

# Eastern Shore Community College Creating Technical Scholars Project: Evaluation Data Report

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# INTRODUCTION

Eastern Shore Community College's (ESCC) Creating Technical Scholars (CTS) project aimed to develop a transition pathway from secondary education to postsecondary education and employment in technical studies fields. To achieve this outcome, the CTS project had four objectives: 1) design dual enrollment technical tracks in specific CTE programs for the region's high school students; 2) create a Technical Studies AAS degree with tracks in cybersecurity, industrial technology, heating, ventilation, and air conditioning (HVAC), welding, and electricity; 3) establish articulation agreements with regional four-year colleges and universities for students wishing to pursue further education in technical studies fields; and 4) devise career tracks with business partners for students wishing to begin careers in technical studies fields.

**Evaluation.** This project evaluation aligned with the four objectives of the CTS project and provided formative and summative information over the course of the evaluation period, which extended from August 2017 to June 2021. Magnolia Consulting, the external evaluator for this project, collaborated with the project team on instrument design and data collection. The Technical Studies AAS degree had several setbacks and did not begin in earnest until fall 2020 (year 4). This delay impacted the evaluation timeline because the summative evaluation questions addressed the project's outcomes over the duration of the program. Specifically, the summative questions addressed enrollment numbers, learning gains, and educational plans for students in the degree tracks. Thus, the project team and evaluators postponed the final student survey until spring 2021 to include students who were officially enrolled in the Technical Studies AAS degree tracks as well as the dual enrollment students. This addendum report presents the formative data for year 4 and the summative data for years 1–4. The formative and summative evaluation questions for the project are listed in Appendix A.

**Methods.** Evaluators developed a student survey to gauge respondents' awareness of the degree tracks and their perceptions of program quality and relevance. This survey used a retrospective pretest approach to measure student gains in confidence and knowledge in three areas (technical knowledge, Science, Technology, Engineering and Mathematics [STEM] skills, and vocational self-efficacy) before and after participating in the project offerings. Due to the delays to the Technical Studies AAS degree tracks, evaluators administered the survey only in years 2 and 4. The following groups of students received the survey: high school students enrolled in the dual enrollment technical classes who had passive parental consent, ESCC students enrolled in the feeder certificate and career studies certificate (CSC) programs, and ESCC students enrolled in the Technical Studies AAS degree tracks (program students). Thus, this addendum report primarily focuses on student data from years 2 and 4.

**Student respondents.** In year 2, 35 dual enrollment respondents and 11 ESCC respondents (8 current ESCC students, 1 recent alumnus, and 2 recent noncompleters) completed the student survey, yielding response rates of 85%<sup>1</sup> and 9%, respectively. In year 4, 19 dual enrollment students completed the spring 2021 student survey, yielding a response rate of 90%. Sixteen ESCC students (4 enrolled in feeder programs and 12 program students) completed at least some of the student survey<sup>2</sup> for a response rate of 33%.

The final evaluation report provides additional information about the project and the evaluation (see Peery and Shannon, 2020).

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<sup>1</sup> Evaluators had email addresses for 41 dual enrollment students; five students did not receive the survey.

<sup>2</sup> Six ESCC respondents did not complete their entire survey but provided enough information to warrant inclusion in the analysis sample. One ESCC respondent completed the year 2 and year 4 student survey.

# 1

## FINDINGS: DESIGN DUAL ENROLLMENT TECHNICAL TRACKS

The CTS project aimed to collaborate with local high schools to develop and initiate new dual enrollment technical studies offerings and conduct outreach to high school students. Dual enrollment programs offer local high school students the opportunity to enroll in rigorous college classes taught by credentialed faculty and simultaneously earn both college and high school credit. By year 2, the project had successfully collaborated with two local high schools to develop and offer dual enrollment technical classes that aligned with a Technical Studies AAS degree tracks.

### Year 4 Formative Findings

In year 4, the project offered the following four dual enrollment technical classes: HVAC II (AIR 121 and AIR 276), Welding II (WEL 123), and a new course, CAD 201. The findings presented in this section address the formative evaluation questions regarding these dual enrollment technical classes. The findings pertain to data collected from the 19 dual enrollment students who were enrolled in these courses in year 4 and completed the 2021 dual enrollment student survey. The majority of these respondents were male (89%). Over half of respondents were White (53%) and the remaining respondents were Black or African American (37%), Hispanic or Latino (5%), or two or more races (5%). All respondents were seniors (74%) or juniors (26%). Of the 14 respondents who were able or willing to share this information,<sup>3</sup> 86% indicated that they receive free or reduced-price lunch for the 2020-2021 academic year.

Most respondents heard about these classes from guidance counselors, followed by teachers and parents.

Eighteen dual enrollment respondents indicated that they heard about the dual enrollment technical classes through high school guidance counselors (67%), teachers (44%), parents (33%), peers (11%), high school career coaches (6%), and the ESCC website (6%). No one indicated hearing about the courses through the newspaper, radio, or social media.

The change to an 8-week term impacted respondents differently.

During the 2020-2021 academic year, ESCC changed from a 15-week term to an 8-week term. Seventeen respondents shared how this change impacted their experience. Seven respondents indicated that this change did not impact them. Six respondents shared negative feedback about the change. Specifically, these respondents mentioned that the shorter term made the classes more difficult ( $n = 2$ ) and took away class time, hands-on experiences, and lab time ( $n = 4$ ). Two respondents shared positive feedback about the shorter term, with one noting that the fast pace encouraged their workflow. The last two respondents shared more neutral feedback. More specifically, one respondent noted that the change had a limited impact but wished for more time, and one respondent indicated that the course was difficult at first but became easier over time.

<sup>3</sup> Five respondents indicated that they did not know.

Most respondents perceived the dual enrollment courses as high quality.

Almost all of the dual enrollment respondents (94%) rated the dual enrollment technical classes as *high quality* or *very high quality*. One respondent preferred not to answer.

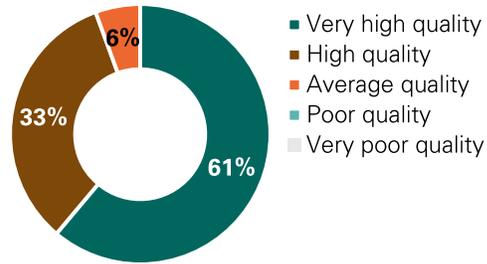


Figure 1. Dual enrollment respondents' perceptions of the quality of the dual enrollment technical classes (n = 18).

67% of respondents perceived the dual enrollment courses as relevant to their educational or career goals.

Dual enrollment respondents indicated that the dual enrollment technical classes were relevant (67%) or somewhat relevant (33%) to their educational goals. Most respondents also indicated that these classes were relevant (67%) or somewhat relevant (11%) to their career goals. Twenty-two percent indicated that these classes were not relevant to their career goals. Four dual enrollment respondents who rated these classes as not relevant or somewhat relevant indicated that there was no way to increase the relevance of these courses. These students shared that they are just working to making money or have a career goal outside of this field. One respondent did not know whether the courses were relevant.

72% of respondents were aware of the degree tracks, and most heard about them from staff at their high schools. Over half of the respondents were aware of scholarships for the degree tracks.

Dual enrollment students can matriculate into the technical studies programs at ESCC. Thus, evaluators gauged dual enrollment respondents' awareness of the Technical Studies AAS degree tracks. In year 4, 72% of dual enrollment respondents were aware of the Technical Studies AAS degree tracks. One respondent preferred not to answer. These respondents heard about the Technical Studies AAS degree tracks from high school guidance counselors (46%), teachers (46%), high school career coaches (23%), ESCC faculty (15%), peers (15%), and parents (15%). No one indicated that they heard about it through the newspaper, radio, the ESCC website, or social media. Additionally, 58% of dual enrollment responders were aware that there are scholarships available to cover the tuition of students enrolled in the Technical Studies AAS degree tracks at ESCC.

58% of dual enrollment respondents showed interest in one or more of the degree tracks.

Evaluators also gauged dual enrollment students' interest in the degree tracks. In year 4, 58% of respondents reported that they were interested in at least one of the degree tracks. More specifically, 38% of these respondents were interested in industrial technology, 33% were interested in welding, 28% were interested in HVAC and 6% were interested in electricity. For each degree track, around one quarter of respondents indicated that they did not know if they were interested in the given degree track.

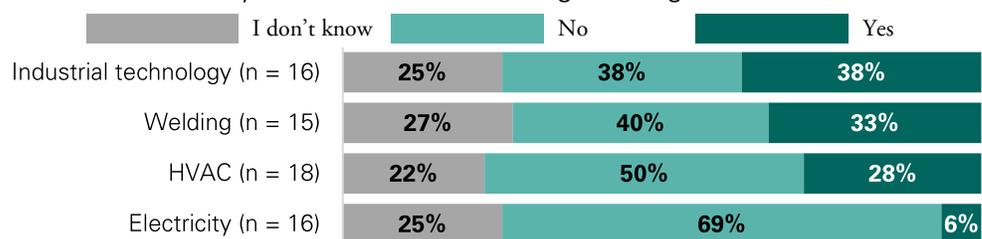


Figure 2. Dual enrollment respondents' interest in pursuing the four available degree tracks

## Summative Findings for All Project Years

The findings presented in this section address the summative evaluation questions regarding the dual enrollment technical classes. These findings include relevant data from all project years and aggregated survey data from respondents who completed the dual enrollment student survey in year 2 or year 4. Appendix B presents the charts for these findings and presents data for just the year 4 dual enrollment student survey respondents.

A total of 103 students enrolled in the dual enrollment technical classes throughout the project.

One key outcome of the project was to increase the number of students participating in the dual enrollment technical classes. Specifically, the project sought to increase the number of students participating in dual enrollment technical classes from 32 students in the baseline year to 64 students in year 3. The CTS project had a promising start in year 2 with 46 dual enrollment students, but in year 3, enrollment decreased to 36 students. In year 4, an additional 21 students enrolled (9 CAD 201; 8 HVAC; and 4 welding). Thus, throughout the project, a total of 103 students participated in the dual enrollment technical classes.

On average, dual enrollment respondents' ratings of their vocational self-efficacy, technical knowledge, and STEM skills were statistically significantly higher after participating in the dual enrollment technical classes.

Across years 2 and 4, 53 dual enrollment students responded to survey questions asking them to rate their vocational self-efficacy, technical knowledge, and STEM skills before and after participating in the project's dual enrollment technical classes. Evaluators used Wilcoxon Signed Rank tests to determine if these respondents' after-participating ratings in these three areas were statistically significantly higher than their before-participating ratings (McCrum-Gardner, 2008). Findings indicated that on average, respondents' ratings were statistically significantly higher after participating in the dual enrollment technical classes. While all average ratings suggest that as a group, respondents' vocational self-efficacy, technical knowledge, and STEM skills improved after participating, not every individual respondent experienced a positive change on each item.

- **Vocational self-efficacy:** On average, dual enrollment respondents indicated that their vocational self-efficacy was higher after participating in the CTS dual enrollment classes than it was before they had participated. Furthermore, on average, all of respondents' ratings related to vocational self-efficacy were statistically significantly higher after participating in the dual enrollment technical classes. On all items, respondents' average ratings corresponded to between *some confidence* and *much confidence* after participating.
- **Technical knowledge:** Dual enrollment respondents rated the technical knowledge addressed in their specific classes. Respondents' average knowledge ratings were higher for each area (HVAC, electricity, industrial technology, CAD, and welding) after participating. Due to small sample sizes, evaluators could only run the Wilcoxon Signed Rank test on HVAC and industrial technology items. Results showed that all respondents' ratings for these items were statistically significantly higher after participating.
- **STEM skills:** On average, dual enrollment respondents indicated that their knowledge of STEM skills on all items related to quantitative

reasoning, scientific reasoning, and critical thinking was significantly higher after participating in the CTS dual enrollment classes. Respondents' average ratings corresponded to between *some knowledge* and *knowledgeable* after participating.

74% of respondents planned to pursue further education, but only 30% planned to major in a STEM field.

Across the aggregate group of year 2 and year 4 respondents, 74% indicated that they planned to pursue further education, 4% did not plan to, and 22% did not know if they planned to do so. Of the dual enrollment respondents who planned to pursue additional education, 30% planned to major in a STEM field after high school, 40% did not plan to major in STEM, and 30% did not know if they planned to major in STEM.

Around half of dual enrollment respondents shared that they were much more likely to pursue a certificate or CSC as a result of participating in the project.

Dual enrollment respondents also shared how participating in dual enrollment technical classes had affected their education plans (Figure 3). Across the aggregate group of year 2 and year 4 dual enrollment respondents, 57% indicated that they were much more<sup>4</sup> likely to pursue a certificate, 47% were much more likely to pursue a CSC, and 33% were much more likely to pursue an associate degree as a result of participating in the dual enrollment classes.

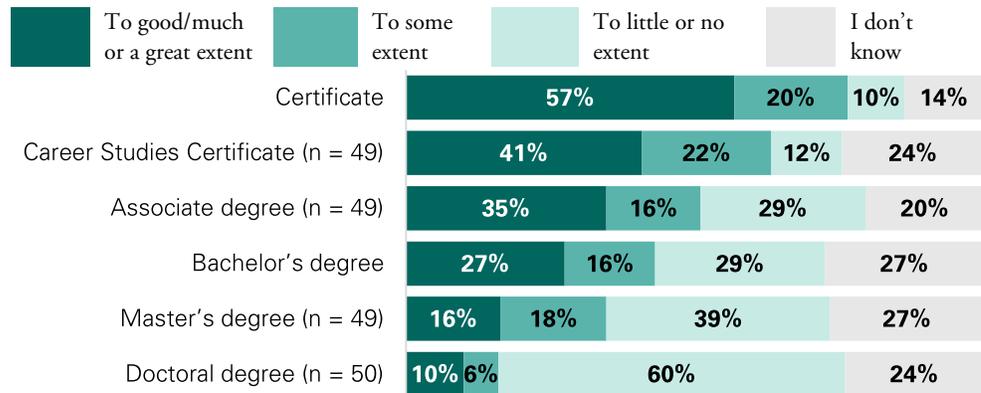


Figure 3. Likelihood that dual enrollment respondents will pursue future educational opportunities- aggregated year 2 and 4 (n = 51).

**Note.** The scale was 1= to no extent, 2 = to little extent, 3 = to some extent, 4 = to good/much extent, and 5 = to a great extent.

## 2

# FINDINGS: CREATE A TECHNICAL STUDIES AAS DEGREE WITH TRACKS

The CTS project aimed to develop and obtain approval for a new Technical Studies AAS degree with five tracks, in cybersecurity, industrial technology, HVAC, welding, and electricity. Four degree tracks were approved in year 3 and began in earnest in fall 2020.

<sup>4</sup> Respondents who selected "to good/much extent" or "to a great extent" were classified as being "much more likely."

## Year 4 Formative Findings

The findings presented in this section include 16 ESCC students who were enrolled in a Technical Studies AAS degree track or a feeder certificate program in year 4 and completed a sufficient amount of the 2021 ESCC student survey. All of these respondents were male. Additionally, half of the respondents were White (50%). The remaining respondents were Black or African American (25%), and Hispanic or Latino (25%). Of the 12 respondents who were able or willing to share this information,<sup>5</sup> 58% indicated that they received financial aid during the 2020-2021 academic year from any of these sources: PELL, WIOA, RHVI.

75% of program respondents came from a feeder program.

Twelve respondents indicated that they were enrolled in the Technical Studies AAS degree tracks. Six respondents were in the HVAC degree track, four were in the industrial technology, one was in the electricity track, and one was in the welding track.<sup>6</sup> Nine of these program students were enrolled in related programs prior to enrolling in their technical studies AAS. More specifically, these respondents indicated that they were enrolled in an HVAC CSC program (67%), an Industrial Technology Certificate program (33%), a Welding Certificate or CSC program (22%), or dual enrollment technical classes (11%).

75% of respondents in a feeder program were aware of the degree tracks and learned about them from ESCC faculty and the website.

Of the 16 ESCC respondents, four were enrolled in feeder certificate programs. Of these respondents, 75% were enrolled in the Electricity CSC program and 25% were enrolled in a Welding Certificate or CSC programs. In year 4, 75% of respondents in the feeder certificate programs were aware of the Technical Studies AAS degree tracks and heard about them from ESCC faculty (67%) and the ESCC website (33%).

75% of students in the feeder programs showed interest in one or more of the degree tracks.

In year 4, 75% of respondents in the feeder certificate programs reported that they were interested in at least one of the degree tracks. More specifically, 75% of respondents were interested in electricity, 25% in industrial technology, and 25% in HVAC. None of these respondents were interested in welding.

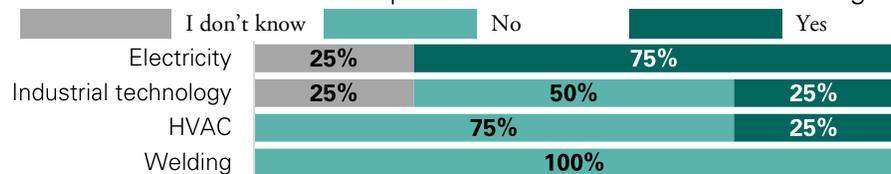


Figure 4. Respondents' interest in pursuing the four available degree tracks (n = 4)

About half of respondents received or were aware of scholarships for the degree tracks.

As part of the program, 45% of the respondents enrolled in the degree tracks received the Ratcliffe Scholarship during the 2020–2021 academic year. One respondent was not sure if they had received it. Half of the respondents in the feeder certificate programs were aware that there are specific scholarships to cover the tuition of students enrolled in the degree tracks.

<sup>5</sup> Four respondents indicated that they did not know or preferred not to answer.

<sup>6</sup> Four of these respondents were not officially enrolled in their Technical Studies AAS degree tracks at the time of the survey. Three of them were still considered to be CSC or certificate students and one respondent will be officially enrolled as of summer 2021.

Over half of respondents felt positive about the change to an 8-week term, but a few experienced difficulties.

During the 2020-2021 academic year, ESCC changed from a 15-week term to an 8-week term. Eight respondents generally felt positive about the shorter class term. Specifically, three respondents felt that the change made the course easier and that it was beneficial. Two respondents felt that the fast pace helped them complete other classes during the semester. One respondent felt that the pace made them work more efficiently in their welding, while another respondent felt that the shorter term allowed them to work more in their job. Three respondents shared negative perceptions of the shorter term. Specifically, respondents felt that the eight-week course was either too difficult, too fast, or stress inducing. Three respondents shared neutral perceptions about the shorter course term, mentioning little to no impact.

Overall, respondents perceived the degree tracks as high quality and relevant.

Seventy-nine percent of ESCC respondents rated the quality of the technical studies courses in their programs as *high quality* or *very high quality*. When asked about the features of the course that contributed to the quality, five students mentioned positive feedback about their instructor.

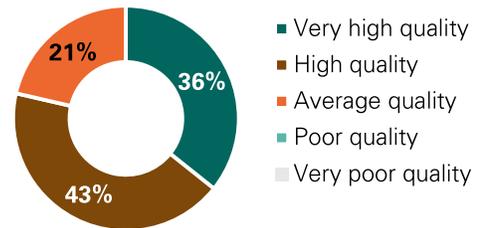


Figure 5. ESCC respondents' perceptions of the quality of the dual enrollment technical classes (n = 14).

Additionally, three respondents mentioned the hands-on aspect of the course and one respondent shared that the equipment provided added to the course quality. One of the respondents who rated these courses as *average quality* shared that the quality could be improved if the online course materials were better organized, and due dates were clear. Additionally, 12 ESCC respondents indicated that the technical studies courses in their programs were relevant (92%) or *somewhat* relevant (8%) to their educational goals. Two respondents did not know. Thirteen respondents indicated that these courses were relevant (100%) to their career goals, and one respondent did not know.

### Summative Findings for All Project Years

The findings presented in this section address the summative evaluation questions regarding the Technical Studies AAS degree tracks. These findings include relevant data from all project years and aggregated survey data from respondents who completed the ESCC student survey in years 2 or 4. Appendix C presents the charts for these findings and presents data for just the year 4 ESCC student survey respondents.

11 ESCC students enrolled in the technical studies degree track in year 4.

The Technical Studies AAS degree tracks began in earnest in fall 2020 and had 11 ESCC students officially enrolled in the fall and spring terms.<sup>7</sup> Four additional ESCC respondents indicated that they were enrolled in the Technical Studies AAS degree tracks on the ESCC student survey. However, these four students had not officially enrolled at the time of the survey and are not included in this total.

<sup>7</sup> Twelve ESCC respondents indicated that they were enrolled in the Technical Studies degree tracks. Four of these respondents were not included on the list of program students provided by ESCC.

Overall, respondents felt that their vocational self-efficacy, technical knowledge, and STEM skills improved after participating in the CTS dual enrollment classes.

Across years 2 and 4, 19 ESCC students responded to survey questions asking them to rate their vocational self-efficacy, technical knowledge, and STEM skills before and after participating in the project’s technical studies offerings. Evaluators used Wilcoxon Signed Rank tests to determine if these respondents’ after-participating ratings in these three areas were statistically significantly higher than their before-participating ratings (McCrum-Gardner, 2008). While average ratings suggest that as a group, respondents’ self-efficacy, technical knowledge, and STEM skills improved after participating, not every individual respondent experienced a positive change on each item.

- **Vocational self-efficacy:** Although respondents indicated that their vocational self-efficacy was higher after participating than before, none of these items were statistically significantly higher after participation. Respondents’ average ratings on all items corresponded to between *some confidence* and *much confidence* after participating.
- **Technical knowledge:** ESCC respondents rated the technical knowledge addressed in their specific programs. Respondents’ average knowledge ratings were higher for each area (HVAC, electricity, industrial technology, and welding) after participating. Due to small sample sizes, evaluators could only run the Wilcoxon Signed Rank test on one item. Results show that knowledge of demonstrating an understanding of quality control principles was statistically significantly higher after participating. Respondents’ average ratings on most items corresponded to between *knowledgeable* and *very knowledgeable* after participating.
- **STEM skills:** On average, ESCC respondents indicated that their knowledge of STEM skills was higher on all items related to quantitative reasoning, and scientific reasoning, and critical thinking after participating in the technical studies offerings than it was before they had participated. Furthermore, four survey items related to their STEM skills had ratings that were statistically significantly higher after participating. Respondents’ average ratings of themselves on all but one item corresponded to between *some knowledge* and *knowledgeable* after participating.

ESCC respondents also shared how participating in technical offerings had affected their education plans (Figure 6). Across the aggregate group of year 2 and year 4 ESCC respondents, 42% indicated that they were much more<sup>8</sup> likely to pursue an associate degree, and 18% were much more likely to pursue a bachelor’s degree as a result of participating in the technical studies offerings.

42% of ESCC respondents were much more likely to pursue an associate degree as a result of participating in the project.

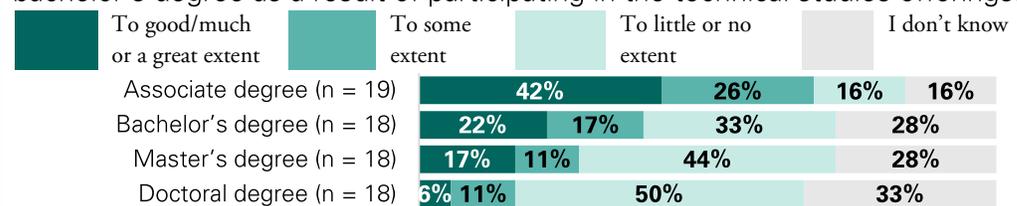


Figure 6. Likelihood that ESCC student respondents will pursue future educational opportunities- aggregated year 2 and 4

**Note.** The scale was 1= to no extent, 2 = to little extent, 3 = to some extent, 4 = to good/much extent, and 5 = to a great extent.

<sup>8</sup> Respondents who selected “to good/much extent” or “to a great extent” were classified as being “much more likely.”

# 3

## FINDINGS: ESTABLISH ARTICULATION AGREEMENTS

Although most graduates from the degree tracks are expected to transition into employment opportunities, the CTS project aimed to establish and promote articulation agreements with regional four-year universities. These articulation agreements are expected to help extend the pathway for students who wish to pursue further education in technical studies fields. Since the degree tracks and articulation agreements were delayed until fall 2020, no graduates of the degree tracks have been able to transfer to a four-year university yet. Thus, there is no additional information provided from the year 4 student surveys.

# 4

## FINDINGS: DEVISE CAREER TRACKS

The CTS project aimed to devise career tracks in partnership with local businesses. These tracks will offer a formalized path for students who have earned postsecondary credentials to move into careers in technical studies fields. The CTS project intends to identify and engage potential employers and provide students with Work-based Learning (WBL) opportunities, which are on-the-job experiences in partnership with local industry and relate to students’ interests and career goals (Giffin, Neloms, Mitchell & Blumenthal, 2018). These WBL opportunities included résumé assistance and mock interview experiences, support career exploration opportunities, identify cocurricular activities, and pilot rotating internship placements. This section presents findings for ESCC student respondents who took the 2021 ESCC student survey. When appropriate, evaluators also included data from previous years to address summative questions.

44 students participated in WBL during the project.

ESCC students participated in WBL during the project. Thirty-nine students participated in internships (15 students in year 1, 14 students in year 2, four students in year 3, and seven students in year 4) and four students participated in RockOn! Workshops. No students participated in workplace tours, engaged in job shadowing, or attended conferences during the project years. COVID-19 impacted the project’s ability to offer WBL opportunities to students.

Most respondents perceived their internship experiences as high quality and relevant.

In year 4, three ESCC respondents indicated that they participated in an internship during the 2020–2021 academic year, which was the main WBL opportunity due to COVID-19. All of these respondents rated their internship as a *high quality* or *very high quality* experience.

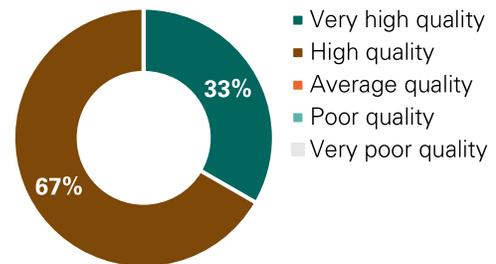


Figure 7. ESCC respondents’ perceptions of the quality of their internship experience (n = 3)

Additionally, of the ESCC respondents who participated in an internship, 67% indicated that it was relevant to their educational goals, and 33% indicated that it was not. The one ESCC respondent who did not find their internship experience relevant to their educational goals suggested that it could be modified by making the classes bigger. All three students indicated that their internship experience was relevant to their career goals.

Given that ESCC could not offer all of the planned WBL opportunities in the 2020-2021 academic year, evaluators gathered information about student interest in potential WBL opportunities. Nine respondents were interested in participating in WBL opportunities in the future. These respondents indicated that they were interested in internships (67%), job shadowing (56%), RockOn! Workshops (44%), workplace tours (44%), competitions (33%), conferences (33%), interview support (22%), and résumé writing (11%). Additionally, one respondent explained that they were interested in everything. Three respondents indicated that they were not interested in any of these WBL opportunities.

Respondents were interested in WBL opportunities, especially internships and job shadowing.

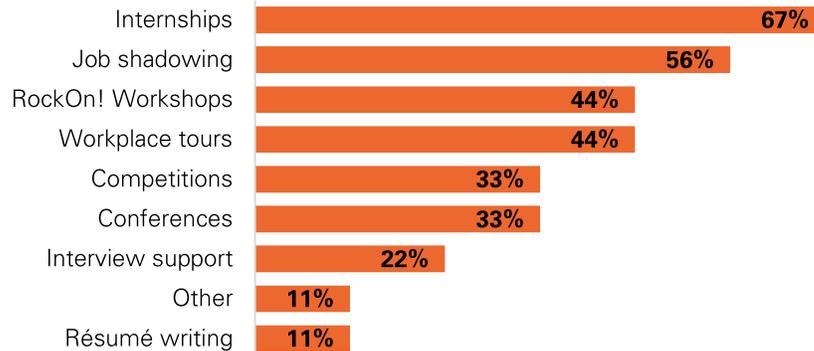


Figure 8. ESCC respondents' interest in participating in WBL opportunities in the future (n = 9)

The evaluation intended to examine gains in technical knowledge and STEM skills, future educational aspirations, and vocational self-efficacy among students who participate in career track and WBL opportunities. However, given that the WBL students are also the ESCC students enrolled in the degree tracks or feeder programs, evaluators determined that it would be difficult to examine WBL gains independently without putting additional burden on survey respondents. Thus, findings related to participants gains in these areas are incorporated in the earlier Technical Studies AAS degree findings.

Evaluators could not evaluate WBL student outcomes separately.

# REFERENCES

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# APPENDIX B. EVALUATION QUESTIONS

The evaluation of the CTS project focuses on the project’s four main objectives. The following table summarizes the key formative and summative evaluation questions for each objective, as well as the relevant indicators and data sources and the timing of data collection.

**Objective 1:** Design dual enrollment technical tracks in specific career and technical education programs for the region’s high school students.

Evaluation Questions	Indicator	Data Source	Timing
<i>Formative Evaluation Questions</i>			
Are outreach programming, workshops, and other activities offered to share information about the project?	# of outreach programs, workshops, and activities Descriptions of outreach programs, workshops, and activities	ESCC documents	Semester
How is the project developing and progressing regarding the intended number and nature of high school student participants in the dual enrollment technical tracks?	# of high school students Description of high school students	Personnel & partner survey ESCC documents	Semester/Annually
Do personnel and students perceive the dual enrollment technical tracks as high quality and relevant to students’ educational and vocational goals?	Quality item bank Goals item bank	Personnel & partner survey Student survey	Annually
<i>Summative Evaluation Questions</i>			
Throughout the course of the project, does high school student participation in dual enrollment technical tracks increase?	# of high school students	ESCC documents Student lists	Annually
Does the percentage of matriculating students from area high schools who major in STEM fields increase throughout the project? <sup>9</sup>	# of matriculating students # of students in STEM	ESCC documents	Annually
Do dual enrollment technical track participants report gains in technical knowledge, STEM skills, and vocational self-efficacy?	Knowledge & skills item bank	Student survey	Annually
Do dual enrollment technical track participants report increases in the likelihood that they will pursue additional educational opportunities in the future?	Future aspirations item bank	Student survey	Annually

<sup>9</sup>This evaluation question was revised to examine the number of high school students who matriculated into the degree tracks.

**Objective 2:** Create a Technical Studies AAS degree with tracks in cybersecurity, industrial technology, HVAC, welding, and electricity.

<b>Evaluation Questions</b>	<b>Indicator</b>	<b>Data Source</b>	<b>Timing</b>
<i>Formative Evaluation Questions</i>			
Is a Technical Studies AAS degree program developed and implemented that offers tracks in cybersecurity, electricity, HVAC, industrial technology, and welding?	Yes/No	ESCC documents	Annually
Does the program target students who have completed ESCC's current programs and high school students who have received advanced placement in technical studies fields?	Description of target students % of target students who have received advanced placement in technical studies fields	Personnel & partner survey ESCC documents	Annually
How is the AAS program promoted?	Descriptions of promotional campaigns and recruitment efforts	Personnel & partner survey ESCC documents	Semester/Annually
How do students learn about it?	How did you hear about the program?	Student survey	Annually
How does the project develop and progress regarding the intended number and nature of participants in the AAS program?	# of students in AAS program Description of participants in AAS program	Personnel & partner survey ESCC documents	Semester/Annually
Does the program create a pathway to upper-division studies?	Yes/No	Personnel & partner survey	Semester/Annually
What are the number and nature of participants in upper-division studies?	# of students in upper-division studies Description of participants in upper-division studies	ESCC documents	Semester/Annually
Do personnel and students perceive the AAS program as high quality and relevant to students' educational and vocational goals?	Quality item bank Goals item bank	Student survey	Annually
<i>Summative Evaluation Questions</i>			
Throughout the course of the project, does student participation in the AAS program increase?	# of participants	ESCC documents	Annually
Do participants in the AAS program report gains in technical knowledge, STEM skills, and vocational self-efficacy?	Knowledge & skills item bank	Student survey	Annually

Evaluation Questions	Indicator	Data Source	Timing
Do participants in the AAS program report increases in the likelihood that they will pursue additional educational opportunities in the future?	Future aspirations item bank	Student survey	Annually

**Objective 3:** Establish articulation agreements with regional four-year colleges and universities for students wishing to pursue further education in technical studies fields.

Evaluation Questions	Indicator	Data Source	Timing
<i>Formative Evaluation Questions</i>			
Are articulation agreements established with regional four-year colleges and universities for students seeking to pursue further education in technical studies fields?	Yes/No	ESCC documents	Annually
What four-year institutions participate?	Names of four-year institutions	ESCC documents	Annually
How are these agreements and transfer opportunities communicated to educators and students?	Description of communications	ESCC documents Personnel & partner survey	Annually
Do personnel and students perceive the articulation agreements as useful in helping students achieve their educational and vocational goals?	Goals item bank	Personnel & partner survey Student survey	Annually
<i>Summative Evaluation Questions</i>			
How many AAS graduates transfer into baccalaureate programs?	# of AAS graduates who transfer	ESCC documents	Annually
Does this number increase throughout the project?	# of AAS graduates who transfer	ESCC documents	Annually

**Objective 4:** Devise career tracks with business partners for students wishing to begin careers in technical studies fields after receiving postsecondary credentials.

Evaluation Questions	Indicator	Data Source	Timing
<i>Formative Evaluation Questions</i>			
Are career tracks with business partners developed for students seeking to begin careers in technical studies fields after receiving postsecondary credentials?	Yes/No	ESCC documents	Semester/Annually
What types of experiences and support are offered?	# of internships, # of workplace tours, # of job shadow opportunities, # of conferences, # of RockOn! workshops, # of other career track experiences	Personnel & partner survey Student survey ESCC documents	Semester/Annually

Evaluation Questions	Indicator	Data Source	Timing
How does the project develop and progress regarding the intended number and nature of business partners that provide placement opportunities to ESCC students?	Descriptions of these experiences and support offered # of business partners with placement opportunities Description of business partners	Personnel & partner survey ESCC documents	Semester/Annually
How does the project develop and progress regarding the intended number and nature of students who participate in WBL experiences?	# of students participating in WBL opportunities Description of students	Student survey ESCC documents	Semester/Annually
Do personnel and students perceive the WBL experiences as high quality and relevant to students' vocational goals?	Quality item bank	Student survey Personnel & partner survey	Annually
<i>Summative Evaluation Questions</i>			
Do students who participate in career track and WBL opportunities (internships, conferences, competitions, résumé and interview support opportunities, etc.) report gains in technical knowledge and STEM skills, future educational aspirations, and vocational self-efficacy? <sup>10</sup>	Knowledge & skills item bank Goals item bank Self-efficacy item bank	Student survey	Annually
Over the course of the project, is there an increase in placement opportunities for ESCC students?	# of placement opportunities	ESCC documents	Semester/Annually

<sup>10</sup> Since WBL students are also dual enrollment students and will also be ESCC students enrolled in the degree tracks, it is difficult to examine WBL gains independently without putting additional burden on survey respondents.

# APPENDIX B. DUAL ENROLLMENT STUDENT RESPONDENTS' KNOWLEDGE AND SKILLS

This appendix presents student data related to the dual enrollment summative evaluation questions from years 2 and 4. There is no year 3 data because the student survey was postponed to year 4 when the Technical Studies AAS degree tracks began in earnest. The charts show dual enrollment student respondents' ratings of their vocational self-efficacy, technical knowledge, and STEM skills before and after participating in the dual enrollment technical classes offered as part of the CTS project. The charts on the left present data only for year 4 survey respondents. The charts on the right present data aggregated across years 2 and 4 survey respondents. The table presents the Wilcoxon Signed Rank Test results.

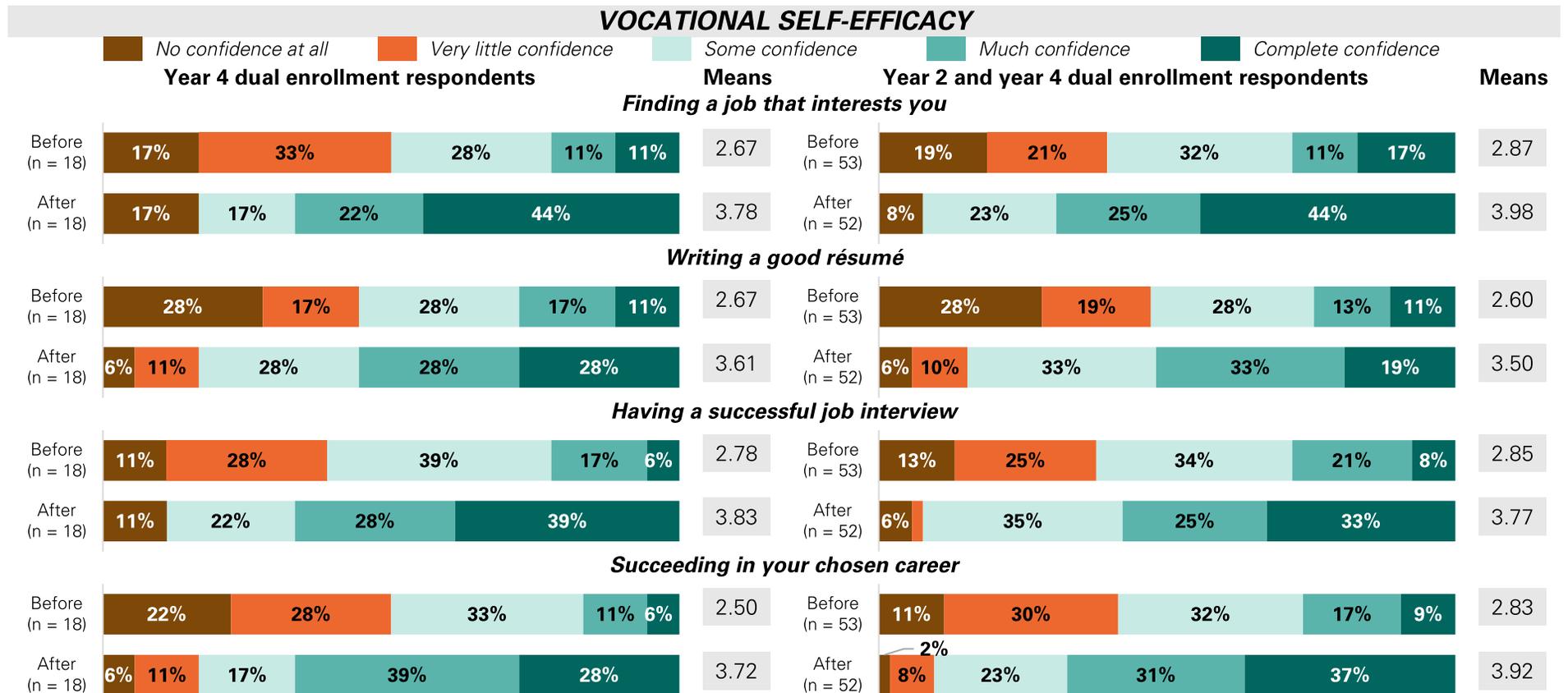


Figure 9. Dual enrollment respondents' ratings of their vocational self-efficacy before and after participating in technical classes in year 4 (n = 18).

Figure 10. Dual enrollment respondents' ratings of their vocational self-efficacy before and after participating in technical classes in year 2 and year 4 (n = 53).

## TECHNICAL KNOWLEDGE

No knowledge    
  Little knowledge    
  Some knowledge    
  Knowledgeable    
  Very knowledgeable

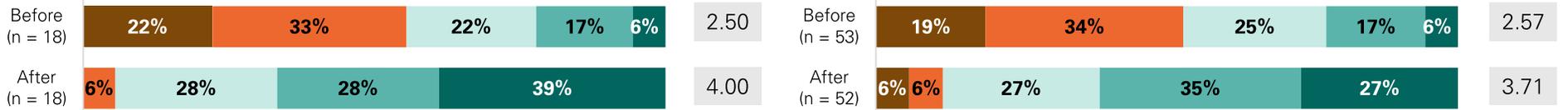
**Year 4 dual enrollment respondents**

**Means**

**Year 2 and year 4 dual enrollment respondents**

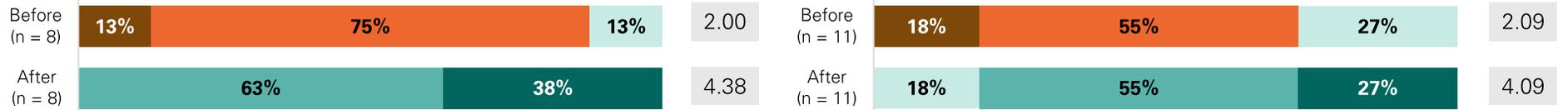
**Means**

*Demonstrating an understanding of quality control principles*

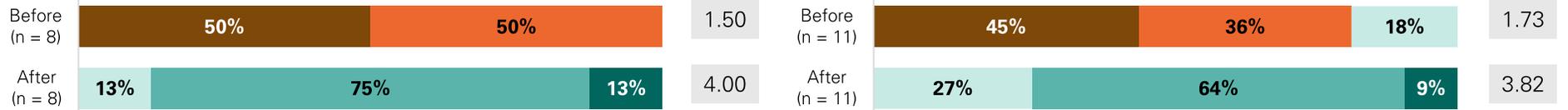


### HVAC

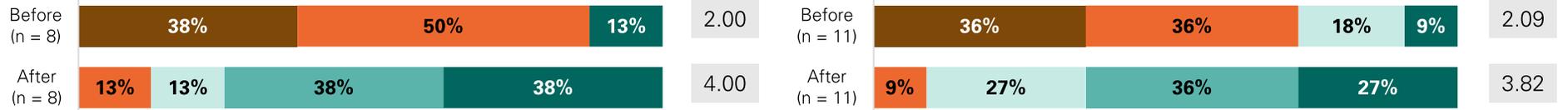
*Properly sizing and installing HVAC systems using current and appropriate codes and industry practices*



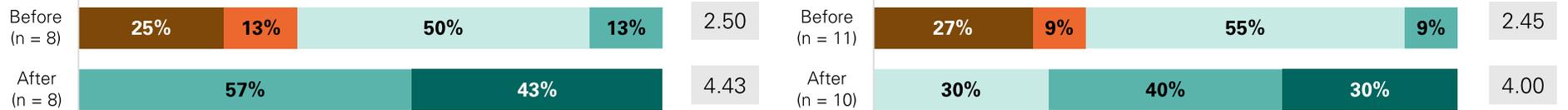
*Diagnosing and repairing faults on HVAC systems*



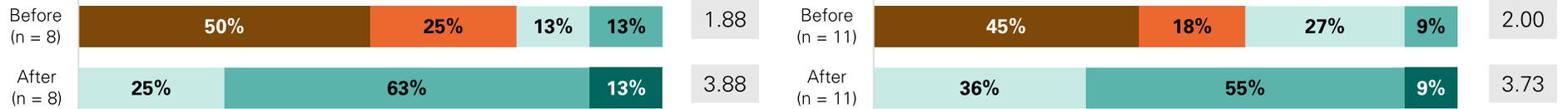
*Performing maintenance on HVAC systems*



*Reading and interpreting electrical diagrams*



*Reading and interpreting repair faults in electrical control systems*



## TECHNICAL KNOWLEDGE

No knowledge    
  Little knowledge    
  Some knowledge    
  Knowledgeable    
  Very knowledgeable

**Year 4 dual enrollment respondents**

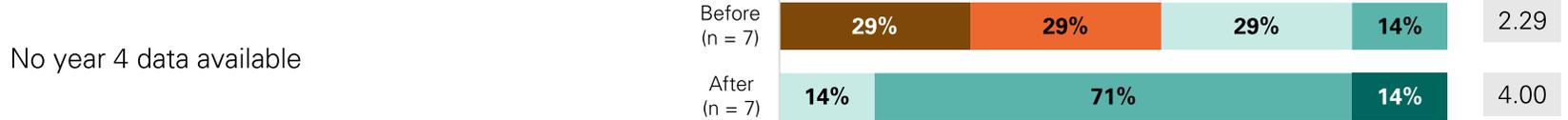
**Means**

**Year 2 and year 4 dual enrollment respondents**

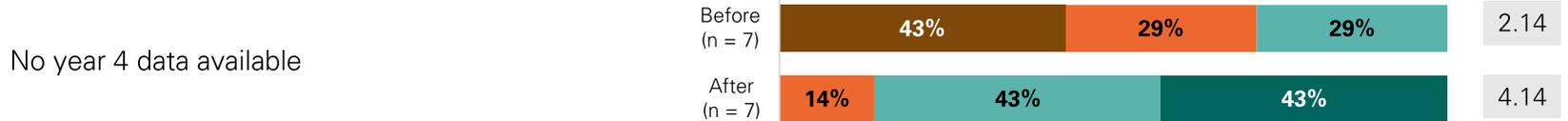
**Means**

### Electricity<sup>11</sup>

#### Reading and interpreting electrical diagrams



#### Reading and interpreting repair faults in electrical control systems



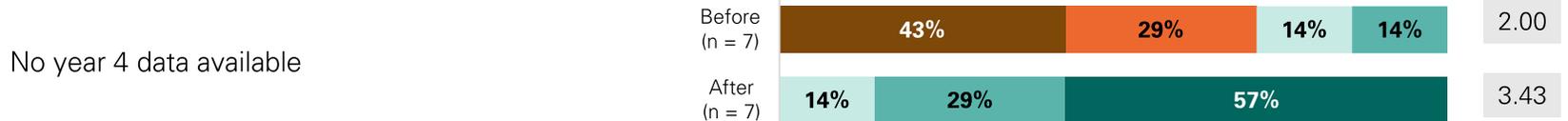
#### Using electrical equipment safely and appropriately



#### Applying National Electrical Code to industrial and residential wiring

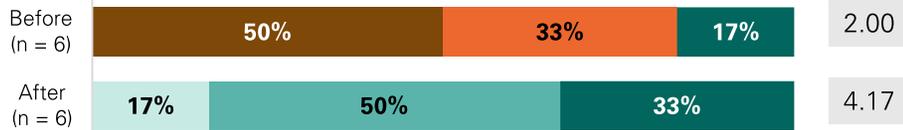


#### Applying fundamental electrical theory to residential and industrial wiring practices



### CAD<sup>12</sup>

#### Create a new drawing using the computer and applicable software



No year 2 data available

<sup>11</sup> There was no dual enrollment class in electricity in year 4

<sup>12</sup> There was no dual enrollment class in CAD in year 2

## TECHNICAL KNOWLEDGE

No knowledge    
  Little knowledge    
  Some knowledge    
  Knowledgeable    
  Very knowledgeable

**Year 4 dual enrollment respondents**

**Means**

**Year 2 and year 4 dual enrollment respondents**

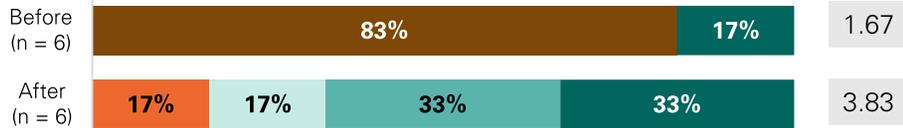
**Means**

***Demonstrate understanding of the software interface in order to produce a drawing***



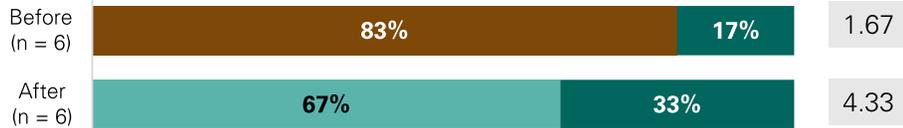
No year 2 data available

***Demonstrate an acceptable skill level in working with current software menu hierarchy***



No year 2 data available

***Demonstrate an understanding of producing a CAD drawing and plotting the drawing***



No year 2 data available

### Industrial Technology<sup>13</sup>

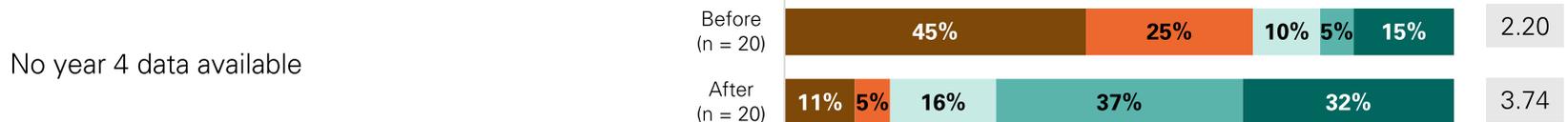
***Identifying typical tools***



***Demonstrating proper use of a variety of devices including precision measurement***



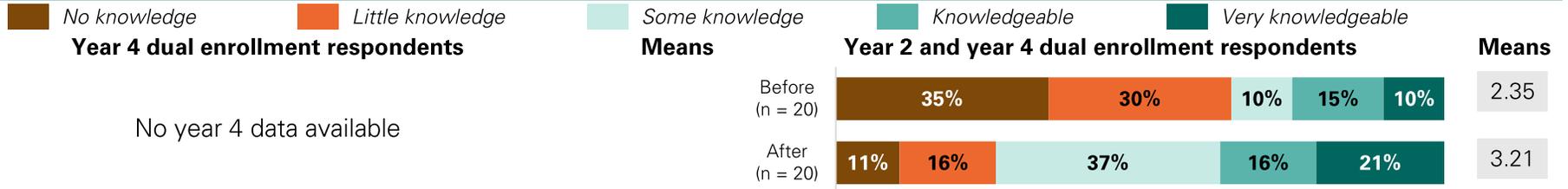
***Reading and interpreting mechanical drawings***



***Performing data collection and evaluation of equipment used in the industrial environment***

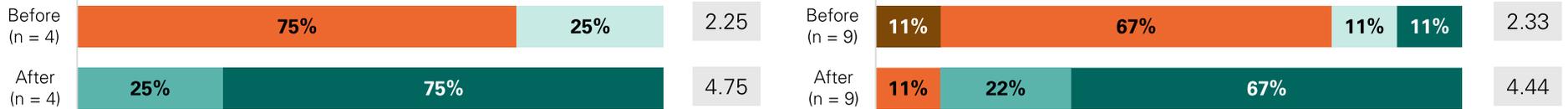
<sup>13</sup> There was no dual enrollment class in industrial technology in year 4

## TECHNICAL KNOWLEDGE

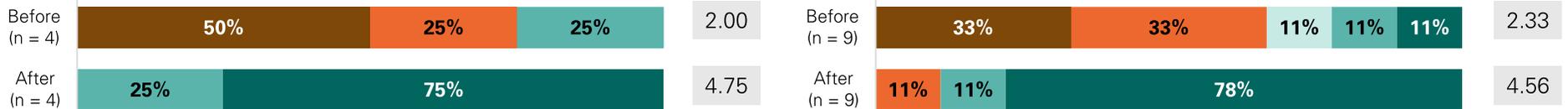


### Welding

#### Demonstrating proficiency in the use of welding tools



#### Safely performing welding techniques using fillers, wires, fluxes, and gases



#### Reading and interpreting blueprints in the welding industry

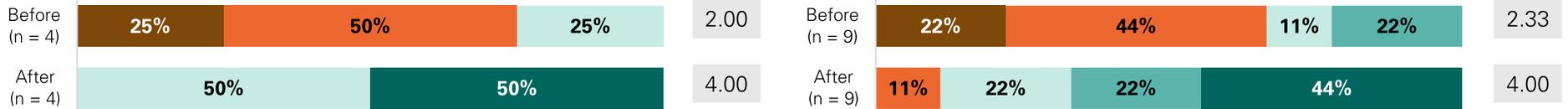
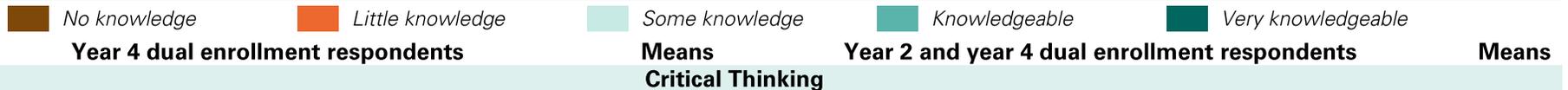


Figure 11. Dual enrollment student respondents' ratings of their technical knowledge before and after participating in technical classes in year 4.

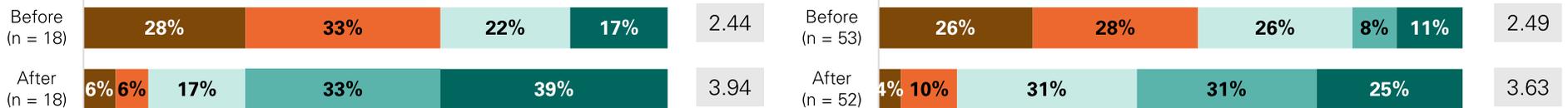
Figure 12. Dual enrollment student respondents' ratings of their technical knowledge before and after participating in technical classes in year 2 and year 4.

## STEM SKILLS



### Critical Thinking

#### Determining the credibility, accuracy, and reliability of conclusions drawn from the data



## STEM SKILLS

No knowledge    
  Little knowledge    
  Some knowledge    
  Knowledgeable    
  Very knowledgeable

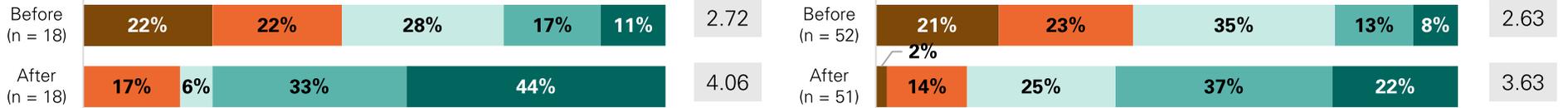
**Year 4 dual enrollment respondents**

**Means**

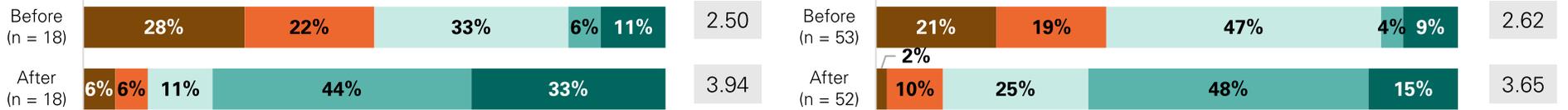
**Year 2 and year 4 dual enrollment respondents**

**Means**

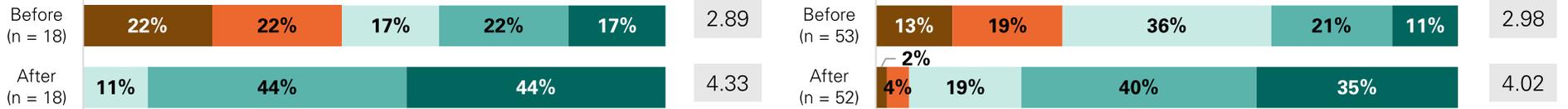
*Evaluating the strengths and relevance of arguments on a particular question or issue*



*Determining whether certain conclusions or consequences are supported by the information provided*

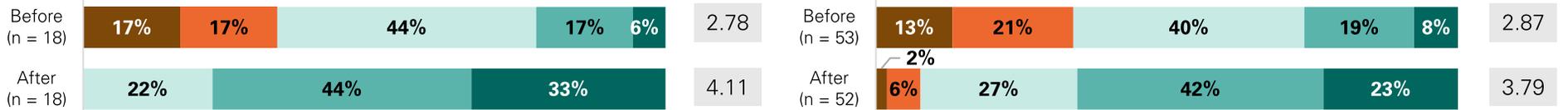


*Using problem solving skills*

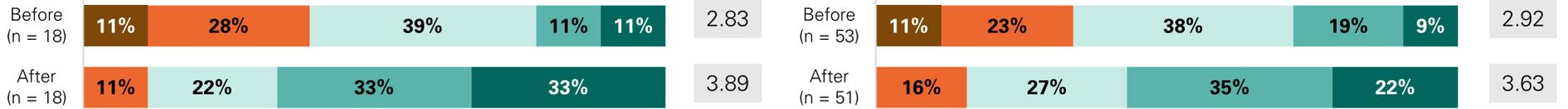


### Quantitative Reasoning

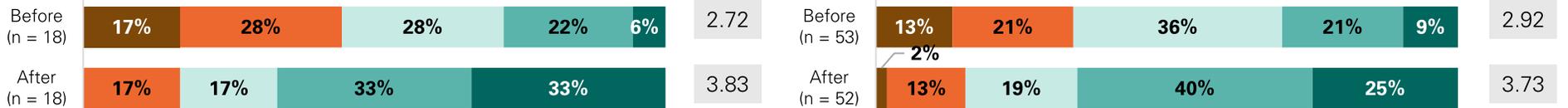
*Using logical and mathematical reasoning*



*Interpreting and using mathematical formulas*



*Interpreting and using mathematical information numerically, symbolically, and visually (e.g., graphs, tables, and charts)*



## STEM SKILLS

No knowledge    
  Little knowledge    
  Some knowledge    
  Knowledgeable    
  Very knowledgeable

**Year 4 dual enrollment respondents**

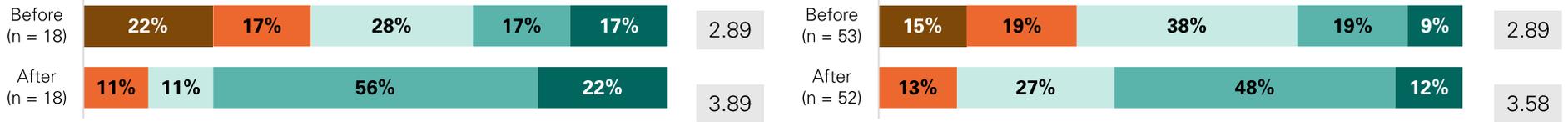
**Means**

**Year 2 and year 4 dual enrollment respondents**

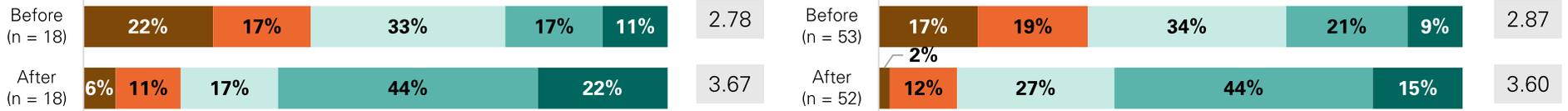
**Means**

### Scientific Reasoning

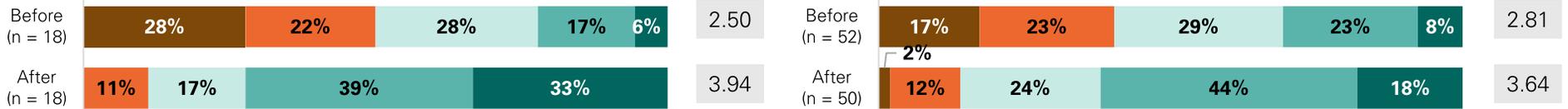
#### Generating a logical argument



#### Distinguishing a scientific argument from a non-scientific argument



#### Distinguishing between causal and correlational relationships



#### Recognizing methods of inquiry (i.e., ways information is collected) that lead to scientific knowledge

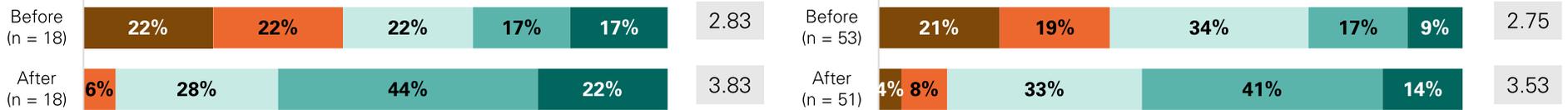


Figure 13. Dual enrollment student respondents' ratings of their STEM skills before and after participating in technical classes in year 4 (n = 18).

Figure 14. Dual enrollment student respondents' ratings of their STEM skills before and after participating in technical classes in year 2 and year 4 (n = 53).

Table 1. Significance tests for 5-point Likert-scale items regarding dual enrollment respondents' vocational self-efficacy, technical knowledge, and STEM skills.

	Before participating in dual enrollment technical classes			After participating in dual enrollment technical classes			Mean Diff	Wilcoxon results	
	N	Mean	SD	N	Mean	SD		Z	Sig.
<b>Vocational Self-efficacy</b>									
Finding a job that interests you	53	2.87	1.33	52	3.98	1.18	1.11	-4.68	0.00
Writing a good résumé	53	2.60	1.34	52	3.50	1.09	0.90	-4.72	0.00
Having a successful job interview	53	2.85	1.13	52	3.77	1.11	0.92	-4.47	0.00
Succeeding in your chosen career	53	2.83	1.14	52	3.92	1.04	1.09	-4.76	0.00
<b>Technical Knowledge</b>									
Demonstrating an understanding of quality control principles	53	2.57	1.15	52	3.71	1.11	1.15	-4.87	0.00

	Before participating in dual enrollment technical classes			After participating in dual enrollment technical classes			Mean Diff	Wilcoxon results	
	N	Mean	SD	N	Mean	SD		Z	Sig.
<b>HVAC</b>									
Properly sizing and installing HVAC systems using current and appropriate codes and industry practices	11	2.09	0.70	11	4.09	0.70	2.00	-2.72	0.01
Diagnosing and repairing faults on HVAC systems	11	1.73	0.79	11	3.82	0.60	2.09	-2.72	0.01
Performing maintenance on HVAC systems	11	2.09	1.22	11	3.82	0.98	1.73	-2.37	0.02
Reading and interpreting electrical diagrams	11	2.45	1.04	10	4.00	0.82	1.55	-2.59	0.01
Reading and interpreting repair faults in electrical control systems	11	2.00	1.10	11	3.73	0.65	1.73	-2.46	0.01
<b>Industrial Technology</b>									
Identifying typical tools	20	2.80	1.32	19	3.53	1.12	0.73	-2.86	0.00
Demonstrating proper use of a variety of devices including precision measurement	20	2.70	1.26	19	3.47	1.02	0.77	-3.02	0.00
Reading and interpreting mechanical drawings	20	2.20	1.47	19	3.74	1.28	1.54	-3.08	0.00
Performing data collection and evaluation of equipment used in the industrial environment	20	2.35	1.39	19	3.21	1.27	0.86	-2.85	0.00
<b>STEM Skills</b>									
<b>Critical Thinking</b>									
Determining the credibility, accuracy, and reliability of conclusions drawn from the data	53	2.49	1.28	52	3.63	1.09	1.14	-4.51	0.00
Evaluating the strengths and relevance of arguments on a particular question or issue	52	2.63	1.19	51	3.63	1.04	0.99	-4.47	0.00
Determining whether certain conclusions or consequences are supported by the information provided	53	2.62	1.15	52	3.65	0.93	1.03	-5.06	0.00
Using problem solving skills	53	2.98	1.18	52	4.02	0.94	1.04	-4.73	0.00
<b>Quantitative Reasoning</b>									
Using logical and mathematical reasoning	53	2.87	1.11	52	3.79	0.94	0.92	-4.89	0.00
Interpreting and using mathematical formulas	53	2.92	1.12	51	3.63	1.00	0.70	-4.48	0.00
Interpreting and using mathematical information numerically, symbolically, and visually (e.g., graphs, tables, and charts)	53	2.92	1.16	52	3.73	1.05	0.81	-4.55	0.00
<b>Scientific Reasoning</b>									
Generating a logical argument	53	2.89	1.17	52	3.58	0.87	0.69	-3.90	0.00
Distinguishing a scientific argument from a non-scientific argument	53	2.87	1.21	52	3.60	0.96	0.73	-4.07	0.00
Distinguishing between causal and correlational relationships	52	2.81	1.21	50	3.64	0.98	0.83	-4.16	0.00
Recognizing methods of inquiry (i.e., ways information is collected) that lead to scientific knowledge	53	2.75	1.24	51	3.53	0.97	0.77	-3.99	0.00

## Year 4 Dual Enrollment Respondents' Educational Plans

These charts present student data related to year 4 dual enrollment respondents' educational plans.

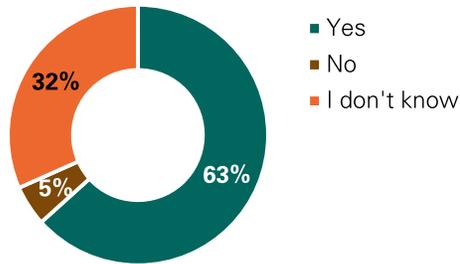


Figure 15. Dual enrollment respondents' plans to pursue further education opportunities after high school (n = 19).

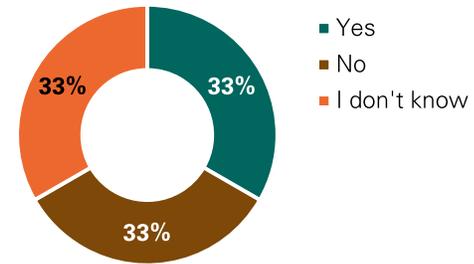


Figure 16. Dual enrollment respondents' plans on majoring in a STEM field after high school (n = 12).

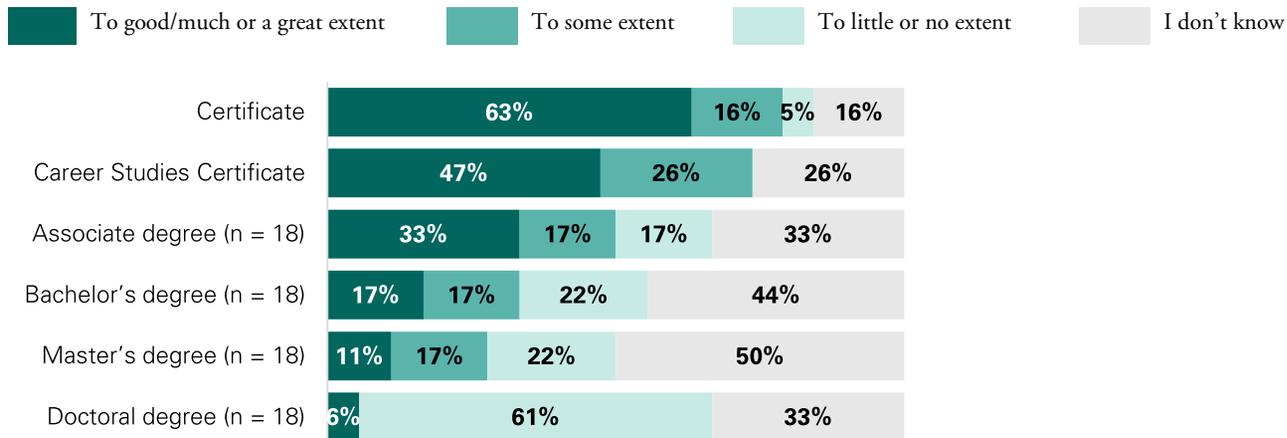


Figure 17. Likelihood that year 4 dual enrollment respondents will pursue future educational opportunities (n = 19)

**Note.** The scale was 1 = to no extent, 2 = to little extent, 3 = to some extent, 4 = to good/much extent, and 5 = to a great extent.

# APPENDIX C. ESCC STUDENT RESPONDENTS' KNOWLEDGE AND SKILLS

This appendix presents student data related to the ESCC summative evaluation questions from years 2 and 4. There is no year 3 data because the student survey was postponed to year 4 when the Technical Studies AAS degree tracks began in earnest. The charts show ESCC student respondents' ratings of their vocational self-efficacy, technical knowledge, and STEM skills before and after participating in the dual enrollment technical classes offered as part of the CTS project. The charts on the left present data only for year 4 survey respondents. The charts on the right present data aggregated across years 2 and 4 survey respondents. The table presents the Wilcoxon Signed Rank Test results.

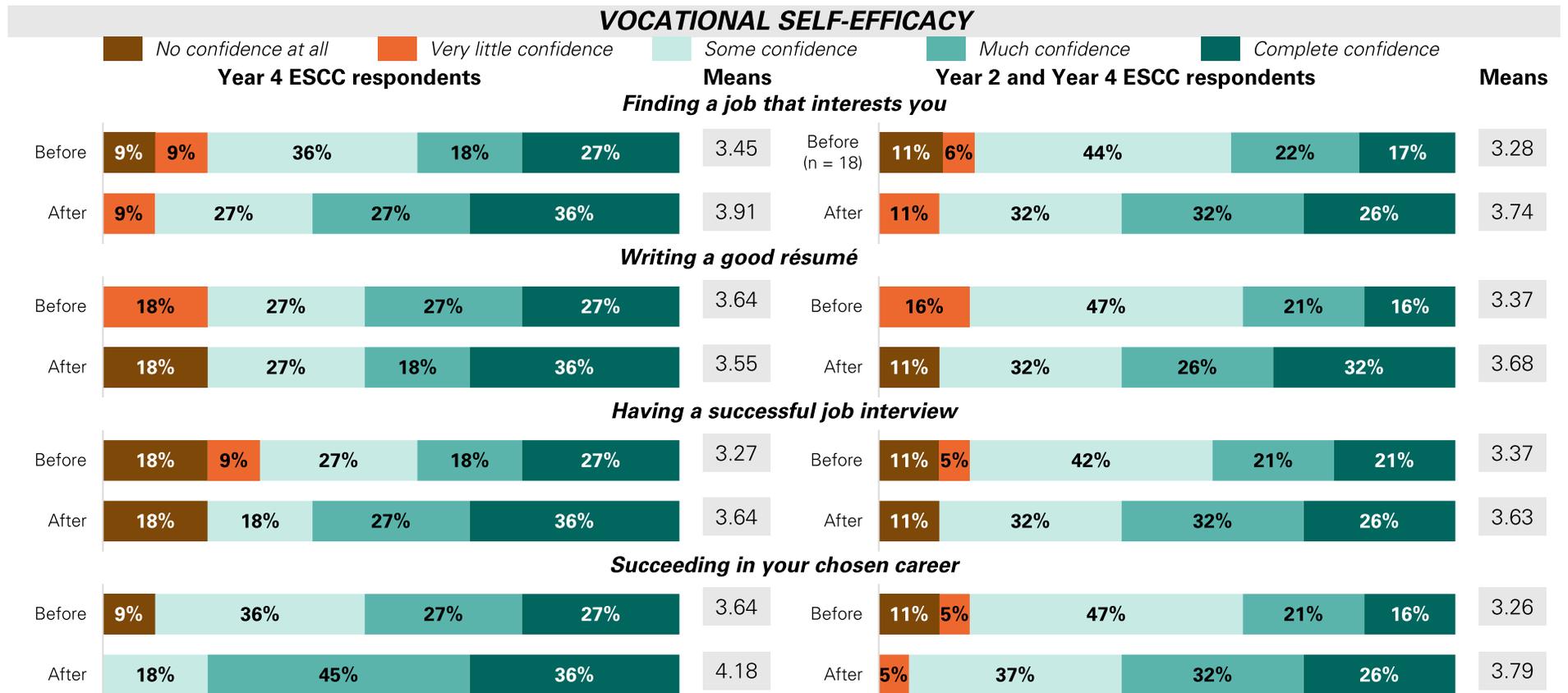
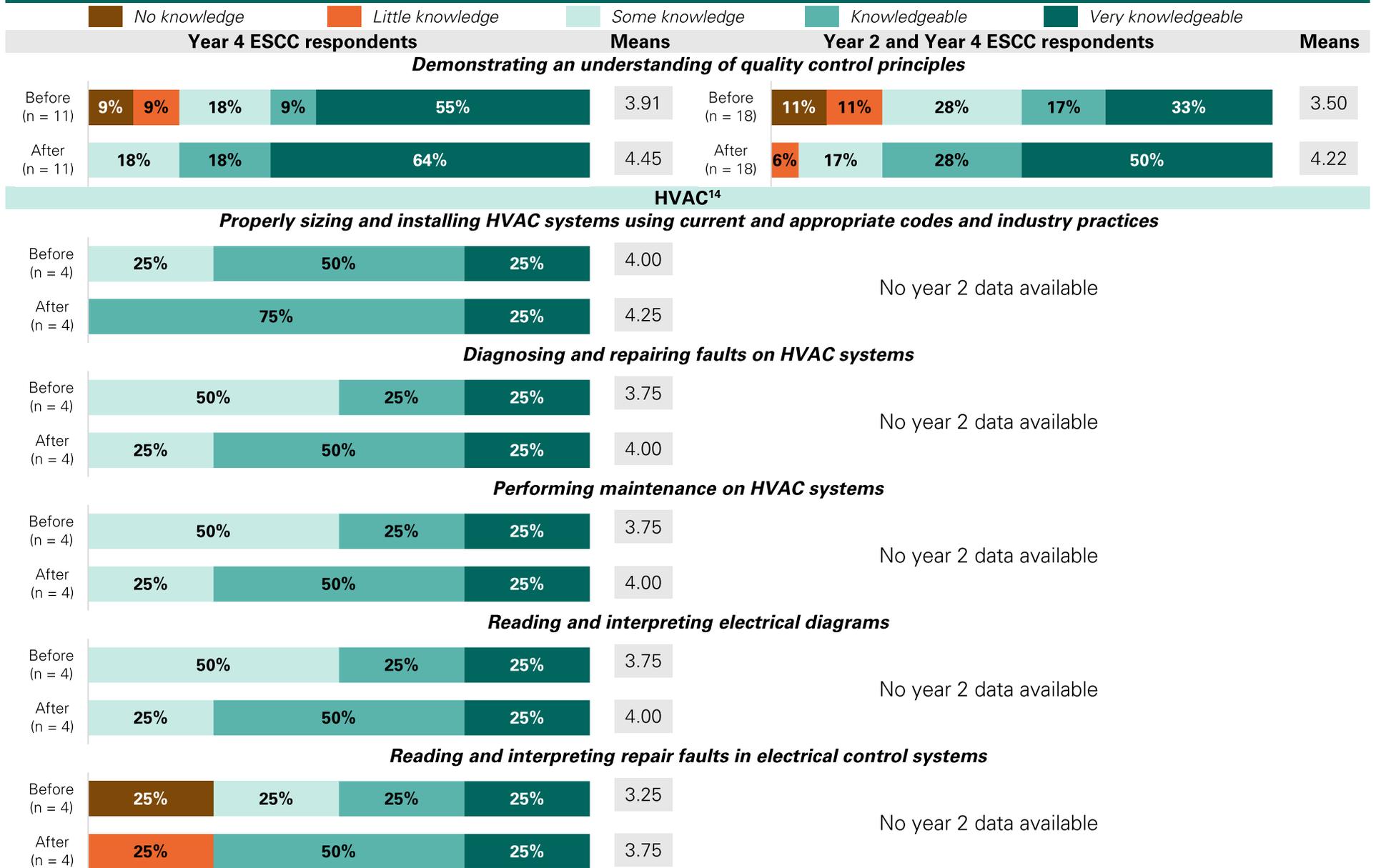


Figure 18. ESCC respondents' ratings of their vocational self-efficacy before and after participating in technical studies offerings in year 4 (n = 11).

Figure 19. All ESCC respondents' ratings of their vocational self-efficacy before and after participating in technical studies offerings in year 2 and year 4 (n = 19).

## TECHNICAL KNOWLEDGE



<sup>14</sup> There were no HVAC respondents in year 2

## TECHNICAL KNOWLEDGE

No knowledge    
  Little knowledge    
  Some knowledge    
  Knowledgeable    
  Very knowledgeable

**Year 4 ESCC respondents**

**Means**

**Year 2 and Year 4 ESCC respondents**

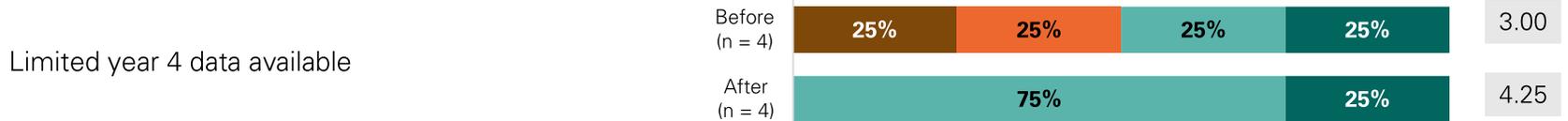
**Means**

### Electricity<sup>15</sup>

#### *Reading and interpreting electrical diagrams*



#### *Reading and interpreting repair faults in electrical control systems*



#### *Using electrical equipment safely and appropriately*



#### *Applying National Electrical Code to industrial and residential wiring*

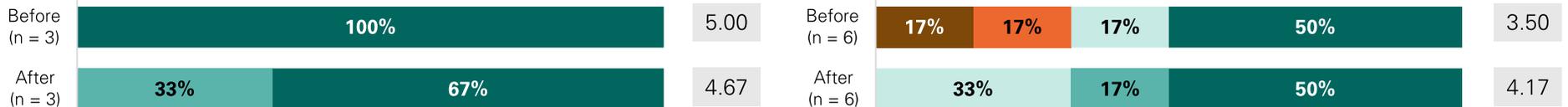


#### *Applying fundamental electrical theory to residential and industrial wiring practices*



### Industrial Technology

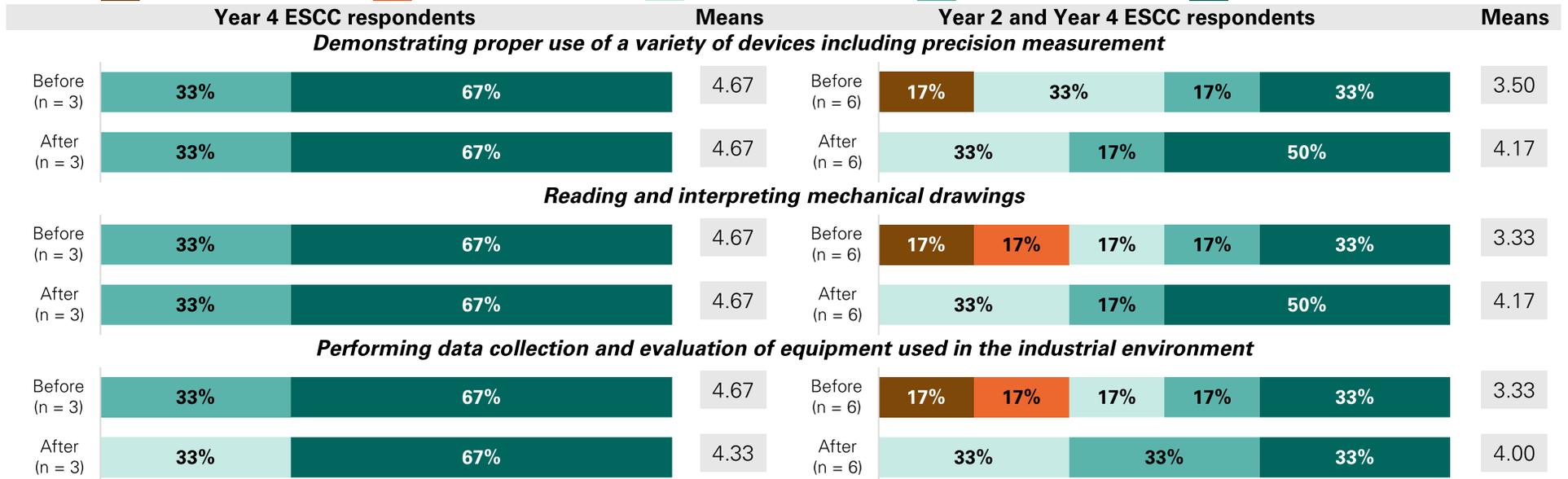
#### *Identifying typical tools*



<sup>15</sup> Only two ESCC respondents were electricity students in year 4.

## TECHNICAL KNOWLEDGE

No knowledge    
  Little knowledge    
  Some knowledge    
  Knowledgeable    
  Very knowledgeable



### Welding<sup>16</sup>

#### Demonstrating proficiency in the use of welding tools



#### Safely performing welding techniques using fillers, wires, fluxes, and gases



#### Reading and interpreting blueprints in the welding industry

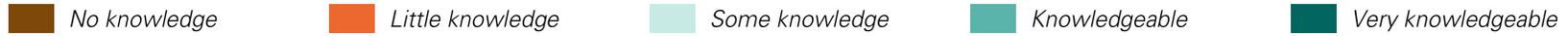


Figure 20. ESCC respondents' ratings of their technical knowledge before and after participating in technical studies offerings in year 4 (n = 10).

Figure 21. ESCC respondents' ratings of their technical knowledge before and after participating in technical studies offerings in year 2 and year 4 (n = 17).

<sup>16</sup> Only two ESCC respondents were welding students in year 4.

## STEM SKILLS



**Year 4 ESCC respondents**

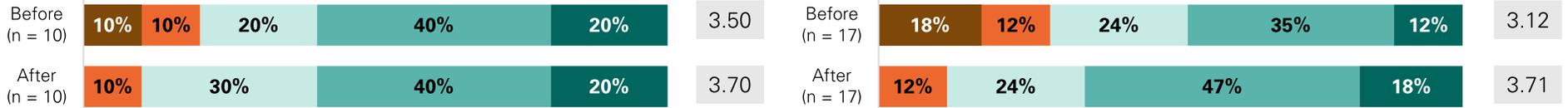
**Means**

**Year 2 and Year 4 ESCC respondents**

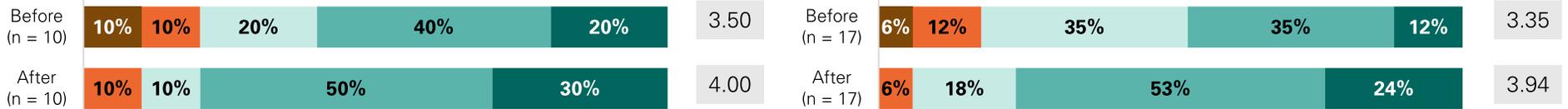
**Means**

### Critical Thinking

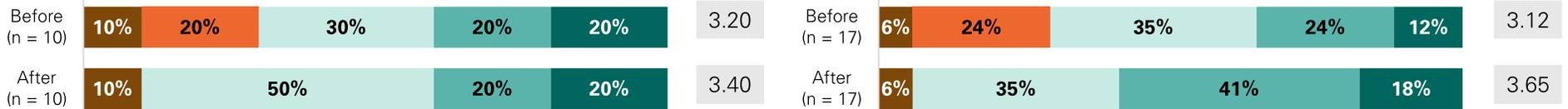
*Determining the credibility, accuracy, and reliability of conclusions drawn from the data*



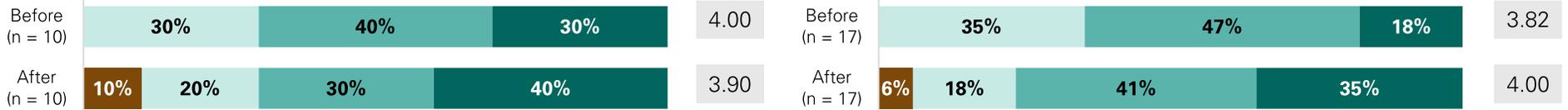
*Evaluating the strengths and relevance of arguments on a particular question or issue*



*Determining whether certain conclusions or consequences are supported by the information provided*

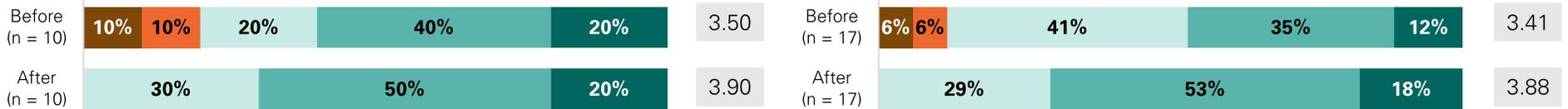


### Using problem solving skills

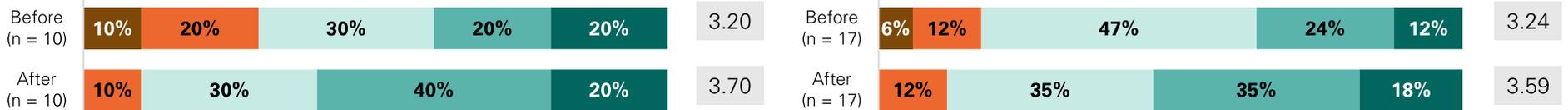


### Quantitative Reasoning

*Using logical and mathematical reasoning*



*Interpreting and using mathematical formulas*



## STEM SKILLS

No knowledge    
  Little knowledge    
  Some knowledge    
  Knowledgeable    
  Very knowledgeable

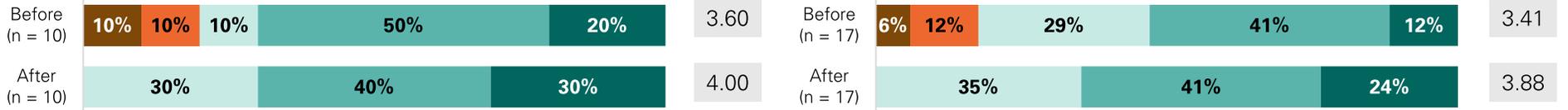
### Year 4 ESCC respondents

### Means

### Year 2 and Year 4 ESCC respondents

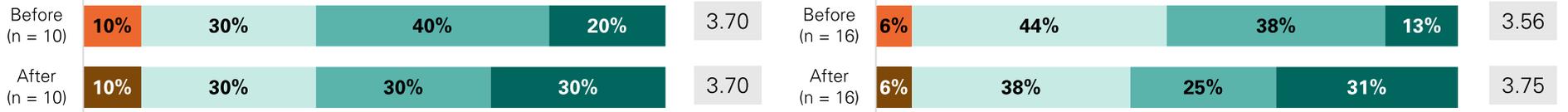
### Means

#### *Interpreting and using mathematical information numerically, symbolically, and visually (e.g., graphs, tables, and charts)*

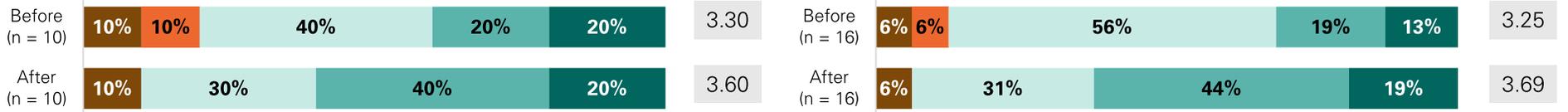


### Scientific Reasoning

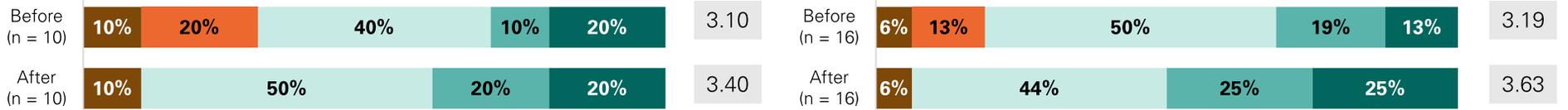
#### *Generating a logical argument*



#### *Distinguishing a scientific argument from a non-scientific argument*



#### *Distinguishing between causal and correlational relationships*



#### *Recognizing methods of inquiry (i.e., ways information is collected) that lead to scientific knowledge*

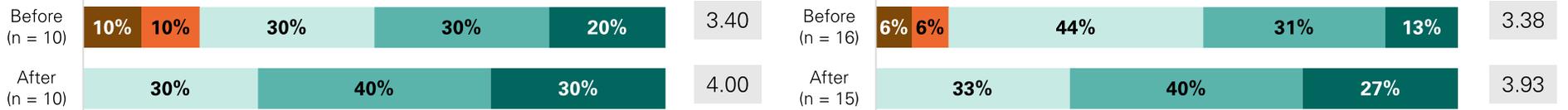


Figure 22. ESCC respondents' ratings of their STEM skills before and after participating in technical studies offerings in year 4 (n = 10).

Figure 23. ESCC respondents' ratings of their STEM skills before and after participating in technical studies offerings in year 2 and year 4 (n = 17).

Table 2. Significance tests for 5-point Likert-scale items regarding ESCC student respondents' vocational self-efficacy, technical knowledge, and STEM skills.

	Before participating in technical offerings			After participating in technical offerings			Mean Diff	Wilcoxon results	
	N	Mean	SD	N	Mean	SD		Z	Sig.
Vocational Self-efficacy									
Finding a job that interests you	18	3.28	1.18	19	3.74	0.99	0.46	-1.28	0.20

	Before participating in technical offerings			After participating in technical offerings			Mean Diff	Wilcoxon results	
	N	Mean	SD	N	Mean	SD		Z	Sig.
Writing a good résumé	19	3.37	0.96	19	3.68	1.25	0.32	-1.27	0.20
Having a successful job interview	19	3.37	1.21	19	3.63	1.21	0.26	-1.09	0.28
Succeeding in your chosen career	19	3.26	1.15	19	3.79	0.92	0.53	-1.56	0.12
<b>Technical knowledge</b>									
Demonstrating an understanding of quality control principles	18	3.50	1.38	18	4.22	0.94	0.72	-2.41	0.02
<b>STEM Skills</b>									
Critical Thinking									
Determining the credibility, accuracy, and reliability of conclusions drawn from the data	17	3.12	1.32	17	3.71	0.92	0.59	-1.58	0.11
Evaluating the strengths and relevance of arguments on a particular question or issue	17	3.35	1.06	17	3.94	0.83	0.59	-2.46	0.01
Determining whether certain conclusions or consequences are supported by the information provided	17	3.12	1.11	17	3.65	1.00	0.53	-1.98	0.05
Using problem solving skills	17	3.82	0.73	17	4.00	1.06	0.18	-0.83	0.41
Quantitative Reasoning									
Using logical and mathematical reasoning	17	3.41	1.00	17	3.88	0.70	0.47	-2.27	0.02
Interpreting and using mathematical formulas	17	3.24	1.03	17	3.59	0.94	0.35	-1.30	0.19
Interpreting and using mathematical information numerically, symbolically, and visually (e.g., graphs, tables, and charts)	17	3.41	1.06	17	3.88	0.78	0.47	-1.51	0.13
Scientific Reasoning									
Generating a logical argument	16	3.56	0.81	16	3.75	1.13	0.19	-1.13	0.26
Distinguishing a scientific argument from a non-scientific argument	16	3.25	1.00	16	3.69	1.01	0.44	-2.07	0.04
Distinguishing between causal and correlational relationships	16	3.19	1.05	16	3.63	1.09	0.44	-1.89	0.06
Recognizing methods of inquiry (i.e., ways information is collected) that lead to scientific knowledge	16	3.38	1.02	15	3.93	0.80	0.56	-1.84	0.07

### Year 4 ESCC Respondents' Educational Plans

These charts present student data related to year 4 ESCC respondents' educational plans.

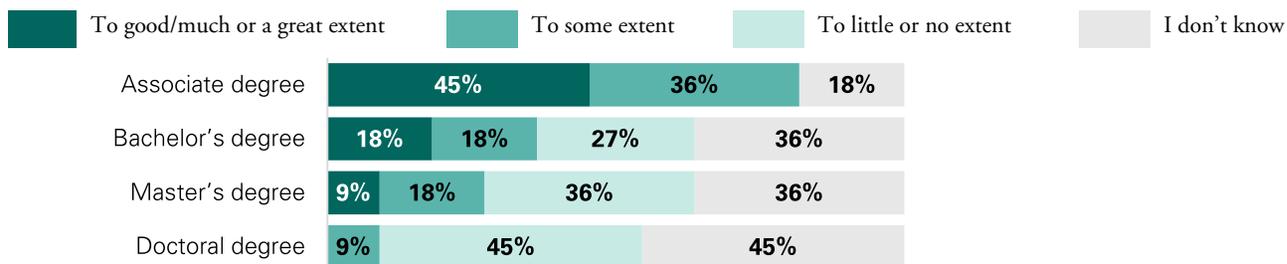


Figure 24. Likelihood that year 4 dual enrollment respondents will pursue future educational opportunities (n = 19)

**Note.** The scale was 1 = to no extent, 2 = to little extent, 3 = to some extent, 4 = to good/much extent, and 5 = to a great extent.