STUDENT SUCCESS AND TRANSFER ARTICULATION THROUGH RESEARCH AND SUPPORT SERVICES (STARS)

California State Polytechnic University, Pomona (CPP)

FUNDED BY THE DEPARTMENT OF EDUCATION
AWARD # P031C210068

YEAR 2 EVALUATION REPORT

December 2023

Submitted by
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This report was written by Cobblestone Applied Research & Evaluation, Inc. (*Cobblestone*) for the DoE Title III funded Student Success and Transfer Articulation Through Research and Support Services (STARS) at Cal Poly Pomona (CPP). *Cobblestone* specializes in designing and conducting program evaluation and applied research studies in the education field. For more information, visit www.cobblestoneeval.com.

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EXECUTIVE SUMMARY

Funded by the Department of Education (DoE; # P031C210068), the **Student Success and Transfer Articulation through Research and Support Services (STARS) project at California State Polytechnic University, Pomona (CPP)** aims to increase the institutional capacity of CPP, Citrus College (Citrus), and Mount San Antonio College (Mt. SAC) to engage Hispanic and other low-income students in STEM disciplines through undergraduate research and related wrap-around services, and propel them through the STEM curriculum more quickly and effectively. Cobblestone Applied Research & Evaluation, Inc. (*Cobblestone*) is conducting the external evaluation of the STARS project. This formative evaluation report provides a summary and analysis of the second year of program implementation (October 1, 2022 to September 30, 2023).

Program Activities

To achieve program goals, the STARS project implements six activities:

Activity 1
Offer a STARS Cohort Experience

Activity 2
Create a Library of Student Success Workshops

Activity 3
Prepare Current and Future Faculty

Activity 4
Establish a Faculty Learning Community (FLC)

Activity 5
Develop Transfer Pathways

Activity 6
Establish a STEM Industry Advisory Board

Difference Education Randomized Control Trial

In addition to the above program activities, a randomized-control trial (RCT) experiment assessing the effectiveness of Stephens et al. (2014) difference-education intervention was implemented for the first time with the 2022-23 STARS Scholars. The treatment condition viewed a pre-recorded student panel discussion of how their different backgrounds shaped their academic experience and success. The control condition viewed a panel of the same students discussing how their different interests shaped their academic experience and success. The evaluation team randomly assigned Scholars to conditions, who completed a pretest survey at the beginning of the academic year, watched their assigned panel asynchronously, completed a post-panel survey, and completed a posttest survey at the end of the academic year. Due to the low sample size, analyses will be conducted after two years' worth of data are collected.

Year 2 Key Findings

STARS Cohort Experience	The full academic year STARS Cohort experience was implemented for the first time in Year 2; a cohort also participated in summer 2023. Students and faculty mentors generally reported positive experiences in the program. While academic year Scholars did not report any significant increases in sense of belonging, academic self-efficacy, college self-efficacy, or research skills, their faculty mentors reported they significantly increased their research skills. Summer 2023 Scholars reported significant increases in college self-efficacy and research skills, but not sense of belonging or academic self-efficacy. This is likely due to the survey administration format (true pretest-posttest for academic year vs. retrospective pretest-posttest for summer).
Student Success Workshops Library	Ten success workshops were developed and recorded, notably expanding beyond those in just the "Academic/STEM Skills" category. With a total of 13 workshops created, this project activity is now on track to create the targeted 30 workshops by Year 5.
Current and Future Faculty Preparation	The PLUTO fellow taught a course, mentored students, hosted workshops, and successfully obtained an Assistant Professor position at a primarily undergraduate institution.
Faculty Learning Community (FLC)	The second FLC was held, focusing on the alignment of CPP's ME 2331: Intro to Design and CE 1011: Surveying Engineering. Many CPP course materials were shared with community college faculty members. However, only one follow-up meeting was held for the summer 2022 FLC group rather than two.
Transfer Pathways Development	By the end of Year 2, the memorandum of understanding establishing the transfer pathways and admission bonus for Mt. SAC and Citrus Civil Engineering students was reviewed by the California State University Chancellor's Office, expected to be finalized in early spring 2024 and implemented for the fall 2024 admissions cycle.
STEM Advisory Board	Six industry professionals agreed to serve on the STARS advisory board. One advisory board member presented to the summer 2023 Scholars; in the future STARS will try to hold one virtual advisory board meeting per year.

Recommendations and Next Steps for Year 3:

- ☐ Focus on orienting community college Scholars to CPP
- ☐ Ensure Scholars are provided with updates on their program requirement completion progress
- ☐ Implement the difference education intervention for the second time
- ☐ Modify Scholar surveys to a retrospective pretest-posttest format
- ☐ Continue to develop workshops for the Student Success Workshop Library
- ☐ Provide training for STARS faculty research mentors
- ☐ Hold academic year follow-up meetings with FLC participants
- ☐ Calculate the impact of the admission bonus for Fall 2024
- ☐ Implement activities with advisory board members
- ☐ Continue to refine and use implementation tracking systems

INTRODUCTION

Science, technology, engineering, and mathematics (STEM) occupations are predicted to grow faster than any other industry in the next decade (Zilberman & Ice, 2021), and more STEM workers are needed to maintain the nation's economic prominence (Committee on Science, Space, and Technology, 2019). While Hispanic/Latino workers constitute 17% of total employment, they only account for 8% of STEM workers (Fry et al., 2021). The low percentage of Hispanic/Latino individuals in the STEM workforce represents an opportunity to attract more Hispanic/Latino undergraduate students interested in pursuing STEM careers.

The underrepresentation of Hispanic/Latino individuals in the STEM workforce mirrors their low representation in the STEM higher-education system. Despite having similar interest in STEM fields, Hispanic/Latino students who begin college as STEM majors are more likely to switch fields or drop out of college entirely, compared to their White peers (Riegle-Crumb et al., 2019). While the percentage of Hispanic/Latino students earning a STEM bachelor's degree has increased in the last decade, Hispanic/Latino adults are still underrepresented among STEM degree recipients and remain less likely to earn a college degree than White, Asian, and Black adults (Fry et al., 2021).

Community colleges (CCs) play a significant role as a pathway for many STEM students, including a substantial portion of Hispanic/Latino undergraduate students. Approximately half of Hispanic/Latino undergraduate students choose to attend CCs (American Association of Community Colleges, 2022). Hispanic/Latino STEM students often aspire to transfer to a four-year college to obtain a high-quality, STEM education (Community College Research Center, 2021). However, STEM students at CCs are less likely to be enrolled full time, and more likely to take more developmental courses, switch out of STEM majors, and drop-out than STEM students enrolled in four-year institutions (National Academies of Sciences, Engineering, and Medicine, 2016). Supporting Hispanic/Latino CC students has become of vital importance given COVID-19's impact on transfer pathways. For Hispanic/Latino students, upward transfer from community colleges to 4-year institutions has declined by 6%, and persistence rates dropped by 1%, almost double that of other racial and ethnic groups (National Student Clearinghouse Research Center, 2022). These facts highlight the importance of implementing evidence-based strategies that provide undergraduate students with opportunities to successfully transfer and/or complete their STEM degree.

To address these concerns, the Department of Education's (DoE) Hispanic Serving Institution (HSI) STEM and Articulation Program awards grants to eligible HSIs that develop and carry out activities to increase the number of Hispanic/Latino and low-income students attaining degrees in STEM fields. The Title-III funded **Student Success and Transfer Articulation through Research and Support Services (STARS)** project at **California State Polytechnic University, Pomona (CPP)** in partnership with Citrus College (Citrus), and Mount San Antonio College (Mt. SAC) aims to increase Hispanic/Latino and low-income STEM student success and

diversify the community of STEM scientists. Cobblestone Applied Research & Evaluation, Inc. (*Cobblestone*) is conducting the external evaluation of the STARS project. This formative evaluation report provides a summary of the second year of program implementation (October 1, 2022 to September 30, 2023). Evaluation of the program will continue for the duration of the five-year grant ending in September 2026.

Program Description

The STARS project aims to achieve two primary goals: (a) develop the institutional capacity of CPP and the partnering CCs to engage Hispanic and other low-income students in STEM disciplines through undergraduate research and related wrap-around services, and (b) enhance institutional capacity to propel students through the STEM curriculum more quickly and effectively via the development of Transfer Pathways and courses for articulation. STARS implements six activities to meet these goals.

Goal 1: Undergraduate Research and Wrap-Around Services

A STARS Cohort experience. Undergraduate research experiences have been shown to increase retention and graduation rates among students from underrepresented groups (e.g., Toven-Lindsey et al., 2015) and sense of belonging can support student motivation and success (e.g., Gopalan & Brady, 2017). Given these favorable outcomes, STARS implements a cohort experience that includes faculty-mentored undergraduate research activities as well as offers social activities to build students' sense of belonging and peer network.

Student Success Workshops Library. Student success workshops have been documented to effectively support Hispanic STEM students' career major decisions, long-term goals, and overall knowledge of the STEM field (Casey et al., 2019). As such, STARS develops workshops on STEM skills, professional and career development, and equity and inclusion in STEM, requiring STARS cohort students to attend at least four workshops per year.

Prepare Current and Future Faculty. Research indicates that faculty mentoring for ethnic minority students is perceived as successful and satisfying for both mentees and mentors when the latter possess the necessary commitment and multicultural competencies, such as addressing students' context (Chan et al., 2015). As such, all faculty members mentoring STARS students will receive training to provide support for students from diverse backgrounds and create a sense of belonging. In addition, STARS supports Postdoctoral Leadership of Underrepresented minorities for Teacher-scholar Occupations (PLUTO) fellows, recent STEM doctorate recipients from Hispanic and low-income backgrounds who serve as mentors, teachers, and researchers at CPP.

Goal 2. Transfer Pathways and Articulation Agreements

California State University (CSU) data indicates that the two-year graduation rate for transfer students dropped from 44% in 2020 and 2021 to 40% in 2022, due to the impacts of COVID-19 and related policies on students, especially those from historically marginalized groups.[1] In accordance, CPP data from recent years shows that most STEM transfer students, many of whom are Hispanic and/or low income, take four years to graduate as opposed to two years.[2] The untimely graduation of STEM transfer students at CPP and other CSU institutions stems in part from the unavailability of many lower-division STEM courses at the CCs, although they are required for upper-division course enrollment. Thus, transfer students often spend one or two years completing lower-division STEM course requirements after transferring, which significantly lengthens their time to degree. STARS applies two strategies to address this problem.

A Faculty Learning Community. STARS increases transfer students' access to lower-division STEM courses at the CCs by bringing CPP, Citrus, and Mt. SAC faculty members together to: develop lower-division courses at the CCs, work on articulation agreements, and develop learning modules that address content gaps.

Transfer Pathways Development. STARS develops agreements between CPP and the partnering CCs that encourage students to take lower-division STEM courses prior to transferring. This is also in line with research suggesting that encouraging underrepresented minority (URM) students to take more STEM credits, even if they are starting their math trajectory below college level, increases their likelihood of successfully transferring to a 4-year institution (Sansing-Helton et al., 2021).

Addresses both Goals 1 and 2

STEM Industry Advisory Board. STEM students' understanding of how the STEM industry works (i.e., commercial awareness) is a key factor for post-graduation job application success (Wilkinson & Aspinall 2007, as cited in Pugh & Grove, 2014). The most effective way to develop such awareness among students is by exposing them to STEM industry experts, who can also help STEM faculties develop curricula that help students attain skills that meet employers' needs (Pugh & Grove, 2014). Thus, STARS will assemble a STEM Industry Advisory Board that will provide experts to guide students professionally (e.g., through career preparedness workshops and internship opportunities) and advise faculty on constructing up-to-date, industry-relevant curricula.

Difference Education Intervention

STARS will implement Stephens and colleagues' (2014) "Difference-Education Intervention" given its previous success in improving students' college transition and first-

[1] https://www.calstate.edu/csu-system/news/Pages/Four-Year-Graduation-Rate-for-First-Time-Students-Hits-Historic-High.aspx
[2] https://www.cpp.edu/studentsuccess/oss/gi-2025/campus-goals.shtml

generation students' academic performance. The intervention is designed to help students understand how their diverse backgrounds can shape their college experience and help them overcome obstacles to success. The intervention is implemented with the STARS cohort students at the beginning of their program experience. Outcomes are assessed after one year of program participation.

EVALUATION OVERVIEW

Evaluation Design

Cobblestone is evaluating the STARS project using a mixed-methods design in which a combination of qualitative and quantitative indicators are used to answer implementation and outcome evaluation questions. The evaluation is based on the theory of change represented in a logic model that links STARS program inputs and activities to specific, measurable outputs and short/long-term outcomes (see Appendix A. STARS Logic Model). The *formative evaluation* is occurring during the first few years to determine the extent to which STARS activities are implemented with fidelity and high quality, assess initial outcomes, and provide stakeholders with ongoing performance feedback. A *summative evaluation* in will occur in the last year of the grant to help determine (a) overall program merit; (b) the extent to which STARS objectives, performance measures (PMs), and whether the difference-education intervention (promising evidence) outcomes were achieved; (c) sustainability of project activities; and (d) the conditions that need to be met by both the intervention and institution for successful replication (e.g., staff capacity, implementation infrastructure). The evaluation was designed to answer evaluation questions related to both program implementation and outcomes.

Randomized Control Trial Experiment

The STARS project includes a randomized control trial (RCT) experiment to assess the effectiveness of the Stephens et al. (2014) difference-education intervention (promising evidence) on student outcomes (e.g., tendency to seek college resources, perceived ability to succeed in college, and academic performance) that is designed to produce evidence about the project's effectiveness that would meet the WWC Evidence Standards without reservations. Scholars in the treatment condition watched a video of a student panel in which demographically diverse upperclassmen discussed how they adjusted to and found success in college while emphasizing *differences in their background*. Scholars in the control condition watched a video of an alternative panel in which students discussed how they adjusted to and found success in college while emphasizing their *diverse interests*. Outcomes assessed at the conclusion of the STARS cohort experience are: academic engagement; perceived ability to succeed in college; resource seeking behaviors; psychological adjustment; social engagement; intergroup understanding; and cumulative GPA. Analysis of the RCT will occur in Year 3 after data is collected for two cohorts of participants to allow a sufficient sample size to be included in the analysis.

Evaluation Questions

The following questions guided the evaluation design and corresponding activities.

Implementation-Focused Evaluation Questions

1. To what extent are the project activities implemented with fidelity and high quality?
    a. To what extent are outputs achieved for each program activity?
    b. To what extent are the difference-education intervention (promising evidence) implementation criteria met?
    c. To what extent are participants' needs being met?
    d. What intended or unintended side effects occurred at CPP as a result of the implementation of the project?[3]

Outcome-Focused Evaluation Questions

2. What is the effect of the difference-education intervention on treatment Scholar outcomes?[1]
3. What is the effect of project activities on Scholar and faculty outcomes?
4. To what extent have key criteria been established to sustain project activities beyond the duration of the grant?
5. Which aspects of project generated most favorable outcomes suitable for replication or testing in other settings?

Evaluation Methods

In Year 2, the evaluation used a variety of methods to measure implementation and preliminary outcomes. See **Table 1** for a list of Year 2 evaluation methods and timelines. **Appendix B.** Program Implementation Outputs that are assessed across all five years of the project. **Appendix C** lists performance measures and progress on these measures in Year 2.

Table 1. Year 2 Evaluation Methods and Timelines

Evaluation Activity	Timeline
Monthly meetings	Ongoing
Document and artifact analysis	Ongoing
Scholar pretest, post-panel intervention, and posttest survey	Academic year cohort: September 2022 (pretest & post-panel) and May 2023 (posttest) Summer cohort: August (retrospective pretest & posttest)
Faculty research mentor survey	May 2023
STARS Scholar focus group	May 2023
PLUTO faculty survey	May 2023
Institutional research data request	October 2023

[3] Will be answered in future years.

EVALUATION FINDINGS: PROGRAM IMPLEMENTATION

The following section describes the second year of the STARS project implementation findings (October 1, 2022 to September 30, 2023).

EVALUATION QUESTION 1: TO WHAT EXTENT ARE THE PROJECT ACTIVITIES IMPLEMENTED WITH FIDELITY AND HIGH QUALITY?

- ☐ TO WHAT EXTENT ARE OUTPUTS ACHIEVED FOR EACH PROGRAM ACTIVITY?

Main Findings: The STARS program was implemented with fidelity in Year 2 although some outputs varied from planned targets. STARS staff improved some processes to enhance program participation in the second half of Year 2, which yielded higher engagement from Scholars. The STARS cohort experience was implemented both during the academic year and the summer with a total of 71 unique Scholars. Data indicating that few Scholars were meeting all program requirements in fall 2022 led to revised procedures in spring 2023 and a corresponding increase in fulfillment of requirements. Seven new success workshops were developed covering all four workshop categories; this brings the cumulative total of workshops developed (10) close to the Year 2 target (12). The PLUTO faculty fellow mentored students, conducted workshops, and taught a course, ultimately obtaining a faculty position at a primarily undergraduate institution. The second FLC was held over two days in summer 2023 to align engineering courses across Citrus, Mt. SAC, and CPP. The summer 2022 FLC group held one of two planned follow-up meetings during the academic year. By the end of Year 2, the memorandum of understanding (MOU) establishing the transfer pathways and admission bonus for Mt. SAC and Citrus Civil Engineering students was reviewed by the California State University Chancellor's Office, expected to be finalized in early spring 2024. Six industry professionals agreed to serve on the STARS advisory board. One advisory board member presented to the summer 2023 Scholars and in the future STARS will try to hold one virtual advisory board meeting per year.

Activity 1: Offer a STARS Cohort Experience

In Year 2, the STARS cohort experience was offered both during the academic year (fall 2022-spring 2023) and the summer 2023. A total of 71 unique Scholars participated in Year 2 (30 in fall 2022; 31 in spring 2023; 40 in summer 2023). Most Scholars were from CPP (73%), male (62%), not first-generation college students[4] (49%), and Hispanic/Latino (44%) (see **Appendix D** for detailed Scholar demographic information). Across Years 1 and 2, 84 participating students were Hispanic and/or low income (**PM 1.1**; Year 5 target: 200).

[4] First-generation status was unknown for 7% of Year 2 participants.

Participation requirements for the program are noted in **Figure 1**. Students could submit a make-up assignment for the culturally relevant cohort activity if they were unable to attend. In fall 2022, 3 of the 30 Scholars (10%) met all participation requirements. After reviewing the fall participation data with the evaluation team, the STARS program changed their process to improve participation rates for spring. The program informed students of their progress midway through the spring semester to increase student awareness of their program requirement completion. In spring, the percentage of students meeting program participation requirements significantly improved: 26 of the 31 Scholars (84%) met all participation requirements. In addition, in summer 2023, 33 of 40 Scholars (83%) met all the requirements. Stipend disbursements in fall 2022 were based only on submission of the final research paper or poster. However, spring and summer disbursements were based on completion of all requirements.

Figure 1. STARS Cohort Participation Requirements, Year 2

Fall 2022 & Spring 2023 Participation Requirements

- Attend the "Narrowing the Topic of Your Research" and "Writing a Literature Review and Abstract" workshops
- Attend one PLUTO-led workshop per semester
- Attend one culturally relevant Cohort activity per semester
- Meet 4 times with assigned peer mentor per semester
- Meet 2 times with a program advisor per semester
- Complete a prelimiary reserach report draft, interim progress report (full academic year participants only) and a final paper
- Present at the Research, Scholarship, and Creative Activities conference

Summer 2023 Participation Requirements

- Submit mentor/mentee agreement
- Attend 7 seminars (held weekly)
- Attend workshops and check-ins (held weekly)
- Submit a preliminary research report
- Attend 2 culturally relevant Cohort activities
- Present at the Summer Creative Activities and Research Symposium (CARS)
- Submit a final research paper

A STARS Scholar was first author on a peer-reviewed article published in Year 2

Natividad, L.E.; Benalcazar, P. Hybrid Renewable Energy Systems for Sustainable Rural Development: Perspectives and Challenges in Energy Systems Modeling. *Energies* 2023, *16*, 1328. https://doi.org/10.3390/en16031328

The difference education intervention was implemented for the first time with the 2022-23 Scholars. Students were randomly assigned to view one of two panel videos recorded in summer 2022. The panel participants were four senior peer mentors with the CPP Achieve Scholars program. All four students participated in both panels. Questions in the treatment panel focused on how students' different *backgrounds* influenced their experience in college while questions in the control panel focused on how students' different *interests* affected their college experience. See the Year 1 evaluation report for a complete script of panel instructions and questions. See **Table 2** for all outputs related to the STARS cohort experience.

Table 2. STARS Cohort Experience Outputs and Year 2 Status

Activity 1: STARS Cohort Experience	Year 2 Status
1. 40-60 students recruited to participate in the STARS program per year (i.e, Scholars)	70 unique students participated in Year 2 (30 in fall; 31 in spring; 40 in summer)
2. 75% of Scholars meet *all* STARS participation requirements per year	In fall 2022, 10% (3/30) of Scholars met all participation requirements. In spring 2023, 84% (26/31) met all participation requirements. In summer 2023, 83% (33/40) met all the requirements.
3. # of Scholars who meet with PLUTO faculty 3 times per semester	The PLUTO fellow directly mentored two STARS Scholars in Year 2.
4. # of Scholars who attend 4 student success workshops per year	In fall 2022, 21 (70%) Scholars attended all three required workshops. In spring 2023, 28 (90%) attended the one required workshop.
5. 2 cohort activities held during the academic year; 1 activity held during winter break; and 1 activity held during summer break	In fall 2022, the cohort activity was a Day of the Dead celebration event. A winter retreat was held in January 2023 in collaboration with the Research through Inclusive Opportunities program. In spring 2023 the cohort activity was the Art Walk. Four cohort-building activities occurred during summer 2023: a campus tour with pizza, a tour of the CPP Biotrek, a Discover Your Strengths workshop hosted by the Career Center, and visiting the Claremont Botanical Garden.
6. # of Scholars who attend cohort-building activities	Fall 2022: 29 Scholars attended the activity or submitted a make-up assignment. Winter 2023: 22 Scholars attended the winter retreat. Spring 2023: 28 Scholars attended the activity/submitted a make-up assignment. Summer 2023: 38 Scholars attended at least one activity.
7. # of Scholars who submit their research papers to Bronco ScholarWorks	Four Scholars have submitted their STARS research to the Bronco ScholarWorks repository.
8. # of Scholars who present their research results at a local/ regional conference	In spring 2023, 20 Scholars attended the RSCA conference. In summer 2023, 33 Scholars presented at CARS.
9. Intervention panels created	Both treatment and control panels were recorded in summer 2022.

Activity 2: Create a Library of Student Success Workshops

In Year 2, ten new workshops were developed and offered (see **Table 3**). All workshops were offered in a virtual or hybrid format, which allowed for recording. Year 2 was also the first year in which workshops in categories beyond "Academic/STEM Skills" were created and offered. See **Table 4** for all outputs related to the Student Success Workshops Library. See **Appendix E** for the complete list of workshops across years.

Table 3. Year 2 Workshops

Workshop Category	Workshop Name
Academic/STEM Skills	Data Analysis and Python
	Data Analysis with Machine Learning
	Literature Review Workshop
	Writing Workshop - Methodology Section
	Writing Workshop - Analysis and Discussion Section
	MATLAB for Excel Users
	Tackling Big Data with MATLAB
Professional and Career Development	Building Open Datasets for Autonomous Perception in Aviation
Equity and Inclusion in STEM	Bridging Aspirations: Latino Young Men and their Transition from Middle School to High School
Essential Skills	Presentation Workshop

Table 4. Student Success Workshops Library Outputs and Year 2 Status

Activity 2: Student Success Workshops Library	Year 2 Status
1. 6 student success workshops developed per year (2 academic/STEM skills, 2 essential skills, 2 professional & career development, and 2 equity and inclusion in STEM); topics	A total of 10 new workshops were developed in Year 2: seven Academic/STEM Skills, one Professional and Career Development, one Equity and Inclusion in STEM, and one Essential Skills. This brings the cumulative total across years to 13.
2. # of workshops held in person/ virtually	Nine of the workshops were hybrid and one workshop was virtual (asynchronous).
3. # of workshops recorded/ uploaded to database	All workshops were recorded and uploaded to Canvas.
4. # of workshop views	Workshop views will be tracked in future years.

Activity 3: Prepare Current and Future Faculty

In Year 2, one PLUTO faculty fellow participated from September 2022 to May 2023. The PLUTO fellow received mentorship training from one of the STARS co-PIs and attended teaching training workshops, ultimately serving as a research mentor for two STARS Scholars. The fellow held two workshops for STARS Scholars: *Data Analysis and Python* in fall 2022 and *How to Conduct a Literature Review and Write an Abstract* in summer 2023. In spring 2023, the fellow

taught CHEM 5990: Chemical Thermodynamics. With the guidance of the PLUTO lead, the fellow applied for and was hired as an Assistant Professor at a primarily undergraduate institution. See **Table 5** for all outputs related to faculty preparation.

Table 5. Current and Future Faculty Preparation Outputs and Year 2 Status

Activity 3: Current and Future Faculty Preparation	Year 2 Status
1. 2 STEM doctorate recipients recruited to serve as PLUTO fellows per year	There was one PLUTO fellow in 2022-23.
2. PLUTO fellows teach one course per year	The PLUTO fellow taught CHEM 5990: Chemical Thermodynamics in spring 2023.
3. PLUTO fellow hold at least 2 workshops each year for STARS Scholars; workshop topics	The PLUTO fellow held 2 workshops: Data Analysis and Python (fall 2022) and How to Conduct a Literature Review and Write an Abstract (summer 2023).
4. PLUTO fellows meet with each Scholar 3 times per semester	The PLUTO fellow mentored two Scholars and also served as a program advisor whom students could choose to meet with to fulfill their two required meetings per semester.
5. PLUTO fellows receive mentor training	The PLUTO fellow received training from a STARS Co-PI and attended teaching training workshops.
6. # of mentor trainings provided; topics covered	The PLUTO fellow participated in three teaching training workshops.
7. # of faculty who attend mentor trainings	STARS has not officially held any mentor trainings, although some research mentors have attended other relevant trainings through other programs. STARS will begin to host and track mentor training in Year 3.

Activity 4: Establish a Faculty Learning Community (FLC)

The second STARS FLC was held over two days in summer 2023 (one day in person at CPP and one day virtually). The goal of the FLC was to share CPP teaching materials with community college faculty to align the learning experience between institutions, ultimately reducing transfer student time-to-degree. The new courses of focus for articulation were CPP's ME 2331: Intro to Design and CE 1011: Surveying Engineering. In addition, the FLC revisited ME 2191: Mechanics of Materials. CPP faculty shared course syllabuses, lesson materials, homework assignments, and exams to assist community college faculty in course

STARS project summer 2023 FLC participants and facilitators

alignment. The 12 CPP attendees included the Engineering Dean, several Associate Deans, administrators, engineering faculty, and the campus Articulation Officer. There were five Mt. SAC and three Citrus College representatives in attendance, including Deans and faculty members from both institutions. In addition, one faculty member from Victor Valley College and Santa Monica College each attended.

The FLC was originally conceived as a two-day summer experience with two follow-up meetings during the subsequent academic year. Follow-up meetings were intended to allow FLC members to seek help and advice as well as receive feedback on their course modifications. One follow-up meeting for the Year 1 FLC was held at Mt. SAC in spring 2023. A total of 17 people were in attendance, including Mt. SAC faculty members, staff members, administrators, students, a Citrus faculty member, and the grant PI and co-PIs. See **Table 6** for all outputs related to the FLC.

Table 6. Faculty Learning Community Outputs and Year 2 Status

Activity 4: Faculty Learning Community	Year 2 Status
1. 6-9 faculty participate in FLC per year	Five CPP, three Mt. SAC, and two Citrus college faculty members participated in the FLC in summer 2023 (a total of ten faculty members). Deans, administrators, and staff were also in attendance.
2. # of faculty who participate in FLC and meet participation requirements per year (attend 2-day summer institute and attend 2 meetings per year)	One follow-up meeting for the Year 1 FLC was held at Mt. SAC in spring 2023 with 17 attendees. The Year 1 facilitators and two community college faculty members from summer 2022 were in attendance. Additional attendees included Mt. SAC staff, administrators, and students.

Activity 5: Develop Transfer Pathways

CPP will award an admissions advantage to Citrus and Mt. SAC transfer applicants who complete designated course sequences that comprise certificates at their community college. In Year 1, engineering certificates qualifying students for the admissions bonus were identified at both Citrus and Mt. SAC (see the Year 1 evaluation report for detailed information on courses that comprise the certificates). By the end of Year 2, the memorandum of understanding (MOU) establishing the transfer pathways and admission bonus for Civil Engineering was reviewed by the CSU Chancellor's Office. It is expected that the MOU will be finalized by early spring 2024 and the admissions bonus will be applied to the incoming transfer class of fall 2024 for the first time. Once the MOU is in place, it is expected that adding additional majors to the agreement will not require the same extensive process.

To raise awareness of the transfer pathways and admissions bonus, several student presentations were held at partner community colleges in Year 2. A presentation at Mt. SAC was held on March 8, 2023 with 41 students in attendance. A presentation at Citrus occurred on April 26, 2023 with four students in attendance. It was originally expected that some students would be awarded the transfer admission bonus for the fall 2023 admissions cycle prior to the formalization of the MOU. CPP representatives planned to manually check to see if students completed the required courses. However, the bonus was not awarded for the fall 2023 group of admits. Once the bonus is awarded for fall 2024 admissions, the STARS team plans to analyze admissions data to convert the bonus into a boost in GPA units, facilitating the communication of the benefit of the bonus to prospective transfer students. See **Table 7** for all outputs related to Transfer Pathways Development.

Table 7. Transfer Pathways Development Outputs and Year 2 Status

Activity 5: Transfer Pathways Development	Year 2 Status
1. Lower-division STEM courses required to transfer to CPP are identified (e.g., course name, major)	Engineering courses were identified at Citrus and Mt. SAC in Year 1.
2. # of learning modules developed by FLC; topics (e.g., content gaps addressed)	The CPP FLC members shared their course materials with partner community college faculty. The development of entirely new learning modules may occur in future years.
3. Transfer Pathways are created for 5 majors at Citrus and Mt. SAC by Year 5 (10 by Year 5; Civil Engineering in Year 1)	The Civil Engineering pathway is expected to be finalized in early spring 2024, representing the completion of one major at both Mt. SAC and Citrus.
4. 50 CC students complete pathway and receive admission "bonus points" to CPP by Year 5	In fall 2023, no Citrus or Mt. SAC transfer applicants received the admission bonus. It is expected the bonus will be implemented for the first time in the fall 2024 admissions cycle.

Activity 6: Establish a STEM Industry Advisory Board

In Year 2, the STARS team revised the original plan for the advisory board structure. Rather than establishing a group of industry partners who meet regularly, the team decided to pursue a more decentralized structure where individual members attend events and support students when they are available. The plan was approved by the DoE program officer as long as the team tries to coordinate one advisory board meeting per year.

Individuals who have agreed to participate in the advisory board include a recent CPP graduate working at Boeing, an Aeronautics Director at Lockheed Martin, a Department Manager at Northrop Grumman, a Mechanical Engineer from the National Aeronautics and Space Administration's (NASA) Jet Propulsion Laboratory (JPL), an Aerospace Engineer from the NASA Armstrong Flight Research Center, and the President of an agricultural drone company.

One of the advisory board members delivered a presentation to the summer 2023 STARS Scholars on how NASA is supporting the creation of autonomous aviation. While industry advisory board members were invited to the Creative Activities and Research Symposium at the conclusion of the summer 2023 research experience, they were unable to attend. See **Table 8** for all outputs related to the STEM Industry Advisory Board Establishment.

Table 8. STEM Industry Advisory Board Establishment Outputs and Year 2 Status

Activity 5: STEM Industry Advisory Board Establishment	Year 2 Status
5. # of advisory board members recruited (industry representation)	Six industry professionals agreed to serve on the advisory board.
6. 2 advisory board meetings per year	In future years, STARS will try to coordinate one virtual advisory board meeting per year.
7. # of members who attend meetings	To be reported once advisory board meetings are held.
8. Advisory board feedback provided on curriculum	To occur in future years.
9. Advisory board feedback provided on learning modules	To occur in future years.
10. Advisory board feedback provided on student research projects	Advisory board members were invited to CARS but were unable to attend.
11. # of STEM seminars held with advisory board experts	One advisory board member gave a presentation to the summer 2023 STARS Scholars.
12. # of people who attend STEM seminars	35 STARS Scholars attended the summer 2023 presentation.

EVALUATION QUESTION 1: TO WHAT EXTENT ARE THE PROJECT ACTIVITIES IMPLEMENTED WITH FIDELITY AND HIGH QUALITY?

- ☐ TO WHAT EXTENT ARE THE DIFFERENCE-EDUCATION INTERVENTION (PROMISING EVIDENCE) IMPLEMENTATION CRITERIA MET?

Main Findings: The difference education intervention was implemented for the first time with the STARS Scholars participating during the 2022-23 academic year. The evaluation team randomly assigned Scholars to conditions. Scholars completed a pretest survey at the beginning of the Fall 2022 semester, watched either the treatment or control panel asynchronously, completed a post-panel survey, and completed a posttest survey at the end of the Spring 2023 semester. Of the 27 STARS Scholars who participated during the entire 2022-23 academic year, 24 completed all three surveys, 13 in the treatment condition and 11 in the control condition.

The difference education intervention was implemented for the first time with the STARS Scholars participating during the 2022-23 academic year. At the beginning of the Fall 2023 semester, Scholars completed a pretest survey and were randomly assigned by the evaluation team to watch either the treatment or control panel video. STARS program personnel were blinded to the condition of each student. The treatment panel video featured upperclassmen CPP students discussing how their different *backgrounds* shaped their college experience and success. The control panel video included the same students discussing how their different *interests* shaped their college experience and success. See the Year 1 evaluation report for a detailed description of the panel videos. The videos were uploaded online by the CPP team and students watched their assigned video asynchronously. After watching the video, students completed the post-panel survey assessing the extent to which they believed the panel information was useful and the extent to which they could relate to the panelists. Students viewed the video and completed the post-panel survey by mid-October 2022. At the conclusion of the spring 2023 semester, students completed the posttest survey. Of the 27 STARS Scholars who participated during the entire 2022-23 academic year, 24 completed all three surveys, 13 in the treatment condition and 11 in the control condition.

EVALUATION QUESTION 1: TO WHAT EXTENT ARE THE PROJECT ACTIVITIES IMPLEMENTED WITH FIDELITY AND HIGH QUALITY?

☐ TO WHAT EXTENT ARE PARTICIPANTS' NEEDS BEING MET?

Main Findings: Most Scholars and faculty mentors indicated that their needs were met. Scholars expected to gain research experience and apply the skills they learned from coursework, an expectation that was met. Most faculty mentors were satisfied with the quality of work Scholars demonstrated and noted valuable contributions to the research laboratories. Both students and faculty mentors identified a need for community college students to receive additional orientation to the campus and research laboratory expectations. Scholars requested additional workshops on career readiness and graduate school, while faculty mentors suggested Scholars attend time management and project management workshops prior to participating.

STARS Scholars

Across surveys and focus groups, most Scholars reported high levels of satisfaction and that their needs were met. Scholars decided to participate in the program because they wanted to gain research experience and have an opportunity to apply and practice their skills. They indicated that these expectations were met. As one Scholar explained, "*[It was] a good way to… practice this in an environment where you're still learning compared to real life*." Most found that their faculty research mentors were friendly, helpful, and understanding of student researchers. However, one Scholar reported "*being kept at arm's length*" by the research

mentor and having a hard time getting on "*the same page*." In addition, a Scholar noted a need for better integration of community college students into the CPP campus, suggesting offering campus tours and opportunities to connect with their faculty research mentor before the start of the program "*to make sure the student is comfortable and there's an understandable way that we can be able to work together*." A couple Scholars noted that they were unable to benefit from their peer mentoring due to being of more senior standing than their mentor. Scholars also requested more workshops on discipline-specific topics, career readiness (e.g., finding internships, creating a portfolio), mental wellness, and graduate school. Some reported that the technical workshops (e.g., MATLAB) were not relevant to their disciplines. See complete survey summaries for the academic year Scholars in **Appendix F** and summer Scholars in **Appendix G**. For the complete focus group summary see **Appendix H**.

Faculty Mentors

Faculty mentors were generally satisfied with the Scholars placed in their laboratories. As one faculty mentor shared, *"It was a pleasure working with all the mentees. They were all at different levels when they started but during their time they have all contributed to the progress of the assigned projects*." Although faculty mentors enjoyed their experience, a few encountered challenges. One faculty mentor stated that a single semester of participation was insufficient for the Scholar to both execute and create a final paper or poster for their project. Faculty mentors' suggestions for improving the mentoring experience included providing training or workshops for STARS Scholars to complete prior to working in their laboratories (e.g., time management, project management), as well as increasing support and clarity of expectations for community college students. For the complete summary of the faculty mentor survey see **Appendix I**.

EVALUATION FINDINGS: PROGRAM OUTCOMES

EVALUATION QUESTION 3: WHAT IS THE EFFECT OF PROJECT ACTIVITIES ON SCHOLAR AND FACULTY OUTCOMES?

Main Findings: While 2022-23 academic year Scholars did not report any significant increases on quantitative outcome constructs (i.e., sense of belonging, academic self-efficacy, college self-efficacy, research skills), their faculty mentors reported they significantly increased their research skills over the course of participation. Summer 2023 Scholars reported significant increases in college self-efficacy and research skills, but not sense of belonging or academic self-efficacy. Differences in these patterns of results are likely attributable to the assessment format (academic year Scholars completed a true pretest while summer Scholars completed a retrospective pretest). Qualitatively, Scholars reported learning research, presentation, communication, and networking skills, as well as building positive relationships with their faculty mentors.

Outcome Assessment Methods

Assessment of faculty outcomes will occur in later years of the grant, and will include outcomes for FLC participants, PLUTO fellows, and faculty mentors. While an exit survey was conducted with the Year 2 PLUTO fellow, these data will not be reported until it can be combined with additional participants in future years. Scholar outcomes were assessed through surveys and focus group interviews. For Scholars participating during the 2022-23 academic year, a pretest survey measuring key constructs was completed at the beginning of their experience and a posttest survey at the end of their experience (see **Appendix F** for the complete summary). In addition, a sample of Scholars participated in a focus group interview at the end of the Spring 2023 semester (see **Appendix H** for the complete summary). Faculty research mentors also rated their 2022-23 Scholar mentees' research skills at the conclusion of the Spring 2023 semester using a retrospective pretest-posttest format (see **Appendix I** for the complete summary). For Scholars participating during the summer 2023 session, a retrospective pretest-posttest survey was completed at the end of their experience, which measured the same key constructs as the surveys completed by academic year Scholars (see **Appendix G** for the complete summary). Quantitative analyses of student surveys only include Scholars who were participating in the STARS cohort for the first time. Students who served as Achieve Scholars Program peer mentors were also excluded due to having significant previous experience with a similar program. Qualitative analyses of the same surveys include all Scholars. See **Table 9** for detailed information about methods used to assess Scholar outcomes.

Table 9. Evaluation Activities Assessing Scholar Outcomes, Year 2

Data Source	Timeline	Participant *n*
2022-23 Scholar Pretest Survey	September-October 2022	Matched (all Scholars): 25 Matched (new Scholars): 18
2022-23 Scholar Posttest Survey	May 2023	
2022-23 Faculty Research Mentor Survey	May 2023	11 faculty mentors rated 21 STARS Scholars
2022-23 Scholar Focus Group	May 2023	10 Scholars
Summer 2023 Scholar Retrospective Pretest-Posttest Survey	August 2023	All Scholars: 35 New Scholars: 27

Scholar Outcomes

Sense of Belonging

Sense of belonging items concerned the extent to which students felt comfortable in their major and at their institution. *Quantitative changes in sense of belonging were not observed for Scholars who participated during the academic year* ($t(17) = 0.52$, $p = .611$) *or during the summer* ($Z(n = 25) = 0.08$, $p = .936$; **PM 1.5**; see **Table 10**). Qualitatively, Scholars generally reported positive experiences with STARS program staff and faculty research mentors. A Scholar from the focus group stated, "*The STARS [advisors] I would say [are] extremely helpful*

and very welcoming… from my personal experience, [STARS advisors] understood me even though I'm not an original student from Cal Poly Pomona." One Scholar noted their research mentor "*helped me both with my personal stuff and with the research itself… Especially because I'm a first year, I don't really have as much experience as some of the upperclassmen, but they were really helpful in explaining all the steps to me in a way that I can understand at my current level*." However, Scholars were less likely to qualitatively note that the program affected their sense of belonging with other students and with the institution overall.

Self-Efficacy

Academic self-efficacy items refer to how well students expect to perform in the courses for their major. *Quantitative changes in academic self-efficacy were not observed for Scholars who participated during the academic year* ($t(17) = 0.35$, $p = .728$) *or during the summer* ($t(26) = 1.47$, $p = .153$; **PM 1.6**; see **Table 10**). Scholars did not comment qualitatively on whether or not their experience affected their course performance.

Course efficacy items concern the extent to which students believe they can successfully complete coursework and manage their time. *While there were no quantitative changes in course efficacy for Scholars who participated during the academic year* ($t(17) = 0.28$, $p = .783$), *Scholars who participated during the summer reported a significant increase in course efficacy with a large effect size* ($t(26) = 5.55$, $p < .001$, Cohen's $d = 1.07$; see **Table 10**). While some Scholars qualitatively described that participating in research increased their confidence and ability to work independently, this was mostly within a research context. However, some Scholars did note that these skills are transferrable, with one Scholar explaining that research "*can help you develop critical thinking skills, problem-solving skills, and other transferable skills that are highly valued in many fields*."

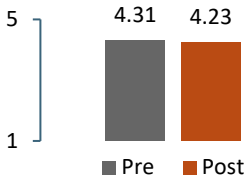
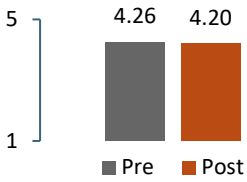
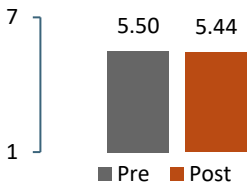
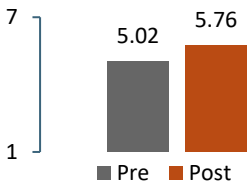
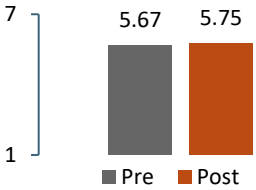
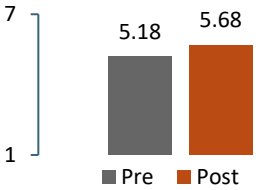
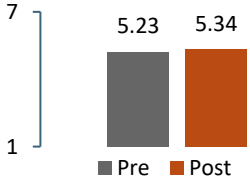
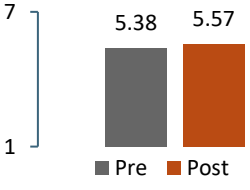
Social efficacy items concern the extent to which students are confident interacting with professors, advisors, and other students in their courses. *While there were no quantitative changes in social efficacy for Scholars who participated during the academic year* ($t(17) = 0.42$, $p = .679$), *Scholars who participated during the summer reported a significant increase in social efficacy with a large effect size* ($t(26) = 3.64$, $p < .001$, Cohen's $d = 0.70$; see **Table 10**). Scholars qualitatively noted that the STARS program experience allowed them to connect with faculty members and other students within their departments. For example, one Scholar noted: "*The grad[uate] student I was helping has become a really good friend of mine. My mentor has been extremely supportive and aided me throughout the program*."

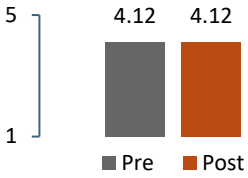
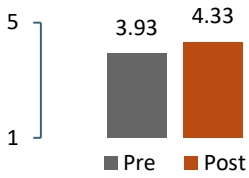
Research Skills

Scholars who participated during the academic year did not self-report a change in research skills ($t(17) = 0.52$, $p = .611$), *however, their faculty mentors reported they significantly increased their research skills with a large effect size* ($t(20) = 9.52$, $p = <.001$, Cohen's $d = 2.09$). *Summer 2023 Scholars also reported a significant increase in research skills with a medium*

effect size ($t(26) = 3.03$, $p = .005$, Cohen's $d = 0.58$; see **Table 10**). Taken together, these results suggest that the STARS program leads to an increase in Scholar research skills, however Scholars are likely to overestimate their skills when completing a "true" pretest. Qualitative findings suggest an increase in research skills as well. One summer 2023 Scholar shared that "*I have a better understanding of the research process thanks to the STARS program… the introduction to research has opened to the door to more career opportunities.*"

Table 10. Changes in Quantitative Outcomes for STARS Scholars, Year 2

Construct	2022-23 Academic Year Scholars (*n* = 19) True Pretest & Posttest	Summer 2023 Scholars (*n* = 25-27) Retrospective Pretest & Posttest
Sense of Belonging (Walton & Cohen, 2007)	X *No significant difference* 	X *No significant difference* 
College Self-Efficacy (Solberg at al., 1993) — **Course Efficacy**	X *No significant difference* 	↑ ***Significant increase*** 
College Self-Efficacy (Solberg at al., 1993) — **Social Efficacy**	X *No significant difference* 	↑ ***Significant increase*** 
Academic Self-Efficacy (Pintrich & DeGroot, 1990)	X *No significant difference* 	X *No significant difference* 

Construct	2022-23 Academic Year Scholars (*n* = 19) True Pretest & Posttest	Summer 2023 Scholars (*n* = 25-27) Retrospective Pretest & Posttest
Research Skills (Kardash, 2000)	X *No significant difference* 	↑ ***Significant increase*** 

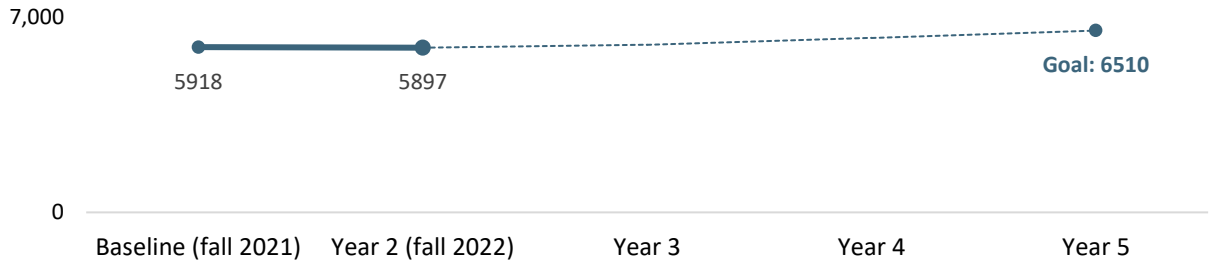
All Hispanic and/or Low-Income Students

STARS performance measures concerning the enrollment and academic progress of Hispanic and/or low-income students were assessed through institutional research data obtained from CPP, Mt. SAC, and Citrus.

Enrollment

The STARS project aims to increase the enrollment of Hispanic and/or low-income full-time degree-seeking undergraduate STEM students at CPP (**PM 1.15**). Baseline was established as 5,918 students enrolled in fall 2021. The five-year goal is to increase this by 10% to 6,510. In fall 2022, there were 5,897 Hispanic and/or low-income full-time degree-seeking undergraduate STEM students enrolled at CPP, a slight decrease from the baseline (see **Figure 2**).

Figure 2. CPP Hispanic and/or Low-Income STEM Enrollment Over Time and Goal



Retention

The STARS project aims to increase the percentage of Hispanic and/or low-income first-time full-time (FTF) STEM degree-seeking undergraduate students who are retained in STEM one year after their initial enrollment (**PM 1.16**). Baseline was established using the fall 2021 cohort: of the 974 Hispanic and/or low-income FTF students who matriculated in fall 2021, 818 were still enrolled at CPP in STEM as of fall 2022 (84%). The five-year goal is to increase this to 88% of students retained. Of the 1,102 Hispanic and/or low income FTF STEM students matriculating in fall 2022, 950 were still enrolled in STEM in fall 2023 (86%; see **Figure 3**).

Figure 3. CPP One-Year STEM Retention Rates and Goal

Baseline N = 974; Year 2 N = 1,102

Graduation

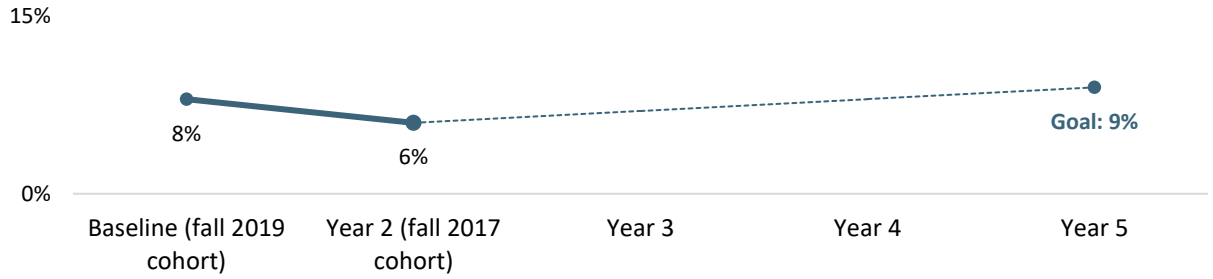
The STARS project aims to increase six-year graduation rates for Hispanic and/or low-income FTF STEM students (**PM 1.17**). Baseline was established using the fall 2016 cohort: of the 1,127 Hispanic and/or low-income FTF STEM students who matriculated in fall 2016, 581 had graduated in STEM by the end of the 2021-22 academic year (52%). The five-year goal is to increase this graduation rate to 55%. Of the 898 Hispanic and/or low income FTF STEM students matriculating in fall 2017, 485 had graduated by the end of the 2022-23 academic year (54%; see **Figure 4**). This graduation rate is already close to the five-year goal.

Figure 4. CPP First-Time Freshman STEM Student Six-Year Graduation Rates and Goal

Baseline N = 1,127; Year 2 N = 898

The STARS project also aims to increase the three-year graduation rates for Hispanic and/or low income FTF STEM students at Citrus and Mt. SAC (**PM 2.3**). Baseline was established by using the 2019 cohort at both campuses: of the 798 Hispanic and/or low-income students who matriculated across campuses in fall 2019, 65 had graduated with a STEM degree by the end of the 2021-22 academic year (8%). The five-year goal is to increase this graduation rate to 9%. Of the 480 Hispanic and/or low income FTF STEM students matriculating across both campuses in fall 2020, 30 had graduated by the end of the 2022-23 academic year (6%; see **Figure 5**). This represents a decrease from baseline.

Figure 5. Citrus and Mt. SAC First-Time Freshman STEM Student Three-Year Graduation Rates and Goal

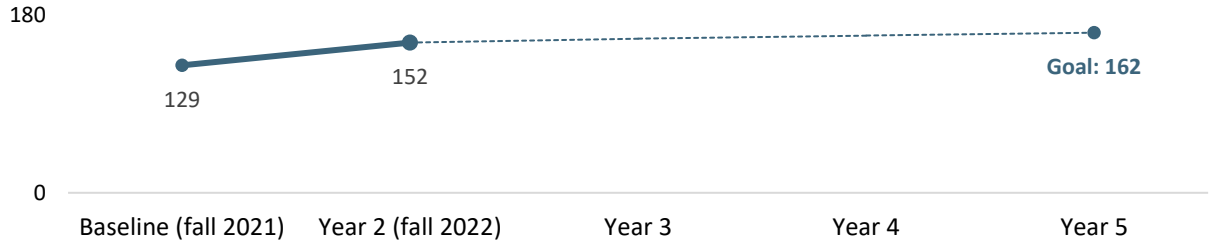


Baseline N = 798; Year 2 N = 480

Transfer

The STARS project aims to increase the number of Hispanic and/or low-income STEM students transferring from Citrus and Mt. SAC to CPP. Baseline was established using the fall 2021 cohort: 129 Hispanic and/or low-income transfer students from Citrus and Mt. SAC matriculated at CPP in fall 2021. The five-year goal is to increase this number by 25% to 162. In fall 2022, 152 Hispanic and/or low-income students from Citrus and Mt. SAC matriculated in STEM at CPP (see **Figure 6**). This represents a substantial increase towards the five-year goal.

Figure 6. CPP Hispanic and/or Low-Income STEM Transfer Enrollment Over Time and Goal



EVALUATION QUESTION 4: TO WHAT EXTENT HAVE KEY CRITERIA BEEN ESTABLISHED TO SUSTAIN PROJECT ACTIVITIES BEYOND THE DURATION OF THE GRANT?

Main Findings: It is expected that new processes and procedures developed because of STARS will be well-documented to serve as a guide for implementation beyond the duration of the grant. The STARS team and evaluation team worked collaboratively to refine tracking systems for implementation of several key activities (i.e., STARS Scholars cohort, PLUTO fellows, success workshops). In addition, the STARS team plans to develop and implement a system that allows STARS program advisors to track the topics discussed during advising meetings. The STARS team should continue to communicate regarding development and refinement of tracking systems to facilitate the sustainability of project activities beyond the duration of the grant.

CONCLUSIONS

In Year 2, the full academic year STARS Cohort experience was implemented for the first time. Students and faculty mentors generally reported positive experiences in the program. During the Fall 2022 semester, it was identified that few students were completing all program requirements. This was subsequently addressed in the Spring 2023 semester through STARS staff providing students with updates on their progress and hosting group peer mentoring events, which yielded higher engagement for Scholars in program activities. These processes should continue to be in place during Year 2 to maximize Scholar involvement in program activities. The PLUTO fellow taught a course, mentored students, and successfully obtained an Assistant Professor position at a primarily undergraduate institution. This fellow completed an exit survey, however, to maintain confidentiality, findings will be reported in Year 3 once they can be combined with the additional fellows participating in 2023-24. Ten success workshops were developed and recorded, notably expanding beyond those in just the "Academic/STEM Skills" category. With a total of 13 workshops created, this project activity is now on track to create the targeted 30 workshops by Year 5. The second FLC was held, focusing on the alignment of two new engineering courses. Many CPP course materials were shared with community college faculty members to aid in the alignment of course content. However, there was only one follow-up meeting held from the summer 2022 FLC. The transfer pathway for Civil Engineering is expected to be finalized in early spring 2024, which should allow for a more streamlined expansion of the agreement to include additional majors in future years. The revised STEM advisory board component received official approval from the program officer. Advisory board members will now primarily engage in disparate rather than concurrent activities, with the STARS team pursuing the coordination of one virtual advisory board meeting per year.

The difference education intervention was implemented for the first time with the 2022-23 Scholars. The evaluation team randomly assigned Scholars to conditions, after which Scholars completed a pretest survey, viewed either the treatment or control panel, completed a post-panel survey, and completed a posttest survey at the end of the Spring 2023 semester. Of the 27 STARS Scholars who participated during the entire 2022-23 academic year, 24 completed all three surveys, 13 in the treatment condition and 11 in the control condition. Data will be combined with the Year 3 implementation of the intervention for analysis to allow a sufficient sample size to be tested.

Outcome findings for STARS Scholars were different for the academic year and summer cohorts. This is likely due to the survey administration format. While academic year Scholars did not report significant change on any of the measured constructs, their faculty mentors reported they increased their research skills. Given their extensive professional experience conducting research, faculty mentors likely have a better perspective on their mentees research skills than the mentees themselves. This is evidence that Scholars were overestimating their skills and

abilities at pretest. In contrast, the summer 2023 Scholars who completed a retrospective pretest survey reported significant increases on multiple outcome constructs: course efficacy, social efficacy, and research skills. Notably, the summer 2023 Scholars did not report significant increases in sense of belonging or academic self-efficacy. This suggests that social desirability (i.e., believing the evaluators want to see an increase and thus adjusting survey responses accordingly) was not a factor when completing the retrospective pretest. Given findings across data sources, there is strong evidence that Scholars do in fact increase their research skills throughout their participation in the program. Consequently, the evaluation team maintains that the new testing format is appropriate for these surveys. Future assessments of Scholar outcomes should continue to use the retrospective pretest-posttest format.

The STARS project aims to affect long-term outcomes related to Hispanic and/or low-income student success across all campuses. At present, CPP retention and graduation rates are trending upward. Overall STEM enrollment rates held steady while the number of STEM students transferring to CPP from Citrus and Mt. SAC increased. Graduation rates at the community college level decreased, however the Year 2 number was for the fall 2020 cohort, a group of students whose first three years of college occurred during the height of the COVID-19 pandemic. These metrics will continue to be tracked throughout the grant.

STARS program personnel and the evaluation team worked closely in Year 2 to develop tracking systems for implementation of program activities. These systems should continue to be used and refined through close collaboration.

Next Steps

STARS will continue implementation in Year 3, including the cohort experience, success workshops, PLUTO fellows program, FLC, and advisory board. Implementation of the difference education intervention will occur for the second time with the 2023-24 STARS Scholars. Cobblestone will continue to track program implementation, performance measure status, and outcomes throughout the entire grant, ending in September 30, 2026.

Recommendations for Year 3

STARS Cohort Experience

- ☐ **Focus on orienting community college Scholars to CPP:** Community college Scholars reported difficulties gaining access to resources (e.g., software) and requested a more thorough orientation to the CPP campus. STARS staff members connecting early and often with community college Scholars helps to ensure they are receiving the appropriate level of support. In addition, these Scholars connecting with their peer mentors as early as possible could help facilitate their orientation to CPP.

- ☐ **Ensure Scholars are provided with updates on their program requirement completion progress:** The modification in spring 2023 to provide Scholars with regular updates on the completion of their program requirements led to a much greater percentage of Scholars completing the requirements. This practice should be continued in future semesters.
- ☐ **Clarify the difference between a STARS program advisor and a faculty research mentor:** During the focus group interview, some Scholars expressed confusion around the distinction between a STARS program advisor and a faculty research mentor. Early clarification of the distinction between these two roles can support Scholars to best use program resources to their advantage.
- ☐ **Ensure peer mentor matches are appropriate:** A small number of Scholars reported being unable to benefit from peer mentoring due to their mentor being of more junior status than them. Care should be taken to ensure peer mentors can appropriately *mentor* Scholars rather than serve as a *peer* only.
- ☐ **Implement the difference education intervention:** The second implementation of the difference education intervention should occur with the 2023-24 cohort of STARS Scholars.
- ☐ **Modify Scholar surveys to a retrospective pretest-posttest format**: Empirical data from Year 2 support the idea that Scholars are better able to assess their skills and abilities retroactively compared to at the program start. Modification of Scholar surveys to a retrospective pretest-posttest format can help better capture the changes that occur over the course of Scholar participation in the program.

Student Success Workshops Library

- **Continue to develop workshops for the Student Success Workshop Library:** The STARS team should continue to develop success workshops, especially focused in the areas of Equity and Inclusion in STEM, Professional and Career Development, and Essential Skills.

Current and Future Faculty Preparation

- ☐ **Continue early recruitment for PLUTO fellows:** Early recruitment of PLUTO fellows was successful and led to three fellows committing to participate in Year 3. This method of recruitment should continue to ensure that eligible postdoctoral fellows can accept offers prior to making other commitments.
- ☐ **Provide training for STARS faculty research mentors:** The original grant proposal noted faculty research mentors would be trained in creating an inclusive and welcoming environment for students from diverse backgrounds. This has not yet formally occurred. STARS should implement training or leverage other existing trainings on campus to provide faculty mentors with appropriate support to facilitate inclusive and welcoming

mentoring practices. Faculty mentors who participate in the training should be documented for implementation records.

Faculty Learning Community (FLC)

- ☐ **Hold academic year follow-up meetings with FLC participants:** The original plan was for STARS to hold two follow-up FLC meetings during the academic year for faculty members to check-in regarding course content implementation. While one follow-up meeting was held in spring 2023, it is not clear if this allowed faculty members to discuss and refine their teaching practice with respect to the courses reviewed during the summer 2022 session. STARS should focus on holding meetings during the academic year, perhaps in a virtual format, to support implementation of alignment between CPP and community college instruction.
- ☐ **Hold a third FLC focusing on a new major:** The first and second FLCs focused on Civil Engineering and Mechanical Engineering. The third FLC should expand to an additional STEM major.
- ☐ **Implement assessment for FLC participants:** The original evaluation design includes assessment of satisfaction and outcomes for FLC participants. This has not yet occurred. The evaluation team will work with STARS project personnel to implement this evaluation activity for Year 3.

Transfer Pathways Development

- ☐ **Calculate the impact of the admission bonus for Fall 2024:** To facilitate the communication of the transfer pathway advantage to students, the STARS team should work with CPP Admissions to calculate the equivalent "GPA boost" the admission bonus provides. The STARS team can also examine the number of students whose admission's decision was ultimately impacted by the bonus (i.e., they would not have been accepted without the bonus).
- ☐ **Develop transfer pathways for additional majors**: Once the Civil Engineering pathway is finalized, select a new STEM major to focus on alignment of transfer pathways in Year 3.

STEM Advisory Board

- ☐ **Implement activities with advisory board members**: The STARS program should work to create opportunities for the advisory board members to interact with students and each other. For example, advisory board members may give presentations or workshops to STARS Scholars, provide an industry perspective during the FLC, or give feedback on student research projects.

- ☐ **Coordinate one virtual advisory board meeting per year:** Per the program officer's instructions, the STARS team should try to coordinate one virtual advisory board meeting per year.

General

- ☐ **Continue to refine and use implementation tracking systems:** The STARS team and evaluation team developed tracking systems for student completion of program requirements, PLUTO fellow participation, and success workshop implementation. These systems should continue to be used in future years and development of additional tracking systems (e.g., faculty mentor training) should occur as needs arise.

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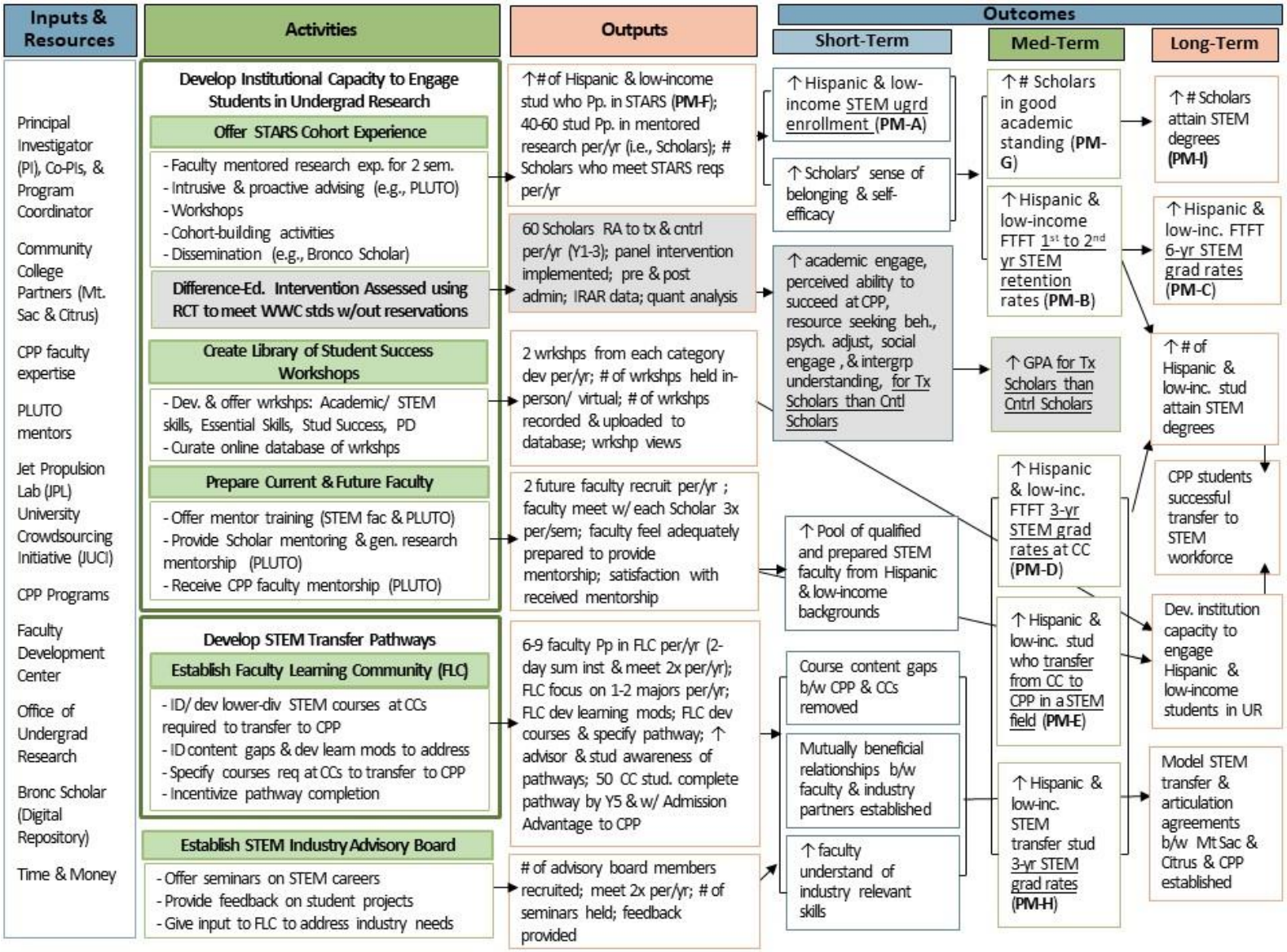
APPENDIX A. STARS LOGIC MODEL



APPENDIX B. PROGRAM IMPLEMENTATION OUTPUTS

Activity 1: Offer STARS Cohort Experience
1. 40-60 students recruited to participate in the STARS program per year (i.e, Scholars; PM F)
2. 75% of Scholars meet *all* STARS participation requirements per year
3. # of Scholars who meet with PLUTO faculty 3 times per semester
4. # of Scholars who attend 4 student success workshops per year
5. 2 cohort activities held during the academic year; 1 activity held during winter break; and 1 activity held during summer break
6. # of Scholars who attend cohort-building activities
7. # of Scholars who submit their research papers to Bronco ScholarWorks
8. # of Scholars who present their research results at a local/ regional conference
9. Intervention panels created
Activity 2: Create Library of Student Success Workshops
1. 6 student success workshops developed per year (2 academic/STEM skills, 2 essential skills, 2 professional & career development, and 2 equity and inclusion in STEM); topics
2. # of workshops held in person/ virtually
3. # of workshops recorded/ uploaded to database
4. # of workshop views
Activity 3: Prepare Current and Future Faculty[5]
1. 2 STEM doctorate recipients recruited to serve as PLUTO fellows per year
2. PLUTO fellows teach one course per year
3. PLUTO fellow hold at least 2 workshops each year for STARS Scholars; workshop topics
4. PLUTO fellows meet with each Scholar 3 times per semester
5. PLUTO fellows receive mentor training
6. # of mentor trainings provided; topics covered
7. # of faculty who attend mentor trainings
Activity 4: Establish Faculty Learning Community
1. 6-9 faculty participate in FLC per year
2. # of faculty who participate in FLC and meet participation requirements per year (attend 2-day summer institute and attend 2 meetings per year)
Activity 5: Develop Transfer Pathways
1. Lower-division STEM courses required to transfer to CPP are identified (e.g., course name, major)
2. # of learning modules developed by FLC; topics (e.g., content gaps addressed)
3. Transfer Pathways are created for 5 majors at Citrus and Mt. SAC by Year 5 (10 by Year 5; Civil Engineering in Year 1)
4. 50 CC students complete pathway and receive admission “bonus points” to CPP by Year 5
Activity 6: Establish STEM Industry Advisory Board
1. # of advisory board members recruited (industry representation)
2. 2 advisory board meetings per year
3. # of members who attend meetings
4. Advisory board feedback provided on curriculum
5. Advisory board feedback provided on learning modules

[5] Cobblestone and the PI will meet to discuss specifics with regard to the PLUTO mentor to student ratio, frequency of meetings and workshops. Specific output targets may be modified based on these discussions.

6. Advisory board feedback provided on student research projects
7. # of STEM seminars held with advisory board experts
8. # of people who attend STEM seminars
Dissemination of Best Practices
1. Think Tank in CSU established by STEM-NET; CPP STARS joins as member (attend annual 2 day summit & share best practices)
2. # of presentations given at conferences and other meetings (Engineering liaison Council ECL; ARI partner meetings)

APPENDIX C. PERFORMANCE MEASURES AND STATUS

Number of Grant Activities: 2

Grant Activity 1/2
Activity Description:
Develop CPP, Citrus, and Mt. SAC institutional capacity to engage Hispanic and low-income students in undergraduate research, including develop best practices in advising and mentoring
Objective 1/18

Objective Description:
Increase the number of Hispanic and low-income students participating in grant funded student support programs or services from 0 to 200 by the end of Year 5. (PM 1.1)
Objective Status: On Schedule
Performance Measure 1/1
Performance Measure Description:
A total of 121 unique Scholars participated across Years 1 and 2. Of those, 84 were Hispanic and/or low income.

Measure Type:	**Date Measured:**	**Frequency Measured:**
Program	09/30/2023	Annually

Data Type: ☒ **Raw Number** ☐ **Ratio**

Target	Actual
200.00	84.00

Objective 2/18

Objective Description:
75% of Scholars meet STARS program participation requirements each year. (PM 1.2)
Objective Status: On Schedule
Performance Measure 1/1
Performance Measure Description:
In fall 2022, 10% (3/31) of Scholars met all participation requirements. In spring 2023, 84% (26/31) met all participation requirements. In summer 2023, 83% (33/40) met all the requirements. Therefore, in an average term in Year 2, 61% of participants met program requirements.

Measure Type:	**Date Measured:**	**Frequency Measured:**
Project	09/30/2023	Annually

Data Type: ☐ **Raw Number** ☒ **Ratio**

Target	Actual
76/101 **75%**	62/101 **61%**

Objective 3/18

Objective Description:
6 Student Success Workshops (1-2 from each category) developed each year. (PM 1.3)
Objective Status: On Schedule
Performance Measure 1/1
Performance Measure Description:
A total of 10 new workshops were developed in Year 2. Seven were Academic/STEM Skills workshops: Data Analysis and Python; Data Analysis with Machine Learning; Literature Review Workshop; Writing Workshop – Methodology Section; Writing Workshop – Analysis and Discussion Sections; MATLAB for Excel Users; and Tackling Big Data with MATLAB. One was a Professional and Career Development workshop: Building Open Datasets for Autonomous Perception in Aviation. One was an Equity and Inclusion in STEM workshop: Bridging Aspirations: Latino Young Men and their Transition from Middle

School to High School. One was an Essential Skills workshop: Presentation workshop. This brings the cumulative total across years to 13.

Measure Type:	**Date Measured:**	**Frequency Measured:**
Project	09/30/2023	Annually

Data Type: ☒ **Raw Number** ☐ **Ratio**

Target	**Actual**
30.00	13.00

Objective 4/18

Objective Description:
2 future faculty members recruited to serve as PLUTO mentors each year. (PM 1.4)
Objective Status: On Schedule
Performance Measure 1/1
Performance Measure Description:
From fall 2022 to spring 2023, one postdoctoral student served as a PLUTO fellow. An additional two fellows began in summer 2023 and are expected to continue through spring 2024. Cumulatively, this brings the total number of PLUTO fellows to 4.

Measure Type:	**Date Measured:**	**Frequency Measured:**
Project	09/30/2023	Annually

Data Type: ☒ **Raw Number** ☐ **Ratio**

Target	**Actual**
10.00	4.00

Objective 5/18

Objective Description:
Scholars' *sense of belonging* will significantly increase from pretest to posttest at the end of one year. (PM 1.5)
Objective Status: On Schedule
Performance Measure 1/1
Performance Measure Description:
Scholars rated their agreement with 12 statements concerning their sense of belonging on a scale ranging from 1 = "Strongly Disagree" to 5 = "Strongly Agree." For Scholars who participated during the 2022-23 academic year, sense of belonging did not significantly change from pretest (M = 4.31, SD = 0.66) to posttest (M = 4.23, SD = 0.46), $t(17) = 0.52$, $p = .611$. For Scholars who participated during summer 2023, sense of belonging also did not significantly change from retrospective pretest (M = 4.26, SD = 0.58) to posttest (M = 4.20, SD = 0.85), $Z(25) = 0.08$, $p = .936$.

Measure Type:	**Date Measured:**	**Frequency Measured:**
Project	09/30/2023	Annually

Data Type: ☒ **Raw Number** ☐ **Ratio**

Target	**Actual**
1.00	0.00

Objective 6/18

Objective Description:
Scholars' *self-efficacy* will significantly increase from pretest to posttest at the end of one year. (PM 1.6)
Objective Status: On Schedule
Performance Measure 1/1
Performance Measure Description:
Scholars rated the extent to which nine statements concerning academic self-efficacy were true of them on a scale ranging from 1 = "Not at All True" to 7 = "Very True of Me." For Scholars who participated during the 2022-23 academic year, academic self-efficacy did not significantly change from pretest (M =

5.23, *SD* = 1.22) to posttest (*M* = 5.34, *SD* = 1.04), *t*(17) = 0.35, *p* = .728. For Scholars who participated during summer 2023, academic self-efficacy also did not significantly change from retrospective pretest (*M* = 5.38, *SD* = 1.24) to posttest (*M* = 5.57, *SD* = 0.97), *t*(26) = 1.47, *p* = .153.

Measure Type: Project
Date Measured: 09/30/2023
Frequency Measured: Annually
Data Type: ☒ **Raw Number** ☐ **Ratio**

Target	Actual
1.00	0.00

Objective 7/18

Objective Description:
Increase the number of Hispanic and low-income students who participated in grant-supported services or programs in good academic standing from 0 to 200 by the end of Year 5. (PM 1.7)
Objective Status: On Schedule
Performance Measure 1/1
Performance Measure Description:
Of the 23 CPP students who participated in STARS for the entire 2022-2023 academic year, spring 2023 cumulative GPA was available for 22 students. All of the students had a GPA above 2.0 and therefore were in good academic standing.

Measure Type: Program
Date Measured: 09/30/2023
Frequency Measured: Annually
Data Type: ☒ **Raw Number** ☐ **Ratio**

Target	Actual
200.00	22.00

Objective 8/18

Objective Description:
RCT Specific: There will be significantly greater academic engagement for the treatment than for the control students at the end of one year. (PM 1.8)
Objective Status: On Schedule
Performance Measure 1/1
Performance Measure Description:
The first cohort of participants in the RCT were the 2022-23 STARS Scholars. Analysis of the RCT will occur in Year 3 after data is collected for two cohorts of participants. Academic engagement will be assessed via pretest and posttest surveys at the beginning and end of the year-long STARS cohort experience.

Measure Type: Project
Date Measured: 09/30/2023
Frequency Measured: Annually
Data Type: ☒ **Raw Number** ☐ **Ratio**

Target	Actual
1.00	999.00

Objective 9/18

Objective Description:
RCT Specific: There will be significantly greater perceived ability to succeed in college for the treatment than for the control students at the end of one year. (PM 1.9)
Objective Status: On Schedule
Performance Measure 1/1
Performance Measure Description:
The first cohort of participants in the RCT were the 2022-23 STARS Scholars. Analysis of the RCT will occur in Year 3 after data is collected for two cohorts of participants. Perceived ability to succeed in

college will be assessed via pretest and posttest surveys at the beginning and end of the year-long STARS cohort experience.

Measure Type:	**Date Measured:**	**Frequency Measured:**
Project	09/30/2023	Annually

Data Type: ☒ **Raw Number** ☐ **Ratio**

Target	**Actual**
1.00	999.00

Objective 10/18

Objective Description:

RCT Specific: There will be significantly greater resource seeking behaviors for the treatment than for the control students at the end of one year. (PM 1.10)

Objective Status: On Schedule

Performance Measure 1/1

Performance Measure Description:

The first cohort of participants in the RCT were the 2022-23 STARS Scholars. Analysis of the RCT will occur in Year 3 after data is collected for two cohorts of participants. Resource seeking behaviors will be assessed via pretest and posttest surveys at the beginning and end of the year-long STARS cohort experience.

Measure Type:	**Date Measured:**	**Frequency Measured:**
Project	09/30/2023	Annually

Data Type: ☒ **Raw Number** ☐ **Ratio**

Target	**Actual**
1.00	999.00

Objective 11/18

Objective Description:

RCT Specific: There will be significantly greater *psychological adjustment* for the treatment than for the control students at the end of one year. (PM 1.11)

Objective Status: On Schedule

Performance Measure 1/1

Performance Measure Description:

The first cohort of participants in the RCT were the 2022-23 STARS Scholars. Analysis of the RCT will occur in Year 3 after data is collected for two cohorts of participants. Psychological adjustment will be assessed via pretest and posttest surveys at the beginning and end of the year-long STARS cohort experience.

Measure Type:	**Date Measured:**	**Frequency Measured:**
Project	09/30/2023	Annually

Data Type: ☒ **Raw Number** ☐ **Ratio**

Target	**Actual**
1.00	999.00

Objective 12/18

Objective Description:

RCT Specific: There will be significantly greater *social engagement* for the treatment than for the control students at the end of one year. (PM 1.12)

Objective Status: On Schedule

Performance Measure 1/1

Performance Measure Description:

The first cohort of participants in the RCT were the 2022-23 STARS Scholars. Analysis of the RCT will occur in Year 3 after data is collected for two cohorts of participants. Social engagement will be assessed via pretest and posttest surveys at the beginning and end of the year-long STARS cohort experience.

Measure Type:	**Date Measured:**	**Frequency Measured:**
Project	09/30/2023	Annually

Data Type: ☒ **Raw Number** ☐ **Ratio**

Target	Actual
1.00	999.00

Objective 13/18

Objective Description:
RCT Specific: There will be significantly greater *intergroup understanding* for the treatment than for the control students at the end of one year. (PM 1.13)
Objective Status: On Schedule
Performance Measure 1/1
Performance Measure Description:
The first cohort of participants in the RCT were the 2022-23 STARS Scholars. Analysis of the RCT will occur in Year 3 after data is collected for two cohorts of participants. Intergroup understanding will be assessed via pretest and posttest surveys at the beginning and end of the year-long STARS cohort experience.

Measure Type:	**Date Measured:**	**Frequency Measured:**
Project	09/30/2023	Annually

Data Type: ☒ **Raw Number** ☐ **Ratio**

Target	Actual
1.00	999.00

Objective 14/18

Objective Description:
RCT Specific: There will be significantly higher *GPA* for the treatment than for the control students at the end of one year. (PM 1.14)
Objective Status: On Schedule
Performance Measure 1/1
Performance Measure Description:
The first cohort of participants in the RCT were the 2022-23 STARS Scholars. Analysis of the RCT will occur in Year 3 after data is collected for two cohorts of participants. GPA will be assessed via institutional data at the beginning and end of the year-long STARS cohort experience.

Measure Type:	**Date Measured:**	**Frequency Measured:**
Project	09/30/2023	Annually

Data Type: ☒ **Raw Number** ☐ **Ratio**

Target	Actual
1.00	999.00

Objective 15/18

Objective Description:
Increase the percentage Hispanic and low-income full-time STEM field degree-seeking undergraduate students enrolled at CPP by 10% from baseline by the end of Year 5. (PM 1.15)
Objective Status: On Schedule
Performance Measure 1/1
Performance Measure Description:
Baseline was established as 5,918 students enrolled in fall 2021. The five-year goal is a 10% increase from baseline, 6,510. In fall 2022, 5,897 Hispanic and/or low-income full-time STEM degree-seeking undergraduate students were enrolled at CPP.

Measure Type:	**Date Measured:**	**Frequency Measured:**
Program	09/30/2023	Annually

Data Type: ☒ **Raw Number** ☐ **Ratio**

Target	Actual
6510	5897

Objective 16/18

Objective Description:
Increase the percentage of Hispanic and low-income first-time, full-time STEM field degree-seeking undergraduate students who were in their first year of postsecondary enrollment in the previous year and are enrolled in the current year who remain in a STEM by 5% from baseline by the end of Year 5. (PM 1.16)
Objective Status: On Schedule
Performance Measure 1/1
Performance Measure Description:
cx
Measure Type: Program
Date Measured: 09/30/2023
Frequency Measured: Annually
Data Type: ☐ **Raw Number** ☒ **Ratio**

Target	Actual
967/1102 **88%**	950/1102 **86%**

Objective 17/18

Objective Description:
Increase the percentage of Hispanic and low-income first-time, full-time degree-seeking undergraduate students enrolled at four-year HSIs graduating within six years of enrollment with a STEM field degree by 7% from baseline by the end of Year 5. (PM 1.17)
Objective Status: On Schedule
Performance Measure 1/1
Performance Measure Description:
In fall 2017, 898 Hispanic and/or low income FTF STEM students matriculated at CPP. By the end of the 2022-23 academic year, 485 of those students had graduated in STEM (54%).
Measure Type: Program
Date Measured: 09/30/2023
Frequency Measured: Annually
Data Type: ☐ **Raw Number** ☒ **Ratio**

Target	Actual
494/898 **55%**	485/898 **54%**

Objective 18/18

Objective Description:
Increase the number of Hispanic and low-income students who participated in grant-supported services or programs and completed a degree or credential from 0 to 80 by the end of Year 5. (PM 1.18)
Objective Status: On Schedule
Performance Measure 1/1
Performance Measure Description:
Fifteen Hispanic and/or low-income STARS Scholars have graduated from CPP.
Measure Type: Program
Date Measured: 09/30/2023
Frequency Measured: Annually
Data Type: ☒ **Raw Number** ☐ **Ratio**

Target	Actual
80.00	15.00

Grant Activity 2/2

Activity Description:

Develop CPP, Citrus, and Mt. SAC's institutional capacity to move STEM Hispanic and low-income students through the STEM curriculum more quickly through the development of Transfer Pathways and courses for articulation.

Objective 1/5

Objective Description:

Transfer Pathways are created for 5 majors at Citrus and Mt Sac by Year 5. (PM 2.1)

Objective Status: On Schedule

Performance Measure 1/1

Performance Measure Description:

By the end of Year 2, the memorandum of understanding establishing the transfer pathways and admission bonus for Civil Engineering was reviewed by the California State University Chancellor's Office. The Civil Engineering pathway is expected to be finalized in early spring 2024, which will represent the completion of one major at both Mt. SAC and Citrus.

Measure Type:	**Date Measured:**	**Frequency Measured:**
Project	09/30/2023	Annually

Data Type: ☒ **Raw Number** ☐ **Ratio**

Target	**Actual**
10.00	0.00

Objective 2/5

Objective Description:

50 Citrus and Mt SAC students complete the Transfer Pathway and receive admission "bonus points" to CPP by Year 5. (PM 2.2)

Objective Status: On Schedule

Performance Measure 1/1

Performance Measure Description:

The admission bonus was not implemented for the fall 2023 admissions cycle. It is expected to be applied for the first time for the fall 2024 admissions cycle.

Measure Type:	**Date Measured:**	**Frequency Measured:**
Project	09/30/2023	Annually

Data Type: ☒ **Raw Number** ☐ **Ratio**

Target	**Actual**
50.00	0.00

Objective 3/5

Objective Description:

Increase the percentage of Hispanic and low-income first-time, full-time degree-seeking undergraduate students enrolled at two-year HSIs graduating within three years of enrollment with a STEM field degree/ credential by 7% from baseline by the end of Year 5. (PM 2.3)

Objective Status: On Schedule

Performance Measure 1/1

Performance Measure Description:

At Citrus college, 110 Hispanic and/or low-income full-time students matriculated in a STEM program in fall 2020. By spring 2023, 13 of these students had graduated with an associate degree in STEM (12%). At Mt. SAC, 370 Hispanic and/or low-income full-time students matriculated in a STEM program in fall 2020. By spring 2023, 17 of these students had graduated with an associate degree in STEM (5%). Across both Citrus and Mt. SAC, the weighted graduation rate was 6% (30/480).

Measure Type:	**Date Measured:**	**Frequency Measured:**
Program	09/30/2023	Annually

Data Type: ☐ **Raw Number** ☒ **Ratio**

Target	Actual
43/480 **9%**	30/480 **6%**

Objective 4/5

Objective Description:
Increase the number of Hispanic and low-income students transferring successfully to a four-year institution from a two-year institution and retained in a STEM field major. (PM 2.4)
Objective Status: On Schedule
Performance Measure 1/1
Performance Measure Description:
A total of 44 Hispanic and/or low-income students from Citrus and 108 Hispanic and/or low-income students from Mt. SAC matriculated in a STEM major at CPP in fall 2023, for a total of 152 students.

Measure Type:	**Date Measured:**	**Frequency Measured:**
Program	09/30/2023	Annually

Data Type: ☒ **Raw Number** ☐ **Ratio**

Target	Actual
162.00	152.00

Objective 5/5

Objective Description:
Increase the percentage of Hispanic and low-income STEM field major transfer students on track to complete a STEM field degree within three years from their transfer date by 8% from baseline by the end of Year 5. (PM 2.5)
Objective Status: On Schedule
Performance Measure 1/1
Performance Measure Description:
A total of 208 Hispanic and/or low-income STEM transfer students from Citrus and Mt. SAC matriculated at CPP in fall 2020. Of those, 109 had graduated with a STEM degree by the end of the 2022-23 academic year.

Measure Type:	**Date Measured:**	**Frequency Measured:**
Program	09/30/2023	Annually

Data Type: ☐ **Raw Number** ☒ **Ratio**

Target	Actual
121/208 **58%**	109/208 **52%**

APPENDIX D. STARS SCHOLARS' DEMOGRAPHIC INFORMATION

	Year 1 (*n* = 60)	Year 2 (*n* = 71)	Cumulative Total (*n* = 121)
CPP	**63%**	**73%**	**69%**
Citrus	7%	11%	8%
Mt SAC	30%	16%	23%
Male	**57%**	**62%**	**60%**
Female	43%	34%	38%
Other	0%	1%	1%
Unknown	0%	3%	2%
First Generation	**50%**	44%	46%
Not First Generation	45%	**49%**	**47%**
Unknown	5%	7%	7%
Hispanic/Latino	**35%**	**44%**	**40%**
Asian	**36%**	31%	34%
Black/African American	3%	3%	2%
White	23%	7%	9%
Two or more races	5%	4%	4%
Unknown	8%	11%	10%

Note: Percentages may not sum to 100 due to rounding. Low-income data are no longer available at the individual student level.

APPENDIX E. SUCCESS WORKSHOPS ACROSS YEARS

Academic/STEM Skills	
Year 1	Introduction to Data Science
	Mastering Excel Data Processing
	Data and Research Ethics
Year 2	Data Analysis and Python
	Data Analysis with Machine Learning
	Literature Review Workshop
	Writing Workshop - Methodology Section
	Writing Workshop - Analysis and Discussion Section
	MATLAB for Excel Users
	Tackling Big Data with MATLAB
Professional and Career Development	
Year 2	Building Open Datasets for Autonomous Perception in Aviation
Equity and Inclusion in STEM	
Year 2	Bridging Aspirations: Latino Young Men and their Transition from Middle School to High School
Essential Skills	
Year 2	Presentation Workshop

APPENDIX F. 2022-2023 SCHOLARS PRETEST AND POSTTEST SURVEY SUMMARY

A total of 27 Scholars participated in the STARS project during the entire 2022-2023 academic year. Of those, 25 consented and completed both pretest and posttest surveys (at the beginning and end of the academic year). However, three Scholars also participated in the Achieve Scholars Program as peer mentors and an additional four had previously participated in the STARS program; these seven Scholars were therefore excluded from the quantitative pretest-posttest analyses. Qualitative findings include data from all Scholars.

Change From Pretest to Posttest

Sense of Belonging

Scholars rated their agreement with 12 statements concerning their sense of belonging on a scale[6] ranging from 1 = "Strongly Disagree" to 5 = "Strongly Agree." A paired samples *t*-test found that *there was no significant difference between Scholars' overall sense of belonging at pretest* (*M* = 4.31; *SD* = 0.66) *and at posttest* (*M* = 4.23; *SD* = 0.46), $t(17) = 0.52$, $p = .611$. See **Table a** for the Sense of Belonging scale descriptive statistics by item. Of note, although Scholars' sense of belonging has not increased throughout the program, they reported an overall strong sense of belonging at pretest.

Table a. Sense of Belonging Scale Descriptive Statistics by Item

	Pretest		Posttest		
Survey Item	***M***	***SD***	***M***	***SD***	**Change**
I am likely to remain in my major until graduation	4.47	0.87	4.65	0.49	0.18
I feel comfortable in my major at [institution]	4.28	0.96	4.39	0.78	0.11
I get along well with people (e.g., faculty, students) in my major at [institution]	4.33	0.69	4.39	0.61	0.06
I am close with other people (e.g., faculty, students) in my major at [institution]	4.11	1.13	4.11	0.90	0.00
I feel like I belong in my major at [institution]	4.39	0.85	4.39	0.78	0.00
I feel like I have a lot in common with other people (e.g., faculty, students) in my major at [institution]	4.06	0.94	4.06	0.64	0.00
I understand the career opportunities associated with my major	4.06	0.73	4.06	0.64	0.00
I fit well in my major at [institution]	4.33	0.91	4.28	0.83	-0.06
I feel like I really belong at [institution]	4.13	0.89	4.00	0.82	-0.12
I like being a student in my major at [institution]	4.47	0.87	4.29	0.77	-0.18
I feel comfortable with other people (e.g., faculty, students) in my major at [institution]	4.61	0.61	4.28	0.57	-0.33
I feel there is a real sense of community at [institution]	4.29	0.77	3.94	0.90	-0.35
Sense of Belonging Composite	**4.31**	**0.66**	**4.23**	**0.46**	**-0.08**

n = 16-18; Scale: 1 = "Strongly Disagree" to 5 = "Strongly Agree"

[6] Walton & Cohen (2007)

Academic Self-Efficacy

Scholars rated the extent to which nine statements concerning academic self-efficacy were true of them on a scale[7] ranging from 1 = "Not at All True" to 7 = "Very True of Me." A paired samples *t*-test found that *there was no significant difference between Scholars' overall academic self-efficacy at pretest* (M = 5.23; SD = 1.22) *and at posttest* (M = 5.34; SD = 1.04), $t(17) = 0.35$, $p = .728$. See **Table b** for the Academic Self-Efficacy scale descriptive statistics by item.

Table b. Academic Self-Efficacy Scale Descriptive Statistics by Item

	Pretest		Posttest		
Survey Item	***M***	***SD***	***M***	***SD***	**Change**
Compared with others in my major at [institution], I think I'm a good student	5.22	1.56	5.44	1.15	0.22
Compared with other students in my major at [institution], I think I know a great deal about the subject	4.89	1.57	5.11	1.18	0.22
I expect to do very well in my major courses at [institution]	5.39	1.20	5.61	1.33	0.22
My study skills are excellent compared with others in my major at [institution]	4.39	1.50	4.61	1.46	0.22
I am sure I can do an excellent job on the problems and tasks assigned for my major courses at [institution]	5.41	1.23	5.59	1.06	0.18
I think I will receive a good grade in my major courses at [institution]	5.18	1.38	5.35	1.41	0.18
I'm certain I can understand the ideas taught in my major courses at [institution]	5.39	1.20	5.56	.98	0.17
Compared with other students in my major at [institution], I expect to do well	5.28	1.36	5.22	1.44	-0.06
I know that I will be able to learn the material for my major courses at [institution]	5.78	1.22	5.67	0.69	-0.11
Academic Self-Efficacy Composite	**5.23**	**1.22**	**5.34**	**1.04**	**0.11**

n = 17-18; Scale: 1 = "Not at All True" to 7 = "Very True of Me"

College Self-Efficacy

Scholars self-evaluated two aspects of their college self-efficacy: their course efficacy and their social efficacy.[8] Specifically, they rated their confidence in completing seven course-related tasks and seven social tasks on a scale ranging from 1 = "Not at All Confident" to 7 = "Extremely Confident." See **Table c** for the College Self-Efficacy sub-scales descriptive statistics by item.

Course Efficacy. A paired samples *t*-test found that there was no significant difference between Scholars' overall course efficacy at pretest (M = 5.50; SD = 0.97) and at posttest (M = 5.44; SD = 0.90), $t(17) = 0.28$, $p = .783$.

Social Efficacy. Although Scholars' social efficacy increased from pretest to posttest, a paired samples t-test found that there was no statistically significant difference between

[7] Pintrich & DeGroot (1990)
[8] Solberg et al. (1993)

Scholars' overall social efficacy at pretest (M = 5.67; SD = 1.00) and at posttest (M = 5.75; SD = 0.89), $t(17) = 0.42$, $p = .679$.

Table c. College Self-Efficacy Scale Descriptive Statistics by Item

		Pretest		Posttest		
	Survey Item	***M***	***SD***	***M***	***SD***	**Change**
Course Efficacy	Do well on your exam	5.33	1.08	5.56	1.29	0.22
	Write a course paper	5.56	1.25	5.78	1.06	0.22
	Research a team paper	5.56	1.15	5.67	1.08	0.11
	Understand your textbooks	5.22	1.00	5.28	0.96	0.06
	Take good class notes	5.67	1.19	5.56	1.10	-0.11
	Keep up to date with your schoolwork	5.89	1.18	5.56	1.10	-0.33
	Manage your time effectively	5.28	1.18	4.72	1.27	-0.56
Course Efficacy Composite		**5.50**	**0.97**	**5.44**	**0.90**	**-0.06**
Social Efficacy	Talk with faculty advisor	5.44	1.58	5.94	1.06	0.50
	Talk with academic advisor	5.83	1.42	6.11	0.96	0.28
	Ask questions in class	5.39	1.50	5.44	1.34	0.06
	Ask a professor a question outside of class	6.00	1.57	6.00	1.08	0.00
	Talk to your professors/instructors	5.89	1.41	5.83	1.29	-0.06
	Join a student organization	5.50	1.04	5.39	1.33	-0.11
	Participate in class discussions	5.67	1.19	5.50	1.20	-0.17
Social Efficacy Composite		**5.67**	**1.00**	**5.75**	**0.89**	**0.08**

n = 18; Scale: 1 = "Not at All Confident" to 7 = "Extremely Confident"

Research Skills

Scholars rated the extent to which they felt they could complete 14 research-related tasks on a scale[9] ranging from 1 = "Not at All" to 5 = "A Great Deal." A paired samples t-test found that there was no significant difference between Scholars' overall self-reported research skills at pretest (M = 4.12; SD = 0.62) and at posttest (M = 4.12; SD = 0.76), $t(17) = 0.10$, $p = .991$. A series of paired samples t-tests examined the change in each research skills and found no significant difference in any of the skills from pretest to posttest (see **Table d**).

Table d. Change in Scholar Research Skills from Pretest to Posttest

	Pretest		Posttest		
Survey Item	***M***	***SD***	***M***	***SD***	**Change**
Understand contemporary concepts in your field	3.94	0.75	4.24	0.66	0.29
Design an experiment or theoretical test of the hypothesis	3.72	0.89	3.94	1.00	0.22
Orally communicate the results of research projects	3.89	0.90	4.11	0.90	0.22
Write a research paper for publication	3.67	1.14	3.83	0.79	0.17
Formulate a research hypothesis based on a specific question	4.00	0.69	4.11	0.96	0.11
Reformulate your original research hypothesis (as appropriate)	4.06	0.87	4.11	0.83	0.06
Identify a specific question for investigation based on the research in your field:	4.00	0.77	4.00	0.84	0.00
Statistically analyze data	4.06	1.06	4.06	0.80	0.00

[9] Kardash (2000)

Survey Item	Pretest *M*	Pretest *SD*	Posttest *M*	Posttest *SD*	Change
Make use of the primary scientific research literature in your field (e.g., journal articles)	4.33	0.91	4.17	0.92	-0.17
Observe and collect data	4.50	0.79	4.33	0.91	-0.17
Interpret data by relating results to the original hypothesis	4.28	0.89	4.06	0.80	-0.22
Relate results to the bigger picture in your field	4.33	0.84	4.11	0.83	-0.22
Understand the importance of controls in research	4.44	0.86	4.11	1.08	-0.33
Research Skills Composite	**4.12**	**0.62**	**4.12**	**0.76**	**0.00**

n = 17-18; Scale: 1 = "Not at All" to 5 = "A Great Deal"

Greatest Benefits

On the posttest survey, STARS Scholars shared the greatest benefits of participating in the program. Scholars indicated that the opportunity to be involved in research was one of the greatest benefits of program participation. As one Scholar stated: "*[The best aspect was] the chance to develop your own research project, which can help you develop critical thinking skills, problem-solving skills, and other transferable skills that are highly valued in many fields.*" Scholars also found great value in connecting with their research mentors. For example, one Scholar noted: "*The grad[uate] student I was helping has become a really good friend of mine. My mentor has been extremely supportive and aided me throughout the program.*" Another benefit cited by several Scholars was developing communication and teamwork skills. This included networking with other students and faculty members and "*learning how to effectively communicate the data and topic researched to others outside of the major and project*." One Scholar explained that "*the potential to publish your research findings or present them at conferences… can help you build your academic and professional profile and demonstrate your expertise to potential employers or graduate schools*." Other benefits Scholars cited included learning more about their academic interests, learning how to work independently, and gaining a sense of belonging and accomplishment.

Suggestions for Improvement

On the posttest survey, Scholars provided suggestions that could enhance the program experience for future STARS Scholars. They shared ideas regarding additional program components, new workshop topics, and aspects of the program that they would change.

A couple Scholars suggested modifying the program requirements to meet more senior students' needs. One of these Scholars explained: "*I think there should be a separation of curriculum between new students entering the program and returning students. I often found the workshops presented are repetitive and irrelevant to me since I am more experienced in research.*" Additional components Scholars suggested included offering "*networking events or social events where STARS students from different projects can meet each other*," providing more information on preparation for health professions, and free printing for scientific posters. Finally, one Scholar suggested providing applicants with more pre-program information and stated: "*There needs to be a way for students who would like to participate in the program to know if they are a good fit in the department [which] they are interested in joining.*"

Scholars also suggested additional workshop topics. Most frequently, Scholars requested career preparation workshops (e.g., resume writing, internships, careers in research,

major-specific career opportunities, and networking). A couple Scholars suggested incorporating writing workshops (e.g., personal essays, professional writing). Other workshop topics Scholars requested included managing imposter syndrome, creating a research template, and graduate school preparation. A few Scholars requested adding content-specific workshops (e.g., medical, engineering, computer science, robotics).

Finally, Scholars indicated what other aspects of the STARS program they would change or improve. Most frequently, Scholars noted that the program lacked organization and clear communication. One Scholar explained: "*Some of the timings on workshops and other sections interfered with classes/other commitments*," and another stated: "*Communicating events at the beginning of each month would be better so that we can accommodate*." Relatedly, another Scholar requested that mentors communicate meeting cancelations in advance. Scholars had mixed experiences with the peer mentor and program advisor meeting requirements: while two Scholars indicated they would like more frequent peer mentor meetings, one Scholar stated that they had too many meetings with their peer and program mentors. Scholars' suggestions regarding program logistics included using the same Zoom link throughout the year and improving the attendance tracking process. Other improvements Scholars suggested included "*more up-to-date Canvas report on program requirements such as listing assignments completed or missing*," increasing their stipend, guaranteeing that Scholars get hands-on experience by working on approved projects, and making the data-related workshops beginner friendly. In addition, one Scholar stated: "*There also needs to be tours for students who are completely new to university systems. There needs to more icebreakers for students wanting to get accustomed to research, other students within the fellowship, or the university itself.*"

APPENDIX G. SUMMER 2023 SCHOLARS RETROSPECTIVE PRETEST AND POSTTEST SURVEY SUMMARY

A total of 40 Scholars participated in the STARS project during summer 2023. Of those, 35 consented and completed a retrospective pretest and posttest survey (at the end of the summer experience). However, eight Scholars had previously participated in the STARS program and were excluded from the quantitative analyses. Qualitative findings include data from all Scholars.

Change From Pretest to Posttest

Sense of Belonging

Scholars rated their agreement with 12 statements concerning their sense of belonging on a scale[10] ranging from 1 = "Strongly Disagree" to 5 = "Strongly Agree." A Wilcoxon Signed Rank test[11] found that *there was no significant difference in students' sense of belonging from pretest to posttest*, as the sum of positive ranks (Positive Ranks Sum = 97.0) was not significantly larger than the sum of negative ranks (Negative Ranks Sum = 93.0), Z (n = 25) = 0.08, p =.936. See **Table e** for the Sense of Belonging scale descriptive statistics by item. Of note, although Scholars' sense of belonging did not increase throughout the program, they reported an overall strong sense of belonging at pretest (M = 4.26).

Table e. Sense of Belonging Scale Descriptive Statistics by Item

	Pretest		Posttest		
Survey Item	***M***	***SD***	***M***	***SD***	**Change**
I feel comfortable with other people (e.g., faculty, students) in my major at [institution]	4.16	0.75	4.36	0.91	0.20
I get along well with people (e.g., faculty, students) in my major at [institution]	4.08	0.70	4.20	0.91	0.12
I am likely to remain in my major until graduation	4.57	0.59	4.61	0.89	0.04
I feel like I really belong at [institution]	4.25	0.85	4.29	0.96	0.04
I like being a student in my major at [institution]	4.28	0.68	4.28	0.94	0.00
I feel comfortable in my major at [institution]	4.44	0.58	4.40	0.87	-0.04
I understand the career opportunities associated with my major	4.32	0.90	4.28	1.02	-0.04
I feel like I belong in my major at [institution]	4.44	0.65	4.36	0.95	-0.08
I am close with other people (e.g., faculty, students) in my major at [institution]	3.96	0.98	3.84	1.18	-0.12
I fit well in my major at [institution]	4.52	0.51	4.24	0.97	-0.28
I feel like I have a lot in common with other people (e.g., faculty, students) in my major at [institution]	4.17	0.76	3.83	1.09	-0.33
I feel there is a real sense of community at [institution]	4.08	0.97	3.75	1.23	-0.33
Sense of Belonging Composite	**4.26**	**0.58**	**4.20**	**0.85**	**-0.06**

n = 23-25; Scale: 1 = "Strongly Disagree" to 5 = "Strongly Agree"

[10] Walton & Cohen (2007)

[11] A Wilcoxon Signed Rank test was used a non-parametric alternative to a paired-samples t-test due to normality assumption violation.

Academic Self-Efficacy

Scholars rated the extent to which nine statements concerning academic self-efficacy were true of them on a scale[12] ranging from 1 = "Not at All True" to 7 = "Very True of Me." A paired samples *t*-test found that *there was no significant difference between Scholars' overall academic self-efficacy at pretest* (*M* = 5.38; *SD* = 1.24) *and at posttest* (*M* = 5.57; *SD* = 0.97), *t*(26) = 1.47, *p* = .153. See **Table f** for the Academic Self-Efficacy scale descriptive statistics by item.

Table f. Academic Self-Efficacy Scale Descriptive Statistics by Item

	Pretest		Posttest		
Survey Item	***M***	***SD***	***M***	***SD***	**Change**
I am / I was sure I can/could do an excellent job on the problems and tasks assigned for my major courses at [institution]	5.30	1.38	5.85	0.86	0.56
I'm / I was certain I can/could understand the ideas taught in my major courses at [institution]	5.52	1.31	5.89	1.01	0.37
I know/knew that I will/would be able to learn the material for my major courses at [institution]	5.52	1.19	5.85	0.99	0.33
I think/thought I will/would receive a good grade in my major courses at [institution]	5.33	1.21	5.67	1.04	0.33
Compared with other students in my major at [institution], I expect/expected to do well	5.38	1.30	5.65	1.09	0.27
Compared with others in my major at [institution], I think/thought I'm / I was a good student	5.35	1.41	5.50	1.17	0.15
I expect/expected to do very well in my major courses at [institution]	5.44	1.22	5.52	1.01	0.07
Compared with other students in my major at [institution], I think/thought I know/knew a great deal about the subject	5.37	1.36	5.26	1.35	-0.11
My study skills are/were excellent compared with others in my major at [institution]	5.22	1.34	4.89	1.48	-0.33
Academic Self-Efficacy Composite	**5.38**	**1.24**	**5.57**	**0.97**	**0.19**

n = 26-27; Scale: 1 = "Not at All True" to 7 = "Very True of Me"

College Self-Efficacy

Scholars evaluated two aspects of their college self-efficacy: their course efficacy and their social efficacy.[13] Specifically, they rated their confidence in completing seven course-related tasks and seven social tasks on a scale ranging from 1 = "Not at All Confident" to 7 = "Extremely Confident." See **Table g** for the College Self-Efficacy sub-scales descriptive statistics by item.

Course Efficacy. A paired samples *t*-test found that *there was a significant increase in Scholars' course efficacy from pretest* (*M* = 5.02; *SD* = 1.30) *to posttest* (*M* = 5.76; *SD* = 0.98), *t*(26) = 5.55, *p* < .001. A large effect size (*Cohen's d* = 1.07) suggests that participation in the

[12] Pintrich & DeGroot (1990)
[13] Solberg et al. (1993)

STARS program may have had a significant and noticeable impact on students' course efficacy. However, given there was no control group, this cannot be directly attributed to the program.

Social Efficacy. A paired samples *t*-test found that *there was a significant increase in Scholars' social efficacy from pretest* (*M* = 5.18; *SD* = 1.33) *to posttest* (*M* = 5.68; *SD* = 1.08), *t*(26) = 3.64, *p* < .001. A large effect size (*Cohen's d* = 0.70) suggests that participation in the STARS program may have had a significant and noticeable impact on students' social efficacy. However, given there was no control group, this cannot be directly attributed to the program.

Table g. College Self-Efficacy Scale Descriptive Statistics by Item

		Pretest		Posttest		
	Survey Item	***M***	***SD***	***M***	***SD***	**Change**
Course Efficacy	Research a team paper	4.78	1.65	5.93	1.07	1.15
	Write a course paper	4.70	1.66	5.81	1.18	1.11
	Manage your time effectively	4.81	1.62	5.48	1.37	0.67
	Keep up to date with your schoolwork	5.26	1.35	5.89	1.16	0.63
	Do well on your exam	5.22	1.22	5.74	1.02	0.52
	Take good class notes	5.19	1.57	5.70	1.49	0.52
	Understand your textbooks	5.19	1.21	5.78	1.01	0.59
Course Efficacy Composite		**5.02**	**1.30**	**5.76**	**0.98**	**0.74**
Social Efficacy	Talk with faculty advisor	5.22	1.28	5.89	1.12	0.67
	Talk to your professors/instructors	5.22	1.40	5.85	1.10	0.63
	Talk with academic advisor	5.22	1.34	5.78	1.25	0.56
	Ask questions in class	5.07	1.54	5.59	1.31	0.52
	Ask a professor a question outside of class	5.22	1.45	5.70	1.30	0.48
	Participate in class discussions	5.22	1.42	5.63	1.21	0.41
	Join a student organization	5.07	1.62	5.30	1.59	0.22
Social Efficacy Composite		**5.18**	**1.33**	**5.68**	**1.08**	**0.50**

n = 27; Scale: 1 = "Not at All Confident" to 7 = "Extremely Confident"

Research Skills

Scholars rated the extent to which they felt they could complete 14 research-related tasks on a scale[14] ranging from 1 = "Not at All" to 5 = "A Great Deal." A paired samples *t*-test found that *there was a significant difference between Scholars' overall self-reported research skills from pretest* (*M* = 3.93; *SD* = 0.87) *to posttest* (*M* = 4.33; *SD* = 0.52), *t*(26) = 3.03, *p* = .005. A medium effect size (*Cohen's d* = 0.58) suggests that participation in the STARS program had a moderate impact on students' research skills development. While there was no control group, the main component of the program was participating in undergraduate research, suggesting these changes are likely attributable to program participation. A series of paired samples *t*-tests examined the change in each research skill and found *that there was a significant difference in most research skills from pretest to posttest* (see **Table h**).

[14] Kardash (2000)

Table h. Change in Scholar Research Skills from Pretest to Posttest

	Pretest		Posttest		
Survey Item	***M***	***SD***	***M***	***SD***	**Change**
Write a research paper for publication	3.54	1.30	4.15	0.78	0.62*
Understand the importance of "controls" in research	3.96	0.84	4.52	0.51	0.56**
Make use of the primary scientific research literature in your field (e.g., journal articles)	3.85	1.01	4.38	0.64	0.54**
Relate results to the "bigger picture" in your field	3.88	1.07	4.42	0.64	0.54*
Identify a specific question for investigation based on the research in your field	3.77	0.99	4.27	0.67	0.50**
Observe and collect data	3.85	0.97	4.35	0.63	0.50**
Formulate a research hypothesis based on a specific question	3.77	0.95	4.23	0.65	0.46*
Interpret data by relating results to the original hypothesis	3.85	0.97	4.31	0.62	0.46*
Reformulate your original research hypothesis (as appropriate)	3.88	1.01	4.28	0.68	0.40**
Design an experiment or theoretical test of the hypothesis	3.92	0.86	4.28	0.68	0.36*
Orally communicate the results of research projects	4.08	0.98	4.42	0.64	0.35*
Think independently	4.08	0.84	4.38	0.64	0.31[M]
Statistically analyze data	4.08	0.84	4.31	0.68	0.23
Understand contemporary concepts in your field	4.08	0.74	4.23	0.71	0.15
Research Skills Composite	**3.93**	**0.87**	**4.33**	**0.52**	**0.40**

*n = 25-26; Scale: 1 = "Not at All" to 5 = "A Great Deal"; * p < .05, ** p < .01, *** p < .001*

Scholars' Feedback

Greatest Benefits

Scholars shared the greatest benefits of participating in the STARS program. Most frequently, they cited the research experience they gained as most valuable. For example, one Scholar stated: "*I feel like I got to learn more about how research works and how the research I was doing can be very beneficial to our lives.*" In addition, several Scholars indicated their appreciation of the program staff, including mentors, professors, and advisors. For example, one Scholar noted: "*[The best aspect was] the professor leading the project, [who] was very understanding and helpful when explaining the difficult concepts*," and another stated: "*[The best aspect was] joining a lab and following a PI's orders. Having him as my mentor brought me into the field of research*." Further, several Scholars reported benefiting from building various skills, including critical thinking, project management, data analysis, communication, teamwork, coding, and organizational skills. Another benefit cited by several Scholars was the contribution of their research experience to their career path. For example, one Scholar explained: "*The research that I participated in has given me a niche area within my major that I am more proficient in. This is great not only for my knowledge in general, but also for job searching after graduation*." Other benefits Scholars cited included learning from others (e.g., professors and

> "*I have a better understanding of the research process thanks to the STARS program… the introduction to research has opened to the door to more career opportunities.*"
>
> - Summer 2023 STARS Scholar

more experienced students), learning about CPP student resources, working on a paper for publication, discovering research opportunities on campus, networking, and financial support.

Suggestions

Additional Program Components. Many Scholars stated no additional components were desired for the STARS program. As Scholar stated: "*I was satisfied with what was offered. It was a good mix of doing research and also being exposed to other ideas through the meetings.*" The few additional components Scholars suggested included making it optional to work remotely, offering "*more peer-review opportunities to help and get helped by other students in the program*," and facilitating "*more interaction with other disciplines for [students'] research.*" In addition, one Scholar requested offering tours but did not elaborate. Finally, one Scholar stated: "*There were too many additional requirements/components to keep track of that ended up taking time from research. However, I think keeping the focus on meetings with the professor in charge of the project and meetings with a mentor in the field of study would be helpful.*"

Additional Workshop Topics. Scholars suggested additional workshop topics. Most frequently, Scholars requested career preparedness workshops (e.g., networking, finding internships, constructing portfolios). In addition, several Scholars suggested incorporating workshops on research-related topics such as "*Industry research compared to academic research*," "*The financial side of research*," "*Creating a research paper*," and "*Diversity and inclusion in research*." A few Scholars requested mental-health-related workshops (e.g., balancing research and social life, imposter syndrome). Further, several Scholars indicated a need for field-specific workshops (e.g., computer science, chemistry, and biochemistry). Scholars had mixed viewpoints on the MATLAB workshop: while two Scholars reported finding it beneficial, one Scholar requested: "*less of MATLAB, because not all the participants are engineers*." Other workshop topics Scholars suggested included data visualization, generative AI, poster presentation, and effective learning.

Program Changes and Improvements. Finally, Scholars indicated what other aspects of the STARS program they would change or improve. Of note, many Scholars stated that they would not change any aspect. The most frequently cited suggestion for improvement was better organization and clear communication. One Scholar explained: "*Many of the assignments were not clearly defined, and delays on things like zoom links, slides, etc. were constant. Also, I would like it if the Canvas page was updated with required links for assignments, modules containing videos, etc. I often found it confusing to find the required submission pages and workshop/event materials.*" In addition, several Scholars offered suggestions regarding the seminars, including making them optional and introducing a variety of topics. Two Scholars also requested making sure the topics presented at the seminars were relevant to all students. As one of these Scholars explained: "*Some of the workshops were quite specific to a certain major, research area, or subject. For example, the one about administrations of universities and CPP. It was interesting, but not very relevant.*"

APPENDIX H. 2022-2023 STARS SCHOLARS FOCUS GROUP SUMMARY

A focus group interview was conducted with ten STARS Scholars in Spring 2023.

Reason for Joining the STARS Program

Several Scholars cited the opportunity to gain research experience as the reason for joining the STARS Program. As one Scholar shared, "*I just joined so that I could get experience in the research process from start to finish*." Other Scholars joined because they thought the experience in the program would be valuable to employers and potential graduate schools. One Scholar noted, "*I just joined because I've always wanted to do grad school and so I know research is something they kind of look at and so would be a good way to kind of get into research and get something for my grad school application*." A few Scholars hoped to apply and practice their skills in a practical setting. One Scholar shared, "*It's a good way to learn how to balance, like say school, work for this, actually living your life. It's a good way to… practice this in an environment where you're still learning compared to real life*."

STARS Faculty Experience

Scholars generally reported positive experiences with STARS program advisors, specifically, feeling understood and welcomed by the advisors. One Scholar stated, "*The STARS [advisors] I would say [are] extremely helpful and very welcoming… from my personal experience, [STARS advisors] understood me even though I'm not an original student from Cal Poly Pomona*." Another Scholar shared, "*If you need to set up a meeting and talk about something then, you know, they're there to be able to talk to. And then if you're having any issues, they'll understand that*." Of note, some Scholars expressed confusion around the distinction between a program advisor and a faculty mentor.

Greatest Benefits

Scholars shared what they identified as the greatest benefits of participating in the STARS program. Several Scholars believed that engaging in research was the greatest benefit of the program, for example "*[getting] a foot in the door with experience in research and the process it takes*" as well as "*writing a report*." In addition, the program provided the opportunity identify knowledge and skill gaps prior to beginning a career: "*[the greatest benefit was the] learning environment to test your skills and see what you need to work on … compared to when you go to a job, and it could affect your employment*."

Skills Gained

STARS Scholars reported gaining a variety of skills during their time in the program, including general research skills, presentation skills, networking skills, and communication skills. For example, one Scholar mentioned that "*learning the literature review and the IRB process was helpful*" while another noted that presenting at the RSCA conference taught them professional presentation skills. With regards to networking, one Scholar explained that "*seminars and dinner sessions*" allowed them to "*communicate with other people that were there and exchange information… I would hopefully be… contacting them down my career path.*" One potentially unintended outcome was a Scholar noting their communication skills improved due to their research mentor "*not communicating exactly how [they] wanted*

everything to be done" requiring the Scholar to "*ask a lot more questions and communicate a lot better to find out what they expected from me*."

Research Laboratory Experience

Most Scholars reported a positive experience with their faculty research mentor. One Scholar shared that their research mentor was friendly and understanding of student researchers: "*If a class was having a midterm or anything, he would have less expectations for what I would've done in [the] research [lab]*." Another Scholar explained how their mentor supported them in ways beyond just providing research guidance: "*They helped me both with my personal stuff and with the research itself. They were super understanding. Especially because I'm a first year, I don't really have as much experience as some of the upperclassmen, but they were really helpful in explaining all the steps to me in a way that I can understand at my current level*."

While most Scholars had a positive experience with their research mentor, one Scholar reported a negative experience. The Scholar expressed "*being kept at arm's length*" by the research mentor and having a hard time getting on "*the same page*." The Scholar stated, "*He didn't realize that I was a student not originally from Cal Poly Pomona. So, his expectation of me was really up there and I did my best to work with him anyway, but he's not that flexible. I think the moment he found out I wasn't a Cal Poly student he just kept me at arm's length and so the relationship wasn't that great*."

Suggestions for Improvement

While Scholars reported gaining valuable experience and skills, they also offer a few suggestions for improvement. A few Scholars were unable to benefit from their peer mentoring due to less-than-ideal matches. One Scholar stated, *"[They] were a sophomore or something and I was already a senior so it kind of felt like the opposite way around*." Scholars did not find all workshop topics relevant to their disciplines. One Scholar with prior research experience shared: "*I think for people that have been in this program and know research a little better should be in separate workshops because it's just very repetitive*." Another Scholar suggested that "*I think maybe grad school would be a really nice topic because a lot of people in this research program do want to prepare for grad school*." One Scholar who experienced difficulties with their research mentor suggested facilitating introductions prior to the beginning of the program: "*If there's a way that there could be some buffer before even beginning, just to make sure the student is comfortable and there's an understandable way that we can be able to work together*." A Scholar from a community college also suggested that Citrus and Mt. SAC student could benefit from tours of the CPP campus and meeting their peer mentors before the start of the program.

APPENDIX I. 2022-2023 STARS FACULTY RESEARCH MENTOR SURVEY SUMMARY

At the end of the Spring 2023 semester, a survey was administered to all STARS faculty research mentors who participated during the 2022-23 academic year. A total of 11 faculty members responded, reporting on the gains in the research capabilities of the 21 STARS Scholars they mentored (faculty mentors could be paired with more than one Scholar). Faculty mentors also reflected on their mentoring experience and provided suggestions for improvement.

Growth of STARS Scholars

At the end of the spring semester, faculty mentors completed a modified version of Kardash's (2000) Research Skills survey, retroactively rating STARS Scholars' ability to perform seventeen research skills at the beginning of the academic year (i.e., pretest) and end of the academic year (i.e., posttest) on a scale from 1= "Poor" to 5= "Excellent." *Faculty mentors indicated that STARS Scholars' ability to perform all seventeen research skills significantly increased from the beginning of participation (M = 2.37, SD = 0.73) to the end of participation (M = 3.79, SD = 0.47; t(20) = 9.52, p = <.001) with a large effect size (Cohen's d = 2.09).* See **Table i** for item by item statistics. Note that due to "Not Applicable" responses, the number of paired ratings varies by skill, resulting in lower statistical power for some comparisons.

Table i. Faculty Mentor's Ratings of STARS Scholar's Research Skills

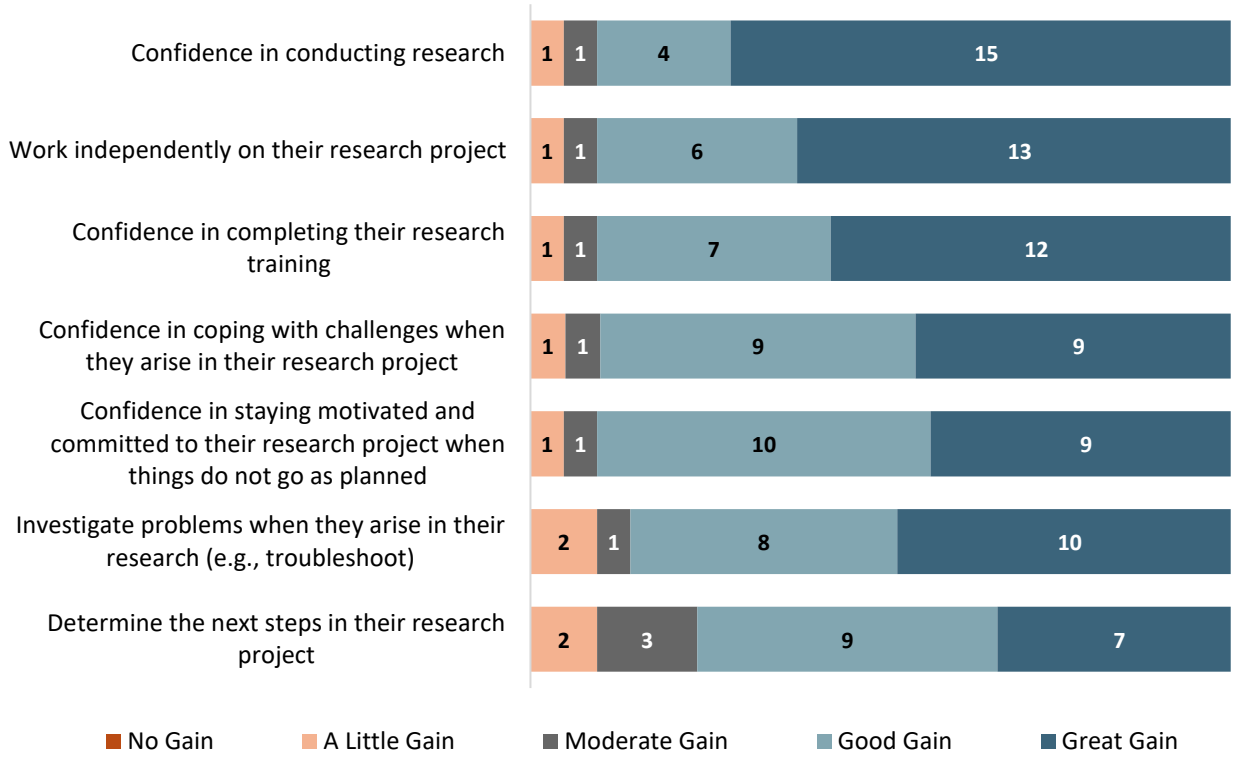
Item	n	Pretest M (SD)	Posttest M (SD)	Mean Difference	Cohen's *d*
Reformulate their original research hypothesis (as appropriate)	14	2.14 (0.86)	3.57 (0.65)	1.43***	2.78
Write a research paper for publication	14	2.14 (0.77)	3.71 (0.73)	1.57***	2.08
Defend their research (e.g., findings) when asked questions	19	2.21 (0.86)	3.63 (0.76)	1.42***	2.05
Formulate a research hypothesis based on a specific question	21	2.43 (0.87)	3.76 (0.77)	1.33***	2.03
Design an experiment or theoretical test of the hypothesis	20	2.30 (0.80)	3.90 (0.72)	1.60***	1.95
Think independently	19	2.26 (1.05)	3.84 (0.77)	1.58***	1.89
Understand contemporary concepts in their field	21	2.33 (0.80)	3.62 (0.50)	1.29***	1.79
Make use of the primary scientific research literature in their field (e.g., journal articles)	20	2.35 (0.88)	3.75 (0.71)	1.40***	1.71
Identify a specific question for investigation based on the research in their field	19	2.16 (0.76)	3.53 (0.70)	1.37***	1.65
Relate results to the "bigger picture" in their field	18	2.39 (1.10)	3.78 (0.73)	1.39***	1.63
Prepare a poster of research results for presentation	16	2.31 (0.87)	3.88 (0.62)	1.56***	1.62
Statistically analyze data	17	2.35 (0.86)	3.94 (0.75)	1.59***	1.58

Item	n	Pretest M (SD)	Posttest M (SD)	Mean Difference	Cohen's *d*
Interpret data by relating results to the original hypothesis	19	2.26 (0.81)	3.84 (0.60)	1.58***	1.55
Tailor their research communications for different audiences	14	2.21 (0.89)	3.71 (0.83)	1.50***	1.47
Orally communicate the results of research projects	19	2.53 (1.02)	3.98 (0.74)	1.37***	1.43
Observe and collect data	19	2.41 (1.12)	4.11 (0.74)	1.63***	1.40
Understand the importance of "controls" in research	18	2.44 (0.98)	3.83 (0.79)	1.39***	1.34
Research Skills Composite	**21**	**2.37 (0.73)**	**3.79 (0.47)**	**1.42*** **	**2.09**

*n = 14-21; Note: *p < .05, **p < .01, ***p < .001*

Faculty mentors also rated STARS Scholars' gains in research confidence and independence on a scale from 1 = "No Gain" to 5 = "Great Gain" (see **Figure a**). Faculty mentors indicated that almost all of the STARS Scholars made a "Good Gain" or "Great Gain" in their confidence in conducting research and handling challenges throughout the research process.

Figure a. Faculty Mentors' Ratings of STARS Scholars' Confidence and Independence



n = 20-21

Faculty mentors were also invited to share other insights, observations, or thoughts regarding their mentees' progress as researchers in their lab. While not all mentors responded

to the open-ended question, most faculty mentors indicated that their mentees made great strides as researchers. One STAR Scholar was described as "*an asset to [faculty mentor]'s research group"* and had an "*excellent grasp of research*." Multiple faculty mentors also noted STARS Scholars' gain in skills and confidence. For example, one faculty mentor explained that: "*Publishing one paper allowed [my mentee] to gain significant confidence in conducting research*." Faculty mentors also noted STARS Scholars learned quickly, were engaged, motivated, and proactive.

Conversely, two faculty mentors noted that STARS Scholars they mentored made insufficient progress and had difficulty with time management. As one faculty mentor explained, "*I didn't see any significant improvements in [STARS Scholar]'s ability to communicate her research with others or to think independently about the research problem*." One STARS Scholar struggled with time management due to other commitments: "*Main problem facing [STARS Scholar] was time management. Ensuring enough time to complete research work in the midst of her busy coursework and work schedule*."

Faculty Mentor Experience

Creating Inclusive Research Environments

Faculty mentors described how they created an inclusive and welcoming research environment for all students. The primary ways they reported doing this were through setting expectations, fostering open communication, and promoting a student-centered research environment.

Faculty mentors described how they set expectations for their students. For example, one gave their students research contracts with written expectations for both mentor and mentee. As one Faculty Mentor stated, "*It is expected that [STARS Scholars] will conduct themselves in a manner that is respectful of others around them*."

Faculty mentors also noted communication was an essential part of creating an inclusive and welcoming research environment for students. Several faculty mentors held regular check-ins and meetings as a way of fostering open communication. As one faculty mentor explained, "*I foster open communication by encouraging students to express their thoughts and ideas without fear of judgment … students have the opportunity to discuss their ups and downs of the week independently of their weekly research goals*."

Several faculty mentors noted they aim to make the research in their lab student-centered. For example, one Faculty Mentor shared that all students are encouraged to provide ideas and feedback: "*All students in my lab have a voice and they have flexibility … I want them to pursue the areas of knowledge that interest them*." Another faculty mentor noted they encourage Scholars' creative inquiry by supporting and building on Scholars' ideas rather than dismissing them due to lack of research experience. One faculty mentor specifically encouraged Scholars to select projects that aligned with their personal background and interests: "*This often results in topics that empower them to allow them to incorporate their knowledge and experience*."

Other ways faculty members sought to create inclusive and welcoming environments for Scholars included encouraging teamwork, correcting any exclusionary, toxic, or competitive behavior, having an open-door policy, and completing mentor training workshops.

General Reflections on the Faculty Mentor Experience

Several faculty mentors shared how much they enjoyed working with the STARS Scholars. As one faculty member stated, *"It was a pleasure working with all the mentees. They were all at different levels when they started but during their time they have all contributed to the progress of the assigned projects."* One faculty mentor described how the Scholars' participation influenced the mentor's own work and thinking: *"Mentoring is an opportunity for mutual learning growth. Students often provide innovative ideas and pose questions that can expand the horizons of the research project."* Although faculty mentors enjoyed their experience, there were moments when some faculty mentors encountered challenges. One faculty mentor said it was difficult for students to meet all program requirements as one semester is *"very short"* and *"not long"* enough to complete the project their students worked on. Another faculty mentor mentioned how their student struggled to find time for research after dealing with some health issues. Another faculty mentor observed a community college student struggled to get started in the program due to other obligations.

Suggestions for Improvement

Faculty mentors provided suggestions for training or workshops that STARS Scholars should complete prior to working in their laboratories. One faculty mentor noted it would be "*highly beneficial*" for students to complete workshops on time management, project management and workshops that focus on *"positive and practical ways of maintaining resilience throughout their research*." Another faculty mentor suggested that community college students receive more support: *"Most [community college] students could benefit from a bit more clarity on expectations for research and maybe about the variety of tasks that are involved in research. Many underestimate the amount of computer work, data analysis, and writing time so it maybe isn't what they expected*."

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