



Pre-Freshman Engineering Program (PREP) Plus: Expanding Technical Career Pathways in Manufacturing for High School Students

Summative Evaluation Report



Bridging Research, Policy, and Practice

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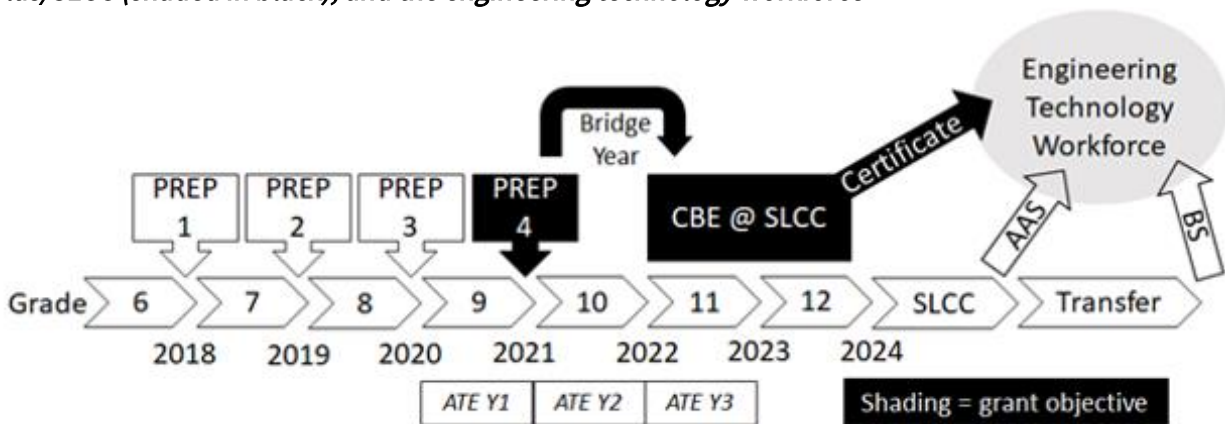
Introduction

Program Background and Context

Pre-Freshman Engineering Program (PREP) Plus at Salt Lake Community College (SLCC) was funded by the National Science Foundation’s (NSF) Advanced Technical Education (ATE) program in 2020 as a three-year award. The project, titled [“Expanding Technical Career Pathways in Manufacturing for High School Students.”](#) built on a previously funded ATE project at SLCC that served as a model for competency-based education in technician training programs. Specifically, PREP Plus has focused on the development of a competency-based engineering technology certificate program at SLCC for high school students from Jordan School District’s PREP program. PREP supports middle school students from at-risk populations in intensive science and mathematics experiences; however, the program ends in middle school. PREP Plus established a partnership between Jordan School District and SLCC to extend the PREP program through high school, connect PREP students with SLCC’s engineering resources, and provide on-site education at SLCC leading to an engineering technology certificate. This partnership also aimed to increase the number and diversity (e.g., women, people of color) of skilled technicians who are prepared to pursue careers in manufacturing companies, an industry need that is especially prominent in the Salt Lake City region.

Like PREP, PREP Plus was designed as a multi-year, cohort-based program. As shown in Figure 1, for each cohort of students, PREP Plus begins in the summer after 9th grade (PREP 4), followed by a Bridge Year during 10th grade and concurrent enrollment courses for the engineering technology certificate program at SLCC beginning in 11th grade. Students continue taking classes at SLCC during 12th grade and graduate with several pathways into the engineering technology workforce: enter directly into the workforce with an engineering technology certificate; continue at SLCC for an additional year to complete the two-year Associate of Applied Science (AAS) degree in engineering technology, and then enter the workforce; or transfer to a four-year institution to earn a bachelor’s degree in engineering technology (e.g., Weber State University’s B.S. in Manufacturing Engineering Technology) and then enter the workforce.

Figure 1. Diagram from the PREP Plus proposal showing pathway between Jordan PREP, PREP Plus/SLCC (shaded in black), and the engineering technology workforce



As indicated in Figure 1, the ATE grant began in 2020 with the following annual cycle: Year 1 (2020-2021), Year 2 (2021-2022), Year 3 (2022-2023). The grant was initially slated to end in June 2023, when the first cohort of PREP Plus students were at the end of their 11th grade year. In 2023, SLCC was awarded a one-year, no-cost extension for Year 4 (2023-2024) to support the first cohort of students through completion of the program and graduation from high school.

Evaluation Overview

The external evaluation of PREP Plus was conducted by the Utah Education Policy Center (UEPC), a university-based research center at the University of Utah. The UEPC evaluation team aimed to provide formative and summative feedback through a mixed-methods approach to data collection and ongoing collaboration with the PREP Plus program personnel. Data sources included various student surveys and annual group interviews with program personnel from Jordan School District and SLCC (see “Methods”).

The evaluation of PREP Plus began in Year 2 (Summer 2021), when the first cohort of students participated in the summer program activities after 9th grade. The no-cost extension allowed for the evaluation to follow these students through the end of the program in Year 4. The evaluation also followed the second cohort of students, who transitioned into PREP Plus in Year 3 (Summer 2022) and finished their 11th grade year at the end of Year 4. These two groups will hereafter be referred to as “Cohort 1” and “Cohort 2.”

Evaluation Questions

The evaluation was guided by a series of questions that address the implementation and impact of PREP Plus throughout the grant period:

- What were the barriers and supports to development and implementation?
- What variations occurred in implementation between Year 1, Year 2, Year 3, and Year 4? Why did these variations occur? How did these variations meet program goals and student needs?
- What is the retention of students in PREP Plus year-to-year, and does retention vary based on student characteristics?
- To what extent do PREP participants’ attitudes about STEM in general and engineering in particular reflect an awareness of career opportunities and pathways, confidence, beliefs, and intentions to pursue education, work, and certifications in engineering and engineering technology (ET)?
- To what extent does each of the PREP Plus program components affect student persistence and completion in ET educational and career opportunities?
- How do participants’ plan to continue to take engineering courses through SLCC before and after high school graduation, earn certifications, and enroll in four-year institutions change over the course of participation in the program?
- What other benefits were there to program participants?
- In what ways are the PREP Plus program stakeholders positioned to sustain and scale up the program and associated practices after the grant funding period is over (e.g., with efforts that use locally available resources)?

Formative reports based on specific data sources were shared with the program team throughout the grant and provided insights into aspects of the evaluation questions (see “Methods”). This summative report synthesizes formative findings to address each evaluation question directly.

Methods

The evaluation team collected data from participating students (Cohort 1 and Cohort 2) and program personnel throughout Year 2, Year 3, and Year 4 of PREP Plus. As shown in Table 1, results from each data collection activity were provided to the program team through ongoing formative reports. These reports include specific details about the instruments, participants, response rates, and analysis approach for each data collection activity. Notably, a consistent bank of student survey items was used throughout the evaluation to assess STEM outcomes in five areas: STEM awareness, STEM confidence, beliefs about STEM, intentions in STEM, and future STEM plans. Surveys that included these items are indicated with an asterisk (*) in Table 1.

Table 1. PREP Plus external evaluation data collection activities & associated formative reports

Data Collection Activity	Timeline	Participants	Formative Report with Results
Year 2 (2021-2022)			
Summer program pre-survey*	June 2021	Cohort 1	Year 2a Summer Survey Report
Summer program post-survey*	July 2021	Cohort 1	Year 2a Summer Survey Report
Bruin Brains Conference post-event survey	December 2021	Cohort 1	Year 2b Bruin Brains Conference Survey Report
Undergraduate Projects & Research Conference (UPRC)/PREP Plus Experiences survey ^{1*}	March 2022	Cohort 1	Year 2c Annual Survey & Interview Report
Program personnel group interviews	March 2022	Program personnel from Jordan SD & SLCC	Year 2c Annual Survey & Interview Report
Year 3 (2022-2023)			
Summer program pre-survey*	June 2022	Cohort 2	Year 3a Summer Survey Report
Summer program post-survey*	July 2022	Cohort 2	Year 3a Summer Survey Report
Bruin Brains Conference post-event survey	December 2022	Cohorts 1 & 2	Year 3b Bruin Brains Conference Survey Report
Program personnel group interviews	March 2023	Program personnel from Jordan SD & SLCC	Year 3c Annual Survey & Interview Report
UPRC/PREP Plus Experiences survey*	April 2023	Cohorts 1 & 2	Year 3c Annual Survey & Interview Report
SLCC Experiences survey	May 2023	Cohort 1	Year 3c Annual Survey & Interview Report

¹ In the report, this survey is referred to as the “Spring 2022 survey.”

<i>Year 4 (2023-2024)</i>			
Bruin Brains Conference post-event survey	December 2023	Cohorts 1 & 2	Year 4a Bruin Brains Conference Survey Report
Program personnel group interviews	March 2024	Program personnel from Jordan SD & SLCC	Year 4b Annual Survey & Interview Report
UPRC/PREP Plus Experiences survey*	April 2024	Cohorts 1 & 2	Year 4b Annual Survey & Interview Report
SLCC Experiences survey	May 2024	Cohort 2	Year 4b Annual Survey & Interview Report
SLCC Exit survey	May 2024	Cohort 1	Year 4b Annual Survey & Interview Report

The findings presented in this summative report are based on a synthesis of data and findings included in the formative reports to address the PREP Plus evaluation questions. This report also contains some data from the May 2024 SLCC Exit survey and the Year 4 program personnel group interviews that was not included in the annual report. Specifically, the additional data focuses on Cohort 1 students' college/career plans, and reflections on the entire PREP Plus program from both students and program staff. Based on the findings, the report concludes with lessons learned that may inform similar programs funded by NSF, as well as considerations for the sustainability and scalability of PREP Plus in local technical centers in the coming years.

Findings

The development and implementation of PREP Plus was supported by individual and collaborative contributions from administrative and program staff at SLCC and Jordan School District

At SLCC, administrative support was led and promoted by the PI throughout the grant period. For example, SLCC's e-learning department endorsed the transition to competency-based assessments for the engineering technology (ET) certificate courses, and supported pilot testing of the assessments during the 2021-2022 school year. SLCC also efficiently and effectively hired a new co-PI partway through the grant who became instrumental to the success of the program when students transitioned into classes at SLCC. Additionally, upper administration at SLCC was supportive of PREP Plus. During the 2022-2023 school year, the SLCC President heard about the success of the program, attended PREP Plus events and talked with students, and remembered their work when she saw them again later in the year. The PI and SLCC administration also supported modifications to the ET certificate program based on feedback from early PREP Plus implementation, and they worked proactively to establish partnerships and lay the foundation for sustainability of the program beyond the grant period.

Similarly, the PREP Plus program coordinator and other staff from Jordan School District provided administrative support and guidance in working with the Utah State Board of Education and SLCC, securing course approval for concurrent enrollment, scheduling, and other program logistics. A connection through the district also led to support from an external company that had designated funds for Title I schools and provided prizes for PREP Plus students' capstone projects during the 2022-2023 school year. Furthermore, relationships at the district level were leveraged for the sustainability of PREP Plus and the planned transition to Jordan Academy for Technology & Careers (JATC), which is part of Jordan School District. The PREP Plus program coordinator worked closely with the JATC principal throughout Year 4 to prepare and plan for the transition.

Finally, program development and implementation were enhanced by the successful working relationship and communication among PREP Plus program personnel. From 2022 to 2024, all program personnel from SLCC and Jordan School District met weekly to touch base and address issues on an ongoing basis. This was particularly important for coordination around scheduling and the logistics of having PREP Plus students on campus at SLCC. In addition to weekly meetings, program personnel collaborated while on campus, and SLCC staff were perceived by district staff to be particularly flexible and helpful in situations that required problem-solving. In 2024, when Cohort 1 students were in their senior year, program personnel embraced the expansion of their role to support PREP Plus students' college and career plans by helping with their resumes and applications, and by spending significant time writing letters of recommendation.

Some barriers arose during the development of the ET certificate program; additional challenges pertaining to SLCC faculty, program personnel roles, and scheduling arose once PREP Plus students began taking classes at SLCC

A few specific barriers impacted the development and early implementation of PREP Plus. For example, while the SLCC team had planned to involve industry partners and employers in developing and selecting courses for the engineering technology certificate program, this was not possible due to limitations from COVID and employer policies. Furthermore, some of SLCC's engineering technology faculty were initially hesitant about implementing the new competency-based assessment approaches. Throughout the program, other barriers emerged with regard to SLCC faculty. A challenge that was commonly cited by PREP Plus students and program personnel was that faculty were slow to grade students' assignments and update their course grades online. As explained by a Cohort 2 student in an open-ended survey response, it is important to "keep up with grading so that people don't get a false impression" about how well they are doing in class. Additionally, some PREP Plus students exhibited academic and behavioral challenges, like late assignments, and SLCC faculty struggled with managing high school students' diverse needs. One student in Cohort 1 noted in an open-ended survey response that "some of the teachers seem to have displayed emotional reactions while teaching."

Some barriers to PREP Plus implementation related to program personnel staffing and roles. Towards the end of the grant, there was less involvement from SLCC's former Engineering Success Coach because her position was absorbed into a different department. For example, after the restructuring, she was no longer able to attend the weekly program personnel meetings; however, she still

supported the Bruin Brains Conference and shared relevant scholarship opportunities for students. Additionally, challenges arose with the PREP Plus program coordinator's role in Year 4, when both cohorts of students were taking classes at SLCC. In Year 3, the coordinator provided extensive direct support in SLCC classes with Cohort 1 students, which allowed her to stay informed about students' progress and help SLCC faculty manage behavior. In Year 4, she was unable to provide support simultaneously in Cohort 1 classes and Cohort 2 classes. She chose to spend more time in Cohort 2 classes since it was the students' first year at SLCC, but she reported feeling less connected and informed about Cohort 1 students as a result. and felt that this may have had an impact on the success of some of these students in their senior year.

The most prominent barriers to PREP Plus implementation were related to the scheduling and logistics of students taking classes on campus at SLCC. For example, there were often challenges coordinating high school schedules with SLCC schedules (e.g., course times, spring break), and some students had high school sports commitments that required them to leave SLCC early and travel separately from their peers. Also, PREP Plus students who did not attend West Jordan High School had to provide their own transportation to the high school so they could catch the bus to SLCC. This was often a financial burden for their families (e.g., covering the cost of Uber rides) and sometimes caused scheduling issues (e.g., if a student's Uber ride was running late). Finally, because of the differences between the high school and SLCC schedules, PREP Plus students missed their lunch period at school. They were provided with ramen soup and peanut butter sandwiches at SLCC during the short break between classes. However, both students and program personnel noted that this lunch was not nutritious, and students consistently cited the lunch options and schedule as their least favorite part of taking classes at SLCC.

Modifications were made throughout the grant to the summer program curriculum, the ET certificate courses and content, and the Bruin Brains Research Conference to better meet program goals and student needs each year

Throughout the grant, PREP Plus program personnel made modifications based on feedback and reflections each year to better meet program goals and student needs. These variations in implementation centered around the program curriculum and staffing, SLCC courses, and the Bruin Brains Research Conference. For example, student capstone projects were the hallmark of the PREP Plus summer program (PREP 4). In Year 3, based on experiences with Cohort 1 capstone projects, the capstone curriculum for Cohort 2 was restructured to include a framework for brainstorming capstone project ideas, as well as student presentations at the end of the summer. These modifications were intended to enhance student preparation and motivation to complete their projects. In addition, the two teachers who run the district STEM fair were hired to teach the capstone class in Year 3, replacing the teaching assistants who led the class in Year 2. This staffing change was meant to address challenges with the teaching assistants' lack of authority in Year 2, and to motivate students to have high-quality capstone projects completed on time so they could compete in the STEM fair. Furthermore, to enhance connections among PREP students, program personnel also added a weekly experience in Year 3 that mixed PREP participants across different years for dialogue, informal mentorship, and support opportunities between older and younger students.

Between Years 3 and 4, some variations in implementation occurred due to modifications to the content and structure of the SLCC courses in the engineering technology certificate program. For example, the PI received approval to change one course in the certificate program to a different course, beginning in Year 4 for Cohort 2. This change was based on feedback from Year 3 about the difficulty level of the course content for Cohort 1 students, and the skills that are most valuable in the evolving engineering technology field. SLCC program personnel and faculty also made adjustments to the content of particular courses for Cohort 2 students in Year 4 based on Cohort 1 students' experiences in Year 3, such as modifying the difficulty level of assignments and duration of labs in the manual machining course to better align with students' needs. While these modifications benefitted students in Cohort 2, when Cohort 1 students reflected on their PREP Plus experiences, they felt that some of the teaching methods and concepts in their SLCC classes were frustrating or difficult to learn.

Finally, program personnel contributed to the planning of SLCC's Bruin Brains Research Conference each year to ensure that the event would address the interests and needs of PREP Plus students. For all three years (Years 2, 3, and 4), the conference agenda included two speakers, a session for poster and/or oral presentations by students, and a networking luncheon. The topics of other sessions varied by year. In Year 2, there was a "Meet the Professors" session that allowed Cohort 1 students in 10th grade to meet SLCC professors before they began taking classes at SLCC the following year. In Year 3, the conference included a PREP Pathways session and a test anxiety workshop, which helped students learn about college/career pathways after PREP Plus and addressed a need for student support around test anxiety. The Year 4 agenda featured sessions that provided information and exposure to programs and resources as students began to think about their college and career plans. For example, there was a presentation on SLCC's TRIO program and student motivation, a presentation on SLCC's Summer Bridge program, a session on college scholarships and funding, and more networking experiences for students compared to previous years.

While PREP Plus retention rates were slightly lower than expected, there were no significant differences based on student characteristics

The PREP Plus program initially sought to achieve a 60% student retention rate. Retention rates for Cohorts 1 and 2 fell slightly short of that goal.² As shown in Table 2, Cohort 1's retention rate was 52%, just below the goal of 60%. Similarly, Table 3 shows that Cohort 2's retention rate was 44%, also below the program's goal of 60%. Despite these overall retention rates, there were no significant differences in the program's ability to retain particular student groups. For example, students of color and female students were no more likely to leave the program than white students and male students, respectively. According to program personnel, students left the PREP Plus program for a variety of reasons. Some students moved away during the program, and some had health issues that caused them to relocate or not be able to attend classes and events. Several students left the program due to interest in and scheduling conflicts with other opportunities, such as the IB program, the engineering program at JATC, AP classes, or jobs/entrepreneurial pursuits.

² This summary of participant demographics and retention relies upon information provided by PREP Plus program personnel. Over the course of the evaluation, the UEPC team noted discrepancies in student ID numbers, demographics, and participant counts provided by program staff. While we worked with staff to resolve these discrepancies, we were unable to account for all inconsistencies. As such, it is possible that the reported retention rates are slight over- or under-estimates.

Table 2. Cohort 1 retention by student characteristic

Cohort 1 Retention Rate = 52%	Summer 2021	Spring 2024
TOTAL PARTICIPANTS	21	11
% Students of Color	67%	82%
% Female Students	38%	36%
% Free Lunch	62%	73%

Table 3. Cohort 2 retention by student characteristic

Cohort 2 Retention Rate = 44%	Summer 2022	Spring 2024
TOTAL PARTICIPANTS	16	7
% Students of Color	69%	71%
% Female Students	50%	29%
% Free Lunch	88%	71%

PREP Plus participants in Cohorts 1 and 2 reported more positive attitudes about STEM and engineering since they began participating in the program

Students who participated in PREP Plus were asked to report on their attitudes toward STEM across four dimensions—STEM awareness, STEM confidence, beliefs about STEM, and intentions in STEM—both during the summer prior to 10th grade (June 2021 for Cohort 1 and June 2022 for Cohort 2) and again in April 2024 (end of 12th grade for Cohort 1 and end of 11th grade for Cohort 2).³ As shown in Figure 2 and Figure 3, participants in both cohorts reported modest improvements in attitudes toward STEM across all four dimensions. Notably, beliefs about STEM were highest for both cohorts at the conclusion of the evaluation period: 4.4 and 4.5 on a scale of 1-5, for Cohorts 1 and 2, respectively. As described in greater detail in previous annual reports, this set of items asked students to rate their level of agreement with statements such as, “STEM skills will play an important role in my future job,” and, “Critical thinking and problem-solving are important skills for engineers to have.”

Furthermore, in open-ended survey responses, several Cohort 1 students highlighted how PREP Plus impacted their attitudes toward STEM across these four dimensions. Exemplary quotes for each dimension are provided below.

- **Awareness:** “From the start of the program, I had an interest in STEM. And after a field trip in 2nd year, I saw someone creating chemical reactions. This infatuated me with chemistry and from that point on I decided to put my effort towards becoming a chemical engineer.” (Cohort 1 student, May 2024)

³ During each survey administration, students were prompted to provide a program-assigned identification number to allow for the longitudinal measurement of individual responses. Due to inconsistencies in the identification numbers that respondents provided in the surveys, the UEPC team was unable to definitively identify the group of students who participated in the surveys at each point in time. Therefore, our summative analyses of student outcomes reflect the perspectives of all survey respondents, regardless of program retention status.

- **Confidence:** “[My favorite part of taking classes at SLCC was] the free reign we are given. We could make mistakes and find out what we did and how to correct them. In [professor name’s] class, I felt this sense of freedom that helped me grow and feel more confident in following instructions and taking risks as compared to my other classes.” (Cohort 1 student, May 2023)
- **Beliefs:** “PREP has advanced my life in ways that people wish they could’ve done. Without PREP I would not have the opportunities to grow I have now, and I would not have been able to push myself for more. PREP has given me a pipeline of what I need to do to prepare and finish to succeed in my future.” (Cohort 1 student, May 2024)
- **Intent:** “I’ve always had a general interest in computers but PREP helped me solidify that I wanted to get a degree in computer science.” (Cohort 1 student, May 2024)

Figure 2. Change in STEM outcomes among Cohort 1 students between June 2021 and April 2024

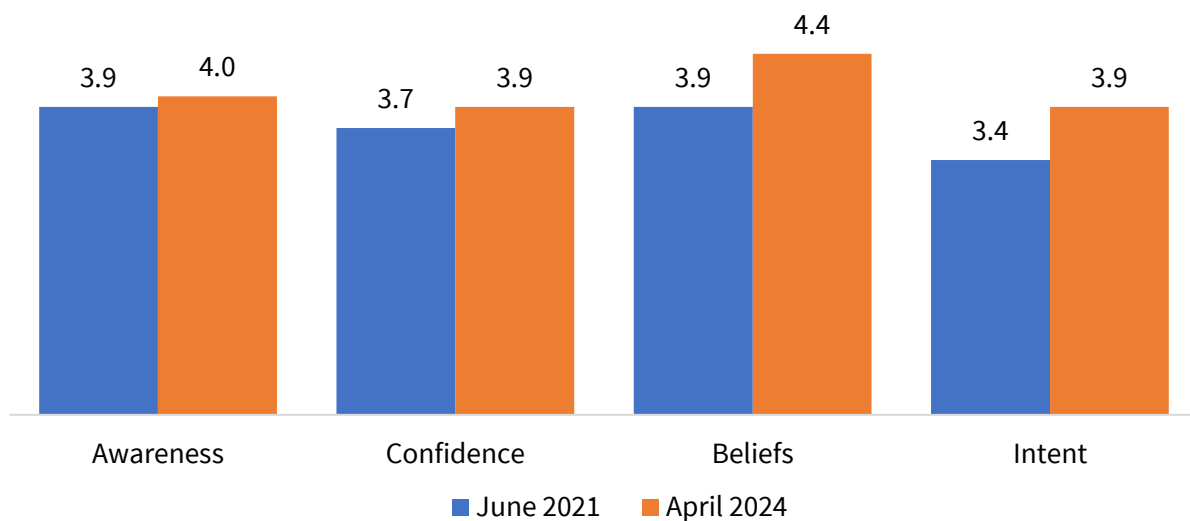
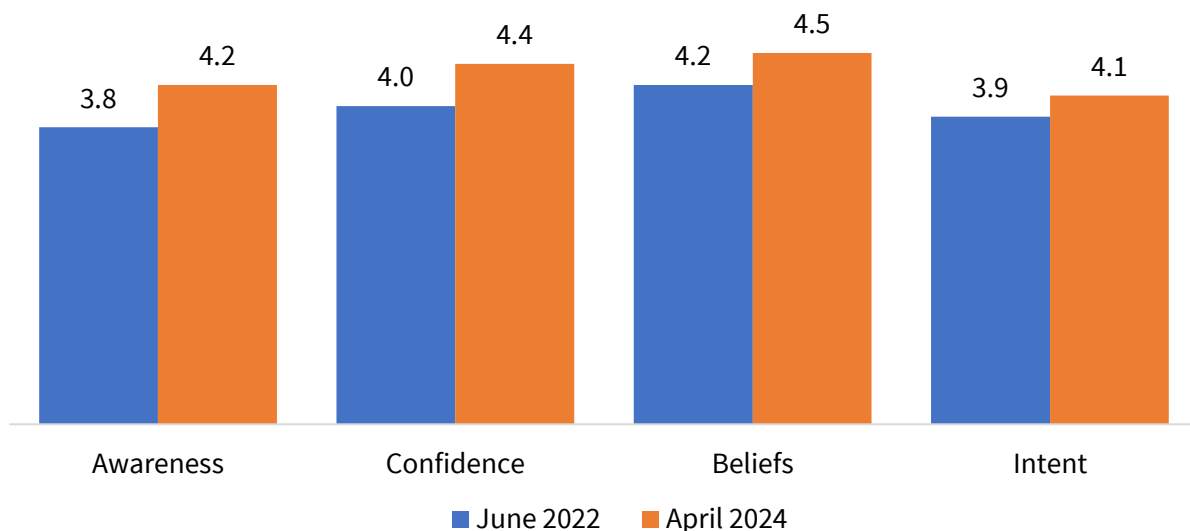


Figure 3. Change in STEM outcomes among Cohort 2 students between June 2022 and April 2024



Student persistence in ET and other STEM educational and career opportunities was most supported by the college campus experience, college application support for seniors, the Bruin Brains conference, and the PREP Plus community; other program components had varied or limited impact

Data about specific components of the PREP Plus program provided insight into how the program influenced students' persistence and completion of ET and other STEM educational and career opportunities. To this end, seven program components are reviewed below: 1) the PREP Plus summer program and capstone experience, 2) the Bridge Year, 3) the college campus experience and SLCC classes, 4) the Bruin Brains Research Conference, 5) the Undergraduate Projects & Research Conference, 6) college application support for seniors, and 7) the cohort experience and PREP Plus community.

PREP Plus summer program (PREP4) & capstone experience: Program personnel reported varied impacts of the summer program (PREP4) and capstone experience in Years 2 and 3. Several students had highly successful capstone projects, integrating corporate mentors and presenting their projects at local and national events. Other students were challenged by generating an idea for their capstone project and lacked motivation to bring their project to completion. Results from the summer program pre- and post-surveys in Years 2 and 3 indicated that these program components had limited effects. In Year 2, 78% of Cohort 1 students became more interested in STEM as a result of the PREP Plus summer program, and 61% reported that their capstone project made them more interested in going into their area of interest. However, in Year 3, only 44% of Cohort 2 students felt this way about the summer program and their capstone project. This may have been due, in part, to the fact that Cohort 2 students entered the summer program with higher STEM outcomes.

Bridge Year (10th grade): The Bridge Year was intended to focus on mentoring and early connections between PREP Plus students and the SLCC engineering technology program. While the Bruin Brains Research Conference was a successful component of the Bridge Year (see "Bruin Brains Research Conference" section below), program personnel experienced challenges keeping in contact with PREP Plus students throughout their 10th grade year. One program staff member reported that the program team realized the importance of having a "seamless academic curriculum," without a gap in academic programming related to PREP Plus, and that future iterations of the program would not include the Bridge Year.

College campus experience & SLCC classes: Both students and program personnel discussed the various impacts of the opportunity to take classes at SLCC as part of PREP Plus. Specifically, the SLCC environment, smaller class sizes, and "hands-on" activities promoted student motivation and learning. As one Cohort 2 student explained, "my favorite part of taking classes at SLCC this year was the hands-on material of my classes and the smaller more intimate class size that helped to facilitate learning." Similarly, a Cohort 1 student noted, "when on a college campus I feel more focused and I try harder to understand the material I'm being taught." Students and program personnel also highlighted the ways in which being on campus at SLCC helped students gain confidence, preparedness, and supportive relationships at the college level. For example, one program staff member emphasized the importance of "building that confidence of being on campus, the confidence

of ‘I know where I’m going...I’ve been here and I belong here.’” This was corroborated by a Cohort 1 student: “...I feel fully integrated into the college community because of how much we work on campus and with the SLCC system.” When asked how SLCC classes differ from high school classes, Cohort 2 students mentioned that they were able to “truly get an idea of what college is like, and that “the teachers actually care about the students” and treat them “more responsibly.” Furthermore, in Year 4, 100% of students from both cohorts reported that their SLCC classes made them feel more prepared for a college program or career in STEM after high school. Some students elaborated on the connections between SLCC classes and their preparation to pursue ET educational and career opportunities. As one student from Cohort 1 stated, “PREP Plus has given me a head start in my engineering degree, and another student from Cohort 2 explained, “the work we did [at SLCC] was clearly shown how it would be applicable in a career setting.”

Bruin Brains Research Conference: Overall, data suggests that the annual Bruin Brains Research Conference supported student interest in STEM and understanding of relevant educational and career opportunities. As discussed earlier in this report, the content of the Bruin Brains conference was intentionally modified each year to meet the needs of PREP Plus students. Across the three years of the conference, there was variation in how much the different speakers promoted students’ interest in STEM. There was also variation in how much the presentation session affected STEM interest, and Year 3 data suggested that this session may have been more impactful for students to give presentations compared to those who did not present. One student from Cohort 1 explained the benefits of the Bruin Brains research presentations when reflecting on their PREP Plus experiences: “My favorite part [of PREP Plus] has been the Bruin Brains. I enjoy being able to see what people are able to do with their work and assignments. I definitely believe these helped me realize what level my future work should be at.” Furthermore, an increasing proportion of students each year indicated that the networking luncheon positively affected their STEM interest (30% in Year 2, 37% in Year 3, 50% in Year 4). The PREP Pathways session that was part of the Year 3 conference was relatively successful, as 50% of students indicated that they had a clearer understanding of the college or career paths they would like to take because they attended the session. The sessions that were part of the Year 4 conference were less specific to STEM and ET educational and career opportunities but had an impact on all students’ knowledge of programs (e.g., SLCC’s TRIO and Summer Bridge programs) and resources (e.g., scholarships, financial aid) for enrolling and being successful in college.

Undergraduate Projects & Research Conference (UPRC): The annual Undergraduate Projects & Research Conference had a differing impact on students in Year 2 compared to Years 3 and 4. In Year 2, 80% of students indicated that their interest in STEM increased because they attended the UPRC. The conference was hosted by SLCC’s School of Science, Math, and Engineering, and had a more explicit STEM focus. In addition, PREP Plus students had the opportunity to present at the conference in Year 2. In Years 3 and 4, when the UPRC was hosted by a non-science department and PREP Plus students were not able to present, approximately half as many students (44% in Year 3; 43% in Year 4) reported an increase in STEM interest because of the conference. These differences were also reflected in students’ open-ended survey responses. In Year 2, one attendee noted that their “favorite part [of the UPRC] was seeing all the other people interested in the sciences.” This was contrasted by a student in Year 4 who noted that their least favorite part of the conference was “the fact that there wasn’t many engineering projects or math.” In line with this student data, program personnel suggested that the UPRC may no longer be an effective event for PREP Plus students, and that other types of events may be more beneficial. One program staff member proposed a job fair or “pathway

to profession” day where students could talk to people from different STEM industries and participate in workshops led by career services about resume writing, interviewing, and similar topics.

College application support for seniors: While not an explicit component of the PREP Plus design, support for 12th grade students applying to college emerged as a critical aspect of the program in Year 4. After the introduction to college topics at the Bruin Brains conference, the PREP Plus program coordinator scheduled specific days to discuss topics such as financial aid, scholarships, and the college application process. More informally, in conversations at lunch, program personnel checked in with students about upcoming application deadlines and requirements. As a Cohort 1 student explained, PREP Plus staff “have helped me understand the flow of college and how to register for college.” The program coordinator and SLCC staff also spent significant time during Year 4 writing letters of recommendation for PREP Plus students. With this support, program personnel reported that all but two of the PREP Plus seniors are planning to go to college next year. Despite these successes, they indicated that there are opportunities to formalize and strengthen the structure for this part of the program. One program staff member noted the importance of proactively helping 12th grade students with planning, gathering relevant information, and systematically working on college and scholarship applications throughout their senior year.

Cohort experience & PREP Plus community: The cohort-based design of PREP Plus provided opportunities for students to develop close relationships within and across cohorts. This allowed for collaborative learning and a sense of community that supported student retention and persistence throughout PREP Plus. One student in Cohort 1, reflecting on their experiences in PREP Plus, explained that their favorite part of the program was “working with classmates and completing assignments together.” Another example of collaboration between students in different years of the program highlighted how the PREP community provided opportunities for peer-to-peer skill development. A 10th grade student in Year 2 wanted to continue their capstone project in Year 3 but was not comfortable with programming, so they planned to team up with an incoming PREP Plus student from Jordan PREP who they knew was interested in programming. Furthermore, in Year 4 of the program, program personnel reported that Cohort 2 students benefitted from “watching the seniors” and learning from them, because they had taken classes at SLCC the previous year and were familiar with that part of the program. Overall, the community that formed among PREP Plus students was described by program personnel as “what keeps students coming back to Jordan PREP.”

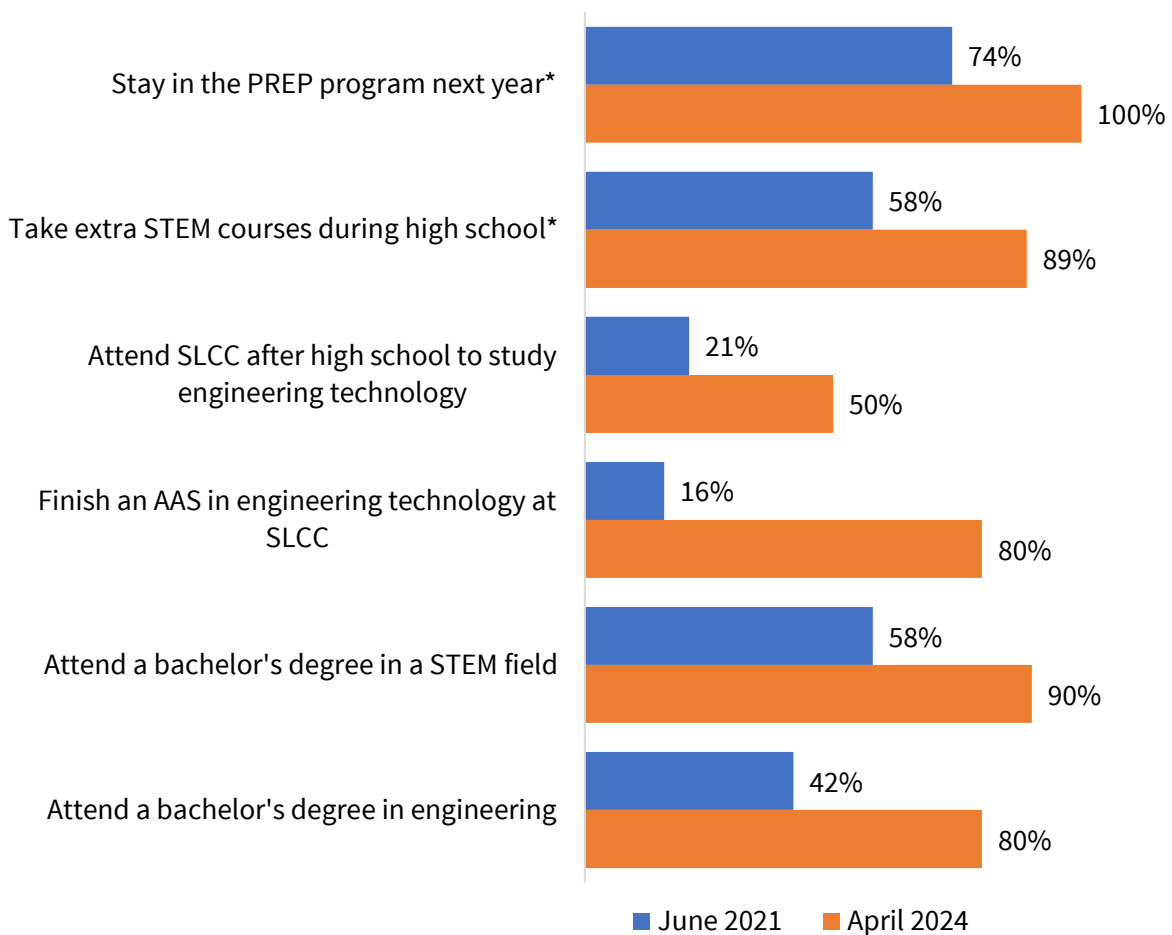
After participating in the PREP Plus program, students were more likely to report planning to pursue a variety of STEM pathways

Participants were asked to report how likely they were to pursue a variety of STEM pathways both during the summer prior to 10th grade (June 2021 for Cohort 1 and June 2022 for Cohort 2) and again in April 2024 (end of 12th grade for Cohort 1 and end of 11th grade for Cohort 2). These results are displayed in Figure 4 (Cohort 1) and Figure 5 **Error! Reference source not found.** (Cohort 2). The values in these figures indicate the percentage of survey respondents who indicated that they were “moderately” or “very” likely to engage in each of the noted activities. In all cases, the likelihood of planning to pursue STEM pathways increased. Among Cohort 1 respondents, there were substantial

increases in plans to complete an Associate of Applied Science (AAS) in engineering technology at SLCC (16% → 80%), attend a bachelor’s degree program in STEM (58% → 90%), and attend a bachelor’s degree program in engineering (42% → 80%). In addition to those pursuing STEM pathways, open-ended survey responses indicated that other Cohort 1 students were planning to enter military service, serve an LDS mission, work a non-STEM job, or begin a non-STEM college program. Among Cohort 2 respondents, 100% planned to attend a bachelor’s degree program in STEM or engineering at the end of their junior year.

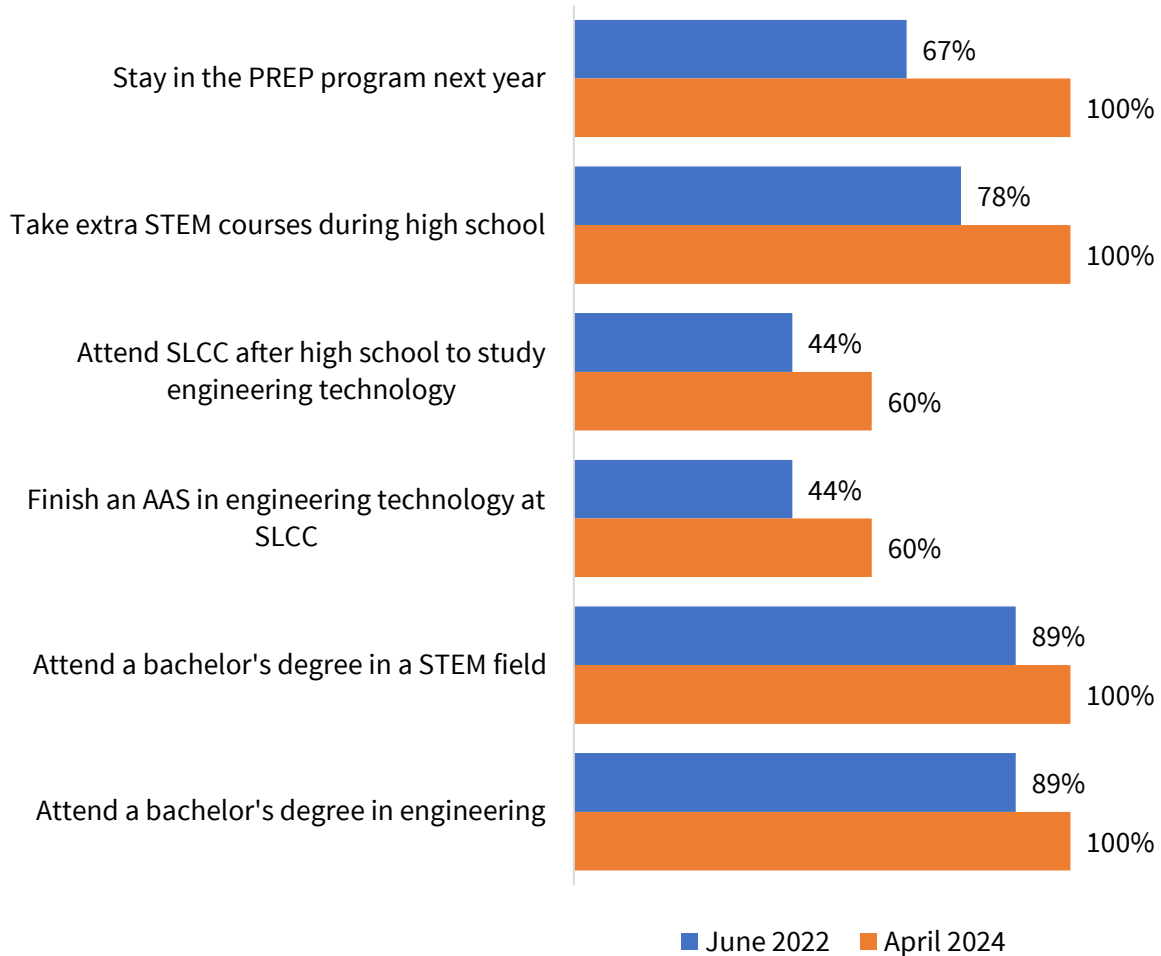
Comparing survey responses among Cohort 1 in June 2021 (Figure 4) and Cohort 2 in June 2022 (Figure 5), we note that these two groups of students were different from one another in terms of their stated plans at the start of the program. For example, Cohort 2 respondents were more than twice as likely as Cohort 1 respondents to report planning to pursue a bachelor’s degree when they were initially surveyed (89% vs. 42%). These results suggest that there were some underlying baseline differences across the two cohorts of participants.

Figure 4. Change in plans to pursue STEM pathways among Cohort 1 students between June 2021 and April 2024



*These outcomes were last measured in April 2023 because they were no longer relevant when students completed the program in 2024.

Figure 5. Change in plans to pursue STEM pathways among Cohort 2 students between June 2022 and April 2024



The PREP Plus program helped seniors solidify their post-secondary plans, and many of them reported learning about and feeling more prepared for college

At the end of their senior year, Cohort 1 students were asked in open-ended survey questions about their college and career plans and how their plans had changed since the beginning of high school. Most students noted that their plans had changed at some point and that they had previously considered different fields (e.g., nuclear engineering, airplane mechanics) or career paths (e.g., surgeon, football player). Several students explained that the PREP Plus program helped them solidify their post-secondary plans:

- “I didn't really know what I wanted to do at the beginning of high school but because of this program I have a solid idea of what I want to do now”
- “[If I didn't participate in PREP Plus], I wouldn't be anywhere near where I am. I believe I would be working an unhappy job and unsure about my next step for college, work, and life in general.”

Many seniors highlighted the ways that their experiences in PREP Plus helped them learn about and prepare for college, in particular. These students explained that understanding the benefits and expectations of college contributed to their feelings of excitement, readiness, and confidence:

- “I have realized that there are a lot more job opportunities that open for me if I pursue college.”
- “[If I didn’t participate in PREP Plus], I think I would still be going to college, but I wouldn’t be nearly as I currently am.”
- “I’ve gained experience in taking college course and the expectations of college professors.”
- “I’ve learned a lot about how college works and am really excited for college.”
- “The experiences I’ve had from PREP has helped me to have prior knowledge going into college. I feel as though I have an advantage and feel more confident in pursuing my education.”

The influence of PREP Plus on college aspirations was corroborated by program personnel who were familiar with Cohort 1 students’ trajectories throughout high school. This was exemplified by one program staff member who recalled how students’ interest in college changed significantly since they began taking classes at SLCC:

“Most [PREP Plus] students, 90% of the students are first generation students. And so, in the beginning, when we talked to them right when they entered the program their junior year, and we asked what they wanted to do with their life, college was not something that was a consideration. Two of them had college dreams, but the others were pro football, doing hair and nails, working on cars, more like a trade apprenticeship than actual college... And now, I think all of them, except maybe one, is really looking forward to a college degree... A lot of them have even enrolled in college. They’ve been accepted. They have a course of action. And so I think that that’s really—that’s a huge change from the beginning to where we are now.”

Other benefits of PREP Plus included students feeling safer at SLCC than at their high school and developing a strong sense of community and motivation because of the program

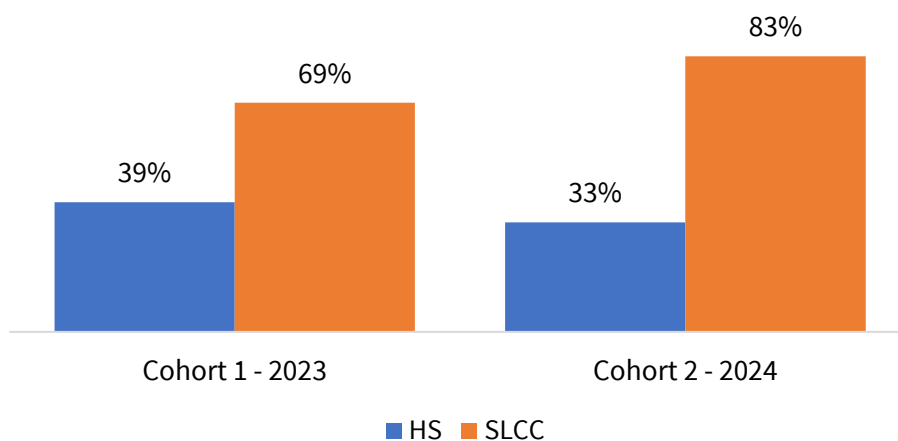
Given that SLCC was a new environment for students as part of PREP Plus, their sense of safety was an important consideration for program implementation and impact. When asked how safe they felt at high school and on the SLCC campus after their first year of taking classes at SLCC (end of 11th grade), both Cohort 1 and Cohort 2 students reported feeling much safer at SLCC, as shown in Figure 6. At SLCC, 69% and 83% of Cohort 1 and Cohort 2 respondents, respectively, felt “very” or “extremely” safe, versus only about one-third of respondents at high school.

In open-ended responses, students explained why they felt safer at SLCC than at their high school. Several students noted that there are fewer and more familiar people (both students and teachers) at SLCC. For example, one Cohort 1 student explained: “I feel a lot safer at the college because of the teachers and my fellow classmates that I’ve known for almost 4 years now.” Other Cohort 1 students specifically mentioned that “there are grown adults at SLCC” and that they feel safer around adults: “Being surrounded by adults made me feel as though there were less possible accidents or potentially dangerous situations.” Finally, students from both cohorts credited SLCC’s physical environment and atmosphere for their feelings of safety. One Cohort 1 student wrote: “Never seen no violent or felt

threatened feels like a second home.” Similarly, Cohort 2 students described SLCC as “a more chill environment” and “in a safe area.” One Cohort 2 student elaborated: “I think it’s a really relax[ed] place so like I think it’s extremely unlikely that something would happen.”

It is worth noting that when describing safety at both their high school and SLCC, several Cohort 1 students described feeling less safe in contexts when they thought anyone could access the building or area they were in. One student mentioned that this was true at SLCC because it is a college campus, and another student felt this way about their high school because “students will open doors for others and the main office doesn’t pay attention to who walks in and out of the building during lunch.”

Figure 6. Perceptions of safety by campus among Cohort 1 (2023) and Cohort 2 (2024) students



In addition to students’ enhanced feelings of safety while participating in PREP Plus at SLCC, another benefit of the program was the sense of community that students gained through the program. As discussed previously in this report, students made connections within and across PREP cohorts. In Year 4, in particular, Cohort 1 and Cohort 2 students developed a stronger sense of community as they spent more time together during lunch and at SLCC. Program personnel felt that Cohort 2 students in Year 4 benefitted by talking with and learning from Cohort 1 students who had taken the same classes at SLCC the previous year: “They’ve all really bonded incredibly well, and they never really had that opportunity to spend that amount of time together before.”

Program personnel explained that the relationships and community developed among PREP Plus students were particularly important in a diverse group and for students from historically marginalized groups in STEM, like women in engineering. For example, several of the female students in PREP and PREP Plus became close friends through the program and joined the high school lacrosse team together. As one program staff member reflected: “There’s no common characteristic between these students other than they really love each other. They’re a community. They support each other...we’ve become family.” This sentiment was also exemplified by a Cohort 1 student when describing their favorite part of PREP Plus: “The group environment has been great and I love knowing everyone and having that sense of community.” While most sentiments around the PREP Plus community were positive, one student also mentioned that their least favorite part of PREP Plus was being away from their high school friends.

Finally, several students in Cohort 1 felt that PREP Plus helped them progress, stay motivated, and recognize opportunities and possibilities for themselves. This was important for students regardless of their field of study, as portrayed in their comments:

- “I really enjoyed the PREP experience, although I'm not really going to pursue engineering. I think this program through all the mental health problems, struggles, and interpersonal complications has always kept me motivated in life and helped with feelings of despair even. I wouldn't be who or where I am, without Jordan PREP.”
- “I think this program is amazing... I wouldn't be as far ahead as I am at without them.”
- “It was an overall really fun experience. I really learned a lot and it helped me see all of the opportunities I have now that I have finished the program.”
- “[PREP Plus] just lets me know I can do anything.”

PREP Plus personnel proactively developed relationships throughout the grant to promote program sustainability and established a robust plan to transition the ET certificate into local technical centers with continued support from SLCC

The sustainability and scalability of PREP Plus was an intentional focus of program personnel throughout the life of the grant. Beginning in Year 2, program personnel began considering alternative ways to fund components of the program (e.g., bussing) after the program ends, and raised the idea of eventually integrating PREP Plus into Jordan School District's technical center, the Jordan Academy for Technology & Careers (JATC). Housing the program at JATC would eliminate the need for, and cost of, separate transportation for PREP Plus students, since the high schools provide transportation to JATC. In Year 3, program personnel secured a one-year no-cost extension to support Cohort 1 students in completing the full program. Furthermore, they entered discussions with JATC and Granite Technical Institute (GTI), in a neighboring district, about transitioning the ET courses into their centers. While these discussions were in the early stages, program personnel also laid the groundwork to ensure other avenues of buy-in and momentum, such as building relationships with SLCC's upper administration and garnering their support for the program.

As a result of these efforts, by the end of Year 4, program personnel had established partnerships with both GTI and JATC. The process of building a relationship with GTI was described by program personnel as challenging because Granite School District had partnered with a different university for concurrent enrollment in the past and was initially hesitant to partner with SLCC. However, with gradual and persistent outreach in Years 3 and 4, GTI agreed and began the process of adopting the ET courses into their concurrent enrollment offerings, including submitting the courses and teacher applications for concurrent enrollment for the Fall 2024 semester. Program personnel expressed uncertainty about the extent to which Granite students will complete the full certificate rather than taking a selection of ET classes. While they have emphasized the importance of the full curriculum for effectively preparing students for ET careers, and they feel that the district understands this, they are unsure whether this will be communicated to and reinforced by teachers. Regardless, the expansion of the ET certificate courses into another district will support more students in pursuing engineering technology and associated college and career pathways. Opportunities for ET students from Granite School District and Jordan School District to connect and build relationships will also enhance their community and support system, which was a hallmark of the success of PREP Plus.

The partnership and transition plan developed between SLCC and JATC was more robust and detailed, stemming from close collaboration between the PREP Plus program coordinator and the JATC principal throughout Year 4. The ET certificate program will be adopted into JATC’s concurrent enrollment offerings and delivered on the JATC campus, with continued support and guidance from SLCC, including a SLCC staff position dedicated to PREP Plus. This will provide a relatively seamless continuation in programming for Cohort 2 (current 11th grade) and Cohort 3 (current 10th grade) students in PREP Plus, though the transition to the JATC campus will be gradual. During the 2024-2025 school year, students from Cohorts 2 and 3 will take classes at JATC during the fall semester. Because the spring semester classes are more advanced machinery-based classes, students will take these classes at SLCC while JATC trains their teachers and installs the necessary equipment. During the 2025-2026 school year, all ET certificate courses will be held at JATC.

Program personnel from SLCC and Jordan School District collectively described this transition as a “win-win” for students and for the longevity of PREP Plus, and they credit the success of the transition plan to the JATC principal’s engagement and commitment. As explained in the Year 4 annual report, the adoption of PREP Plus into JATC will bring myriad benefits for students, many of which will alleviate the challenges that were described by program personnel and students throughout the grant. These benefits include:

- Greater access to the program for students interested in engineering technology, and opportunities for more students to participate
- Transportation provided for all students
- Access to healthier and more varied lunch options
- Better alignment between schedules (e.g., spring break) because students’ high schools and JATC are both within Jordan School District (though program personnel noted that the high school and JATC bell schedules are different, which poses continued scheduling challenges)
- Familiarity of JATC faculty and staff with managing high school students’ academic and behavioral challenges
- Coordination of individual class schedule needs supported by JATC counselors (e.g., balancing ET courses with AP or IB classes)
- Dedicated counselors and a CTE (career and technical education) coordinator to provide more systematic support for seniors applying to colleges and scholarships

Program personnel also described a range of benefits for JATC, including new resources and equipment for students as part of the new course offerings and partnership with SLCC. In addition, the ET certificate program will help JATC differentiate their curriculum: “We get those college-bound students, but also those engineering tech students that maybe want to just enter the workforce instead of a four-year degree. But we can get tracks and serve all students in whatever they want to do.”

Overall, considering the transition of the ET certificate program out of SLCC and into GTI and JATC, SLCC personnel expressed excitement about the opportunities ahead. One program staff member highlighted the potential impact of SLCC’s connections with local high schools: “We also have a way to now influence the high schools, and we didn't have a way before. And we can influence them in areas that we have a power position on, which is understanding the engineering layout and landscape of the [Salt Lake City] valley.” However, this sentiment was coupled with a concern that without SLCC faculty teaching the ET courses, it may be more difficult to infuse the perspective of the knowledge

and skills that are most important for local industry into the day-to-day of each class. SLCC staff also raised some concerns about the program losing the true college campus experience, an aspect of PREP Plus that clearly contributed to students' growth and outcomes. As explained by one program staff member: "...That's a thing that's going to go away [next year], right? That benefit on the college preparation, which may have played a big role in taking a bunch of students that weren't interested in college, and now, almost all of them, if not all of them, are interested in college." It will be important for SLCC personnel to consider how to incorporate their expertise in local industry needs and elements of the college campus experience as they support the ET curriculum at GTI and JATC.

Lessons Learned & Considerations

As described throughout this report, the external evaluation of PREP Plus highlighted a range of successes and supports to program implementation and impact, as well as challenges and barriers. These findings can be used to inform the design and implementation of future NSF-funded programs that are similar to PREP Plus, and to guide the transition of PREP Plus into JATC and GTI in the coming years. To this end, lessons learned for similar programs and considerations for the sustainability and scalability of PREP Plus in technical center contexts are presented below.

Lessons Learned for Similar Programs

- 1) **Ensure that students have an adequate lunch break with nutritious food options.** Differences between the high school and college schedules led to PREP Plus students missing their school lunch period on the days they took classes at SLCC. Because of limitations with scheduling and funding, students ate ramen soup and peanut butter sandwiches for lunch at SLCC during the short break between classes, and this was consistently raised as an issue by both students and program personnel. Similar programs that involve travel to college campuses should consider developing the schedule to ensure that students can attend their high school lunch period—particularly for students who qualify for free and reduced lunch—or secure alternative funding to provide students with an adequate break and varied, nutritious lunch options while on the college campus.
- 2) **Consider a “seamless academic curriculum” without a bridge year or gap year.** The PREP Plus Bridge Year, during 10th grade, was intended to focus on mentoring and early connections between PREP Plus students and the SLCC engineering technology program. However, PREP Plus program personnel noted challenges with the interrupted academic curriculum and maintaining contact with students during the gap year. Similar programs may consider eliminating the bridge year or gap year, or developing a hybrid approach that sustains certain academic elements and includes more specific expectations and opportunities for communication between program staff and students.
- 3) **Incorporate a structure for program staff to support 12th grade students' college and career plans.** With the no-cost extension, PREP Plus continued through Year 4, when the first cohort of students were seniors in high school. In addition to their typical program responsibilities, program staff embraced the expansion of their role to support 12th grade students with their

resumes, college and scholarship applications, and letters of recommendation. Similar programs that serve students during their senior year should consider defining roles, procedures, and expectations for program staff to provide college and career supports more feasibly and systematically. This could include monthly meetings with each student to discuss their plans and outline related tasks, a timeline and procedure for students to request letters of recommendation, and collaboration with the high school counseling/CTE department.

- 4) **Explore relationships and opportunities for program sustainability early in the grant period.** PREP Plus program personnel began generating ideas and developing relationships to promote program sustainability in Year 2 of the grant. They simultaneously pursued multiple avenues for the continuation and expansion of PREP Plus, and garnered support for diverse possibilities through SLCC, Jordan School District, and other local school districts. This allowed for a gradual approach to establishing partnerships, a targeted planning period during Year 4, and a staggered transition that met the needs of all parties. Similar programs may consider an intentional, proactive approach to generating ideas, building and leveraging relationships, and entering discussions about sustainability early in their grant period. This can also provide time to work through logistical and scheduling challenges, particularly between high schools and technical centers, to ensure that a strong partnership and realistic transition plan is in place by the end of the grant.

Considerations for Sustainability & Scalability in Technical Centers

- 1) **Develop a detailed two-year transition and support plan.** As PREP Plus moves out of SLCC and into JATC and GTI over the next two years, it will be critical to have a clear plan that defines program personnel roles and organizational expectations during the transition period. For example, this could include a description of responsibilities each year for the new SLCC staff member who will be supporting the program, based on the co-PI role for the PREP Plus grant, as well as expectations for coordination among SLCC personnel and technical center personnel (e.g., monthly meetings). The plan might also outline specific contributions and supports that SLCC will provide, as well as the services that JATC and GTI will provide as part of the program. Furthermore, funding commitments, future funding needs, and responsibilities for securing additional funding, with associated timelines, should be clarified. Funding considerations may also inform targets for the recruitment of new students into the program, which should be included in the plan along with an approach for student recruitment at both JATC and GTI. Finally, the plan should outline how seniors will be supported and connected to the technical centers' college and career resources. This will be particularly important for current PREP Plus 10th grade students (Cohort 3) who will be in their senior year when PREP Plus is in its first full year at JATC.
- 2) **Consider incorporating support from SLCC focused on local industry insights and college campus experiences.** As part of the transition and support plan, SLCC's role in supporting future PREP Plus programming should be clearly defined. Based on findings from the evaluation, SLCC is poised to provide unique offerings for future iterations of the program in two areas. First, because SLCC faculty are familiar with the local engineering technology

industry, they could provide ongoing communication and targeted teacher professional development at JATC and GTI around the local industry and how to best support students who are interested in engineering technology careers. Second, based on the impact that college campus experiences had on PREP Plus students, SLCC could support ET students' attendance at the Bruin Brains Research Conference, field trips to SLCC's campus, and other opportunities for students to become comfortable on campus, create connections with SLCC faculty and resources, and learn what to expect in college.

- 3) **Create opportunities for PREP Plus/ET student connections within and across JATC and GTI.** The familiarity and sense of community among PREP Plus students was highlighted as one of the most beneficial aspects of the program. As the format of the PREP Plus program shifts and expands, it will be important to maintain community building among participating students. This may include opportunities for PREP Plus students, or students in the ET certificate program, to take classes as a cohort or participate in program-specific events, like a PREP Plus lunch or end of semester party. It will also be valuable to create opportunities for ET students from Jordan School District to socialize with ET students from Granite School District, ultimately expanding their personal and professional networks. Some of these cross-district social events could be held in conjunction with events on SLCC's campus, like an engineering technology ice cream social after the Bruin Brains conference.
- 4) **Collect feedback from students and teachers to monitor success and inform program modifications.** Throughout the PREP Plus program, in addition to data collected as part of the external evaluation, program personnel gathered informal feedback and input that was used to guide program modifications. As the program transitions out of SLCC, it will be important to outline new roles and procedures for collecting feedback, either formally or informally, from students and teachers about courses, program events, and general experiences. This should include the identification of specific goals and metrics. For example, as part of understanding the impacts of the transition away from SLCC's campus, it may be interesting to explore students' feelings of safety at JATC and GTI. SLCC's faculty liaisons who work with the technical centers may be able to facilitate the feedback process and provide their own insights about the courses and participant experiences. In addition to helping program personnel monitor success, student and teacher input can be used to guide decisions about programming and scalability moving forward.