called "Camo2Commerce" awarded to a local workforce development board to help serve the workforce needs of the large numbers of military service people released from the military at this nearby base. In addition to working closely with CAMPS on the Cam2Commerce program, the C2E project has an ongoing relationship with this organization because it is a membership organization that represents small- to medium-sized manufacturing firms in the region.

A final strategy for bringing the Mechatronics Associate Degree into closer relationship with local employers has been the creation of a capstone project. Students are now encouraged to find an actual firm to be the "customer" for their capstone project, rather than developing a theoretical project that does not have a specific client. This has resulted in applied projects that help students develop relationships with specific firms in the region. The program would like to work with employers to create more formal internships for students as well.

Interaction with the Public Workforce System

The C2E program explored the possibility of developing a formal relationship with the Tacoma/Pierce County Workforce Development Council for the referral of appropriate training candidates to the C2E program. Although CPTC provided some funding to the local WIB to help conduct outreach and refer customers to the Mechatronics Program, the decentralization of the workforce system to individual career center operators prevented the creation of a functional process for referral of prospective students. In the absence of a strong referral partner in the local workforce system, CPTC undertook its own active Mechatronics Associate Degree program outreach activities, as described in the next section.

Meeting Enrollment Targets

The grant proposal indicated that 220 students would be enrolled in the Mechatronics Program under the grant, about evenly divided between students who planned to complete only the one-quarter long FSME certificate, and students who planned to complete the seven-quarter Mechatronics Associate Degree.

An analysis of administrative records for the Mid-Program Report completed in September 2016 showed that about one-third of the earliest enrollees in the program—from the entry cohorts in between fall 2014 and fall 2016—were students who planned to complete only the FSME certificate;[10] the remaining two-thirds indicated upon enrollment that they intended to complete the associate degree.

After the current Grant Manager was hired by Clover Park Technical College in the winter quarter of 2016, he refocused the program on recruiting students who wanted to complete the

[10] Some of these early C2E project enrollees had been recruited through a program called "Camo2Commerce" targeted to individuals exiting the military from the nearby Joint Base Lewis McChord (JBLM). The Camo2Commerce program paid for only short-term training; participants who enrolled in the FSME one-quarter-long certificate program as part of Camo2Commerce were assisted by staff of that program in finding employment after they completed the certificate. Others were high school students who were dual-enrolled in high school and the FSME certificate program at CPTC.

full 7-quarter associate degree program.[11] The decision to focus on recruiting such students—and not those who planned to exit the C2E program after the one-quarter long FSME certificate—reduced the number of enrollees who had time to complete the program and enter the labor market during the evaluation period. However, this recruitment focus was better aligned with the objective of the C2E program, which was to prepare students for high-paying mid-skill-level jobs in the manufacturing sector.

Exhibit V-1 illustrates how this shift in enrollment priorities changed the mix of students over time from the first grant entry year, when almost half of enrollees planned to complete only the FSME certificate, to the third and fourth grant entry years, when over three-quarters of enrollees stated at program entry that they intended to complete the full Mechatronics degree.

Exhibit V-1:
Intended Degree of Participants by Grant Entry Year

	Academic Year of Enrollment				
Intended Degree at Enrollment	**Fall 2014**	**Fall 2015**	**Fall 2016**	**Fall 2017**	**Total, All Grant Years**
FSME Certificate	24 (47%)	20 (54%)	8 (22%)	4 (12%)	56 (35%)
Associates Degree	27 (53%)	17 (46%)	29 (78%)	29 (88%)	102 (65%)

Source: Clover Park Technical College (2018)

Enrollment in the program remained below the projected target levels throughout the first grant year. To enhance recruitment during the second and third years of the grant, the grant-funded staff members undertook extensive outreach beyond the regularly scheduled program information sessions at the college, making presentations about the FSME certificate and the Mechatronics Associate Degree program at high schools, Joint Base Lewis-McCord (JBLM), veterans' networking events, and job fairs organized by the Organization of Washington Businesses and Goodwill Career Centers. In addition, grant staff members reached out to individuals who were qualified for training under Washington's workers' compensation system—referred to as Labor & Industries (L&I)—and a state-funded dislocated worker program.

[11] During the study period, after the initial associate degree faculty member made some changes to the curriculum, he asked for and received CPTC curriculum review board approval to reduce the associate degree program from 7 quarters to 6 quarters. This change was subsequently reversed back to 7 quarters, after the final pair of associate degree instructors added some courses and rearranged course sequencing to make the content of classes more logical.

In early 2017, because student enrollment was expanding less rapidly than originally anticipated, the Grant Manager revised the C2E enrollment goal downward to 150 students enrolled in grant-funded services. Although the C2E project struggled to meet its original enrollment goal, it did reach this revised goal.

Supporting the Enrolled Students

Supporting participant success through intensive coaching and career navigation services was another key C2E component outlined in CPTC's proposal to DOL. To ensure that students began the program with appropriate understanding of its rigor, the Career Navigator emphasized in prospective student interviews the requirements of the program (that they attend classes during the day and, if interested in the AAS-T degree, complete pre-calculus and physics). She also described the support services—career coaching, academic support and counseling, and life coaching—that would be available to them through the program and noted the other services provided on campus and in the community.

Students participating in the site visit focus groups and completing the survey agreed that the C2E Career Navigator helped them decide whether to enroll in the program and learn how to be successful in the program. The Career Navigator was the main point of contact available to answer potential students' questions about the program; the navigator responded to all inquiries from CPTC's website and co-facilitated bimonthly program information sessions. This staff person was also active in supporting the success of enrolled students; the navigator provided an intake packet that informed students of the career navigation services available to them and contacted faculty members to request that they provide the names of students who might need support services.

After ensuring that the program was a good match for a student, the Career Navigator continued to meet with the student throughout the program to answer questions about how the academic system works and to support them during the program. The Career Navigator provided training in job search skills and supported job search efforts as students neared program completion. During student focus groups conducted as part of the annual site visits, students expressed satisfaction with the services they had received from the Career Navigator, explaining that she reached out to students regularly, was easily accessible, and was able to troubleshoot problems related to financial aid, enrollment, and credit. One student stated, "She goes above and beyond [the requirements of her job]."

In addition, the Career Navigator helped link students to programs that could help pay their tuition, which was not covered by the C2E grant. Some students received assistance from the GI Bill and state worker retraining programs. WIOA funds were not used by any students because

mechatronics was not specifically defined as a demand occupation by the local workforce board.

Summary

During the initial nine months of program operations, the C2E program did not have the administrative staff in place to provide strong leadership or student support services. In addition, due to the absence of experienced instructors with a strong commitment to program success, students who entered in the first cohort experienced shortcomings in the curriculum, the available technology, and the quality of instruction. Even after the first full-time faculty member was hired for the new program, there was substantial student dissatisfaction with the quality of the instruction (although students valued the services available from the Career Navigator). Despite strong recruitment efforts, the number of enrolled students did not increase as quickly as had been hoped.

Eventually, after energetic and qualified instructors were hired and up-to-date training machinery installed, program quality improved markedly. Word of mouth started spreading the news among potential students and interested employers that CPTC had a Mechatronics Associate Degree program that offered valuable training. At this point, enrollment increased and ultimately reached the point at which the program could be self-sustaining with student tuition fees. Throughout the difficult start-up, both the Grant Manager and the college dean responsible for overseeing the program kept their focus on the goal of building a high-quality program with strong employer engagement and long-term viability. By the end of the grant it appeared that this steadfast commitment to continuous improvement had paid off.

III. Grant Accomplishments

In this chapter, we assess CPTC's performance in realizing the five objectives for the C2E project described in Chapter 1. To review, these objectives, which were designed to develop the capacity of CPTC to implement a strong Mechatronics Associate Degree program, were as follows:

- establish a new, 18-credit, one-quarter-long Fundamental Skills for Manufacturing and Engineering (FSME) Certificate;
- develop a new 108-credit Mechatronics Associate Degree program, with the FSME Certificate curriculum as its required first quarter;
- create a dynamic lab space for advanced manufacturing, made possible by the purchase and installation of new equipment;
- provide students with support services to ensure student retention and successful program completion; and
- build a competency database that assesses the skills mastered by individual program students compared to the competencies needed by manufacturing employers for different manufacturing occupations.

As described in Chapter II, CPTC experienced some challenges in realizing these system-building objectives. Nevertheless, the college ultimately succeeded in building the program components originally envisioned in the grant proposal.

Establishing the FSME Certificate

By the summer quarter of 2016, when the college hired an instructor dedicated to teaching the courses that make up the FSME certificate, CPTC had fully established the one-quarter-long certificate program and made it an integral part of the Mechatronics Associate Degree program.

In the fall of 2017, the program experimented with allowing several students to enroll directly into the Mechatronics degree program without previously completing the FSME certificate. These students found that they were handicapped by not having had the same hands-on basic skills preparation as the students that had completed the FSME certificate program. By the time of the third site visit, the instructors emphasized that they strongly recommend completion of FSME as the standardized entry point to the Mechatronics Associate Degree program. In the future, CPTC may develop a more open-ended introductory manufacturing certificate that could serve as an entry point to a broader range of advanced manufacturing programs.

Developing the Mechatronics Associate Degree

Recognizing that any number of different levels of training may lead to employment, and wanting the Mechatronics Program to be consistent with the idea of flexible career pathways, college administrators and faculty members established four different "exit points" for the Mechatronics Program. Students may leave the program after completing any of the credentials shown in Exhibit III-1:

Exhibit III-1. Possible Exit Points from CPTC's Mechatronics Program

Credential	Credits	Duration of Training
FSME certificate	18	1 quarter
Mechatronics certificate	43	3 quarters
Mechatronics Associate in Applied Technology (AAT) degree	91	5 quarters
Mechatronics Associate in Applied Science-Transfer (AAS-T) degree	106	7 quarters

Students may continue from the FSME certificate into any of the additional certificate or degree programs. Completion of the FSME certificate is considered a required part of and a pre-requisite for the rest of the credentials.

- The Mechatronics certificate does not require students to take either pre-calculus or physics. Only one student in the outcome study chose to exit after completing the requirements for the Mechatronics certificate.
- The AAT Degree does not require the completion of the general education courses required for transfer to a 4-year degree program, whereas the AAS-T Degree does.

In addition to giving students in the Mechatronics career pathway flexibility, having these four exit points helps the college improve its program completion rate by making it more likely that students will earn at least one academic credential upon exit from the program.

During the 3rd grant year, the two new Mechatronics instructors revamped and reorganized the Mechatronics curriculum, better integrating the theory taught in lecture courses with hands-on practice and creating a new program course sequence that finds natural connections between courses taught at the same time and better leverages opportunities to apply theoretical

knowledge in applied courses.[12] One of the instructors explained: "We paired up courses that had a logical flow: for example, AC Circuits and power generation is now offered at the same time as motors and drives; DC circuits is offered at the same time as programming. There are constant interactions between the paired courses."

In the final curriculum design, the physics content has been imbedded into the Statics and Strengths course. The new course sequencing includes four additional required courses and makes "Sensors and Actuators" an elective course. A textbook has now been identified for each course, except for the programming course. (For this course, all students purchase a kit of physical tools instead of a textbook).

Creating State-of-the-Art Laboratory Space

Creating state-of-the-art labs in which students can practice the skills they are learning was a key part of the C2E project. From the perspective of the CPTC Dean of Instruction and other college faculty and staff members, gaining the ability to purchase training equipment that simulates the equipment currently being used in advanced manufacturing workplaces was one of the greatest benefits of the grant. Both laboratories—for the FSME certificate program and for the rest of the Mechatronics curriculum—now have up-to-date modular trainers for students to work with, and program staff members can show local employers through their laboratories on "Local Manufacturing Day" confident that their equipment is current and of high quality. Student access to lab facilities has also been increased; because the program has two full-time Mechatronics Associate Degree instructors, an instructor is usually available to support "open lab" during expanded hours.

Although lab conditions are still not perfect—due to the age of the lab facilities themselves—students reported in the focus group that they are happy that the labs support hands-on tasks and enable them to complete individual projects that demonstrate their ability to use different tools and techniques. As described in Chapter VI on sustainability of the grant-funded accomplishments, the construction of a new facility for a Center for Advanced Manufacturing on the CPTC campus within the next 18 months will provide fully functional instructional space for the program as well as strengthen the coordination and sharing of resources between the four advanced manufacturing programs that will be housed in the new center.

[12] In November 2017, after the site visit, the college's curriculum review board reviewed and approved the new courses and the program's proposed scope and sequence.

Providing Services to Support Student Progress

The goal of supporting students' progress in the Mechatronics degree program hinged on the creation of a Career Navigator position. Over the course of the grant, this position was filled by two competent and experienced individuals and, as described in the previous chapter, the Career Navigators succeeded in providing the services envisioned in the proposal. One of the important roles of the Career Navigator was to interview prospective students to make sure they fully understood the program's requirements and expectations. The navigator was also key in providing career coaching to enrolled students and supporting them with referrals to the other services available to them on campus and in the community.

Building a Mechatronics Competency Database

Finally, as part of the C2E proposal, the college committed to creating "a database that links industry-defined skill standards to student achievement of specific course competencies." This objective was one of the more innovative proposed features of the grant and its importance was indicated by its use in the project's name—C2E stands for "connecting competencies to employers." The competency database was envisioned as a tool through which employers could continuously provide feedback to the college on the alignment of the curriculum to their workforce needs. In addition, because it would provide profiles of students that included instructors' ratings on their performance of the various industry-defined competencies, it was also seen as a way to support employers' efforts to recruit mechatronics talent.

The competency database was designed to improve the ability of job seekers to communicate with employers about the skills they had mastered and to allow employers to specify clearly the skills they needed and to write job descriptions that drew on the list of competencies students learned in the CPTC Mechatronics Associate Degree program. In this way, the competencies system created under the grant would meet the needs of both job seekers and employers.

While its rationale and aims remained unchanged throughout the grant period, the design and function of the competency database evolved substantially after the beginning of the project. The C2E proposal called for the purchase of a new physical server for storage of data on the competencies needed by specific employers and the skills mastered by individual students. This equipment was to be housed on the CPTC campus and managed by the college's Information Technology staff. However, after grant startup, the project team determined that it would be problematic to grant employers permission to access network resources within the college's IT system and that a database housed on a dedicated server might become a maintenance burden after the grant project term.

In response to these concerns, in early 2017 the college contracted with JobWorthy, a private start-up firm, to support fulfillment of the grant's competency database requirements.

JobWorthy provides a cloud-based platform that enables users to map college curricula to labor market competencies and thereby "bridge the gap between colleges and the labor market." Instructors are now feeding data into JobWorthy's Smartmatching Competency Database System by rating student mastery of learning outcomes in the form of "competencies" rather than traditionally worded learning objectives. Defined competencies are intended to act both as terms that hiring managers use to describe the specific knowledge, skills, and abilities they seek in a candidate and as performance-based achievements that students attain by meeting course learning objectives.

The grant-funded Instructional Designer—who also served as the project's liaison with the JobWorthy development team—worked with the faculty for each course in the Mechatronics Program beyond the FSME foundation courses to identify at least four competencies per course. At the time of the most recent evaluation team communication with the Instructional Designer in the spring of 2018, the Mechatronics Program instructors and Instructional Designer had developed a list of more than 100 competencies drawn from 17 of the 19 targeted courses in the Mechatronics Associate Degree program. Instructors in the Mechatronics Program plan to integrate competency evaluation for current and future courses into their regular grading system and workflow moving forward.

Employers were invited to select from these competencies to describe the skills they needed for specific job openings. At the time data for the Final Report were gathered through telephone follow-up conversations with grant staff members, employers had drawn on the competencies in the system to create profiles for more than 60 distinct hiring positions. For example, the competencies identified for the robotics course include:

- Knowledge of the components that make up robotic systems, including power, motion control, and robotic interfaces.
- Ability to break down robotic tasks into discrete movements and whiteboard a program flow to achieve a task.
- Ability to jog and program points for use in fine, continuous, and circular motions on six-axis robotic arms.
- Ability to create main loop programs that call on many subroutine programs to perform complex tasks.

Through their interface to the Smartmatching Competency Database System, local employers can select any of the competencies that are relevant to their hiring needs for specific positions. The matching system interface for instructors, employers, and students includes a section on matching careers to each competency that is defined. As an example, for the robotics skills named above, the system presents the relevant job titles of Robotics Technician I and Automation Engineer II, along with salary data. Another feature of the system is that its value as an information system for jobseekers will expand as increasing numbers of employers use the system, generating a growing database of job descriptions and prospective employers.

As of the time of the last telephone conversation with project staff members, the system had not yet been populated with student data from CPTC's instructional database. However, the plan is that student data will ultimately be used to match students to the competency profiles developed by employers. The system's hiring tools will conceal personally identifiable and demographic details about students (including race, gender, and even job seekers' names) from employers until later in the engagement process, as a strategy to increase diversity in hiring for advanced manufacturing employment. Grant staff members explained that the goal is for employers to select students based on their documented knowledge, skills, and abilities and not to be influenced by preconceived notions and biases.

Other programs within the college—including the Non-Destructive Testing program, also part of the School of Advanced Manufacturing—have expressed interest in customizing the competency database approach to fit their own programs. The Non-Destructive Testing program is currently using the system to facilitate communication about skill requirements among members of its advisory committee. Further, as of spring of 2018, the project team had been invited by the eLearning and Open Education team at the Washington State Board for Community & Technical Colleges (the 34-member system of which CPTC is part) to produce a webinar on its experience with the competency database.

IV. The Student Perspective

Since the C2E Mechatronics Program was developed primarily to aid its students, knowing how these students perceived the program is a critical aspect of the evaluation. SPR was interested in learning the extent to which students were satisfied with the curriculum and instruction, how they viewed the quality and usefulness of the navigation services and career coaching they received, and what they thought about the information they received about employment opportunities in the mechatronics field. We also wanted to hear from students who had completed the associate degree about their post-program experiences.

At various points during the evaluation period, SPR researchers solicited student input about these topics using three different methods:

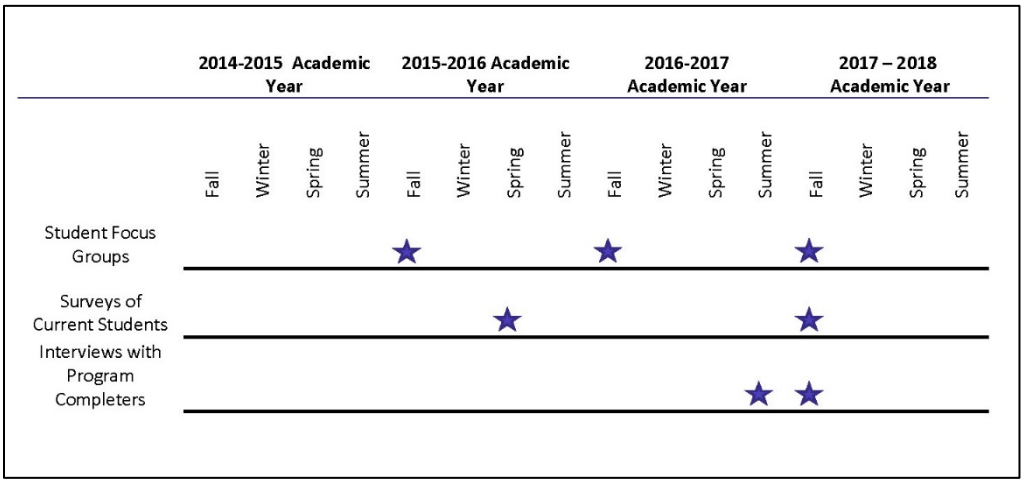
- During each of the three annual site visits, in October 2015, October 2016, and October 2017, we conducted face-to-face focus groups with samples of ten to fifteen FSME certificate and associate degree students who were participating in the program at the time.
- During the spring quarter of 2016 and then again in the fall quarter of 2017 (18 months apart), we administered a structured survey of all students then active in the program.[13] Across both rounds, fifty-four of the possible seventy-two respondents participated in the survey, for a combined response rate of about 75 percent.[14] (Detailed survey data are included in Appendix A.)
- In the spring and summer of 2017, we conducted in depth telephone interviews with six of the twelve students who had completed the associate degree at least six months before the time of the interview. These interviews were undertaken to collect information about how individuals were influenced by the program in determining their career interests and goals and the experiences and challenges they faced in the labor market both prior to entering the program and upon graduating from it.

Exhibit IV-1 summarizes the timing of data collection activities related to student perspectives on the program.

[13] Two questions about student satisfaction with instructional quality were included only in the second version of the survey; otherwise the two survey instruments were identical.

[14] Although it was conceivable that several students might have completed the survey twice (once in 2016 and once in 2017), we determined that the possible overlap was at most two students, so we analyzed the survey as a single survey with two independent samples of current students.

Exhibit IV-1.
Timing of Collection of Data from Students Participating in the C2E Program



In this chapter, we use the difference sources of information about how students assessed the program to describe the student perspective on curriculum and instruction, Career Navigator services, support services received from other college staff, information about career options, and experiences after leaving the program.

Curriculum and Instruction

The rapid launch of the Mechatronics Program after the grant award—before permanent program faculty were hired, prior to the purchase and installation of state-of-the-art machinery and teaching stations, and before the program curriculum was fully developed—meant that students who began their studies during the first 18 months of the program had access to less well-developed instructional resources than students who enrolled later in the grant period. Focus groups with students conducted during the fourth quarter of program operations (at the time of the first evaluation site visit in October 2015) revealed that students in the early entry cohorts were frustrated by the lack of a well-developed curriculum and stable group of instructors. The students who participated in face-to-face focus groups in the fall of 2015 expressed concern about the high rate of turnover of instructors, the lack of an established curriculum or written texts, and the absence of enough equipment to give them "hands-on" time in the lab sessions, among other issues.

Student comments from the early focus groups express disappointment that the program experience was not what students had hoped:

> *"For the first [cohort], things were difficult because we had three instructors who quit on us or got fired. In the second quarter [a new teacher] had no experience with CAD*

design, so we had one of our own students teaching the class…It worked out and we learned a lot, but the instructor did nothing."

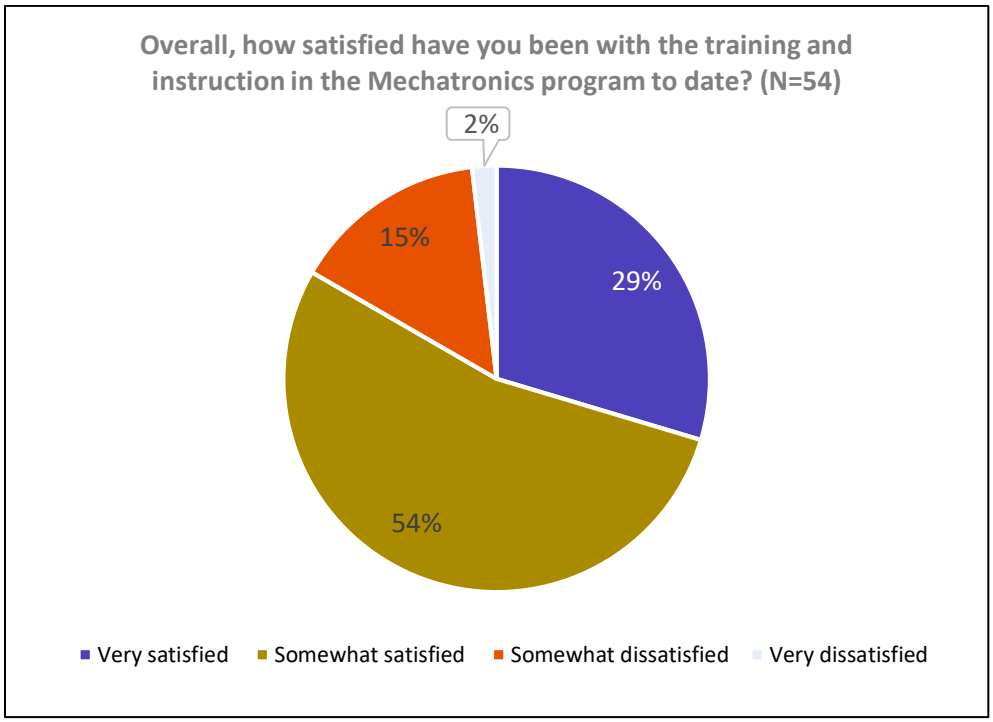
"During the first month, instead of starting our studies, the students worked to clean out the lab space which we shared with the automotive mechanics program and build the tables for our lab space…"

"A third of the initial class was comprised of high school students; another third were military personnel exiting the service, and the final third were students interested in mechatronics. We didn't have similar backgrounds or levels of motivation."

"The advertised program curriculum for the FSME quarter was supposed to include calibration and diagnostics, but the tools didn't come in on time."

By the time the surveys of current students were conducted in the spring of 2016 and the fall of 2017, most students expressed a significantly higher level of satisfaction with most features of the program. These survey results were undoubtedly influenced by the substantial progress that had been made toward overcoming the initial challenges. By the second grant year, the C2E project had hired an effective instructor for the FSME curriculum, had hired a full-time faculty member for the Mechatronics Associate Degree program, and had made substantial progress in developing the detailed sequence of courses and course curricula for the associate degree program. As shown in Exhibit IV-2, over 85 percent of the students surveyed in spring of 2016 and the fall of 2017 reported being very satisfied or somewhat satisfied with training and instruction.

Exhibit IV-2. Student Satisfaction with the Curriculum

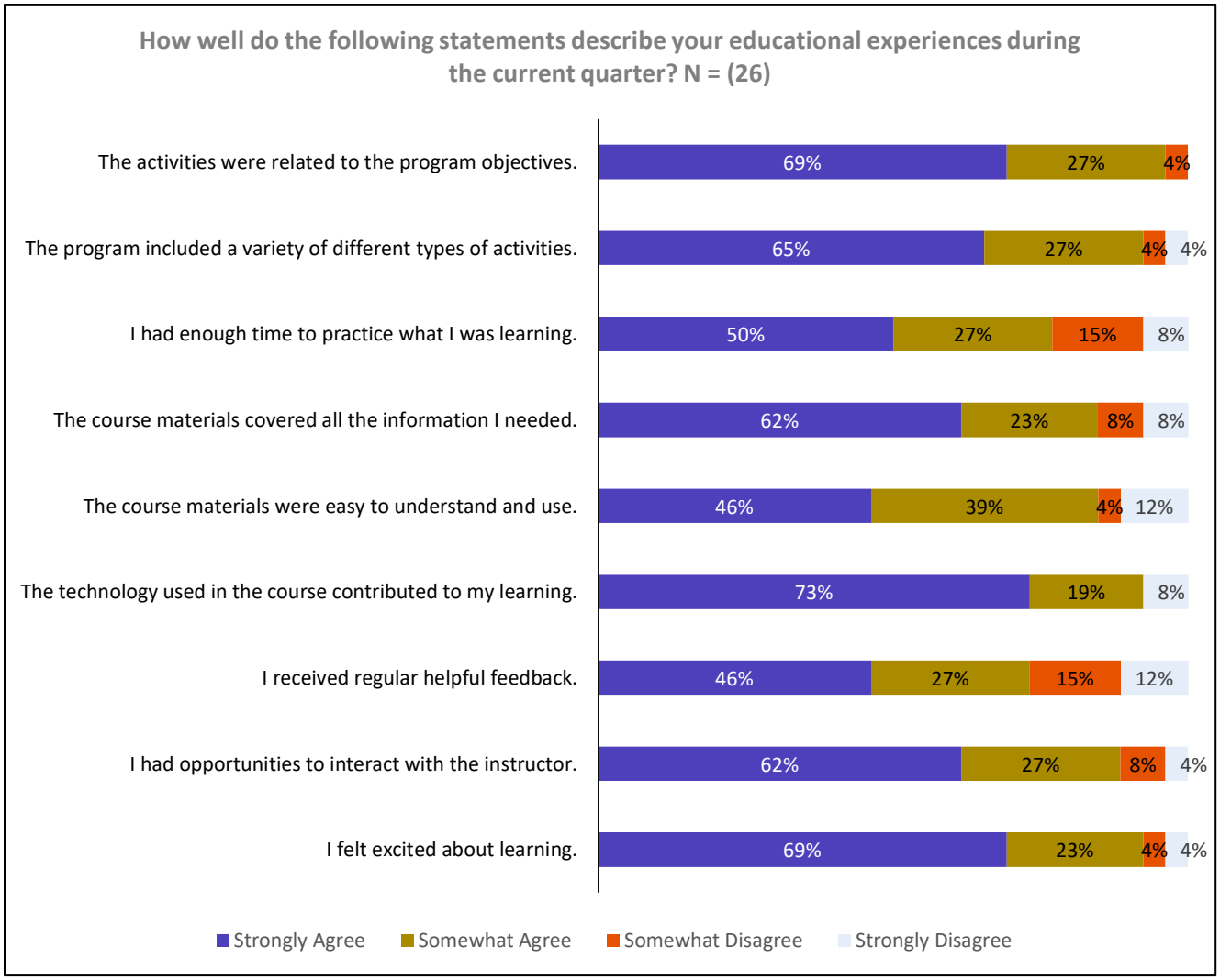


Source: *Current Student Survey, Rounds 1 and 2 (Spring 2016 and Fall 2017)*
Note: Percentages do not add to 100% due to rounding error

Overall, students' suggestions for program improvement, regardless of their satisfaction levels, focused on how to improve the quality of the instruction provided by course instructors and how to increase student access to and use of equipment. Several survey respondents felt that the program could benefit from having additional instructors or lab assistants helping in the course labs. About one-fourth of survey respondents requested further curriculum improvement. Students asked for more structure, clarity, and general sense of preparedness when program instructors presented material. In addition, three survey respondents asked for more hands-on training and three respondents noted that additional relevant tools and projects would improve the program. Several students said that they would like the FSME curriculum to include the award of one or more industry-recognized credentials.

The fall 2017 version of the current student survey included two additional questions about students' satisfaction with the quality of the curriculum and the quality of their course instructors. The responses to these questions from the round 2 survey are presented in Exhibits IV-3 and IV-4 below.

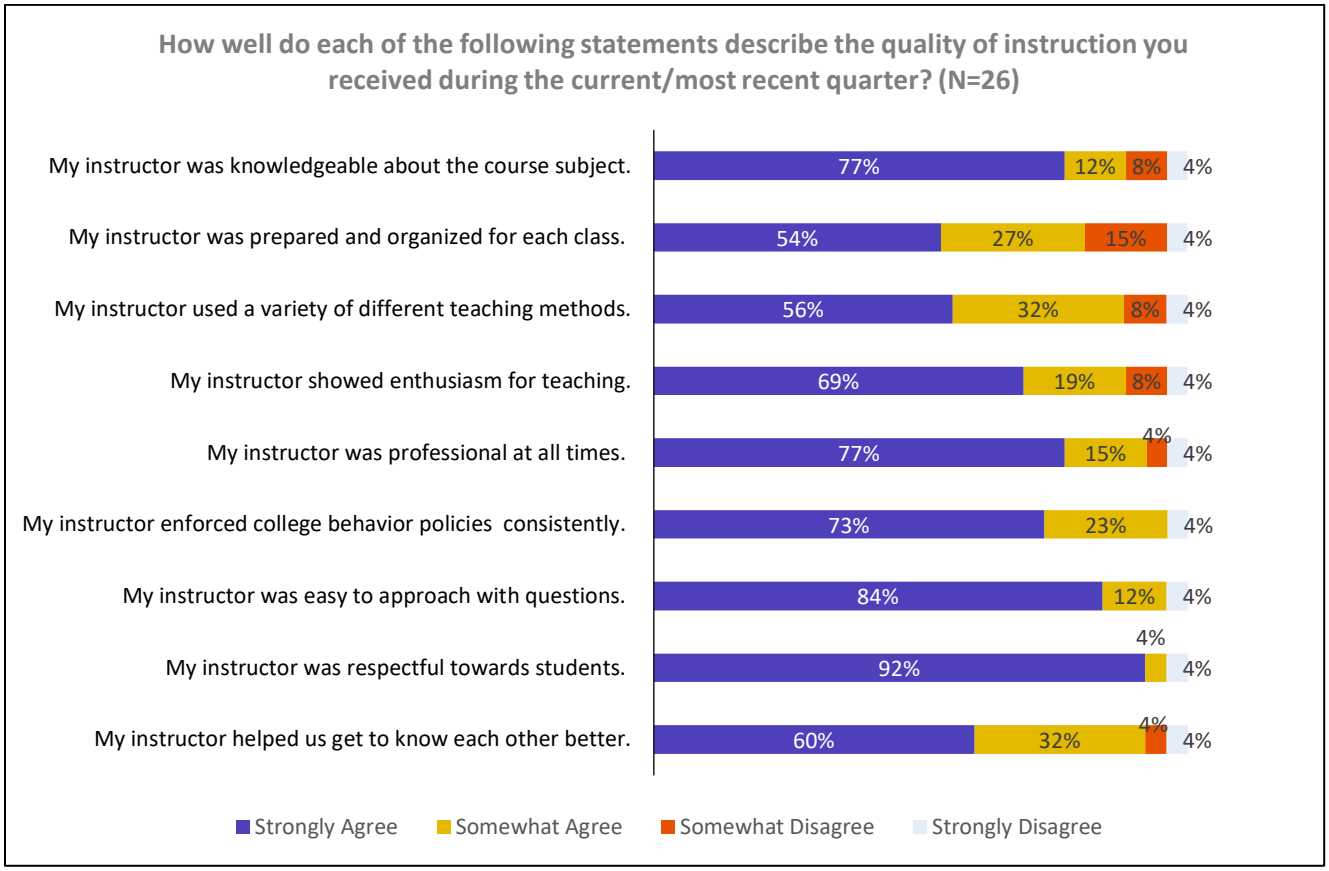
Exhibit IV-3: Percent of Students Surveyed in Fall 2017 Who Agreed with Statements about Educational Experiences



Source: Current Student Survey, Round 2 (Fall 2017)

Exhibit IV-3 shows that a large proportion of respondents agreed with positive statements about the curriculum and instructors. The strongest levels of agreement were expressed for positive statements on the way technology contributed to learning in the course, the comprehensiveness of course materials, the diversity of course activities, and the relationship of activities to stated objectives. Most respondents agreed that they felt excited about learning and appreciated the opportunities they had to interact with other students and with the instructor. Somewhat lower levels of agreement were expressed for statements about the amount of feedback received from instructors and the amount of time available for practicing skills.

Exhibit IV-4: Percent of Students Surveyed in Fall 2017 Who Agreed with Statements about the Quality of Instruction



Source: *Current Student Survey, Round 2 (Fall 2017)*

Exhibit IV-4 shows that high proportions of students also agreed with positive statements about the quality of program instruction. Students most appreciated that the instructors were knowledgeable about the course material, enthusiastic, professional, approachable, and respectful. Students were slightly less satisfied, on average, with how organized and well-prepared the instructors were for each class session, the accessibility of textbooks, and the frequency of provision of performance feedback.

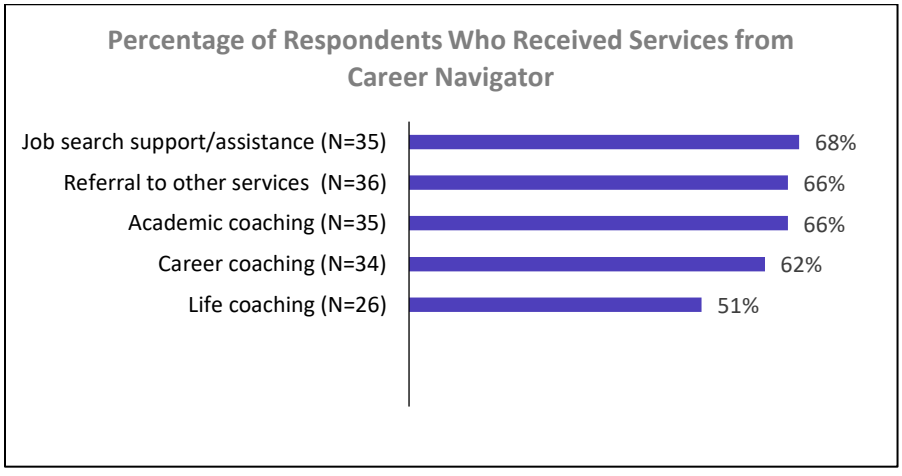
Survey respondents were invited to provide open-ended suggestions on how to improve the quality of hands-on training and the quality of instruction. Two survey respondents suggested that the program create additional opportunities for hands-on training. Two respondents suggested that instructors offer more guidance during labs as well as provide more feedback on class projects.

Career Navigator Services

The funding of a 100%-time Career Navigator was a feature of the C2E grant that was intended to ensure that project students would have a dedicated support system to promote student retention and successful completion of the program. Students who participated in on-site focus groups and those surveyed as part of the current student survey expressed satisfaction with the Career Navigator's services.

As described elsewhere in this report, the Career Navigator provided different supports to C2E students, including academic coaching, referrals to student financial aid or other funding, career coaching, life coaching, assistance in searching for jobs, and referrals to other services at the college or in the larger community. As shown in Exhibit IV-5, over 50% of all respondents reported receiving each service available from the Career Navigator, or alternatively, that a significant minority of students did not receive supports from the Career Navigator. This is not necessarily a problem; it is consistent with findings in other TAACCCT evaluation studies performed by SPR, which show that some students do not need or request student support services, while other students make more frequent requests for support. The services received most frequently from the Career Navigator were referrals to financial aid and job search assistance.[15] The least utilized Career Navigator service was coaching students on life issues (received by only 51 percent of respondents). Some students did not need these services; others may have been reluctant to talk about life issues that did not pertain directly to their academic experience.

Exhibit IV-5. Support Services Received from Career Navigator

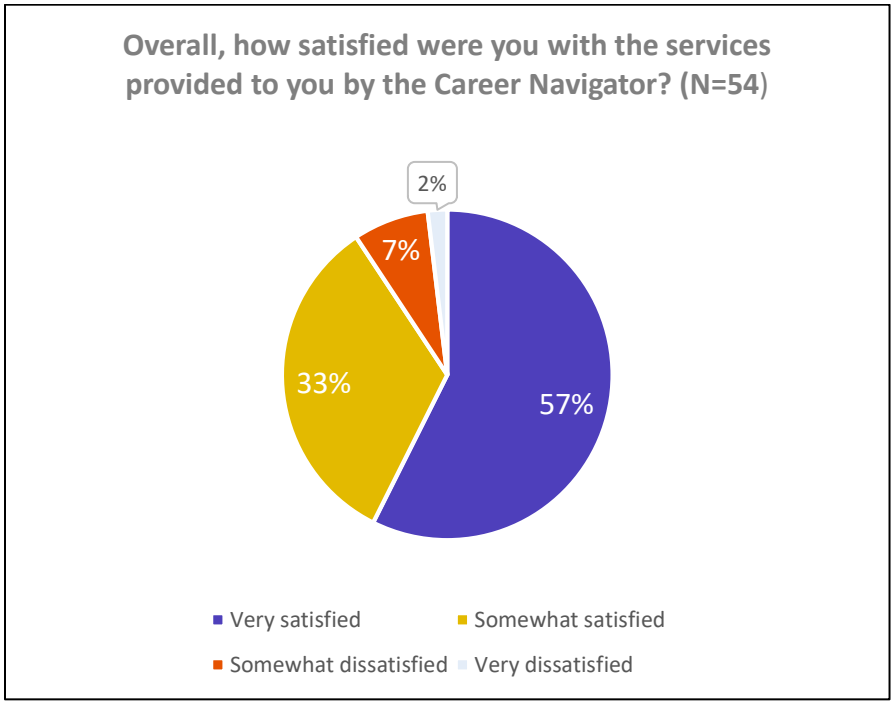


Source: Current Student Survey, Rounds 1 and 2 (Spring 2016 and Fall 2017)

[15] Since these responses were gathered from active students who were at various points in their 7-quarter program, it is likely that the frequency of job search support/assistance is underreported, since this service was more likely to be provided as students approached the end of the program.

As shown in Exhibit IV-6, most survey respondents (90 percent) were either very satisfied or somewhat satisfied with the support services that they received from the C2E Career Navigator. Of these, 57 percent were very satisfied, and 33 percent were somewhat satisfied.

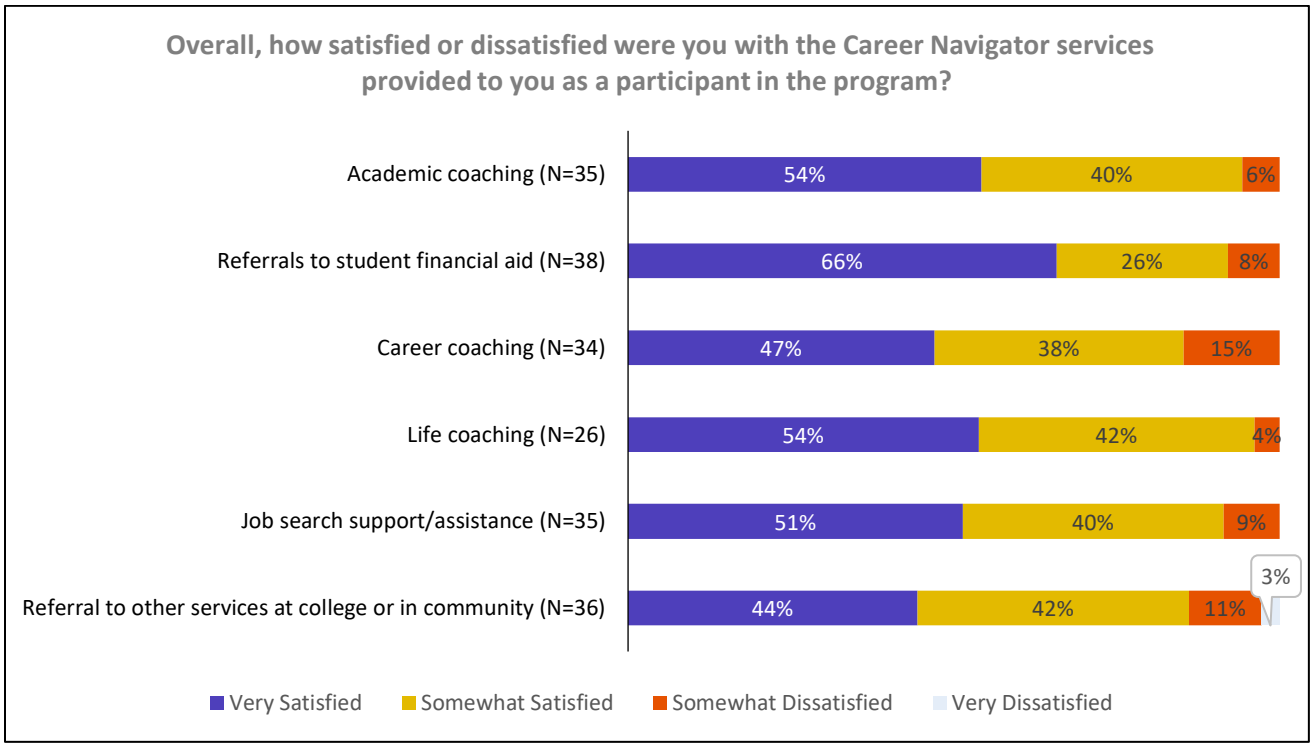
Exhibit IV-6. Satisfaction with Services Received from Career Navigator



Source: *Current Student Survey Rounds 1 and 2 (Spring 2016 and Fall 2017)*

Exhibit IV-7 shows how satisfied students were with each type of service provided by the Career Navigator. Students expressed a high level of satisfaction with most services provided by the Career Navigator. Compared to the services they were most satisfied with, they expressed slightly lower levels of satisfaction with career coaching and referral to other services at the college or in the community. In the final section of this chapter, we turn to the issue of whether the career information provided by the program was optimal.

Exhibit IV-7. Satisfaction with Each Type of Career Navigator Service

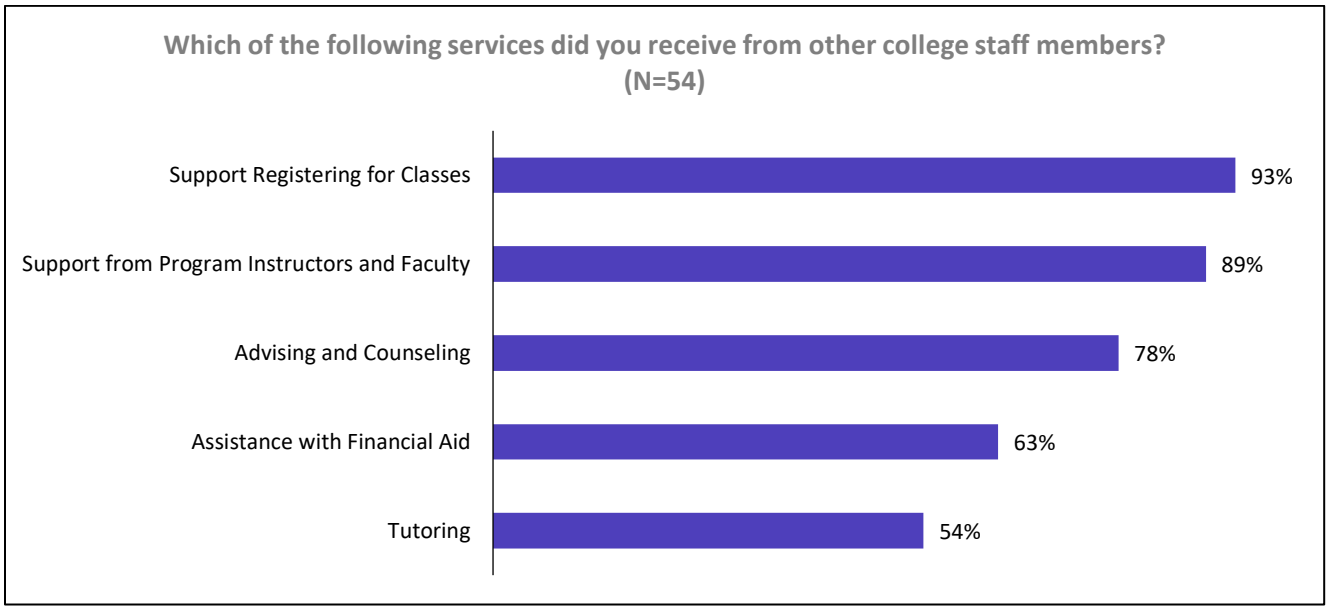


Source: Current Student Survey Rounds 1 and 2 (Spring 2016 and Fall 2017)

Support Services Received from Other College Staff Members

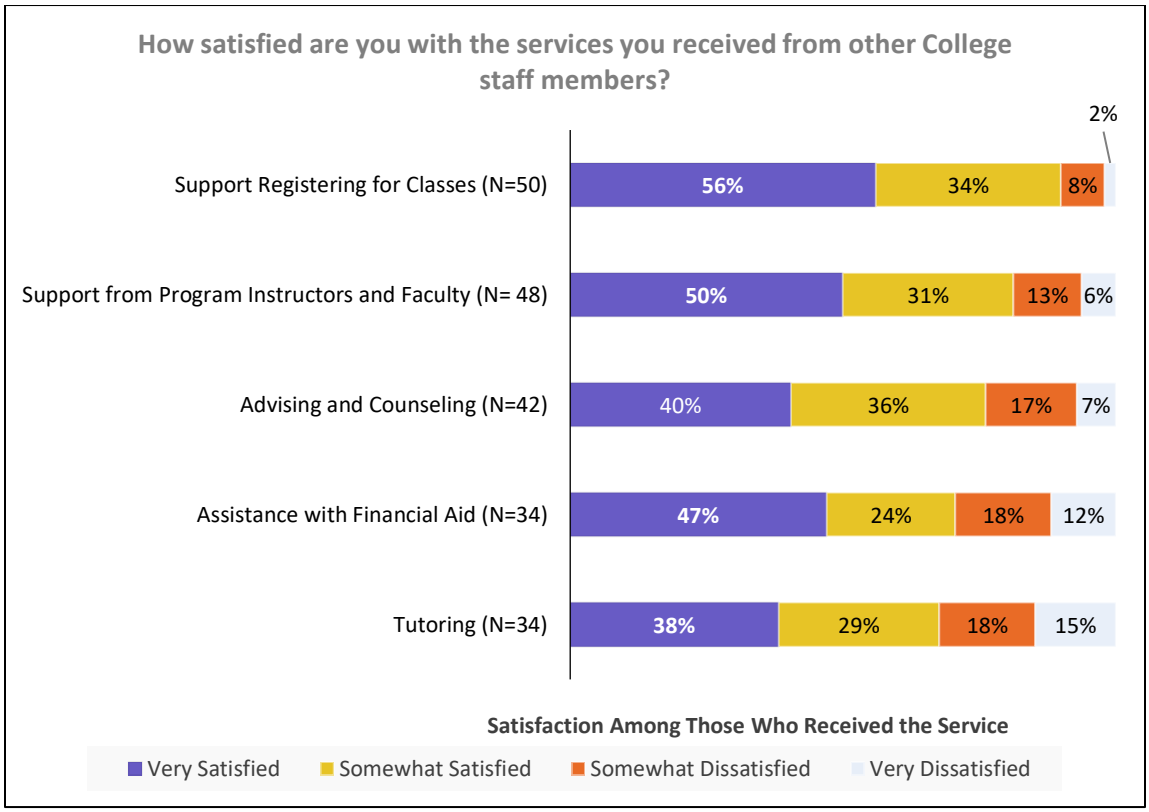
Students surveyed also reported receiving a different set of support services from other individuals and offices within CPTC, including academic advisors, program instructors, academic tutors, and financial aid advisors. As shown in Exhibit IV-8, the services reported as most frequently received from other college staff persons (usually after referral from the Career Navigator) included support for registering for classes, college advising and counseling, and direct assistance with financial aid. Most students who reported receiving these additional services were satisfied (Exhibit IV-9). However, satisfaction was not evenly distributed across these services. Twenty-four percent of students expressed dissatisfaction with college advising and counseling, 30% with financial aid services, and 33% with tutoring.

Exhibit IV-8. Support Services Received from Other College Staff Members



Source: Current Study Survey Rounds 1 and 2 (Spring 2016 and Fall 2017)

Exhibit IV-9. Student Satisfaction with Support Services Received from Other College Staff



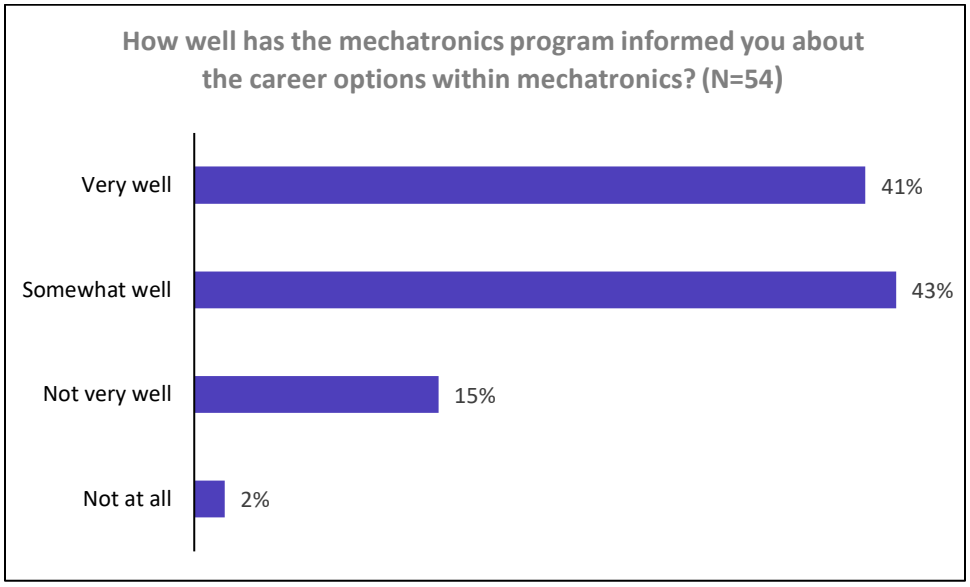
Source: Current Student Survey Rounds 1 and 2 (Spring 2016 and Fall 2017)

Information and Coaching on Career Options

To be successful in preparing students for employment in mid-skill-level high-paying jobs, CPTC had not only to develop a curriculum that taught the skills needed by manufacturing employers in the region but also to inform students about the advanced manufacturing job market and what types of employers hired workers with mechatronics skills. Students needed to learn how to prepare themselves for jobs in their desired manufacturing sector and determine whether they needed a particular specialization or a more advanced degree to advance in a career path within the diverse field of manufacturing.

Several questions in the survey of current students addressed student satisfaction with the career information and career coaching provided by the program. As shown in Exhibit IV-9, about 84% of the respondents to the survey of current students said that the Mechatronics Program had informed them about the career options in mechatronics either very well or somewhat well. A small proportion of respondents (about 17 percent) were less satisfied with the adequacy of the career information provided by the program.[16]

Exhibit IV-9. Overall Satisfaction with Career Information Provided



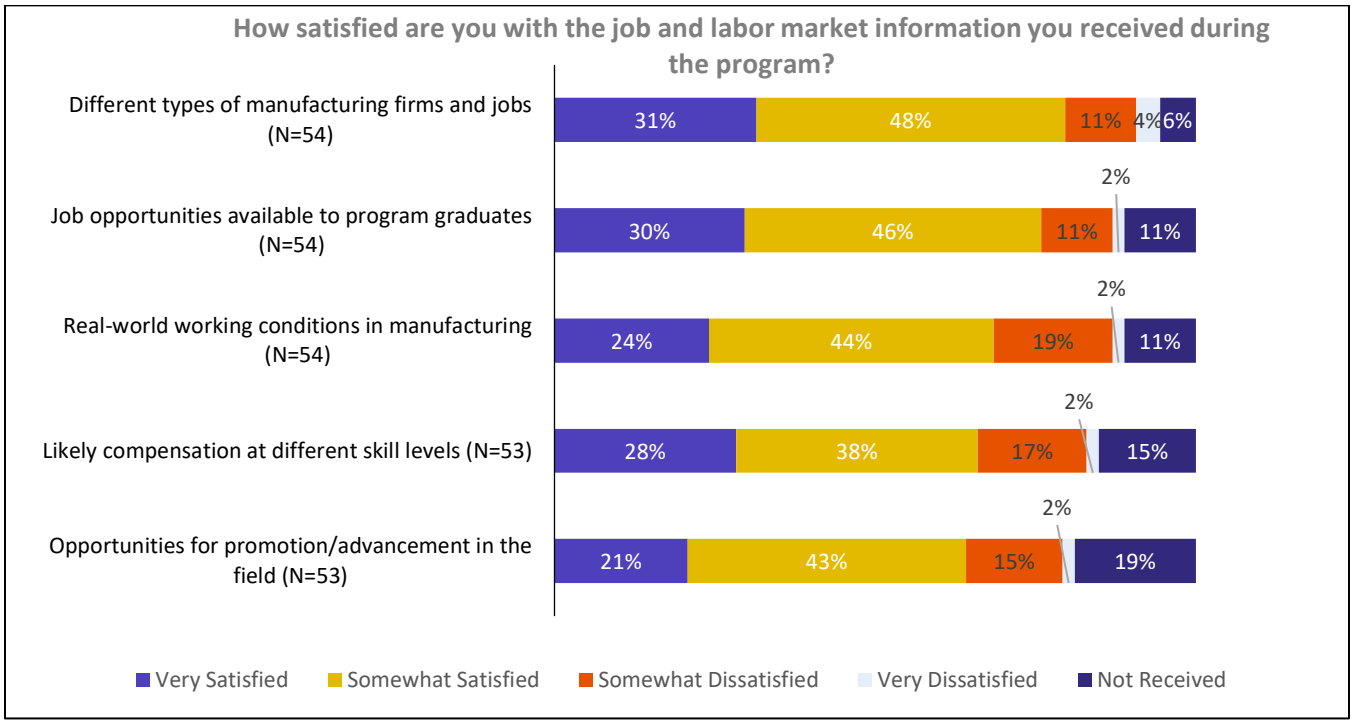
Source: *Current Study Survey Rounds 1 and 2 (Spring 2016 and Fall 2017)*

While students were generally pleased with the career information they received, their level of satisfaction varied for individual types of career information. As shown in Exhibit IV-10, students were most satisfied with the information that the program provided on the entry points into the mechatronics career ladder—basic information about the different types of

[16] Since these students were at a variety of different stages in their completion of the program, they may have received additional information about career options later in the program.

manufacturing employers and jobs, and the types of jobs students would be qualified for when they completed their certificate or degree. Slightly lower proportions of respondents were satisfied with the information provided about the wages that might be available to them at different points in the career ladder and the opportunities for advancement in the field. It is concerning that about 11 percent of the respondents said that they had not yet received information about the real-world working conditions in the manufacturing fields they might enter.[17]

Exhibit IV-10. Level of Satisfaction with Job and Labor Market Information

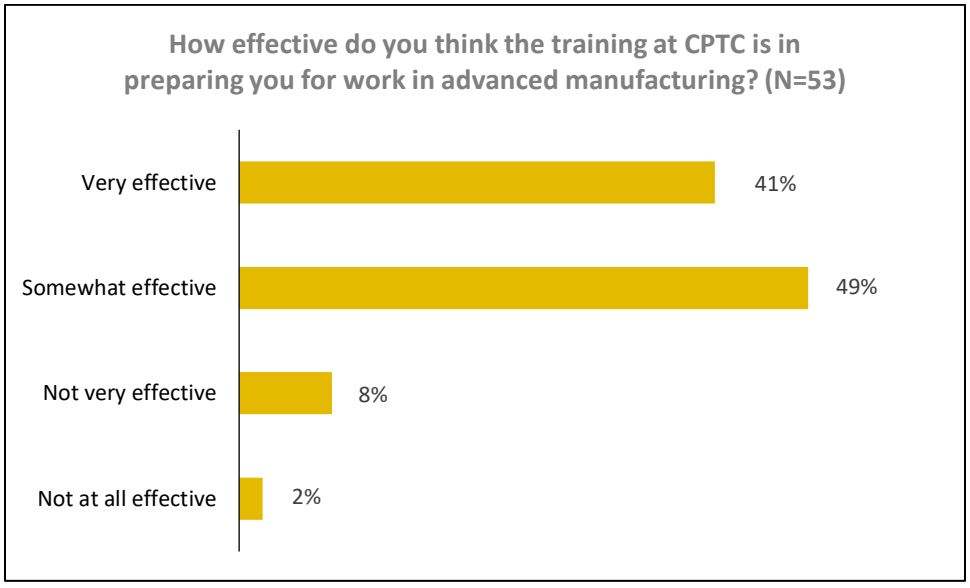


Source: *Current Student Survey Rounds 1 and 2 (Spring 2016 and Fall 2017)*

Overall, current students were largely optimistic that the Mechatronics Program was preparing them for good jobs in advanced manufacturing (See Exhibit IV-11). Interpretations of this finding should take into account the fact that respondents had not yet tested themselves and their preparation in the labor market.

[17] As the Mechatronics Program matured, instructors and the program manager spent time addressing this gap in information, by building in field trips to manufacturing sites, and encouraging local employers to create paid or unpaid internships for students as they approached completion of the program. They also created a requirement for each student to complete an individual capstone project and encouraged students to find a specific company as the client for their project.

Exhibit IV-11. Student Opinion about the Effectiveness of the Preparation they Received for Work in Advanced Manufacturing



Source: *Current Student Survey Rounds 1 and 2 (Spring 2016 and Fall 2017)*

The student focus groups also provided evidence that, by the end of the study period, students were increasingly aware of the career options available to them and had developed a variety of specific career objectives. During a focus group held in the fall of 2015 number of students said they picked the Mechatronics Program somewhat haphazardly and didn't have a good idea of what kind of job they wanted after completing the program. Many respondents said they wanted to work for the Boeing Company, the largest and most well-known aerospace manufacturing employer in the Seattle-Tacoma metropolitan area. In contrast, students in the final focus group held in the fall of 2017 were much better informed about the field and had very specific ideas about what they wanted to do after completing the associate degree in Mechatronics. Part of this change seemed to be due the fact that as the Mechatronics Program matured it began to attract students with higher levels of education and more students who had taken prior courses in manufacturing-related fields.

Some respondents pointed out that the technology of advanced manufacturing was changing so rapidly that it was hard to predict what jobs would be available in the future. Other students described very specific occupational goals; these included

- working in a bottling plant servicing the machines on an automated manufacturing line,
- working in robotics or prosthesis design and prototyping,
- developing a career working in the field of automated farming systems, and
- working outdoors, on automated construction.

Several focus group participants mentioned that they wanted to continue their education and get a bachelor's or master's degree so that they could pursue careers in fields such as supply chain management, mining, green power, and robotics instruction.

Post-Program Experiences

In this section, we summarize the experiences of three program completers interviewed by telephone between six and twelve months after they had completed the Mechatronics Associate Degree. We were interested in learning how they had fared since leaving the program, where they wanted to be working in five years and in what capacity, and how they planned to get there. The three profiles offered here are drawn from six detailed interviews we conducted with associate degree completers. These profiles help illustrate how the program influenced the career paths of students who had varied educational and work backgrounds prior to enrolling in the C2E program.

We have masked the identity of the individuals profiled by using fictional names and changing some of the details of their personal situations.

Student A

"Tommy," age 35, had had prior experience in electronic maintenance before enrolling in the C2E program and was planning to apply for an apprenticeship in electronic maintenance operated by the Boeing Company in a few years, so he could eventually become an aerospace engineer or electric company manager.

As one of the more mature enrollees in the program, Tommy had previously worked in the construction field and had five years of previous full-time work experience as an electronic technician. He was attracted to the Mechatronics Program at CPTC because of its interdisciplinary curriculum and its relevance to automation, and because it seemed to be a good stepping stone to his vision of getting a job with the Boeing Company as an electronics maintenance technician, where he hoped he would eventually make between $60,000 and $80,000 per year.

Tommy entered the C2E program during one of the early program cohorts. Within a month of completing his associate degree, Tommy found a job on his own as an industrial maintenance technician for an air freight company. He is satisfied with his job and added that he's using many of the skills he learned in the C2E program. He plans to work at this job for about three years before applying to an apprenticeship program in electronics maintenance at the Boeing Company. Eventually, Tommy would like to go back to school to get a bachelor's degree in industrial management or engineering. If all goes well, Tommy says, this career path should culminate in a job as an aerospace engineer or a manager at an electric company.

Student B *After completing his mechatronics degree, "Gary," an Army veteran in his late 20s when we interviewed him, enrolled in a bachelor's degree program in an unrelated field after completing his associate degree in mechatronics.*	Gary enrolled in the Clover Park Mechatronics Program in one of the first program cohorts of students at age 25 and completed his associate degree in the summer of 2016. Prior to enrolling in the Mechatronics Program, Gary had served in the Army for three years in work assignments that had included responsibility for "diagnosing and fixing things like radios and satellites." After leaving the military, he had worked in a customer service position with a national telecommunications company where he had worked his way up to a position of supervisor, and then had transferred to another supervisorial position with a large online retailer. Gary discovered that he was interested in the work being performed in the machine maintenance department of his then current employer; it reminded him of the technical tasks he had performed while in the Army. To pursue his interest in machine maintenance, Gary researched available "technical" programs, and decided to apply to the new associate degree program in Mechatronics being offered at CPTC. He liked the multi-disciplinary nature of the mechatronics curriculum. After completing his associate degree in Mechatronics, Gary says he never looked for a job in the mechatronics field because he didn't want an entry-level job as a mechatronics technician. Instead he decided that he needed to "broaden [his] resume" by enrolling in a bachelor's degree program in Organizational Leadership at a local private university. He explained that this program would draw on his personal strengths in communication and "influencing people." He is now going to school full time at night while working for a security company full-time during the day. He anticipates that he will end up working in the HR field, although he might still be interested in a management-level job in manufacturing.
Student C *The C2E program enabled "Kenneth," a 20-year old man who became interested in robotics immediately after*	After graduating from high school, Kenneth enrolled in a robotics technician program at a local technical college but didn't complete it because he was unsatisfied with the program. He continued to cultivate his interest in manufacturing and enrolled in Clover Park's Mechatronics Program early in the history of the program. Three months after graduating from the program, Kenneth was hired as a maintenance mechanic at a small company. Although he was applying the skills he learned in the Mechatronics Program, there was

high school, to get his first job as a maintenance mechanic and to begin working on a career path that he hoped would eventually lead to a management career in manufacturing operations.	little room for career advancement and he was getting paid minimum wage. He worked there a little over a year before finding a new job as a robotics technician at a large company in the Seattle area. During the next five years, Kenneth hopes to get a bachelor's degree in manufacturing operations or in applied science manufacturing. He would like to work in a lead or managerial role for a major employer in Seattle and earn a salary between $60,000 and $65,000.

Given that we have provided profiles for only three students and that the profiled students had such different backgrounds and career aspirations, it is somewhat difficult to draw generalizations from their stories. One common theme is that the students were attracted to the mechatronics field because it offered a career path that was expected to have a strong demand for workers into the future. In the rapidly changing advanced manufacturing landscape, jobs that involve maintaining machinery will still be required, even if much of the actual production process is increasingly automated.

In addition, the students interviewed perceived that the career path for mechatronics not only began with a relatively high starting hourly wage for a mechatronics technician, but also offered opportunities to move up a career ladder to manufacturing management and/or engineering technical specializations. Each of the profiled students expected that they would subsequently continue their education through an apprenticeship or a 4-year college degree program to realize their ultimate career goals.

Summary

The rapid launch of the Mechatronics Program after the grant award—before permanent program faculty were hired, prior to the purchase and installation of state-of-the-art simulated work stations, and before the program curriculum was fully developed—meant that students who began their studies during the first 18 months of the program had access to less well-developed instructional resources than students who enrolled later in the grant period. Focus groups with students conducted early in the grant period revealed that students were frustrated by the lack of a well-developed curriculum and stable group of instructors. The students expressed concern about the high rate of turnover of instructors, the lack of an

established curriculum or written texts, and the absence of enough equipment to give them "hands-on" time in the lab sessions, among other issues.

When students were surveyed during the 2nd and 3rd year of the grant, most students expressed a significantly higher level of satisfaction with most features of the program. These survey results were undoubtedly influenced by the substantial progress that had been made toward overcoming the initial challenges. Over 85 percent of the students surveyed in spring of 2016 and the fall of 2017 reported being very satisfied or somewhat satisfied with training and instruction and with the support services they had received from the Career Navigator. Most students (90 percent) believed that they were receiving training that was preparing them for employment in the advanced manufacturing field.

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V. Findings from the Outcome Study

The C2E project at Clover Park Technical College (CPTC) was designed to prepare program completers for high-paying mechatronics technician jobs within the advanced manufacturing field. The outcome study assesses whether the students enrolled during the study period achieved academic, employment, and earnings outcomes consistent with the program's goals. The initial sections in this chapter describe the characteristics of the students enrolled in the grant, which directly influenced the reported outcomes. The next section describes which students were eligible for inclusion in the evaluation's assessment of academic outcomes and its assessment of employment and earnings outcomes. The final two sections describe the academic and employment and earnings outcomes for students included in these two outcome study components, which were conducted to see if the outcomes were consistent with the program objectives.

As described in Chapter 1, in analyzing the characteristics and outcomes of students enrolled in the C2E program, SPR's research team drew on two major sources of data.

- TAACCCT grant administrative records, which contained individual-level data drawn from the grant's records on the characteristics of program enrollees, credits completed, academic credentials earned and project entry and exit dates.[18]
- Quarterly aggregates of employment and earnings data for three groups of C2E enrollees who had exited from the program. The employment and earnings data were prepared for SPR by CPTC institutional research staff members.[19] They computed means for each of the three subgroups described below and provided aggregate outcome data for each of these three subgroups to SPR, as required by WSESD:

    Outcome Group 1: students who had completed the Mechatronics Associate Degree, which included the Fundamental Skills for Manufacturing and Engineering (FSME) 18-credit certificate.

[18] CPTC shared the individual-level administrative data with the research team after the removal of all individual student identifiers, following the terms of an executed data exchange agreement between CPTC and SPR.

[19] Upon enrolling in the C2E program, all students had signed informed consent forms to allow their public records from CPTC and other public agencies to be used for the project evaluation. However, the State of Washington State Employment Security Department (SWESD) determined partway through the evaluation that CPTC could not share individual-level data on employment and earnings with its external evaluator. CPTC received and compiled individual-level data from the Washington State Employment Security Department (WSESD), under a data exchange agreement developed between WSESD and the state's Community and Technical College Board, and provided SPR with aggregate outcome summaries

Outcome Group 2: students who had completed only the one-quarter-long FSME certificate.

Outcome Group 3: students who had enrolled in the grant-funded program but had completed neither academic credential (because of leaving the program prior to completing either credential or failing to earn passing grades on the FSME certificate program requirements).

Student Characteristics and Progress Through the Program

Exhibit V-1 summarizes in detail the characteristics of the students that enrolled in the C2E program. Enrollees varied broadly in age, ethnicity, educational level, and work experience. The age of students ranged from 18 to 64, with a mean age of 30 years. About sixty percent of students were non-traditional in terms of age: twenty percent were between 25 and 29, thirty percent were between 30 and 39, and about 15 percent over 40.

For about one-third of all students, the Mechatronics Program was the first exposure to college-level course work. Some of these were high-school students who were dual-enrolled in the community college FSME course while attending high school. However, over half of all enrollees had some previous college experience and 14 percent of students already held an associate or higher degree.

Fifty-one percent of enrolled students were white non-Hispanic, 12 percent African-American, and 10 percent Hispanic/Latino. Although most students were males, the Grant Manager was proud of the fact that the C2E program had succeeded in attracting 12 females to a field in which women are substantially underrepresented.[20] Thirty percent of all enrollees were veterans, about half of whom were in the process of exiting from military service at nearby Joint Base Lewis-McCord (JBLM) at the time they enrolled in the program. Only 14 percent of participants had any experience working in the manufacturing sector before enrolling in the Mechatronics Program.

[20] The students enrolled in the Mechatronics Program differed in several ways from the overall student body at CPTC, 44 percent of whom identified as members of minority racial or ethnic groups and 48 percent of whom were female. (*2017-2018 Environmental Scan* Clover Park Technical College, downloaded from http://www.cptc.edu/about).

Exhibit V-1:
Characteristics of Students Enrolled in C2E Programs

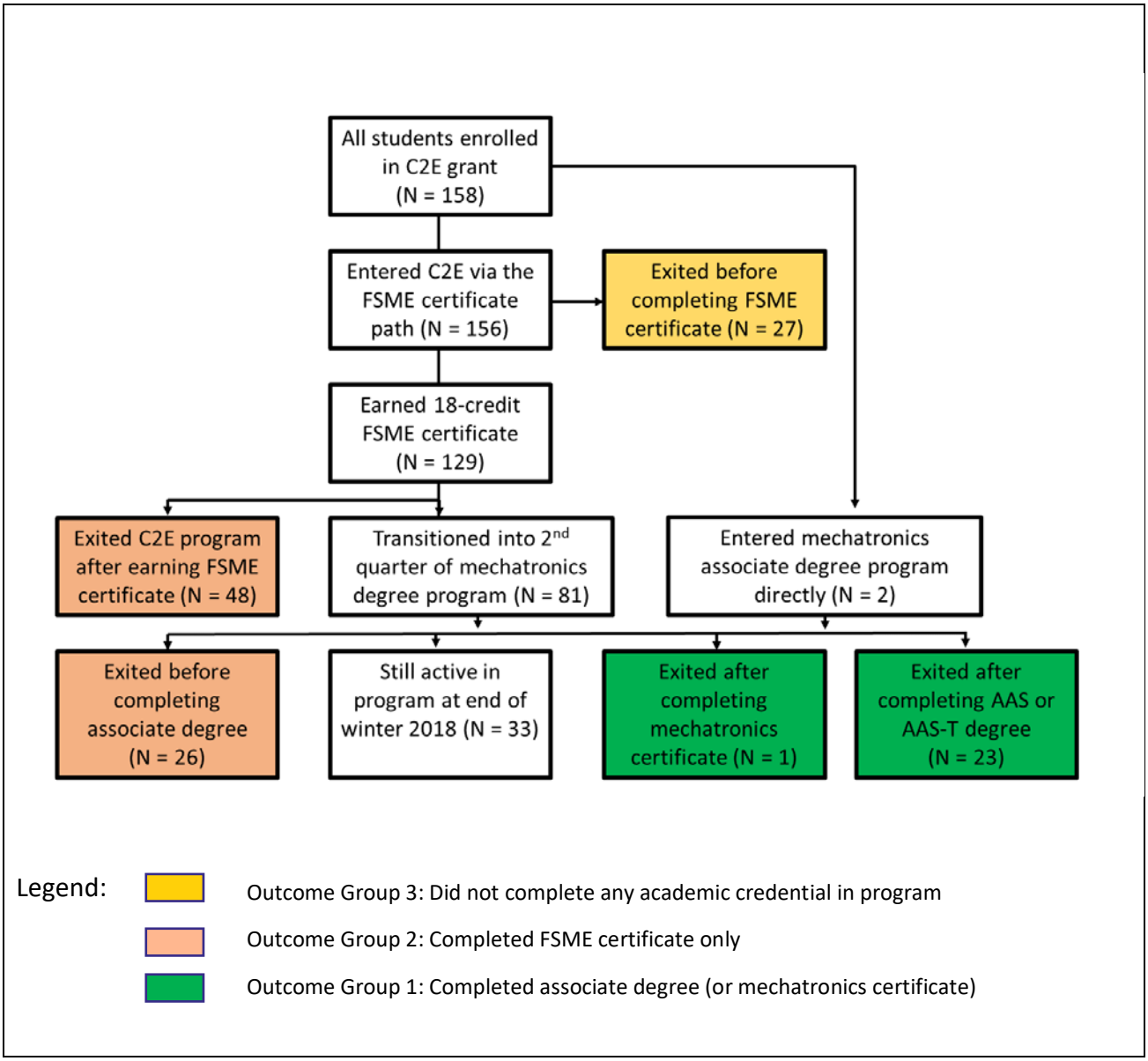
	All Students N=158
Age	
Age range in years	18 to 64
Mean age in years	30
18-24	61 (39%)
25-29	31 (20%)
30-34	29 (18%)
35-39	15 (9%)
40-49	12 (8%)
50 or older	10 (6%)
Gender	
Male	146 (92%)
Female	12 (8%)
Ethnicity	
Hispanic/Latino	15 (10%)
Not Hispanic/Latino	122 (77%)
Data missing	21 (13%)
Race	
Asian	10 (6%)
African American	19 (12%)
American Indian/Alaskan Native	5 (3%)
Native Hawaiian/Pacific Islander	1 (1%)
White	87 (55%)
More than one race	18 (11%)
Data missing	18 (11%)
Employment Status at Enrollment	
Employed	62 (39%)
Unemployed	61 (39%)
Data missing	35 (22%)
Disabled Status	
Yes	12 (8%)
No	114 (72%)
Data missing	32 (20%)
TAA Eligible	
Yes	2 (1%)
No	110 (70%)
Data missing	46 (29%)
Veterans	
Yes	48 (30%)
No	107 (68%)
Data missing	3 (2%)
Highest Grade Completed	
Some High School	29 (18%)
High School Diploma/GED	39 (25%)
Post High School Vocational/Skills Credential	5 (3%)

Some College	61 (39%)
Associates Degree	13 (8%)
Bachelor's Degree	7 (4%)
Above Bachelor's	2 (1%)
Data missing	2 (1%)
Previous Manufacturing Experience	
Yes	22 (14%)
No	99 (63%)
Data missing	37 (23%)

Source: Clover Park Technical College (2018)

Exhibit V-2 shows how students flowed through the FSME certificate and Mechatronics Associate Degree programs during the study period. As shown in the exhibit, of the 158 students who enrolled in C2E during the study period (from the fall quarter of 2014 through the winter quarter of 2018), 125 exited the program by the end of the study period (where "exit" is defined as either graduating with a certificate or a degree, or leaving the program before obtaining any credential), while 33 were still active students mid-way through the associate degree. Outcome Group 1—shaded in green in Exhibit V-2—included 24 students (23 who exited the program after completing either the Mechatronics AAS-T degree or AAS degree and 1 student who exited after completing the Mechatronics certificate). Outcome Group 2—shaded orange in Exhibit V-2—included 74 students (48 students who exited the program after completing the FSME certificate plus 26 additional students who began the 2nd quarter of the associate degree program but exited the program before completing the associate degree or Mechatronics certificate). Outcome Group 3—shaded yellow in Exhibit V-2—included 27 students who exited the program before completing the FSME certificate.

Exhibit V-2:
Flow of Students Through the Mechatronics Program, Fall 2014 - Winter 2018



Source: Clover Park Technical College (2018)

Exhibit V-3 looks more closely at the characteristics of the 125 students included in the outcome study (excluding the 33 students who were still active in the program at the end of the evaluation period) and compares the characteristics of students in the three outcome groups described at the beginning of this chapter—associate degree completers, FSME certificate completers, and those who did not complete any academic credential offered by the program.

As shown in Exhibit V-3, there are significant differences in background characteristics of the students in the three outcome groups. [21]

- Enrolled students who failed to complete the FSME certificate were much more likely to be under 24, less likely to have completed high school (i.e. to be a dual-enrolled high school student), and less likely to have previously worked in a manufacturing-related job, compared to their peers.
- The students who completed only the FSME certificate were more likely to be 40 or older, more likely to be African-American, and more likely to be veterans in the process of separating from the military (with transition benefits from the military often including funding for 90 days of training).
- Students who completed the Mechatronics Associate Degree were more likely to have received an associate or higher degree prior to enrolling in the Mechatronics Program and less likely to be employed at program entry.

Exhibit V-3:
Characteristics of Students who Exited the C2E Program During the Study Period
By Degree Completed (N=125)

	Outcome Group 1: Completed Associate Degree in Mechatronics N=24	Outcome Group 2: Completed FSME Certificate Only N=74	Outcome Group 3: Exited Mechatronics Program with No Credentials N=27
Age **			
Age range in years	19 to 48	19 to 64	19 to 55
Mean age in years	30	30	25
18-24	8 (33%)	26 (35%)	17 (63%)
25-29	4 (17%)	13 (18%)	8 (30%)
30-34	6 (25%)	16 (22%)	1 (3%)
35-39	4 (17%)	7 (9%)	0 (0%)
40-49	2 (8%)	6 (8%)	0 (0%)
50 or older	0 (0%)	6 (8%)	1 (4%)
Gender			
Male	23 (96%)	71 (96%)	22 (82%)
Female	1 (4%)	3 (4%)	5 (18%)
Ethnicity			
Hispanic/Latino	2 (8%)	9 (12%)	3 (11%)

[21] As described in the next section on outcomes, these differences make it inappropriate to do a direct comparison of outcomes across the three outcome groups, because we cannot control for differences in individual student characteristics in the analysis of aggregate outcomes.

Not Hispanic/Latino	22 (92%)	56 (76%)	16 (59%)
Data missing	0 (0%)	9 (12%)	8 (30%)
Race **			
Asian	1 (4%)	8 (11%)	1 (4%)
African American	1 (4%)	12 (16%)	2 (7%)
American Indian/Alaskan Native	0 (0%)	2 (3%)	3 (11%)
Native Hawaiian/Pacific Islander	1 (4%)	0 (0%)	0 (0%)
White	19 (79%)	35 (47%)	12 (44%)
More than one race	1 (4%)	9 (12%)	1 (4%)
Data missing	1 (4%)	8 (11%)	8 (30%)
Employment Status at Enrollment *			
Employed	8 (33%)	34 (46%)	8 (30%)
Unemployed	16 (67%)	22 (30%)	6 (22%)
Data missing	0 (0%)	18 (24%)	13 (48%)
Disabled Status			
Yes	1 (4%)	4 (6%)	2 (7%)
No	23 (96%)	52 (70%)	14 (52%)
Data missing	0 (0%)	18 (24%)	11 (41%)
TAA Eligible			
Yes	1 (4%)	1 (1%)	0 (0%)
No	23 (96%)	53 (72%)	9 (33%)
Data missing	0 (0%)	20 (27%)	18 (67%)
Veterans *			
Yes	5 (21%)	30 (41%)	7 (26%)
No	19 (79%)	44 (59%)	20 (74%)
Highest Grade Completed *			
Some High School	1 (4%)	16 (22%)	12 (44%)
High School Diploma/GED	4 (17%)	16 (22%)	6 (22%)
Post High School Vocational/Skills Credential	2 (8%)	2 (3%)	0 (0%)
Some College	11 (46%)	31 (42%)	7 (26%)
Associates Degree	4 (17%)	4 (5%)	1 (4%)
Bachelor's Degree	2 (8%)	3 (4%)	1 (4%)
Above Bachelor's	0 (%)	2 (3%)	0 (%)
Whether Previously Worked in Manufacturing Jobs			
Yes	3 (12%)	9 (12%)	0 (0%)
No	21 (88%)	45 (61%)	14 (52%)
Data missing	0 (0%)	20 (27%)	13 (48%)

Source: Clover Park Technical College (2018)

Note: (**) The difference is statistically significant at the .05 level using a chi-square test of association.

Note: (*) The difference is statistically significant at the .10 level using a chi-square test of association.

Academic Outcomes

One of the outcomes of interest was whether students completed an academic credential that they could use to market their skills to employers. As shown in Exhibit V-4, of the 125 students who exited the program during the study period, 19 percent completed the Mechatronics

associate degree; 59 percent completed only the FSME certificate, and 22 percent withdrew or left the program without completing any academic credential.

Exhibit V-4:
Academic Outcomes for Students who Exited During the Study Period

Intended Degree	Did not Complete a Credential	Completed FSME Only	Completed Mechatronics Associate Degree	Total
FSME Certificate	15 (29%)	37 (71%)	0 (0)%	52 (100%)
Mech. Associate Degree	12 (16%)	37 (51%)	24 (33%)	73 (100%)
All Exited Enrollees	27 (22%)	74 (59%)	24 (19%)	125 (100%)

Source: Clover Park Technical College (2018)

Exhibit V-4 also examines how the successful completion rates differed among exited students who intended to complete the FSME certificate versus the Mechatronics Associate Degree. Sixty-one percent of the 73 exited students who intended to complete the associate degree were successful in completing at least one credential, although only 33 percent actually completed the desired seven-quarter-long associate degree. Among the 52 exited students who intended to complete the one-quarter-long FSME certificate, 71 percent were successful. None of the exited students who intended to leave after completing the FSME continued to work towards the associate degree. Given the short length and less complex content of the FSME certificate, it is not surprising that the success rate for completing the FSME certificate was higher than the success rate for completing the longer and more-demanding associate degree.

It is important to note that another 33 of the students enrolled during the study period were still active students in good standing working toward their associate degrees at the end of the study period (more than the number who had completed their degrees during the study period). Depending on what proportion of the current students successfully complete the associate degree, the overall successful completion rate for the associate degree students enrolled under the grant will change over time. One could expect the successful completion rate to increase, now that the program curriculum is complete and the instructional staff is stable.

Employment and Earnings Outcomes

As mentioned in the introduction to this chapter, the data obtained on the earnings and employment outcomes of C2E program exiters consisted of aggregate quarterly employment and earnings levels calculated for each of the three outcome groups by Clover Park Technical College, using the individual-level data provided by the State of Washington Employment Security Department (SWESD). For each of the three outcome groups, the research team arranged for CPTC to obtain individual-level data, for the four calendar quarters prior to student enrollment and the four calendar quarters after student exit from the program. (The calendar quarters studied include quarters prior to program enrollment and after program exit. The quarters when students were enrolled in school completing their program were not included in either the pre-training or the post-training periods.) We arranged for CPTC to compute aggregate statistics for each of the pre- and post-participation quarters across all C2E program exiters in each outcome group including (a) the number of student records for which data matches with the UI wage records had been completed, (b) the total earnings for the subgroup, (c) the number of individuals from the subgroup with reported non-zero earnings, and (d) the mean and median quarterly earnings during the quarter.

The final numbers of individuals for whom data matches were made included 23 of 24 associate degree completers, 71 of 74 FSME certificate-only completers, and 21 of 27 C2E participants who exited during the study period without earning any credentials. In practice, the number of individuals with post-program quarterly employment and earnings data varied by quarter and became smaller each subsequent post-program quarter, because students who enrolled later in the program had fewer post-program quarters of experience.

Given the data constraints, there are several limitations that should be kept in mind when reviewing the descriptive statistics that follow on employment and earnings outcomes.

- First, because of the substantial differences in the characteristics of the individuals across each of the three outcome groups, as discussed earlier in this chapter, it is not appropriate to compare the aggregate mean quarterly earnings across the three outcome groups in any given quarter. Due to the aggregate nature of the data, we cannot adjust for the individual characteristics of the outcome group participants.
- Second, it is not possible to analyze individual earning trajectories over time, because in every group and in every quarter, the participants with available quarterly earnings data are not constant, and the individuals with non-zero earnings in one quarter may have earnings in a different quarter. This is especially important to consider for associate degree earners, among whom recent graduates had fewer quarters of post-program earnings data available than did FSME certificate completers.

- Third, because of the small numbers of participants with available earnings data, it is not appropriate to conduct tests of statistical significance.

The earnings and outcome data document differences in the aggregate pre- and post-training employment and earnings outcomes for the three outcome groups. However, because of the data limitations, we cannot determine whether these aggregate differences accurately describe the employment and earnings trends for individuals within each group.

Exhibit V-5 summarizes the number of participants with data in each group during each pre- and post-program quarter, the number of individuals for whom earnings were a positive (non-zero) number, and the employment rates for each group, by quarter, computed as the proportion of individuals with non-zero earnings in that group.

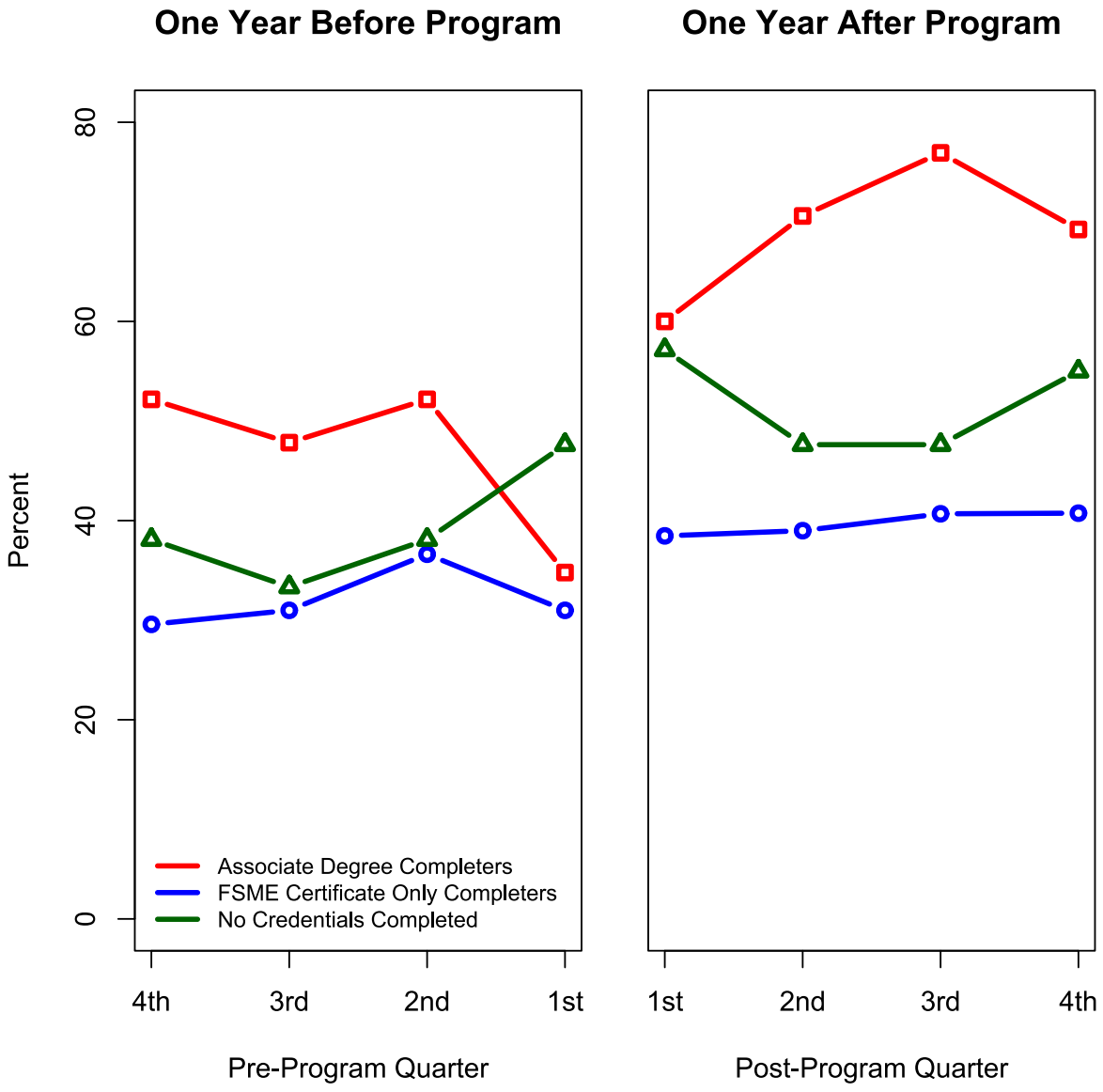
Exhibit V-5:
Frequency and Rate of Employment (Non-Zero Earnings) for the Three Groups of Exiters

	Associate Degree Completers			FSME Certificate Only Completers			No Credentials Completed		
Analytic Quarter	# of Data Matches	# with Non-zero Earnings	Employment Rate	# of Data Matches	# with Non-zero Earnings	Employment Rate	Number of Data Matches	# with Non-zero Earnings	Employment Rate
Pre-program 4	23	12	52%	71	21	30%	21	8	38%
Pre-program 3	23	11	48%	71	22	31%	21	7	33%
Pre-program 2	23	12	52%	71	26	37%	21	8	38%
Pre-program 1	23	8	35%	71	22	31%	21	10	48%
Post-program 1	20	12	60%	65	25	38%	21	12	57%
Post-program 2	17	12	71%	59	23	39%	21	10	48%
Post-program 3	13	10	77%	59	24	41%	21	10	48%
Post-program 4	13	9	69%	54	22	41%	20	11	55%

Source: *State of Washington Employment Security Department and Clover Park Technical College (2018)*

Exhibit V-6 graphically illustrates the frequency of employment (non-zero earnings) during each analytic pre-program and post-program quarter for each outcome group. Exhibit V-6 suggests that as a group, individuals who completed the Mechatronics Associate Degree appeared to have had higher quarterly rates of employment compared to the other two outcome groups during the four quarters before entering the C2E program as well as during the four quarters after exiting the program. The members of this group appear to have experienced a sharp dip in employment rates during the quarter prior to entering the C2E program, which is not uncommon in studies of individuals who participate in training programs. They also appear to have experienced rapid employment gains during the first several quarters after leaving the program.

Exhibit V-6:
Aggregate Quarterly Employment Levels
(Proportion of Individuals with Non-Zero Earnings)
Pre-Program and Post Program Quarters, By Outcome Group



Source: *State of Washington State Employment Security Department and Clover Park Technical College (2018)*

Exhibit V-7 shows the mean earnings computed from the aggregate level data for each of the pre-program and post-program quarters for each of the three outcome groups; Exhibit V-8 presents these averages graphically.

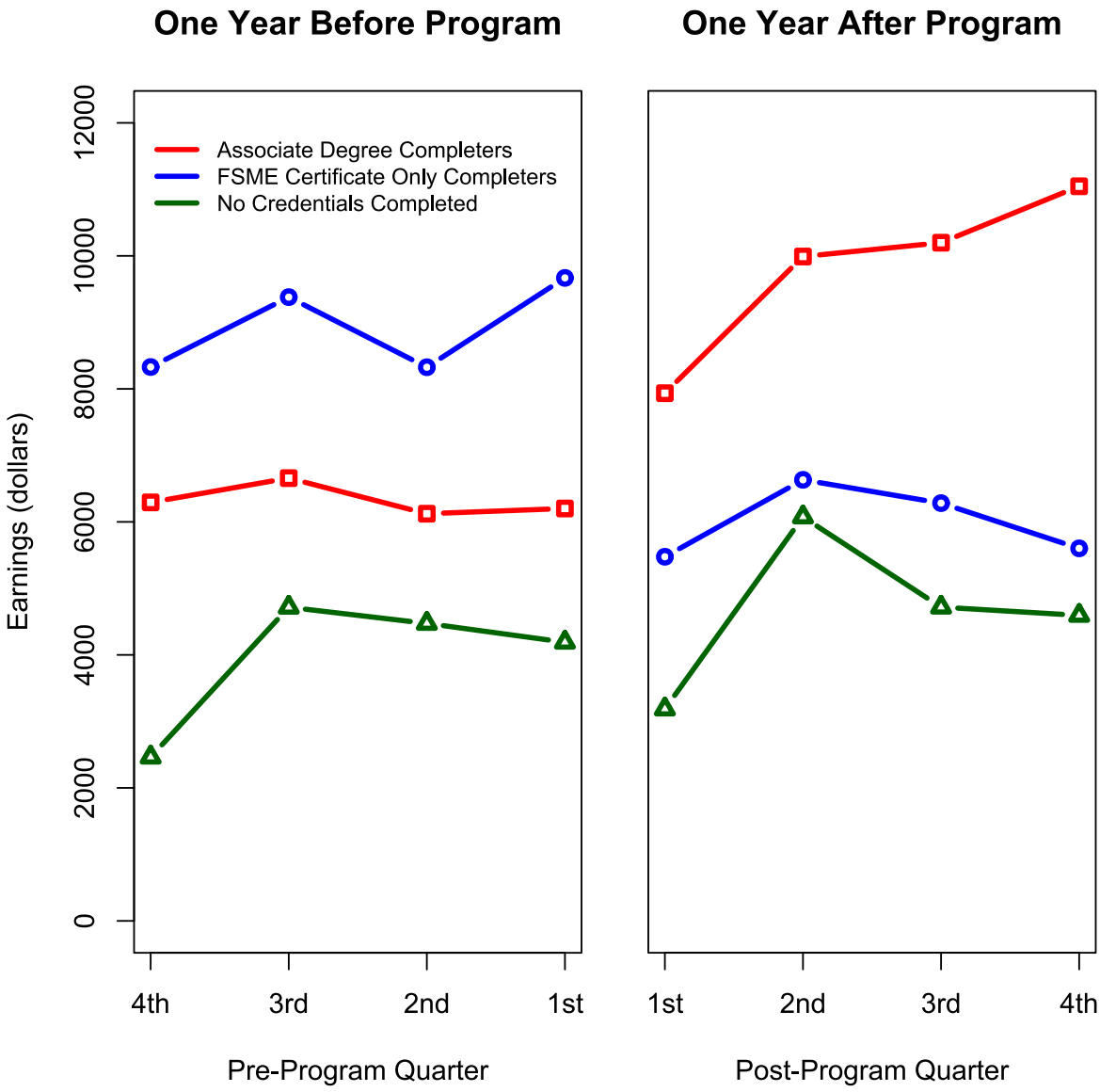
Exhibit V-7:
Mean Quarterly Earnings for Three Groups of Exiters

	Associate Degree Completers	FSME Certificate Only Completers	No Credentials Completed
Analytic Quarter	**Mean Earnings**	**Mean Earnings**	**Mean Earnings**
Pre-program 4	$6,293	$8,328	$2,463
Pre-program 3	$6,658	$9,379	$4,716
Pre-program 2	$6,123	$8,325	$4,473
Pre-program 1	$6,202	$,9668	$4,190
Post-program 1	$7,934	$5,475	$3,186
Post-program 2	$9,980	$6,632	$6,074
Post-program 3	$10,197	$6,281	$4,717
Post-program 4	$11,046	$5,601	$4,594

Source: *State of Washington State Employment Security Department and Clover Park Technical College (2018)*

The trends in mean quarterly earnings differ substantially among the three outcome groups. We note that the pre-program average quarterly earnings levels were highest for the individuals who ultimately completed the FSME certificate, mid-level for the individuals who ultimately completed the associate degree, and lowest for the individuals who did not complete an academic credential before exiting the program. Due to the limitations in the analysis of aggregate data, it is impossible to determine whether this is because of differential impacts of the different degrees, a reflection of actual differences in characteristics between those two groups or simply an artifact of the fact that the characteristics of the individuals with earnings in each group were different from one quarter to the next. As described at the beginning of this chapter, the certificate and degree completers did indeed differ on some characteristics (e.g., certificate completers had a higher proportion of older workers with some manufacturing experience, and a higher proportion of veterans than other outcome groups).

Exhibit V-8:
Quarterly Mean Earnings of Employed Students who Finished the C2E Program



Source: *State of Washington State Employment Security Department and Clover Park Technical College (2018)*

In terms of post-program earnings, Exhibit V-7 shows that the associate degree completers are the only group for which mean earnings in post-program quarters are consistently higher than mean earnings in pre-program quarters. This fact is consistent with the hypothesis that associate degree completers have experienced an advantage in terms of earnings power in the labor market; however, it cannot be considered unequivocal evidence of this occurrence as we are unable to assess how the individual composition of each quarterly sample has changed.

Summary

The outcome study was constrained by several factors.

- The study period was not long enough to document a full year of post-program educational and labor market outcomes for many of the students who had enrolled in the Mechatronics Associate Degree program, including the 33 students who were still active in the program at the end of the study period.
- The aggregate employment and earnings data were not sufficient for the study to analyze individual student employment and earning trajectories.
- The study population consisted of two substantially different groups of students, some of whom were intending to complete only a one-quarter-long certificate, and some of whom were intending to complete a seven-quarter-long associate degree. These two groups were not expected to achieve the same outcomes, yet were combined in the aggregate outcome data.
- The small number of individuals included in the outcome study prevented us from developing generalizable conclusions about the differences in outcomes among the three groups of program exiters (those who had completed the associate degree, those who had completed only the FSME certificate, and those who had not completed any academic credential while in the program).

Nevertheless, the outcome study documents some very interesting trends.

- During the year before they enrolled in the C2E program, the average employment rate of the individuals who had completed the Mechatronics Associate Degree was higher than the average employment rate of individuals that had completed only the FSME certificate. However, the average quarterly earnings of the group of individuals who had completed the Mechatronics Associate Degree was lower than the average quarterly earnings of the group that completed only the FSME certificate.
- During the post-training quarters, the group of associate-degree completers had a substantially *higher* incidence of employment (non-zero earnings) and higher average quarterly earnings compared to the pre-training quarters.
- In contrast, the mean post-training outcomes for the group that completed the FSME certificate were *lower* than they had been for that group during the pre-training period and were substantially below the post-program mean incidence of employment and the average quarterly earnings for the group of associate degree completers.
- The group of individuals who did not complete either academic credential had a higher average frequency of employment than the FSME certificate completers but had

substantially lower average earnings than either of the other two groups during both the pre-training and post-training quarters.

These findings indicate that that the individuals who completed the associate degree in Mechatronics were employed more frequently and may have experienced higher average quarterly earnings than individuals who completed only the FSME certificate or neither academic credential. Because of data limitations, we cannot we cannot determine whether these increases were due to the skills learned in the Mechatronics Associate Degree program, were influenced by the differing individual characteristics of the students, or are an artifact of aggregate data analysis. However, the findings are consistent with the hypothesis that training in the associate degree program made participants more attractive to manufacturing employers and helped them more readily gain high-paying employment.

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VI. The C2E Program Experience and Its Lessons

The early implementation experience of the C2E grant at Clover Park Technical College is a cautionary tale about the dangers of launching an educational program before important components—strong leadership, a completed curriculum, and experienced instructors—are in place. Because the Mechatronics Program was not sufficiently prepared for launch when it enrolled the first cohort of students in the fall of 2014, the first 18 months of the C2E grant were dominated by efforts to complete the needed program infrastructure. Early students in the C2E grant program complained that equipment for training and practice had not yet been installed, temporary instructors were not committed to the program and did not have completed curriculum materials or designated textbooks, and the roles of grant and program administrative staff members were still evolving.

Given this rocky start-up, it is admirable that strong grant leadership emerged in the persons of three key staff members: an effective grant manager with the strong support of the CPTC Dean of Instruction, an effective Career Navigator with experience reaching out to employers, and a specialist in curriculum development. These individuals initiated best practices that helped the program mature into a leading program for CPTC.

- C2E grant money was used to purchase simulated workstations for laboratory instruction, giving the program what students and employers thought of as a "state of the art" practice facility.
- Instructors capable of providing academic leadership in the development of the program curriculum were ultimately secured; these individuals added more opportunities to apply theoretical knowledge to the curriculum and improved the sequence of courses.
- Active outreach to high schools and community organizations—far beyond the on-campus "information sessions" typically held for interested prospective students—brought information about the program out into the community. Through word of mouth, the reputation of the program improved, and, by the end of the grant period, enrollment was robust enough for mechatronics to become a self-sustaining program at CPTC.
- Business representatives were continuously involved in various stages of the program design and implementation. Employers were invited to on-campus open houses for the program, opportunities for students to have internships and capstone projects with local employers were developed, and local employers were encouraged to develop competency requirements for their job listings that were aligned with the competencies matrix developed by the instructors. (One measure of the success of the program in influencing how employers thought about their hiring needs was that one of the largest

regional manufacturing employers, the Boeing Company, introduced "mechatronics technician" as a new hiring category during the grant period.)

By the end of the grant period, the Mechatronics Program was not only well-established at CPTC, but it had exercised a positive influence on the growth and development of other manufacturing programs at the college. College administrators no longer had to wonder whether the Mechatronics Program was sustainable after the end of the grant. For the 2018-2019 academic year, the CPTC administration established a School of Advanced Manufacturing that brought together previously separate associate degree and certificate programs in manufacturing technologies, non-destructive testing, advanced composites, and mechatronics in a new Advanced Manufacturing Center facility on the CPTC campus funded by the State of Washington.[22] The Mechatronics Program was a key tenant of the new center.

The aggregated outcomes data available for the small number of students who completed the associate degree program during the study period are encouraging though not conclusive. They show that the students who completed the associates degree, as a group, worked more frequently and earned more than they had before entering the program, and were more likely to be employed and to have higher earnings than other groups of program enrollees who did not complete this credential. This suggests that regional employers valued the skills students gained in the Mechatronics Program, and, as the program logic model posited, were interested in hiring and paying relatively high wages to students who had completed the Mechatronics degree.

To confirm these hypotheses, it will be necessary to conduct evaluations that follow a larger number of students who complete the Mechatronics Associate Degree for a longer post-program period and to collect individual-level data that will allow the analysis to more adequately assess the individual benefits gained by different types of participants in terms of individual employment and earnings outcomes. In the future, it would also be informative to assess the net impacts of participating in the Mechatronics Associate Degree program at CPTC by implementing an evaluation that compares individual-level outcomes for program enrollees to those of a matched set of individuals in other manufacturing training programs.

[22] The School of Manufacturing also includes an applied science bachelor's degree in operations management, initiated at the same time as the mechatronics associate degree program, that prepares students for positions as industrial production managers. Students who complete the associate degree in mechatronics may apply to transfer into this program.

Appendix A. Responses to the Survey of Current Students

Clover Park Technical College Mechatronics Program Student Survey

With Aggregated Responses, Round 1 and Round 2 Surveys

Current Status in Program

Some students in this program intended to complete only the first quarter of the program when they entered--The Fundamentals of Manufacturing and Engineering (FSME) certificate--and then find a job or continue with training in another program.

Q1. Which of the following best describes your intentions when you started the FSME curriculum? N = 54

I planned to complete only the FSME certificate and then get a job or enter another training program. 2 (3.7%)

I planned to complete the full Mechatronics Associate Degree. 51 (94.4%)

Other (please describe): 1 (1.9%)

Q2. When did you begin the first quarter of the FSME/Mechatronics program? N = 54

Fall 2014	6 (11.1%)
Spring 2015	5 (9.3%)
Fall 2015	4 (7.4%)
Winter 2016	1 (1.2%)
Spring 2016	15 (27.8%)
Summer 2016	1 (1.2%)
Fall 2016	5 (9.3%)
Spring 2017	6 (11.1%)

Satisfaction with Educational Experience in FSME/Mechatronics Program

Q3. Overall, how satisfied have you been with the training and instruction in the Mechatronics program to date? N = 52

1) Very satisfied ⇒ **Go to Q5**	16 (30.8%)

2) Somewhat satisfied ⇒ **Go to Q5**	29 (55.8%)
3) Somewhat dissatisfied	8 (15.4%)
4) Very dissatisfied	1 (1.9%)

Q4. What are the reasons that you are dissatisfied with your training and instruction? (Skip this questionif you are very or somewhat satisfied) *Check all that apply:*

☐ The program is not preparing me for a job in industry	7
☐ Instruction was not at the right pace	5
☐ Program wasn't what I expected	3
☐ Program was too difficult	3
☐ Program was too simplistic	3
☐ Content was not "hands-on" enough	1
☐ Other (please specify):	10

Questions A and B below were included only in the Round 2 survey (Fall 2017).

A. How well do the following statements describe your educational experiences in the program during the current quarter? N=26

	Strongly Agree	Somewhat Agree	Somewhat Disagree	Strongly Disagree
The activities in the program were related to the program objectives.	18 (69.2%)	7 (26.9%)	1 (3.8%)	0 (0.0%)
The activities in the program included a variety of different types of activities, such as demonstrations, lectures, group discussions, quizzes, team or individual projects.	17 (65.4%)	7 (26.9%)	1 (3.8%)	1 (3.8%)
I had enough time and opportunity to practice what I was learning.	13 (50%)	7 (26.9%)	4 (15.4%)	2 (7.7%)
The textbook and other course materials covered all the information I needed to complete my assignments successfully.	16 (61.5%)	6 (23.1%)	2 (7.7%)	2 (7.7%)
The textbook and other course materials were easy to understand and use.	12 (46.2%)	10 (38.5)	1 (3.8%)	3 (11.5%)

The technology used in the course (if any) contributed to my learning in a meaningful way.	19 (73.1%)	5 (19.2%)	0 (0.0%)	2 (7.7%)
I received regular, helpful feedback about how I was doing on all assignments and program activities.	12 (46.2%)	7 (26.9%)	4 (15.4%)	3 (11.5%)
I had many opportunities to interact with other students and the instructor in ways that made learning more interesting and enjoyable.	16 (61.5%)	7 (26.9%)	2 (7.7%)	1 (3.8%)
While taking this course, I felt excited about learning.	18 (69.2%)	6 (23.1%)	1 (3.8%)	1 (3.8%)

B) How well do each of the following statements describe the quality of instruction you received during the current/most recent quarter? N=26

	Strongly Agree	Somewhat Agree	Somewhat Disagree	Strongly Disagree
My instructor was knowledgeable about the subject of the course. N=26	20 (76.9%)	3 (11.5%)	2 (7.7%)	1 (3.8%)
My instructor was prepared and organized for each class session. N=26	14 (53.8%)	7 (26.9%)	4 (15.4%)	1 (3.8%)
My instructor used a variety of different teaching method, such as discussion groups, lectures, online activities, videos, guest speakers, etc. N=25	14 (56%)	8 (32%)	2 (8%)	1 (4%)
My instructor showed enthusiasm for the material and for teaching. N=26	18 (69.2%)	5 (19.2%)	2 (7.7%)	1 (3.8%)
My instructor was professional at all times. N=26	20 (76.9%)	4 (15.4%)	1 (3.8%)	1 (3.8%)
My instructor enforced college and classroom policies for behavior and student conduct	19 (73.1%)	6 (23.1%)	0 (0.0%)	1 (3.8%)
My instructor was easy to approach with questions. N=25	21 (84%)	3 (12%)	0 (0.0%)	1 (4%)
My instructor was respectful towards students and colleagues. N=25	23 (92%)	1 (4%)	0 (0.0%)	1 (4%)
My instructor helped us get to know each other better. N=25	15 60%)	8 (32%)	1 (4%)	1 (4%)

* N=25 for this category, because one survey respondent left this question blank.

Q5. Overall, how satisfied or dissatisfied were you with the Student Navigator services provided to you as a participant in the program? N = 54

1) Very satisfied	31 (57.4%)
2) Somewhat satisfied	18 (33.3%)
3) Somewhat dissatisfied	4 (7.4%)
4) Very dissatisfied	1 (1.9%)

Q6. How satisfied or dissatisfied are you with how well the Student Navigator met each of your service needs? (Please circle the best answer for each type of service. If you did not receive this service, circle "Not Received"). N = 54

	Very Satisfied	Somewhat Satisfied	Somewhat Dissatisfied	Very Dissatisfied	Not Received
Academic coaching	19 (35.2%)	14 (25.9%)	2 (3.7%)	0 (0.0%)	18 (33.3%)
Referrals to student financial aid or other funding	25 (46.3%)	10 (18.5%)	3 (5.6%)	0 (0.0%)	16 (29.6%)
Career coaching	16 (29.6%)	13 (24.1%)	5 (9.3%)	0 (0.0%)	20 (46.5%)
Coaching and support on life issues	14 (25.9%)	11 (20.4%)	1 (1.9%)	0 (0.0%)	26 (48.1%)
Job search support or assistance	18 (33.3%)	14 (25.9%)	3 (5.6%)	0 (0.0%)	17 (31.5%)
Referral to other services at college or in community	16 (29.6%)	15 (27.8%)	4 (7.4%)	1 (1.9%)	18 (33.3%)

Q7. How satisfied are you with how well other College staff members met your needs for the following services? (Please circle the best answer for each type of service. If you did not need this service, circle "Not Received"). N = 54

	Very Satisfied	Somewhat Satisfied	Somewhat Dissatisfied	Very Dissatisfied	Not Received
Advising and Counseling	17 (31.5%)	15 (27.8%)	7 (13.0%)	3 (5.6%)	12 (22.2%)
Tutoring	13 (24.1%)	10 (18.6%)	6 (11.1%)	5 (9.3%)	25 (46.3%)
Support Registering for Classes	28 (51.9%)	17 (31.5%)	4 (7.4%)	1 (1.9%)	4 (7.4%)
Assistance with Financial Aid	16 (29.6%)	8 (14.8%)	6 (11.1%)	4 (7.4%)	20 (37.0%)
Support from Program Instructors and Faculty	24 (44.4%)	15 (27.8%)	6 (11.1%)	3 (5.6%)	6 (11.1%)

Q8. Overall, how well has the FSME/Mechatronics program informed you about the career options within advanced manufacturing/mechatronics? N = 54

1) Very well	21 (38.9%)
2) Somewhat well	24 (46.2%)
3) Not very well	8 (14.8%)
4) Not at all	1 (1.9%)

Q9. How satisfied or dissatisfied are you with the information provided to you about each of the following? N = 54

	Very Satisfied	Somewhat Satisfied	Somewhat Dissatisfied	Very Dissatisfied	Not Received
Job opportunities available to program graduates	16 (30%)	25 (46%)	6 (11%)	1 (2%)	6 (11%)
Different types of manufacturing firms and jobs	17 (31%)	26 (48%)	6 (11%)	2 (4%)	3 (6%)
Real-world working conditions in manufacturing	13 (24%)	24 (44%)	10 (19%)	1 (2%)	6 (11%)
Likely compensation at different skill levels	15 (28%)	20 (38%)	9 (17%)	1 (2%)	8 (15%)
Opportunities for promotion/advancement in the field	11 (21%)	23 (43%)	8 (15%)	1 (2%)	10 (19%)

Q10. How effective do you think your training and education at Clover Park Technical College is in preparing you with the skills you will need to work in advanced manufacturing? N = 52

1) Very effective	22 (42.3%)
2) Somewhat effective	26 (50%)
3) Not very effective	4 (7.7%)
4) Not at all effective	1 (1.9%)

Q11. What suggestions do you have for improving training in the Mechatronics program and Clover Park Technical College? (Please write in the space provided below)

Your Plans After Leaving the FSME and/or Mechatronics Program

Q12. Are you currently in the 2nd semester or higher of the Mechatronics Associate Degree program? N = 54

1) Yes	31(57.4%)
2) No	23 (42.6%)

Q13. Do you currently plan to complete the Mechatronics Associate Degree? N = 54

1) Yes **Go to Q15**	48 (%)
2) No **Continue**	2 (3.7%)
3) Not Sure **Continue**	3 (5.5%)

Q14. If you do not plan to complete the Mechatronics Associate Degree, or are unsure whether you will continue in the program, what are the reasons for this decision?

Check all that apply:

☐ Found a job that may conflict with my ability to continue in the program	1
☐ Scheduling conflicts between course times and my work schedule	1
☐ High cost of the program/lack of financial aid	1
☐ Life issues (e.g. childcare issues, illness, etc.)	1
☐ Planning to move out of the area	1
☐ Disappointed with program quality	1
☐ Concerns about the quality of instruction	2
☐ Transferring/considering transferring to another educational program	2
☐ Other, please specify:	3

_____

Q15. In what particular subsector of the manufacturing industry would you ultimately like to work?

1) Aerospace	18 (33.3%)
2) Manufacturing	23 (42.6%)
3) Supply Chain	7 (13.0%)
4) Food Processing	3 (5.5%)
5) Information Technology	9 (16.7%)
6) Don't Know	23 (42.6%)

Q16. Is there a particular company you would like to work for, or a particular job you would like to work at in the future?

1) Yes
   Please describe: _____

2) No

Student Characteristics

We would like to learn a little bit about you.

Q17. What was your age in years when you began the first quarter of the FSME/Mechatronics program? N = 54

1) Under 18	2 (3.7%)
2) 18 – 24	16 (29.6%)
3) 25 – 29	7 (13.0%)
4) 30 – 34	11 (20.4%)
5) 35 – 39	4 (7.4%)
6) 40 – 49	7 (13.0%)
7) 50 or older	7 (13.0%)

Q18. What is your gender? N =53

1) Female	2 (3.8%)
2) Male	51 (96.2%)

Q19. What is the highest level of education you had completed before you started the first quarter of the FSME/Mechatronics program? N = 49

1) High school diploma or GED	16 (32.7%)
2) Some college	21 (42.9%)
3) Academic certificate	2 (4.1%)
4) Associates degree	4 (8.2%)
5) 4-year college degree	5 (10.2%)
6) Other (please describe highest certificate or degree completed):	1 (2.0%)

Q20. Prior to enrolling in the FSME/Mechatronics program, had you ever taken a college course or earned a certificate related to engineering or advanced manufacturing? N=54

1) Yes	19 (35.2%)
2) No	35 (64.8%)

Q21. Prior to enrolling in FSME/Mechatronics program, had you ever worked in advanced manufacturing or mechatronics? N=54

1) Yes	7 (13.0%)
2) No	47 (87.0%)

Q22. Are there any other comments you would like to make about your experiences to date with the FSME/Mechatronics program at Clover Park Technical College