Northern Virginia Community College DCO Tech Project: Year 2 Evaluation Interim Report

June 29, 2023

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ACKNOWLEDGEMENTS

Magnolia Consulting appreciates the opportunity to conduct the external evaluation of Northern Virginia Community College's DCO Tech project. We want to thank the project team for their collaborative approach to the evaluation. We also want to thank the students, educators, and industry partners who completed evaluation surveys. Last, we want to thank the Magnolia team members who supported this work.

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Preferred citation: Gruber, J. A. (2023). *Northern Virginia Community College DCO Tech Project: Year 2 Evaluation Interim Report.* Magnolia Consulting, LLC.

EXECUTIVE SUMMARY

Evaluation: Treatment-only design with mixed methods and formative and summative components to determine how the DCO Tech project is implemented and its associated outcomes.

Data Collection: Progress tracker, surveys, document review

Participants: Bridge program participants (11th–12th grade students), externship participants (K–12 professionals), industry partners

The DCO Tech project team contracted with Magnolia Consulting to conduct an external evaluation of the project. This interim report includes evaluation findings through June 2023. Below are some of the key findings and a sample of associated recommendations.

The DCO Tech project aims to improve the pipeline of students prepared to enter the engineering technology (ET) workforce, including data center operations (DCO).

To achieve this goal, the DCO Tech project provides the following:

1. Summer Bridge Program for high school students
2. Internship Preparation Program for ET students to prepare for careers
3. K–12 Externship Program for educators to raise awareness of ET careers
4. Industry Externship Program for industry professionals to engage in ET education
5. Veteran Outreach Program to inform veterans of ET career pathways

Key Findings	Recommendations
Students rated the Summer Bridge Program positively and reported increased understanding of ET and DCO training and careers, workplace safety, and college success skills. Students requested more hands-on activities.	Consider continuing to provide—and potentially increase—the number of hands-on activities (e.g., tours, networking activities, group activities) for the program.
The project team modified the Internship Preparation Program to capitalize on existing Northern Virginia Community College programs. Recruitment continues to be a barrier.	Consider offering 1–2 workshops that relate to career preparation alongside the opportunity to participate in tours.
The project team modified the Industry Externship Program to focus on deepening relationships with existing partners. Industry partners indicated they were confident in providing tours, but additional information helps them feel more confident.	As feasible, consider sharing additional background information about the interests and knowledge of attendees with industry partners providing tours.
Educators provided positive perceptions of the K–12 Externship Program and indicated increased awareness of ET and DCO opportunities and confidence in guiding students after the program. Educators noted limited institutional capacity to disseminate information about ET and DCO.	If feasible, consider generating PowerPoints, information packets, or flyers for educators to use to disseminate information about ET and DCO pathways and careers to colleagues, students, and families.
The project team shared NOVA DCO and ET opportunities for veterans through presentations, events, and a podcast.	Consider capturing the number of veterans engaged in outreach activities.

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INTRODUCTION

The DCO Tech project team contracted with Magnolia Consulting—a woman-owned, small business specializing in research and evaluation—to conduct an external evaluation of the project. The project evaluation includes annual interim reports, with a final report due in June 2024. This interim report includes evaluation findings through June 2023. Because most DCO Tech project activities occur in the summer, the findings in this report largely relate to the first year (July 2021–June 2022) of the project.

Project Background

With funding from the National Science Foundation's Advanced Technological Education (NSF-ATE) program, Northern Virginia Community College (NOVA) developed the Data Center Operations and Engineering Technicians Outreach and Development (DCO Tech) project. The DCO Tech project aims to improve the pipeline of students prepared to enter the workforce as technicians for engineering technology (ET), which includes data center operations (DCO). To achieve this goal, the DCO Tech project provides (1) a Summer Bridge Program for high school students, (2) an Internship Preparation Program for ET students, (3) a K–12 Externship Program for secondary teachers and administrators to develop knowledge of ET, (4) an Industry Externship Program for industry professionals to engage in ET education, and (5) a Veteran Outreach Program to inform veterans of careers in ET. Through these key activities, the DCO Tech project aims to increase the number and depth of partnerships with local industry and education partners to support activities that prepare students to enter the ET and DCO workforce.

MAIN ACTIVITIES

VETERAN OUTREACH PROGRAM

Duration: Discrete events
Dates: Year-round
Participants: Veterans

Develop and implement an outreach program to inform veterans of ET and DCO career pathways.

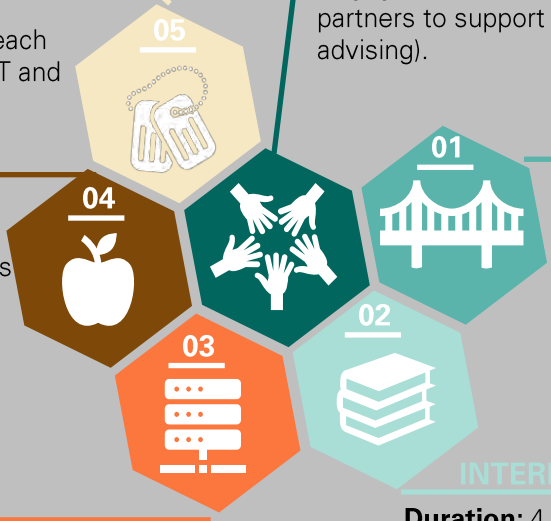
PARTNERSHIPS

Engage local industry and K–12 education partners to support project activities (e.g., advising).

K–12 EXTERNSHIP

Duration: 4 days
Dates: Spring-Summer
Participants: 10 secondary educators

Design and implement an externship for K–12 educators to learn about ET and DCO career pathways and engage with industry partners.



SUMMER BRIDGE PROGRAM

Duration: 10 days
Dates: Summer
Participants: 16 high school juniors and seniors

Plan and coordinate a two-week summer program to introduce high school students to ET and DCO careers and pathways.

INDUSTRY EXTERNSHIP

Duration: 4 days
Dates: Summer
Participants: 6 industry professionals

Design and implement an externship for industry professionals to engage in higher education and connect with students.

INTERNSHIP PREPARATION PROGRAM

Duration: 4 days
Dates: Spring
Participants: 16 current NOVA ET students

Incentivize and support current NOVA ET students' participation in career readiness workshops and provide tours of local industry partners.

Project Evaluation Design, Purpose, and Methods

Magnolia evaluators developed an evaluation plan that aligns with the DCO Tech project's goal to improve the pipeline of students prepared to enter the ET and DCO workforce. The evaluation is a non-experimental, treatment-only design and includes mixed-methods approaches (i.e., quantitative and qualitative data collection and analysis) with formative and summative components. The formative component includes methods that assess the extent to which the project is implemented as planned and identify areas of strength and areas for improvement for the project. The summative component includes methods that assess the extent to which the project is achieving its intended outcomes. The evaluation matrix—which includes the evaluation questions, methods, and data collection timelines—is presented in Appendix A.

Evaluation Questions

This interim report focuses on the following formative evaluation questions:

1. To what extent does the project team implement the DCO Tech programs as planned? What factors strengthen or impede the implementation of DCO Tech activities? What modifications were made to the DCO Tech activities?
2. How does the project develop and progress regarding the intended number and nature of participants in the DCO Tech programs?
3. What are stakeholders' perceptions of the quality of DCO Tech programs in supporting interest and pathways to careers in the data center operations or engineering technology industry?
4. How can the DCO Tech programs be improved to foster interest and engagement?

This interim report also focuses on the following summative evaluation questions:

1. To what extent do participating DCO Tech students report improvement in their knowledge, skills, and interest with respect to data center operations or engineering technology careers?
2. To what extent does the externship program improve educators' perceptions and awareness of DCO and ET careers and their preparedness to support students in this field?

Data Collection

Magnolia evaluators utilize mixed methods to evaluate the DCO Tech project, collecting both quantitative and qualitative data. In this report, data collection measures and participants include:

Project Benchmark Tracker (Quarterly). To benchmark progress toward meeting project outcomes, evaluators use Google Sheets to develop a spreadsheet that tracks project tasks, activities, timelines, and key participant outcomes. Evaluators and the project team update the spreadsheet periodically using data from various sources. This spreadsheet is used for informal reporting and for reflection on project progress during quarterly calls.

Document Review (Annual). To understand project implementation, including project modifications, evaluators review important project documents (e.g., recruitment materials) shared by the project team and meeting minutes.

Summer Bridge Program Surveys (Annual). Following the Summer Bridge Program, evaluators administer a retrospective pretest to assess students' perceived changes in their knowledge and skills in ET and DCO. This survey also includes questions about students' perceptions of the quality of the program and their engagement. Twenty students participated in the 2022 program, and 15 responded to the survey, for a 75% response rate.

K–12 Externship Program Surveys (Annual). Following the externship program, participants complete a survey so evaluators can better understand their perceptions of the program and its impact on their ability to help guide students to careers in ET or their capacity to design educational activities in this field. Eighteen educators participated in some aspect of the externship, and 16 provided survey data, for an 89% response rate.

Industry Partner Surveys (Annual). Industry partners who support the DCO Tech project by offering tours completed a survey regarding their awareness and knowledge of ET and DCO educational pathways (broadly and at NOVA) and their confidence in offering tours. The project team sent the survey to seven organizations. Eight industry partners from four organizations (57%) responded to the survey.

Data Analysis

Evaluators analyzed quantitative and qualitative data to generate the findings presented in this report.

Quantitative Data. Evaluators analyzed close-ended survey items by calculating frequencies and means for each item. For retrospective pre–post outcomes where respondents provided ratings for before and after a program, evaluators used paired samples *t*-tests to determine whether the mean difference between the two sets of ratings was statistically significant.[1]

Qualitative Data. Evaluators conducted a content analysis of the open-ended survey items, using the overall survey purpose and questions to provide context and understand the responses (Forman & Damschroder, 2008; LaDonna et al., 2018).

[1] Some research indicates *t*-tests yield more accurate results for Likert scale data and small samples compared to other nonparametric approaches, such as Wilcoxon Signed-Rank tests (Meek et al., 2017).

SUMMER BRIDGE PROGRAM FINDINGS

The DCO Tech Summer Bridge Program offers high school juniors and seniors an introduction to ET and DCO by experienced professionals in the field. Current NOVA professors serve as instructors. In the program, students participate in a college-accredited course, SDV 101: Orientation to Engineering Technology, which introduces them to college success skills with an emphasis on ET. Students who earn the Occupational Safety and Health Administration (OSHA) 10 certification receive credit for SAF130: Industrial Safety.

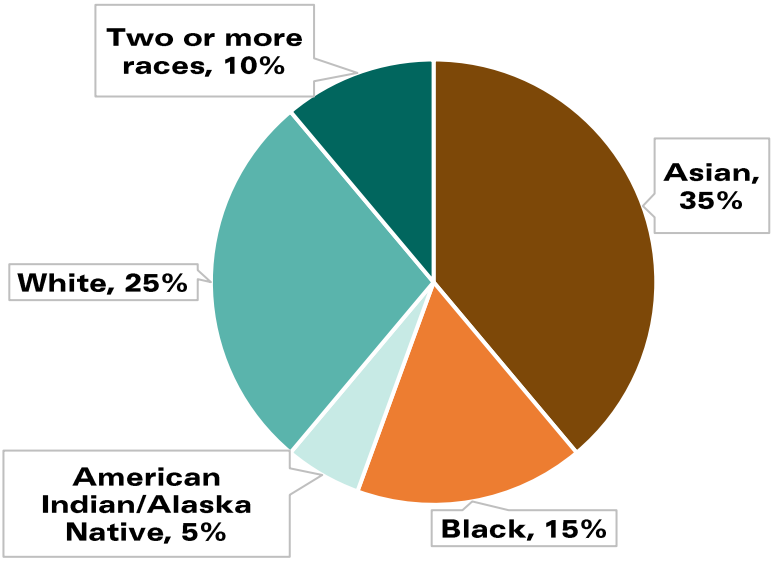
The first Summer Bridge Program took place on June 21 through June 30, 2022. Week 1 of the program was conducted at NOVA's Manassas Fab Lab and covered the basics of the ET career field and NOVA curriculum. The first week ended with a tour of Micron Technology, where students saw ET professionals at work. Week 2 took place at the NOVA Loudoun Data Center Lab and included a tour of STACK Infrastructure, where instructors introduced students to the specialty field of DCO. At the end of the week, students gave a short presentation on what they had learned about the ET field, including the benefits of an ET career and the necessary education that NOVA offers to prepare them for an ET career.

As of this report, 40 students are registered to participate in the second Summer Bridge Program. The 2023 Summer Bridge Program will have two sessions. The agendas for each session are presented in Appendix B. The first session is scheduled for June 20–29 and the second for July 17–28. Because the 2023 Summer Bridge Program is ongoing, this section of the report includes evaluation findings for only the 2022 Summer Bridge Program.

Participants in the 2022 Summer Bridge Program

Twenty high school students participated in the 2022 Summer Bridge Program. Overall, 10 students (50%) were from groups that are underrepresented in science, technology, engineering, and math (STEM): women, Hispanic or Latino, and/or Black (Figure 1).

Figure 1. Demographics of 2022 Summer Bridge Program Participants



- **14 students (70%) were in 11th grade, and 6 (30%) were in 12th grade.**
- **14 students (70%) were male, and 6 (30%) were female.**
- **3 students (15%) identified as Hispanic or Latino.**

Student Perceptions of the 2022 Summer Bridge Program

After participating in the Summer Bridge Program, 15 students completed a survey that included questions related to their perceptions of the program and their engagement.

Students primarily chose to participate in the Summer Bridge Program to learn more about engineering

When students were asked why they chose to participate and what they hoped to gain, they shared they wanted to:

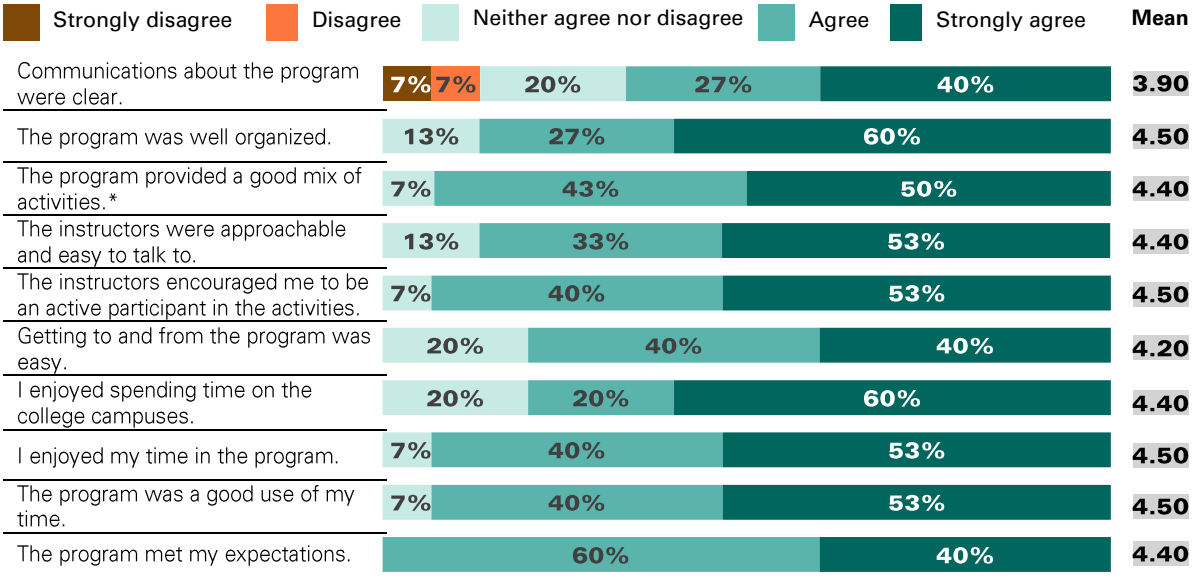
- Gain an understanding of engineering or engineering technology (*n* = 13)[2]
- Explore or clarify their major or career path (*n* = 3)
- Have a fun experience (*n* = 2)
- Learn more about computer science (*n* = 2)
- Visit Micron Technology (*n* = 1)
- Get an idea of a daily schedule for college students (*n* = 1)

> ***"I was interested to see what the field offers. Safe to say, I was not disappointed."***
>
> **—Bridge participant**

Most students rated the delivery of the Summer Bridge Program positively and enjoyed their time in the program

Most students provided positive feedback on the delivery of the Summer Bridge Program (Figure 2), although three students *neither agreed nor disagreed*, one student *disagreed*, and one student *strongly disagreed* that communications about the program were clear. All students indicated the program met their expectations.

Figure 2. Students' ratings of the delivery and enjoyment of the Summer Bridge Program (*n* = 15)



Note. *n* = 14. Totals may not add to 100% due to rounding. Some items may be abbreviated.

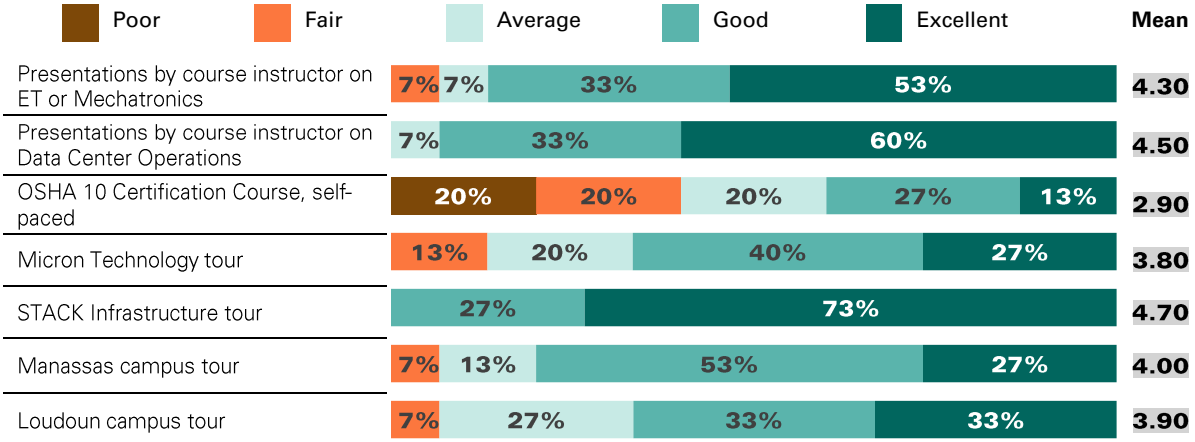
[2] In their responses, students often referenced engineering broadly. Students might not have understood the difference or used the term engineering to encompass engineering technology.

Students rated the quality of most Summer Bridge Program components positively, in particular the STACK Infrastructure Tour

When asked to rate the quality of different components of the Summer Bridge Program, students provided mostly positive feedback (Figure 3). All students rated the STACK Infrastructure tour as *good* or *excellent*, whereas two thirds of students rated the Micron Technology and Loudoun campus tours as *good* or *excellent*. Most students rated the course instructor presentations as *good* or *excellent*. Fewer students rated the OSHA 10 certification course as *good* or *excellent* relative to the other components of the program.

> ***"I enjoyed the trip to STACK Infrastructure data center. I learned a great deal about why data centers are important."***
>
> **—Bridge participant**

Figure 3. Students' ratings of the quality of the Summer Bridge Program components (n = 15)

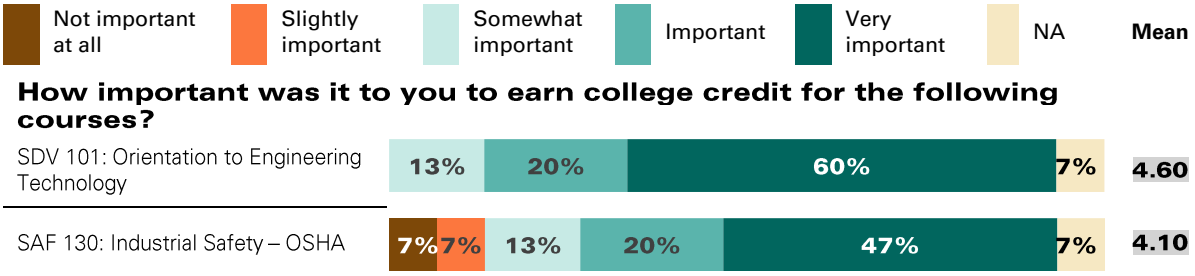


Note. Totals may not add to 100% due to rounding. Some items may be abbreviated.

Most students indicated it was important to earn college credit for SDV 101 for their participation in the Summer Bridge Program

Students had the opportunity to earn college credit for two courses during the Summer Bridge Program—SDV 101: Orientation to Engineering Technology, and SAF 130: Industrial Safety – OSHA. Overall, students' ratings suggest they thought it was more important to earn college credit for SDV 101 than for SAF 130 (Figure 4).

Figure 4. Students' ratings of the importance of earning college credit for courses (n = 15)



Note. Totals may not add to 100% due to rounding. Some items may be abbreviated. NA response indicates a student did not take the course for college credit.

All students reported they would recommend the Summer Bridge Program to a friend, and students reported enjoying the hands-on activities

All students reported they would recommend the Summer Bridge Program to a friend. In addition, students provided positive feedback when asked what they enjoyed about the program.

100% of students would recommend the program to a friend.

Specifically, students reported enjoying:

- The hands-on activities (*n* = 10)
  - In particular, the tours of Micron Technology and STACK Infrastructure (*n* = 5)
- Learning new things (*n* = 8)
- The people and making new friends (*n* = 7)

> ***"I really enjoyed building connections and understanding the different fields of STEM. I never understood data centers in this depth."***
>
> **—Bridge participant**

Students reported that more hands-on activities could improve the Summer Bridge Program

When asked for feedback on how to improve the Summer Bridge Program for future students, some students suggested including more hands-on activities (*n* = 6). Three students said they would not change anything and provided additional positive feedback about the program.

Some students shared additional recommendations:

- Have the program be a longer duration (e.g., have a summer and fall course; *n* = 1)
- Clarify communications around where the classes are held (*n* = 1)
- Consider providing free meals to students (*n* = 1)
- Have slides available for students to access after lectures (*n* = 1)
- Promote the program, especially for underrepresented students (*n* = 1)

Student Outcomes of the 2022 Summer Bridge Program

The 2022 Summer Bridge Program survey also included questions to assess students' perceptions regarding the following outcomes:

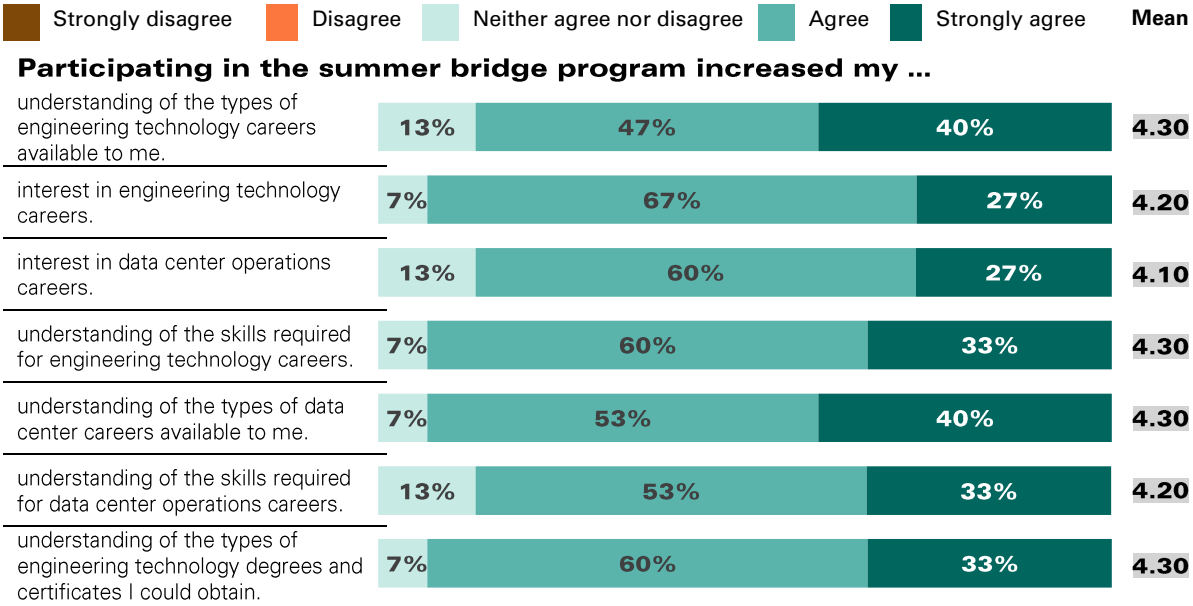
- Their understanding and interest in ET and DCO career pathways
- Their understanding of workplace safety and college success skills
- What they learned most from the Summer Bridge Program
- The likelihood they would go on to pursue an ET degree at NOVA

Additionally, the DCO Tech project team provided evaluators with data on whether 12th grade Summer Bridge Program participants went on to pursue an ET degree at NOVA.

Most students indicated the Summer Bridge Program increased their understanding of or interest in ET and DCO training and careers

When asked to rate the impact of their participation in the Summer Bridge Program, most students indicated their participation increased their understanding of and interest in ET and DCO training and career opportunities (Figure 5).

Figure 5. Students' feedback on the impact of the Summer Bridge Program (n = 15)



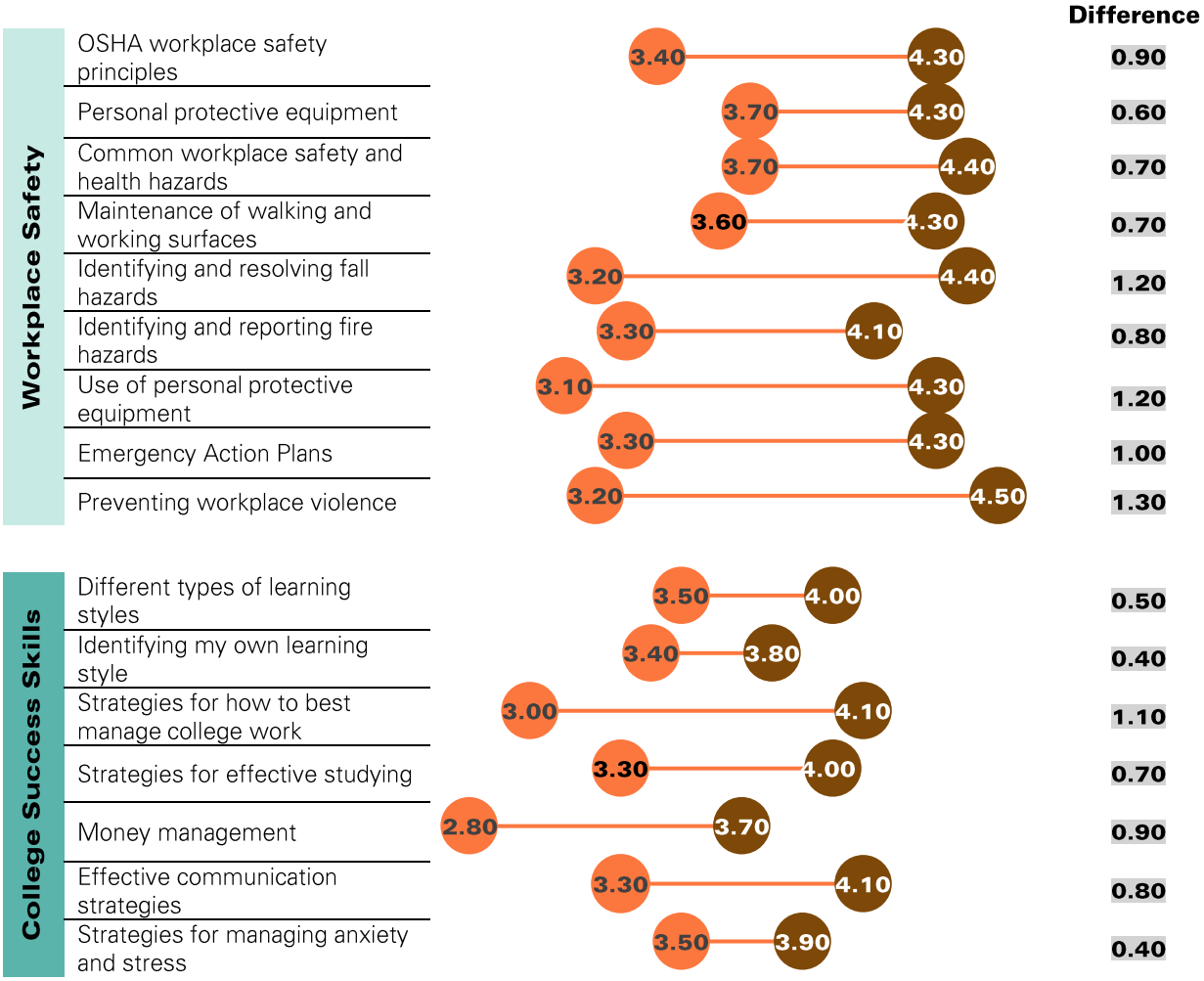
Note. Totals may not add to 100% due to rounding. Some items may be abbreviated.

Students reported greater understanding of workplace safety and college success skills after participating in the Summer Bridge Program relative to before

Students' average ratings of their understanding of workplace safety were higher after the Summer Bridge Program relative to before (Figure 6). The largest mean differences in ratings before and after participation were for preventing workplace violence ($M_{difference}$ = 1.30), use of personal protective equipment ($M_{difference}$ = 1.20), and identifying and resolving fall hazards ($M_{difference}$ = 1.20). Further, a paired samples t-test indicated that students' overall average ratings of their understanding of workplace safety after the program (M = 4.33, SD = 0.51) were statistically significantly higher than before the program (M = 3.93, SD = 0.91; $t(14) = 3.76$, $p < .01$, Cohen's d = 1.21).

Students' average ratings of their understanding of college success skills were also higher after the Summer Bridge Program relative to before. The largest mean difference in ratings before and after participation was for managing college work ($M_{difference}$ = 1.10). Further, a paired samples t-test indicated that students' overall average ratings of their understanding of college success skills after the program (M = 3.93, SD = 0.86) were statistically significantly higher than before the program (M = 3.26, SD = 0.71; $t(14) = 3.57$, $p < .01$, Cohen's d = 0.85).

Figure 6. Student's ratings of understanding of workplace safety and college success skills **before** and **after** participating in the Summer Bridge Program (*n* = 15)



Note. Scale: 1 = No understanding, 2 = A little understanding, 3 = Some understanding, 4 = A good understanding, 5 = A great understanding.

Students reported their greatest learning to be about operating a data center

Several students referenced their greatest learning to be about data center operations, broadly (*n* = 6). More specifically within DCO, students reported their greatest learnings to be about:

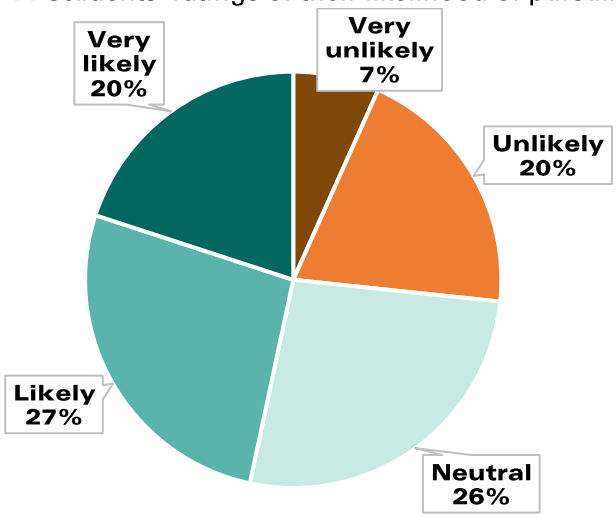
- The refrigeration cycle (*n* = 5)
- Fiber and copper cables (*n* = 2)
- Powering a data center (*n* = 2)
- Transformers and generators (*n* = 1)
- Business operations of a data center (*n* = 1)

In addition, one student noted their greatest learning was about ET career opportunities.

Nearly half of students indicated they would likely pursue an ET degree at NOVA

When asked how likely they were to pursue an ET degree at NOVA, students offered mixed responses (Figure 7). Nearly half indicated they were *likely* or *very likely* to do so, over a quarter indicated they were *neutral*, and over a quarter indicated they were *unlikely* or *very unlikely* to.

Figure 7. Students' ratings of their likelihood of pursuing an ET degree at NOVA (*n* = 15)



All 12th grade student participants went on to enroll in NOVA in related programs

All 12th grade student participants (*n* = 6) enrolled in engineering, computer science, or information technology programs at NOVA for the 2022–23 school year. No students have enrolled in NOVA DCO or ET programs yet.

INTERNSHIP PREPARATION PROGRAM FINDINGS

The Internship Preparation Program is a four-day program to prepare current ET students at NOVA for internships by providing support with resumes, interviewing and networking, and knowledge of the ET industry. The DCO Tech project team intended for 16 current NOVA ET students to complete career-readiness workshops and activities in the following categories each year:

- Resume and cover letter writing
- Interview preparation
- LinkedIn profile development
- Internship search strategies
- Networking; professionalism in the workplace
- Career and job expectations
- Communication, teamwork, and problem-solving; salary negotiation
- Diversity in the workplace
- Ethics and organizational culture
- Careers and co-ops
- Industry certifications
- Security clearances

The project team modified the Internship Preparation Program such that the workshops leveraged the already existing Career Readiness and Leadership Institute (CLRI) program, with additional industry tours for students in the Internship Preparation Program. To recruit students for the Internship Preparation Program, the DCO Tech project coordinator conducted classroom visits and recruited via the DCO Tech project website.

In spring 2022, the Internship Preparation Program took place with three ET student participants. In spring 2023, seven ET students participated. Participating students completed the workshop series through CLRI and joined tours of data centers. Upon completion of the Internship Preparation Program components, students received a stipend for their participation. The project team noted that a major challenge to recruiting current NOVA ET students was that many applicants to the Internship Preparation Program were not in ET programs. The team is also planning additional career preparation support for ET students. Specifically, in fall 2024 they will offer a program for ET students on how to integrate skills into their resumes.

The project team developed a pre–post survey for internship participants about perceived career readiness and knowledge of ET career pathway resources. Because of the small number of participants, Magnolia evaluators will aggregate these survey findings in the final report to increase the sample size and maintain student anonymity.

INDUSTRY EXTERNSHIP PROGRAM FINDINGS

The DCO Tech project team intended for the Industry Externship Program to be a four-day program with six industry professionals from the ET and DCO fields. Industry professionals would attend a series of virtual presentations on NOVA's information and engineering technologies (IET) and ET programs, the responsibilities and credentials of NOVA adjunct professors, and the DCO side of NOVA's IET program. Participants would end the program with an in-person tour of the Manassas Fab Lab and teach a brief lesson during the Summer Bridge Program.

For first year of the project, the project team intended for the Industry Externship Program to run from April 2022 through June 2022. The project team designed marketing materials for recruiting industry professionals (see Appendix C), emailed them to their industry contacts, and posted them in local industry workplaces. Despite these efforts, only three individuals reached out about the externship. The project team decided to postpone this component of the project.

For the second project year, the project team adapted the Industry Externship Program to focus on their current industry partners. Specifically, the project team engaged with representatives at organizations that offer tours for the DCO Tech project. Magnolia evaluators developed a pre- and post-tour survey that included questions about industry partners' awareness of educational pathways for ET and DCO careers and their confidence to administer tours. The project team administered the pre-tour survey in spring 2023 and used the findings to inform one-on-one meetings with these partners to share information related to ET and DCO educational pathways. As of June 2023, project team is administering the post-tour survey, which also includes questions about partners' perceptions of these one-on-one meetings. As such, this section of the report includes only the pre-tour survey findings.

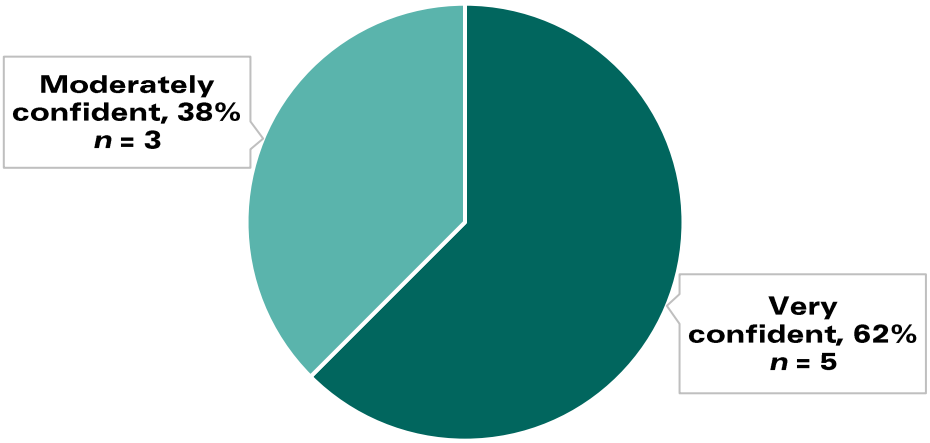
Industry Partner Survey Findings

Eight individuals provided complete responses to the survey, representing STACK Infrastructure (n = 3), QTS Data Center (n = 3), Lockheed Martin (n = 1), and Iron Mountain Data Center (n = 1). The individuals' roles at their organizations varied, with representation from individuals in leadership roles (e.g., vice president of operations), management roles (e.g., operations manager, site manager, project manager), and marketing or relationship roles (e.g., director of academic and community relations).

All industry partners rated themselves as moderately to very confident to provide tours of their organization

When asked to rate their confidence in providing tours to youth and adults who may not know anything about ET or DCO, all industry partners rated themselves as *moderately* to *very confident* (Figure 8).

Figure 8. Industry partners' ratings of their confidence providing tours (*n* = 8)



When asked to explain their ratings, industry partners shared that they and/or their organizations have:

- Extensive experience providing tours to individuals from various backgrounds (*n* = 4)
- Vast knowledge of the field and of mentoring and training recent high school graduates, as well as familiarity with NOVA programs (*n* = 1)
- Familiarity with data centers (*n* = 1)

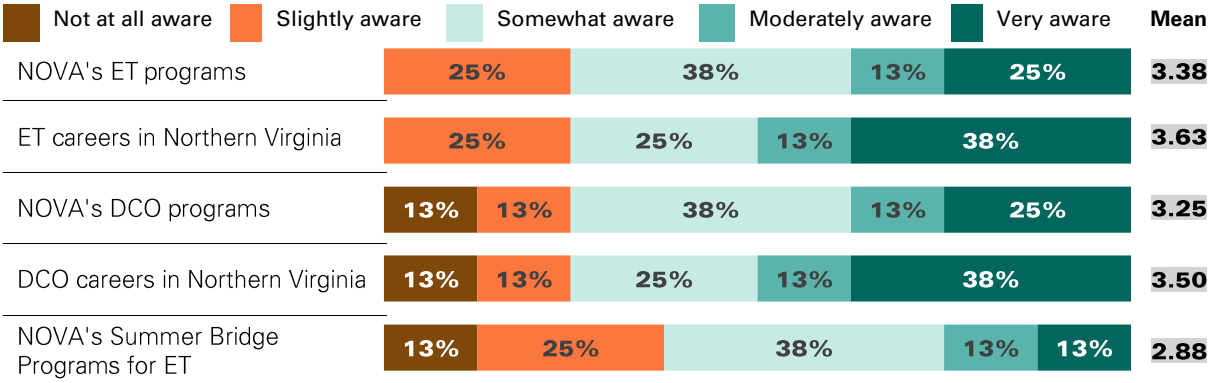
When asked what, if anything, would help them feel more confident in providing tours, industry partners shared the following:

- Additional information on the goals and attendees (*n* = 3)
    - Specifically, information on the main goals of the tour (e.g., networking, career opportunities), the career pathways attendees are most interested in learning about, and the backgrounds of attendees
- Sufficient time for questions (*n* = 1)
- Learning the specific norms and rules of providing a tour at their site because they are somewhat new to their organization (*n* = 1)

Industry partners' awareness of ET and DCO programs and careers in Northern Virginia varied

Over half of industry partners indicated they were *somewhat* to *very aware* of NOVA's ET and DCO programs and ET and DCO careers in Northern Virginia (Figure 9). Some industry partners indicated they were *slightly aware* of NOVA's ET (*n* = 2), DCO (*n* = 1), and Summer Bridge (*n* = 2) programs. One industry partner indicated they were *not at all aware* of NOVA's DCO programs, DCO careers in Northern Virginia, or NOVA's Summer Bridge Program.

Figure 9. Industry partners' awareness of ET and DCO programs and careers ($n = 8$)

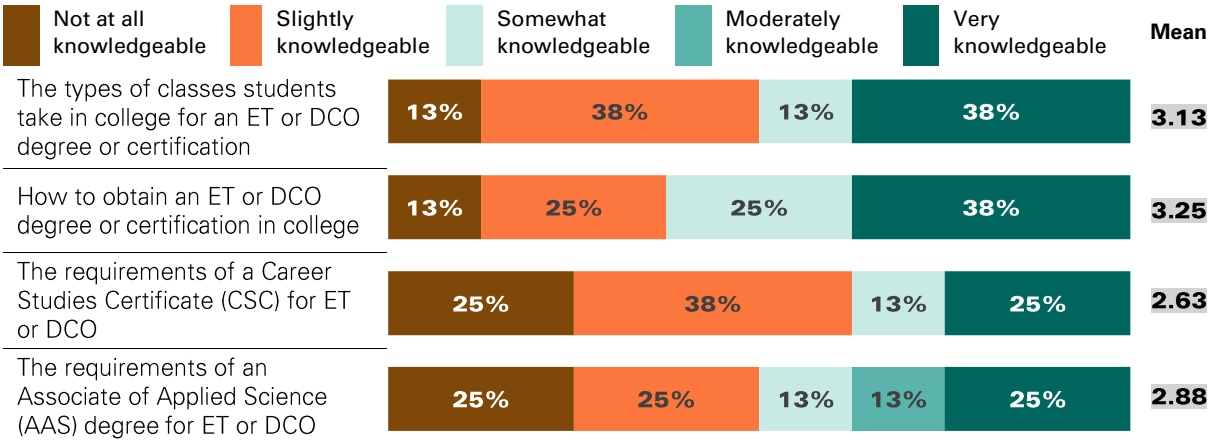


Note. Totals may not add to 100% due to rounding. Some items may be abbreviated.

Industry partners' reported knowledge of ET and DCO educational requirements varied

Five industry partners indicated they were *not at all* or *slightly knowledgeable* about the requirements of a Career Studies Certificate (CSC) for ET or DCO (Figure 10). Half of industry partners indicated they were *not at all* or *slightly knowledgeable* about the types of classes students take in college and the requirements of an Associate of Applied Science (AAS) degree for ET or DCO.

Figure 10. Industry partners' knowledge of ET and DCO educational requirements ($n = 8$)



Note. Totals may not add to 100% due to rounding. Some items may be abbreviated.

Three quarters of industry partners indicated they did not know the difference between requirements for a CSC and AAS degree for ET or DCO

Industry partners indicated whether they knew the difference between the requirements for a CSC and an AAS degree for ET or DCO. The CSC is a one-year program, and the AAS degree is a two-year program.

Six industry partners (75%) responded *no*. Two industry partners (25%) who responded *yes* shared the following:

- "The CSC, although accredited, is designed not to transfer and for students to be able to get through the program quickly (9 months or so). It can also be used for career switchers that already have a degree. The AAS is used for students looking to get a full two-year associates degree. This can take two or more years to complete and has to meet the state requirements for graduation."
- "The AAS is a two-year associates degree program whereas the certificate program is a shorter program that is designed to get your foot into the industry."

Half of industry partners indicated they knew which NOVA campuses have facilities supporting ET or DCO programs

Industry partners also indicated whether they knew which NOVA campuses have facilities supporting ET or DCO programs. Currently, ET programs are located at the Manassas campus, and DCO programs are at the Loudoun campus.

Four industry partners (50%) responded *no*. Four industry partners (50%) who responded *yes* shared the following:

- "Loudoun and Manassas. Woodbridge will have one soon."
- "Loudoun campus and Manassas campus. There are HVAC classes in Woodbridge as well, but they are not as widely utilized in the DCO or ET degree programs."
- "Loudoun. "
- "Manassas and Woodbridge."

K–12 EXTERNSHIP PROGRAM FINDINGS

The K–12 Externship Program is a four-day program intended to provide K–12 educators, administrators, and counselors with an in-depth overview of the ET program at NOVA and a greater understanding of the ET career field. The goals of the K–12 Externship Program are to increase participants':

1. Awareness of in-demand career and educational pathways in ET within the region
2. Understanding of the skills required to pursue ET careers
3. Ability to connect students with information about college educational pathways and industry opportunities

Originally, the externship was intended to run as follows. On Day 1, participants would receive an overview of the ET and DCO programs at NOVA and a tour of NOVA's Manassas Fab Lab. On Day 2, participants would tour the Micron Technology facility and speak with Micron's human resources and recruitment office to gain an understanding of career opportunities. On Day 3, participants would tour a select data center and once again meet with human resources and recruiters to learn about career opportunities within the DCO specialization. On Day 4, participants would tour the Loudoun Data Center Lab and review strategies for directing students into these career fields through postsecondary education with NOVA faculty.

For the 2022 K–12 Externship Program, the DCO Tech project team adapted the program to run from April through July and provide group tours of Micron Technology, STACK Infrastructure, and NOVA's Manassas Fab Lab. Eighteen individuals participated.

For the 2023 K–12 Externship Program, the project team designed marketing materials for recruiting educators (see Appendix D) and shared them with their networks. Currently, 25 educators are participating in the 2023 externship, which runs from March through August 2023 (see agenda in Appendix E). Because the 2023 externship is ongoing, this section of the report includes only findings from the 2022 program.

Participants in the 2022 K–12 Externship Program

Eighteen individuals participated in the 2022 K–12 Externship Program. The majority of participants were women (Figure 11), and half were school counselors (Figure 12).

Figure 11. 2022 K–12 Externship Program participants' genders

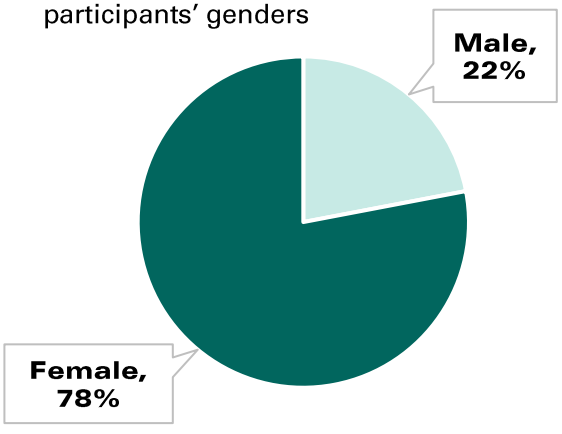
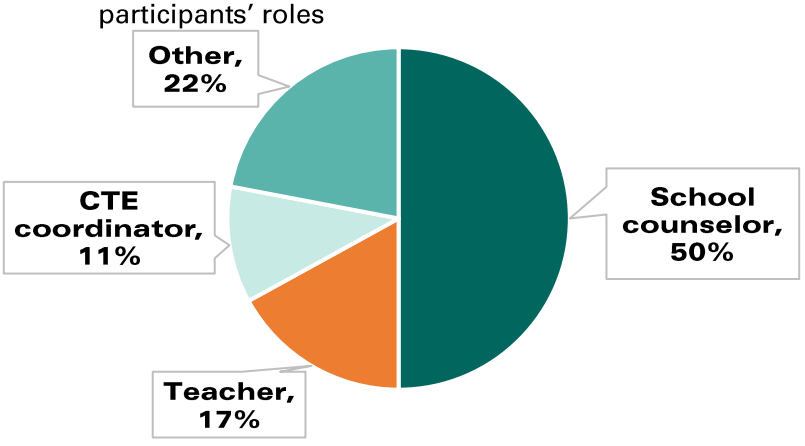


Figure 12. 2022 K–12 Externship Program participants' roles



Over half of participants worked at public high schools (n = 11). Other participants represented administration (n = 4), non-public schools (n = 2), and a public middle school (n = 1; Figure 13). Excluding the two individuals from non-public schools, participants represented three districts: Loudoun County Public Schools (LCPS; n = 11), Prince William County Public Schools (PWCS; n = 3), and Alexandria City Public Schools (ACPS; n = 2). Over half of participants worked at LCPS (Figure 14).

Figure 13. 2022 K–12 Externship Program participants' school types (n = 18)

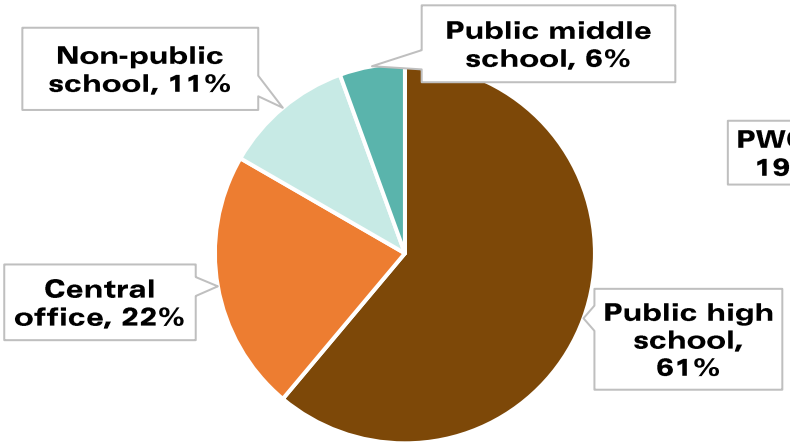


Figure 14. 2022 K–12 Externship Program participants' districts (n = 16)

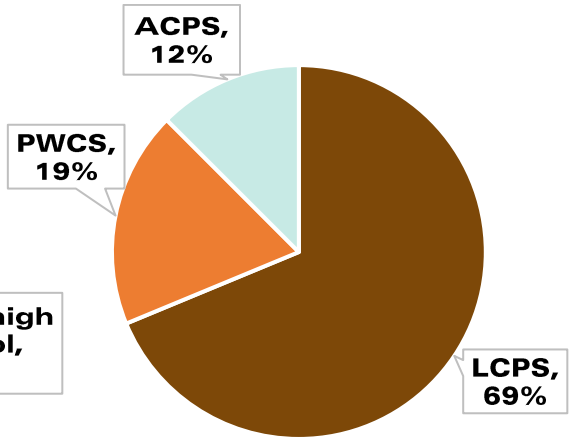
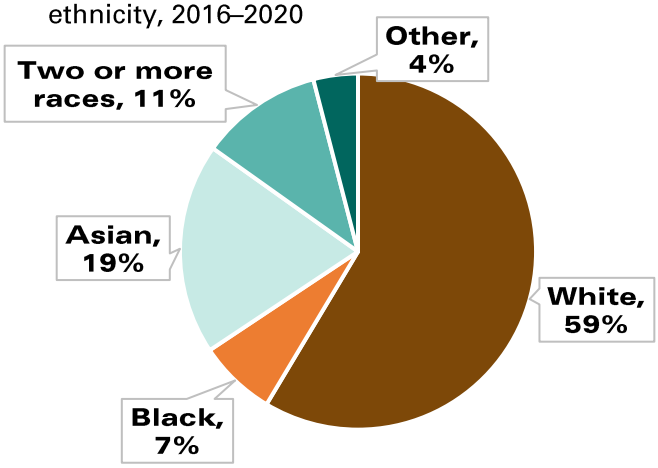


Figure 15. LCPS District student race and ethnicity, 2016–2020



Additionally, Magnolia evaluators examined the demographics of students in the three public school districts represented by the K–12 Externship Program participants, using data from the National Center for Educational Statistics (n.d.).[3]

For LCPS, over half of students were White, and nearly one fifth were Asian (Figure 15). The median income for families was $174,869.

For PWCS, over half of students were White, and over one fifth were Black (Figure 16). The median income for families was $115,641. Finally, for ACPS, nearly half of students were White, and nearly one third were Black (Figure 17). The median income for families was $77,721.

[3] These demographic data represent averages from the 2016–17 school year through the 2019–20 school year.

Figure 16. PWCS District student race and ethnicity, 2016–2020

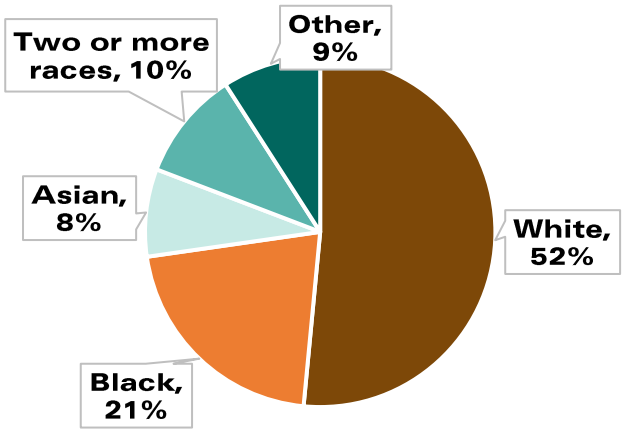
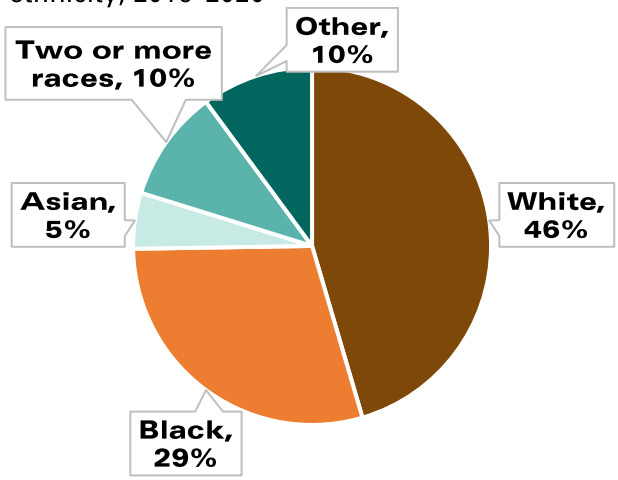


Figure 17. ACPS District student race and ethnicity, 2016–2020



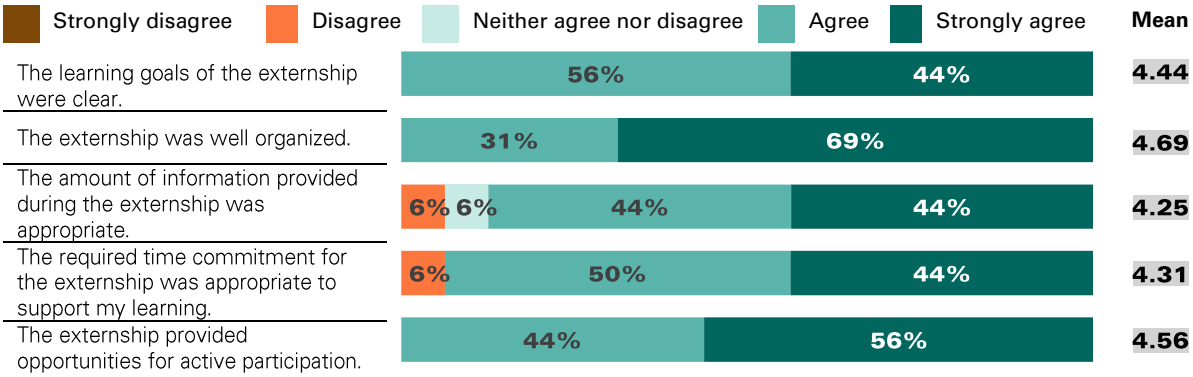
Educator Perceptions of the 2022 K–12 Externship Program

After participating in the 2022 K–12 Externship Program, 16 educators completed a survey that included questions related to their perceptions of the program and their engagement.

Most educators rated the delivery of the K–12 Externship Program positively

Overall, most educators provided positive feedback on the delivery of the K–12 Externship Program (Figure 18). All educators *agreed* or *strongly agreed* the externship had clear learning goals, was well organized, and provided opportunities for active participation. Most educators *agreed* or *strongly* agreed the amount of information and the time commitment were appropriate, with one educator *disagreeing* with each of these statements.

Figure 18. Educators' ratings of the delivery of the K-12 Externship Program (n = 16)



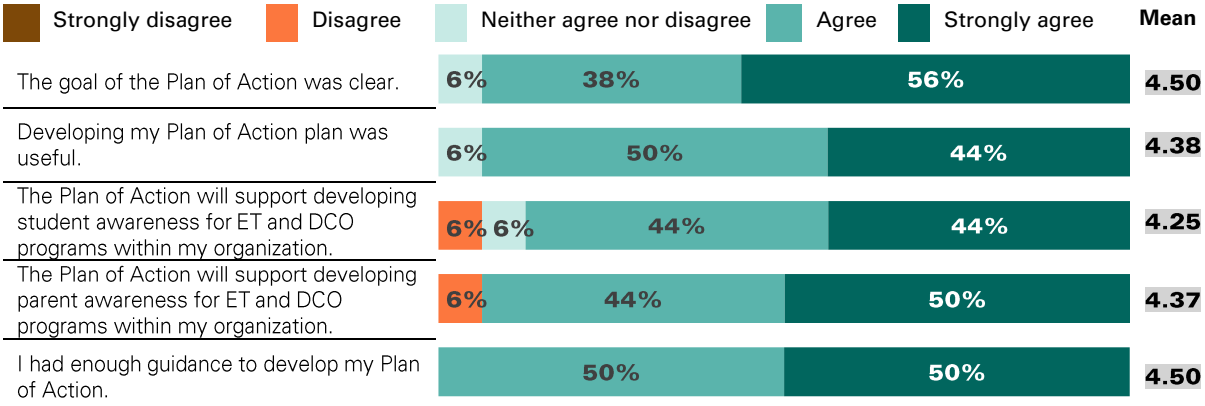
Note. Some items may be abbreviated.

Most educators rated the Plan of Action positively

At the conclusion of their externship experience, participants completed a "Plan of Action." The purpose of this plan was for participants to detail the actions they planned to take after the externship to share the information they learned with students, families, and schools.

Most educators provided positive feedback on the Plan of Action (Figure 19). All educators *agreed* or *strongly agreed* they had enough guidance to develop their plan. Most educators *agreed* or *strongly agreed* the plan was clear and useful and would support developing student and parent awareness of ET and DCO programs, with one educator *neither agreeing nor disagreeing* with each of these statements. Additionally, one educator *disagreed* the plan would support developing student awareness within their organization, and one educator *disagreed* it would support parent awareness within their organization.

Figure 19. Educators' ratings of the Plan of Action (n = 16)

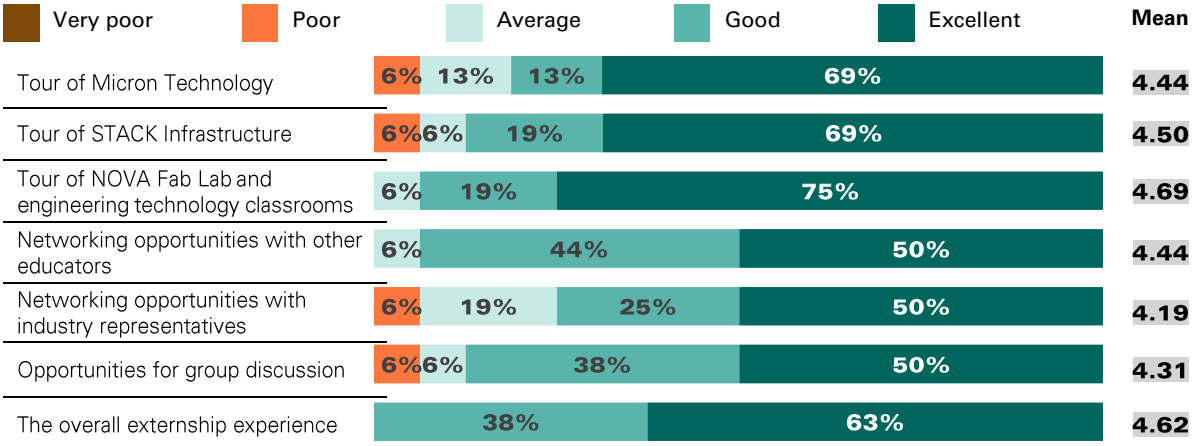


Note. Some items may be abbreviated.

All educators rated the overall externship experience as good or excellent

When asked to rate the quality of different components of the K–12 Externship Program, educators provided mostly positive feedback (Figure 20). All educators rated the overall externship experience as *good* or *excellent*. Fewer educators rated the opportunities to network with industry representatives as *good* or *excellent* relative to other components.

Figure 20. Educators' ratings of the quality of the K–12 Externship Program components (n = 16)

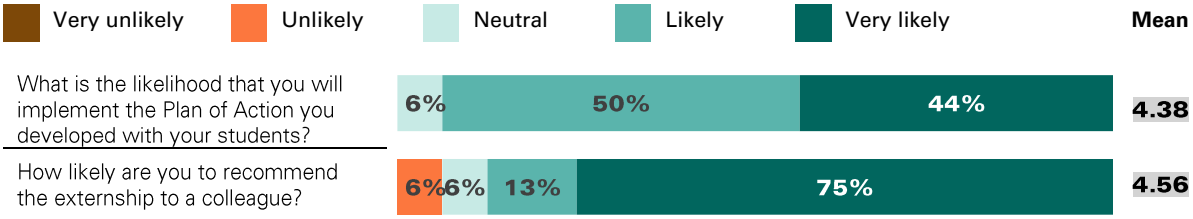


Note. Totals may not add to 100% due to rounding. Some items may be abbreviated.

Most educators indicated they would likely implement their Plan of Action and would recommend the externship to a colleague

Most educators indicated they were *likely* or *very likely* to implement the Plan of Action they developed with their students, with one educator indicating the likelihood was *neutral* (Figure 21). Similarly, most educators indicated they were *likely* or *very likely* to recommend the externship program to a colleague, with one educator indicating the likelihood was *neutral* and one indicating they were *unlikely* to do so.

Figure 21. Educators' ratings of the likelihood of implementing their Plan of Action and recommending the K–12 Externship Program to a colleague (n = 16)



Note. Some items may be abbreviated.

Educators offered areas for improvement

When asked how the externship opportunity could be improved, educators provided the following feedback:

- Provide additional information (n = 3)
  - Specifically, regarding industry partners and their facilities, educational pathways broadly and at NOVA, and realistic job outcomes and forecasts
- Offer additional tour locations or date options (n = 2)
- Offer the externship earlier in the school year (n = 1)
- Consider including a student panel (n = 1)
- Order the tours differently, starting at NOVA's Manassas Fab Lab (n = 1)
- Ensure the correct tour facilitators are present (n = 1)

> ***"It was a solid opportunity to learn more about these career fields and connect with other educators."***
>
> **—K–12 externship participant**

Six educators offered additional, positive feedback on the externship program in response.

Educator Outcomes of the 2022 K–12 Externship Program

The 2022 K–12 Externship Program survey also included questions to assess educators' perceptions of the following outcomes:

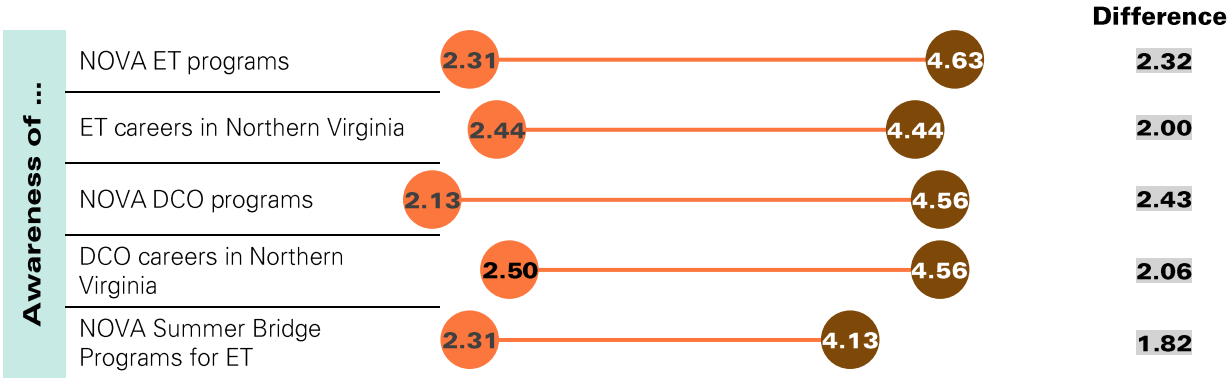
- Their awareness of ET and DCO opportunities
- The importance of different skill sets required for ET careers
- Their confidence in guiding secondary students toward ET and DCO careers

Additionally, members of the DCO Tech project team read and analyzed participants' written Plans of Action using thematic data analysis. Evaluators include the team's analyses in this report to understand educators' takeaways from the externship.

Educators reported greater awareness of ET and DCO opportunities after the K–12 Externship Program relative to before

Educators' average ratings of their awareness of ET and DCO opportunities were higher after the externship relative to before (Figure 22). The largest mean difference in ratings before and after participation was for awareness of NOVA ET and DCO programs ($M_{difference}$ = 2.32). Further, a paired samples *t*-test indicated that educators' overall average ratings of their awareness of opportunities after the program (M = 4.46, SD = 0.88) were statistically significantly higher than before the program (M = 2.34, SD = 1.21; $t(15) = 5.54$, $p < .001$, Cohen's d = 2.01).

Figure 22. Educators' ratings of awareness of ET and DCO opportunities **before** and **after** participating in the K–12 Externship Program (n = 16)



Note. Scale: 1 = Not at all aware, 2 = Slightly aware, 3 = Somewhat aware, 4 = Moderately aware, 5 = Very aware.

When asked how the externship impacted their awareness of ET and DCO career pathways and opportunities, educators shared the following:

- The exposure to the educational pathways for ET and DCO, broadly and at NOVA, positioned them to promote these pathways to students (n = 8).
- Learning more about the ET and DCO industry and job opportunities increased their understanding of the types of careers available in the field (n = 5).
- There are great opportunities for students (n = 2).
- They hope to develop a DCO pathway in their division (n = 1).
- It was useful to learn what type of student would succeed in an IET program (n = 1).
- They learned a lot and are more comfortable sharing with students and families (n = 1).

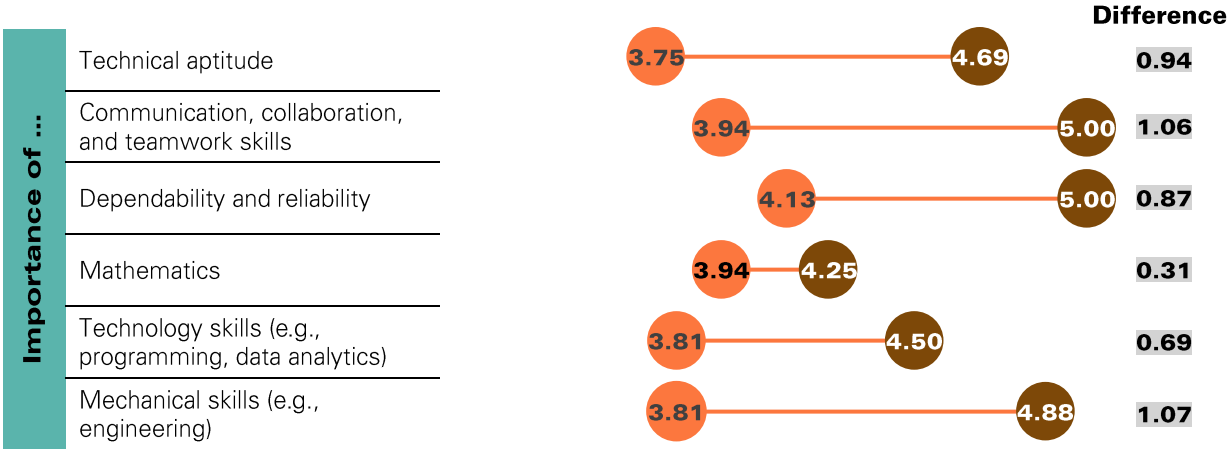
> ***"It impacted me greatly as I had no idea NOVA offered these programs. Understanding all these programs gives me the opportunity to take this information back to the classroom and share other career pathways to students."***
>
> **—K–12 externship participant**

Educators reported increased importance of the skillsets required for ET careers after the K-12 Externship Program

Educators' average ratings of the importance of the different skill sets required for ET careers were higher after the externship relative to before (Figure 23). The largest mean differences in ratings before and after participation were for mechanical skills ($M_{difference}$ = 1.07) and communication, collaboration, and teamwork skills ($M_{difference}$ = 1.06). Further, a paired samples *t*-test indicated that educators' overall average ratings of the importance of different skill sets for

ET careers after the program (M = 4.72, SD = 0.49) were statistically significantly higher than before the program (M = 3.90, SD = 0.81; $t(15)$ = 3.42, $p < .01$, Cohen's d = 1.23).

Figure 23. Educators' ratings of the importance of skillsets for ET careers **before** and **after** participating in the K–12 Externship Program (n = 16)



Note. Scale: 1 = Not at all important, 2 = Slightly important, 3 = Somewhat important, 4 = Moderately important, 5 = Very important.

When asked how the externship impacted their understanding of the skill sets required for ET careers, educators shared the following:

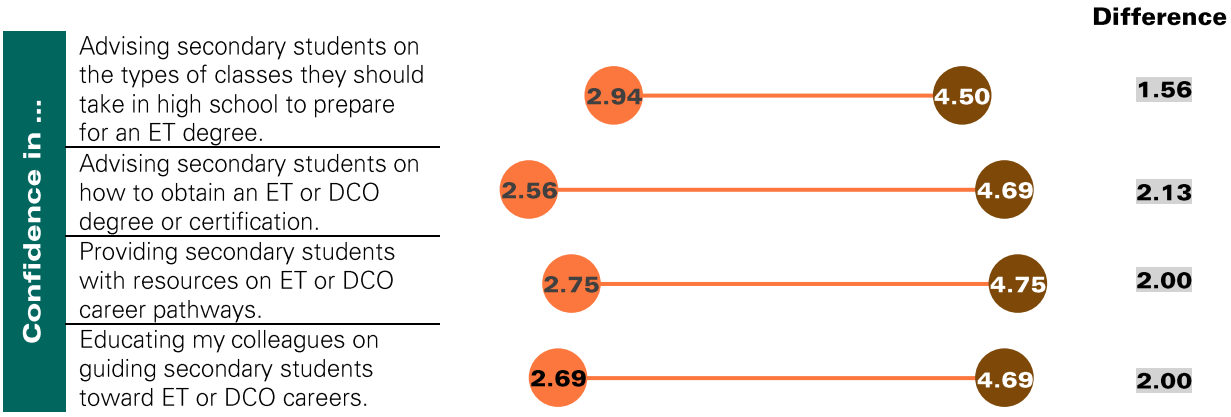
- Exposure to and discussion with industry partners and NOVA helped them understand what is required in the field (n = 6).
- They learned that basic math is important, but advanced math skills are not needed for most jobs (n = 5).
- They learned that "soft skills" (e.g., teamwork, collaboration, work ethic) are just as important as technical skills in the field (n = 2).
- They discovered that prior experience is not critical for entry-level positions (n = 2).

> ***"It was helpful to hear from the presenters, employees, and NOVA staff members, to understand the skills required for this field. It was also helpful to paint a picture of which student would be most successful in this program."***
>
> **—K–12 externship participant**

Educators reported increased confidence in guiding secondary students toward ET and DCO careers after the K–12 Externship Program

Educators' average ratings of confidence in guiding students toward ET and DCO careers were higher after the externship relative to before (Figure 24). The largest mean difference in ratings before and after participation was for advising secondary students on how to obtain an ET or DCO degree or certification ($M_{difference}$ = 2.13). Further, a paired samples t-test indicated that educators' overall average ratings of their confidence after the program (M = 4.66, SD = 0.42) were statistically significantly higher than before the program (M = 2.73, SD = 1.25; $t(15)$ = 6.13, $p < .001$, Cohen's d = 1.98).

Figure 24. Educators' ratings of the importance of skillsets for ET careers **before** and **after** participating in the K–12 Externship Program (n = 16)



Note. Scale: 1 = Not at all confidence, 2 = Slightly confident, 3 = Somewhat confident, 4 = Moderately confident, 5 = Very confident.

When asked how the externship impacted their confidence in guiding secondary students toward ET or DCO careers, educators shared the following:

- Improved understanding of ET and DCO educational pathways and careers increased their confidence to guide students to this field (n = 13).
    - Some educators specifically shared that the firsthand experience of touring facilities and receiving information from industry partners and NOVA facilitated this increase (n = 8).
- It impacted their confidence a lot (n = 2).
- It did not significantly impact their confidence (n = 1).

> ***"We were given a clear picture of the type of student that would succeed in this industry, the skill sets needed, along with the curriculum. This along with actually touring the facility increase my awareness, and as such, I feel more confident in sharing this with students, parents, and teachers."***
>
> **—K–12 externship participant**

When asked how developing their Plans of Action impacted their confidence in guiding secondary students toward ET or DCO careers, educators shared that developing the plan allowed them to:

- Identify concrete steps and goals to share these opportunities with students, colleagues, and families (n = 6)
- Set aside time to brainstorm, reflect, and critically think about how to best share the information they learned (n = 3)
- Be more confident and prepared to share the information they learned (n = 3)
- Discuss and collaborate with other educators (n = 2)
- Get a better sense of which students would be good candidates for the field (n = 1)

> ***"Developing the Plan of Action helped me identify small steps to make a large impact in guiding students toward in-demand careers."***
>
> **—K–12 externship participant**

Additionally, one educator shared that they felt very prepared to write the plan and it was "very doable." Another educator recommended that NOVA consider developing a dual enrollment course and providing outreach to younger students (e.g., middle school, early high school).

In their Plans of Action, educators indicated they were excited to share what they learned with students, families, and school professionals

The Plan of Action documents included three prompts for educators to indicate:

- What they learned through participating in the externship
- Three actions they could take to share the information they learned
- How NOVA and industry partners can deepen connections between institutions

The DCO Tech project team identified four themes from participants' Plans of Action: barriers to implementation, industry/institutional knowledge, plans for implementation, and desire for collaboration with NOVA. The project team generated Table 1, which summarizes findings regarding each of these themes.

Table 1. Themes and codes from K–12 Externship Program participants' Plans of Action

Barriers to Implementation (*n* = 11, 61%)	
Administrative knowledge (*n* = 3, 27%)	"It's hard to highlight the specific steps students need to take: [high school] classes, applications they need to complete, forms, etc."
Lack of hands-on activities (*n* = 7, 63%)	"…it's hard to talk to them about it when students learn by seeing and doing."
Industry working conditions (*n* = 2, 18%)	"These jobs are high pay but not attractive. It doesn't match the lifestyles of young adults fresh out of high school."
Industry/Institutional Knowledge (*n* = 15, 88%)	
Industry need for talent (*n* = 15, 100%)	"I didn't realize the extent of the need for talent at Micron and all the data centers and am eager to let my students know that NOVA students are getting hired quickly, often prior to finishing their programs."
Technical/operational details (*n* = 3, 20%)	"A data center needs power and heat, thus the building needs a balance of controlled power and cooling energy."
NOVA programs and credentials (*n* = 7, 46%)	"They [students] can prepare for a good-paying career in the technology field in their community in a short time and with much lower or no student loan debt."
Plans for Implementation (*n* = 16, 94%)	
Parental engagement (*n* = 9, 56%)	"The first action is to inform parents of the opportunities …."
Sharing with colleagues (*n* = 10, 63%)	"I plan to share the resources from this externship with my counseling department when I return to work this August."
Direct student discussion (*n* = 10, 63%)	"… share information with students about the different program pathways and available degree options during yearly senior conference meetings."
Dual enrollment (*n* = 5, 31%)	"It would be great to work with the school system to eventually offer [dual enrollment] courses … if certified teachers become available."
Collaboration with NOVA (*n* = 16, 94%)	
Professional development (*n* = 9, 56%)	"NOVA presentations directly to teachers throughout the school division to be able to best support questions and provide clear and common messaging …"
Field trips (*n* = 4, 25%)	"We'd like to collaborate this upcoming year to take a group of students to Micron (and the Fab Lab if possible!) so they can see up close what they could be doing."

Presentations from NOVA staff (*n* = 9, 56%)	"A representative from these programs could join a parent information night to briefly cover these programs offered at NOVA."
Dedicated NOVA staff member (*n* = 3, 19%)	"Seek staffing support from NOVA for one NOVA employee to support questions, presentations, information, outreach, etc. within the division."

The project team shared additional information about educators' experiences with Magnolia evaluators. The team noted that after the externship, educators were largely positive about the potential for DCO, praising the potential for high starting salaries, regional demand, and the low cost of credentials. The team also shared that most Plans of Action identified multiple ways to share information with community stakeholders (i.e., students and parents). Plans were largely in line with the typical role that counselors occupy within a K–12 institution.

The project team shared that the *Barriers to Implementation* theme demonstrates the extent to which institutional and pedagogical capacity is limited. The team noted that these issues are compounded by a lack of credentialed teachers and dual enrollment programs, which are more available in adjacent but distinct fields (e.g., information technology, cybersecurity). Additionally, the team shared that participants' suggestions for future collaboration with NOVA align with the issues related to capacity. The repeated requests for a full-time NOVA staff member dedicated to providing career education support for schools illustrate the few resources available. The team observed that the other identified codes highlight the importance of high levels of ongoing NOVA support to fill gaps in educator knowledge and expertise.

Overall, the project team summarized that while participants indicated the K–12 Externship Program increased awareness of in-demand regional careers in ET and DCO, the analysis of their Plans of Action revealed gaps in educators' capacity to implement structural change.

VETERAN OUTREACH PROGRAM FINDINGS

There are no evaluation activities for the Veterans Outreach component. Instead, the DCO Tech project team internally tracks and provides updates for this component. The project team put the Veterans Outreach activities on hold for the first year due to the amount of time and resources required for the other project activities.

During the second year, the project team and project partners reported several activities related to Veteran's Outreach, including the following:

- Conducted virtual presentations with the Office of Military and Veteran Services to promote IET and upcoming opportunities to NOVA students
- Developed a podcast with the Nomad Futurist foundation discussing DCO at NOVA and how Veterans would be a good fit for these opportunities
- Attended the Navy Seal Foundation tribute event in Houston, TX and promoted the NOVA DCO program to special forces members
- Oversaw STACK Infrastructure's enrollment into the Department of Defense's SkillBridge program

SUMMARY AND RECOMMENDATIONS

This section summarizes the evaluation findings for the DCO Tech project at the end of its second year and includes recommendations to support and sustain project activities moving forward.

Summary

This section of the report includes a summary of findings pertaining to each evaluation question.

To what extent does the project team implement the DCO Tech programs as planned?

The DCO Tech project team implemented several programs as intended, including the Summer Bridge Program and the K–12 Externship Program. The project team's strong relationship with local industry partners supports the implementation of these activities, particularly the industry tours. The project team modified the Internship Preparation Program and the Industry Externship Program in response to difficulties in recruiting students and industry partners. The team put Veteran Outreach activities on hold for the first year, and in the second year began outreach efforts such as sharing NOVA DCO and ET opportunities for veterans through presentations, events, and a podcast.

How does the project develop and progress regarding the intended number and nature of participants in the DCO Tech programs?

So far, the DCO Tech project has engaged a number of participants. The project partners with seven local organizations in the ET and DCO fields to provide tours for the project activities. Twenty students participated in the 2022 Summer Bridge Program, half of whom were from underrepresented groups in STEM (women, Hispanic or Latino, and Black students). Currently, 40 students are signed up for the 2023 Summer Bridge Program. Eighteen educators participated in the 2022 K–12 Externship Program and represented three districts, two of which served populations where nearly half or more than half of students were Students of Color. Currently, 25 educators are signed up for the 2023 K–12 Externship Program.

What are stakeholders' perceptions of the quality of DCO Tech programs in supporting interest and pathways to careers in the DCO or ET industry?

The industry partners who offered tours to support DCO Tech programs indicated they were confident in providing tours to youth and adults who may not know anything about ET or DCO.

Additionally, they shared that their organizations have extensive experience in this area, indicating they are well positioned to support the project goals.

Students mostly rated the delivery and quality of the 2022 Summer Bridge Program positively, and they reported enjoying the program. Similarly, educators mostly rated the delivery and quality of the 2022 K–12 Externship Program positively, and most indicated they were likely to implement their Plans of Action after the experience. Educators shared that developing their Plans of Action allowed them to identify concrete steps to support students and guide them toward ET and DCO educational pathways and careers.

How can DCO Tech programs be improved to foster interest and engagement?

Industry partners shared that—to feel more confident in providing tours—it would be helpful to have additional information on the main goals of the tour (e.g., networking, career opportunities), the career pathways attendees are most interested in learning about, and the backgrounds of attendees. Additionally, industry partners' understanding and awareness of ET and DCO educational programs, educational requirements, and local career opportunities varied, indicating room for growth to ensure they can share this information during tours.

For the 2022 Summer Bridge Program, students shared they appreciated the hands-on activities and suggested including even more opportunities for these types of activities. Additionally, students rated the quality of the OSHA safety course lower relative to other components, indicating this may be an area for improvement. For the 2022 K–12 Externship Program, some educators requested additional information regarding industry partners and their facilities, educational pathways broadly and at NOVA, and realistic job outcomes and forecasts. In their Plans of Action, educators identified largely structural barriers to implementing their plans, such as limited capacity to teach dual enrollment or ET courses for high school students or limited resources to disseminate information to colleagues, students, and families.

To what extent do participating DCO Tech students report improvement in their knowledge, skills, and interest with respect to DCO or ET careers?

Most students indicated the 2022 Summer Bridge Program increased their understanding or interest in ET and DCO training and careers. Students reported a statistically significantly higher average understanding of workplace safety after the Summer Bridge Program relative to before. Students also reported a statistically significantly higher average understanding of college success skills after the Summer Bridge Program relative to before.

To what extent does the externship program improve educators' perceptions and awareness of DCO careers and their preparedness to support students in this field?

Educators reported a statistically significantly higher average awareness of ET and DCO opportunities, higher importance of required skill sets of ET careers, and increased confidence in guiding secondary students toward ET and DCO careers after the 2022 K–12 Externship Program relative to before.

When asked how the K–12 Externship Program impacted their awareness, understanding, and confidence, educators shared that the externship exposed them to educational pathways for ET and DCO and provided them with information about the industry and job opportunities. These activities increased their understanding of the different educational pathways, types of careers, and necessary skill sets for the field, positioning them to promote these pathways to students.

Recommendations

Based on the evaluation findings, Magnolia evaluators offer the following recommendations.

With respect to project implementation moving forward:

- Summer Bridge Program participants appreciated the hands-on activities and requested more. Consider continuing to provide—and potentially increasing—the number of hands-on activities (e.g., tours, networking activities, group activities) for the program.
- Summer Bridge Program participants rated the quality of the OSHA safety course the lowest relative to other program components. Consider ways to make the course more engaging, or ways to emphasize the importance of the OSHA course content in other program components.
- K–12 Externship Program participants shared that they learned a lot of helpful information from the program. However, in their Plans of Action, they noted limited institutional capacity to disseminate information and educate students about ET and DCO careers. If feasible, consider generating PowerPoint presentations, information packets, or flyers for educators to use.
- Fewer K–12 Externship Program participants rated the opportunities to network with industry representatives as *good* or *excellent* relative to other program components. Additionally, some educators wanted more information about industry partners and their facilities, as well as realistic job outcomes. Consider ways to increase networking and information-sharing opportunities between industry representatives and K–12 externship participants. For instance, if feasible, consider hosting a "career fair" after the tours where industry representatives are available to discuss career pathways and opportunities in more detail. This event could also support individuals who participate in the Summer Bridge Program, Internship Preparation Program, and Veteran Outreach Program activities.

- Recruitment for the Internship Preparation Program continues to be a barrier. If participation in the full CLRI program is too burdensome, consider alternative ways to engage with current ET students at NOVA. For instance, if feasible, consider offering one or two workshops that relate to career preparation alongside the opportunity to participate in tours.
- Industry partners indicated they were confident in providing tours of their organizations. However, they also shared it would be helpful to have additional information on the main goals of the tour (e.g., networking, career opportunities), the career pathways attendees are most interested in learning about, and the backgrounds of attendees. Consider sharing additional background information, as feasible, about attendees' interests and knowledge with industry partners providing tours.
- Industry partners' awareness of ET and DCO educational requirements, programs, and career opportunities varied. The one-on-one meetings the DCO Tech project team is scheduling with industry partners may address this issue. Consider ways to continue to educate industry partners on the educational requirements and pathways for these careers.
- Continue to consider ways to engage with veterans and disseminate information related to ET and DCO educational pathways and career opportunities. As feasible, consider ways to integrate these activities with other project components (e.g., workshop opportunities, career fairs).

With respect to project evaluation moving forward:

- Currently, there is no reportable data related to the DCO Tech project's engagement with current NOVA ET students. Consider ways to ensure that any ET students who participate in the CLRI program and industry tours take the evaluation survey (e.g., administering it in-person) so these data can be included in the final report.
- There are no evaluation activities related to the Veteran Outreach component of the DCO Tech project. However, the project team could consider capturing the number of veterans that engage in different outreach activities to understand the reach of this component.

REFERENCES

Forman, J., & Damschroder, L. (2008). Qualitative content analysis. In L. Jacoby & L. A. Siminoff (Eds.), *Empirical methods for bioethics: A primer* (pp. 39–62). Elsevier JAI.

LaDonna, K. A., Taylor, T., & Lingard, L. (2018). Why open-ended survey questions are unlikely to support rigorous qualitative insights. *Academic Medicine, 93*(3), 347–349. https://doi.org/10.1097/acm.0000000000002088

Meek, G. E., Ozgur, C., & Dunning, K. (2007). Comparison of the t vs. Wilcoxon Signed-Rank test or Likert scale data and small samples. *Journal of Modern Applied Statistical Methods, 6*(1), 91–106. https://doi.org/10.22237/jmasm/1177992540

National Center for Education Statistics. (n.d.). *Common Core of Data: Search for public schools*. https://nces.ed.gov/ccd/schoolsearch/index.asp

APPENDIX A: EVALUATION MATRIX

To assess the extent to which the project achieves its objectives, the DCO Tech project evaluation addresses the formative and summative questions shown in Table A1, which also provides an overview of the evaluation tasks and timelines.

Table A1. DCO Tech Project Evaluation Matrix

EVALUATION MATRIX			
Bridge Program	2-week non-residential program for potential engineering technology (ET) students		
Evaluation Questions	Indicators	Data Collection Sources	Timeline
Formative			
To what extent does the project team implement the DCO Tech bridge program as planned? What factors strengthen or impede the implementation of the bridge program? What modifications were made to the DCO Tech bridge program?	Agenda/curriculum shows all intended offerings	Project calls	Quarterly
	# of products delivered	Progress Tracker	Quarterly
		Document review	Ongoing
How does the project develop and progress regarding the intended number and nature of participants in the DCO Tech bridge program?	16 juniors/seniors participate each year	Project calls	Quarterly
	% of underrepresented minorities	Progress Tracker	Quarterly
What are stakeholder's perceptions of the quality of DCO Tech bridge program in supporting interest and pathways to careers in the data center operations and engineering technology industry?	% of participants and partners indicate positive perceptions of the quality of the bridge program.	Project calls	Quarterly
		Bridge participant surveys	Annual
		Bridge program interviews/focus groups	Annual
		Partner survey	Annual
How can the bridge program be improved to foster interest and engagement?		Bridge participant surveys	Annual
		Bridge program interviews/focus groups	Annual
SHORT TERM OUTCOME #1: Improved student knowledge of engineering technology skills.			
Summative			
To what extent do participating DCO Tech bridge program students report improvement in their knowledge, skills, and interest with respect to data center operations and engineering technology careers?	% of participants report increased their knowledge & skills	Bridge participant surveys	Annual
	% of participants report increased interest in ET and DCO careers	Bridge program interviews/focus groups	Annual
		Progress Tracker	Quarterly
Does the program reach and recruit its intended audiences for participation in the pipeline?	48 juniors/seniors participate each year	Project calls	Quarterly
	% of underrepresented minorities	Progress Tracker	Quarterly
	# of participants show interest in the pipeline	Bridge participant surveys	Annual
	# of participants enroll in ET or DCO program	Bridge program interviews/focus groups	Annual

Internship Program	a 4-day career development program to prepare students to enter workforce		
Evaluation Questions	Indicators	Data Collection Sources	Timeline
Formative			
To what extent does the project team implement the DCO Tech internship program as planned? What factors strengthen or impede the implementation of the internship program? What modifications were made to the DCO Tech internship program?	Agenda/curriculum shows all intended offerings	Project calls	Quarterly
	# of products delivered	Progress Tracker	Quarterly
		Document review	Ongoing
How does the project develop and progress regarding the intended number and nature of participants in the DCO Tech internship program?	16 ET or DCO students participant	Project calls	Quarterly
	% of underrepresented minorities		
	% of first-generation students	Progress Tracker	Quarterly
What are stakeholder's perceptions of the quality of DCO Tech internship program in supporting interest and pathways to careers in the data center operations and engineering technology industry?	% of participants and partners indicate positive perceptions of the quality of the boot camp.	Project calls	Quarterly
		Boot camp participant surveys	Annual
		Partner survey	Annual
How can the internship program be improved to foster interest and engagement?		Boot camp participant surveys	Annual
SHORT TERM OUTCOME #2: Increased student interest in engineering technology careers and internships.			
Summative			
To what extent and in what ways does the DCO Tech boot camp improve preparedness for engineering tech and DCO pathways?	% of students indicate preparedness for ET and DCO pathways	Boot camp participant surveys	Annual
Does the program reach and recruit its intended audiences for participation in the pipeline?	16 ET or DCO students participant	Project calls	Quarterly
	% of underrepresented minorities	Progress Tracker	Quarterly
	% of first-generation students	Boot camp participant surveys	Annual
	# of participants show interest in the ET and DCO careers		
	# of participants apply for an internship		

Industry Externships	structured introductions to DCO education for industry professionals		
Evaluation Questions	Indicators	Data Collection Sources	Timeline
Formative			
To what extent does the project team implement the DCO Tech industry externship as planned? What factors strengthen or impede the implementation of the industry externship? What modifications were made to the DCO Tech industry externship?	Agenda/curriculum shows all intended offerings	Project calls	Quarterly
	# of products delivered	Progress Tracker	Quarterly
		Document review	Ongoing
How does the project develop and progress regarding the intended number and nature of participants in the DCO Tech industry externship?	# of industry externs participating	Project calls	Quarterly
	% of industry externs who provide two lessons in the bridge program	Progress Tracker	Quarterly
What are stakeholder's perceptions of the quality of DCO Tech industry externship in supporting interest and pathways to careers in the data center operations and engineering technology industry?	% of participants and partners indicate positive perceptions of the quality of the externship.	Project calls	Quarterly
		Externship participant survey	Annual
		Partner survey	Annual
How can the industry externship be improved to foster interest and engagement?		Externship participant survey	Annual
SHORT TERM OUTCOME #4: Improved availability of engineering technology and DCO pathways.			
Summative			
To what extent and in what ways does the DCO Tech industry externship improve availability for engineering tech and DCO pathways?	% of industry externs who show interest in becoming a credentialed ET faculty member	Externship participant survey	Annual
	% of industry externs who understand the credentials required to teach ET or DCO courses as an adjunct instructor for NOVA		

K12 Externships	structured introductions to data centers and associated careers for K12 staff (e.g., counselors, administrators)		
Evaluation Questions	Indicators	Data Collection Sources	Timeline
Formative			
To what extent does the project team implement the DCO Tech K12 externship as planned? What factors strengthen or impede the implementation of the K12 externship? What modifications were made to the DCO Tech K12 externship?	Agenda/curriculum shows all intended offerings	Project calls	Quarterly
	# of products delivered	Progress Tracker	Quarterly
		Document review	Ongoing
How does the project develop and progress regarding the intended number and nature of participants in the DCO Tech K12 externship?	# of educators participating	Project calls	Quarterly
		Progress Tracker	Quarterly
What are stakeholder's perceptions of the quality of DCO Tech K12 externship in supporting interest and pathways to careers in the data center operations and engineering technology industry?	% of participants and partners indicate positive perceptions of the quality of the externship.	Project calls	Quarterly
		Externship participant survey	Annual
		Partner survey	Annual
How can the K12 externship be improved to foster interest and engagement?		Externship participant survey	Annual
SHORT TERM OUTCOME #3: Increased awareness of secondary staff awareness of degrees and careers in engineering technology			
Summative			
To what extent does the externship program improve educators' perceptions and awareness of ET and DCO careers and their preparedness to support students in this field?	% of participants indicate increased awareness of ET and DCO careers	Externship participant survey	Annual
	% of participants who feel prepared to support students		
	% of participants who plan to provide information about ET and DCO careers and pathways		

Veteran's Outreach	marketing effort to recruit NOVA-affiliated veterans to engineering tech		
Objective 5: Increase recruitment of veterans into engineering technician and DCO pipeline.			
Evaluation Questions	Indicators	Data Collection Sources	Timeline
Formative			
How does the project develop and progress regarding the intended number and nature of participants in the DCO Tech veteran's outreach activities?	# of events	Project calls	Quarterly
	# of veterans reached	Progress Tracker	Quarterly
SHORT TERM OUTCOME #6: Increased veteran knowledge of DCO.			
INTERMEDIATE OUTCOME: Increased veteran exploration of engineering technology programs.			
Summative			
Does the program reach its intended audiences for participation in the veteran outreach activities?	# of events	Project calls	Quarterly
	# of veterans reached	Progress Tracker	Quarterly
	# of veterans who explore ET programs further		

Partnerships			
Evaluation Questions	Indicators	Data Collection Sources	Timeline
Formative			
In what ways does the program foster partnerships among industry, K-12 educators, and NOVA faculty? How can partnerships be improved?	# of activities completed by the partners each year	Project Calls	Quarterly
	% of partners who completed planned activtities	Progress Tracker	Quarterly
	# of Wilder Factors Inventory above the benchmark	Document review (letters of commitment?)	Ongoing
		Partnership baseline interviews	Year 1
		Partner Survey	Annual
SHORT TERM OUTCOME #5: Increased collaboration/ between secondary, post-secondary and industry.			
Summative			
To what extent did DCO Tech increase collaboration among industry, K-12 educators, and NOVA faculty to support the development of engineering technician and DCO pipeline? What was the collective impact of this collaboration?	# of activities completed by the partners each year	Project Calls	Quarterly
	% of partners indicate impacts on their organizations	Progress Tracker	Quarterly
	# of ways partners benefit the project activities and participants	Partnership interviews	Year 1/Year 3
		Partner Survey	Annual

APPENDIX B: 2023 SUMMER BRIDGE PROGRAM AGENDAS

June 20–29 Session

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
JUNE 2023 BRIDGE PROGRAM						
	***19 National Holiday Juneteenth No activities today	20 9:30-2:30 Carlos day 1 SDV 101 / Eng. Tech LO campus tour Introduce research presentation/ make groups	21 9:30-2:30 Carlos day 2 SDV 101 Eng. Tech 1 hour - ET research	22 9:30-2:30 TJ day 1 Trip to Stack ENE 195 SAF 130	23. 9:30-2:30 TJ day 2 Stack ENE 195 SAF 130	
	26 9:30-2:30 Manassas Tour	27 9:30-2:30 SDV 101/Eng. Tech	*28 Micron tour(half day) Ind. guest speaker (externship) 1 hour - ET research	29 9:00-4:00 Group Research Presentations Ice Cream Social		

July 18–27 Session

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
July 2023 BRIDGE PROGRAM						
	17	18 9:30-2:30 WO Campus Tour	*19 9:30-2:30 Micron tour(half day) Ind. guest speaker (externship) 1 hour - ET research	20 9:30-2:30 SDV 101/Eng. Tech I	21 9:30-2:30 SDV 101/Eng. Tech	
	24 9:30-2:30 AN Campus Tour	25 9:30-2:30 TJ day 1 STACK ENE 195 overview SAF 130 (2.5 hours) 1 hour - ET research	26 9:30-2:30 TJ day 2 STACK ENE 195 overview SAF 130 (2.5 hours) 1 hour - ET research	27 9:30-2:30 Ice Cream Social	28	

APPENDIX C: 2022 INDUSTRY EXTERNSHIP PROGRAM MARKETING MATERIALS

INSPIRE THE NEXT GENERATION OF ENGINEERING TECHNICIANS

Are you an engineering technology professional or data center technician? NOVA is launching an **Industry to Education Externship Program** that will prepare you to teach and inspire the upcoming technology workforce!

Externship Goals:

1. Engage industry professionals to support high school students who are learning about technician careers.
2. Develop a pathway for professionals to become adjunct faculty through the applicable credentialing process.

Virtual PD Sessions: May 5, 12, 19, 2022
In-Person PD Session: June 10, 2022 | NOVA Fab Lab
Bridge Program Instructing: June 24 or 30, 2022

Externship Participants will:

- Be introduced to NOVA's engineering technology programs and facilities.
- Receive guidance on the credentials required to teach as an adjunct instructor at NOVA and explore the pathways to becoming a credentialed engineering technology or data center operations faculty member.
- Develop and deliver two lessons for the summer bridge program to inspire high school students to pursue careers in Engineering Technology.

For more information contact
Matt Lambert at blambert@nvcc.edu

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APPENDIX D: 2023 K–12 EXTERNSHIP PROGRAM MARKETING MATERIALS

APPENDIX E: 2023 K–12 EXTERNSHIP PROGRAM AGENDA

2023 K-12 Externship Program Agenda	
March 15, 2023	Welcome and NOVA Programs Review
April/May 2023	Industry Site Tours Each participant is required to tour one engineering technology and one data center.
July 7 or July 13, 2023	Fab Lab Professional Development Day Tour Fab Lab, see engineering technology classrooms, review NOVA programs, begin work on Plan of Action.
August 2023	Submit Plan of Action Complete post-survey