STEM TP^2 REPORT 2017

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Addendum

STEM TP^2 REPORT 2017

I. INSTITUTIONAL PROCESSES

The status of the four main institutional processes that are underway to implement the different components of the program are reported in four parts:

I.A. Advertising and recruiting
I.B. Program Advisory Committee contributions
I.C. Cohort enrollment at Mt. SAC
I.D. Cross-enrollment at UCI.

Findings, lessons learned, and recommendations are reported within each part.

I.A. Advertising and recruiting

Findings: The advertising and recruiting procedures for the third cohort of Mt. SAC student participants generated 12 applications. The procedures were more similar to the procedures used to recruit the first cohort that resulted in 30 applications, as compared to the procedures used to recruit the second cohort that resulted in 9 applications. Also, the procedures to recruit the third cohort were expanded by the project leadership team, who initiated a collaboration with the Mt. SAC Teacher Preparation Institute (TPI) to raise awareness of the program and begin early recruiting of potential applicants. After the application review period, the program accepted 11 applicants into the third cohort.

Lessons learned: The main lesson is that the project leadership team has had to implement intensive effort into recruitment of applicants to the program (see I.B.3. Recruitment challenges), including more than 50 personal visits to classes, and this approach was the most effective recruiting tool this year as confirmed by the Cohort 3 students (Table 1, next page).

In addition, the project leadership team initiated outreach efforts to the Mt. SAC Teacher Preparation Institute (TPI) and Transfer Math Activities Resource Center (TMARC) that were effective in attracting applicants to the program (Table 1). These efforts have been critical to developing campus awareness of the program and increasing the applicant pool.

Table 1. Methods by which cohort students first learned about STEM TP^2.

Answer choices in survey question	Response% (Cohort 1, n=16)	Response% (Cohort 2, n=8)	Response% (Cohort 3 this year, n=14)	Response count (Cohort 3, n=14)
Dr. Iraj Nejad or Dr. Charles Newman made an in-class announcement or other verbal communication to me.	62.5%	37.5%	42.9%	6
Another professor (not Dr. Nejad or Dr. Newman) made an in-class announcement or other verbal communication to me.	12.5%	0.0%	0.0%	0
I saw a printed flyer located in the Chemistry department bulletin board or office.	6.3%	0.0%	0.0%	0
I saw a printed flyer located on the Mt. SAC campus, but not in the Chemistry department.	6.3%	25.0%	0.0%	0
A classmate or friend told me about the program.	6.3%	37.5%	21.4%	3
I received an email communication.	0.0%	0.0%	0.0%	0
I was searching the Mt. SAC website.	6.3%	0.0%	0.0%	0
Other - I was informed by the Mt. SAC Teacher Preparation Institute.	-	-	14.3%	2
Other - A previous STEM TP2 student told me about the program.	-	-	7.1%	1
Other - Dr. Iraj Nejad made a visit to the Transfer Math Activities Resource Center (TMARC).	-	-	7.1%	1
Other - A family member told me about the program.	-	-	7.1%	1

Recommendations: The main recommendation is to continue the current intensive recruiting procedures. Although time consuming, the project leadership should continue their efforts to visit math and science classes, utilize current and past cohort students as recruiters, and develop recruitment opportunities through teacher preparation and other organizations on campus. Similarly, the top suggestion provided by this year's cohort to

enhance recruitment efforts was to make classroom visits, including the involvement of cohort students, providing printed flyers, and potentially creating a short video (Table 2).

Table 2. Recruitment approaches suggested by cohort students.

Categories of open-ended responses	Response count
Make visits to classes, including the use of cohort students (3 responses), printed flyers (1 response), and a short video (1 response).	6
Post more advertising around the math and science buildings.	1
Have a periodic information stand hosted by cohort students.	1

The creation of a recruitment video was also recommended by the Program Advisory Committee (see I.B.3. Recruitment challenges). In addition, based on the benefits that cohort students are starting to report as outcomes from their participation in STEM TP^2, potentially incorporate some of the reported benefits, particularly developing a professional network for support in becoming a teacher, in recruitment materials (see II.F.2. Final benefits gained by cohort students from STEM TP^2).

I.B. Program Advisory Committee contributions

The Program Advisory Committee (PAC) met on January 26, 2017 to review the progress of the project and share their advice and feedback, and the members highlighted below attended and participated in the meeting. The PAC consists of Mt. SAC faculty, administrators, and program directors; faculty and program directors from other institutions of higher education; Walnut Valley Unified school district personnel; industry representatives; and local community members.

Jennifer Alcazar, Assistant Principal (Chaparral Middle School)
Marty Bonsangue, Professor of Mathematics (CSU Fullerton)
Barbara Gonzalez, Professor of Chemistry (CSU Fullerton)
Lorenzo Harmon III, Veterans Service Program Specialist (Mt. SAC)
David Hall, President, Mt. SAC Foundation (Mt. SAC)
David Hong, Dean, STEM Instruction (Diamond Bar High School)
Karelyn Hoover, Associate Dean, Natural Science Division (Mt. SAC)
Kris Houston, Co-Director, UC Irvine Cal Teach Program (UCI)
Dough Hughey, Coordinator, Teacher Preparation Institute (Mt. SAC)
Leija Irvin, 5th grade teacher (Collegewood Elementary School)
Matthew Judd, Dean, Natural Sciences (Mt. SAC)
Irene Malmgren, Vice President, Instruction (Mt. SAC)
Thomas Mauch, Dean, Counseling Center (Mt. SAC)
Virginia Parish, Coordinator, UC Irvine Cal Teach Program (UCI)
Clark Rucker, Senior Manager, Phantom Works (The Boeing Company)
Terry Shanahan, Co-Director, UC Irvine Cal Teach Program (UCI)
Cindy Shannon, Professor of Biology (Mt. SAC)
Said Shokair, Director, Undergraduate Research Opportunities Program (UCI)
Rosalyn Soto, Higher Education Project Manager (JPL)
Mary Su, City Councilwoman (City of Walnut)
Robert Taylor, Superintendent (Walnut Valley Unified School District)
Matt Witmer, Assistant Superintendent, (Walnut Valley Unified School District)

Findings: The main contributions from the PAC members were to provide advice, feedback, and support for program success, and five specific areas were addressed: UCI teacher preparation course for STEM TP^2 cohort students, Implementation of research experiences for STEM TP^2 cohort students, Recruitment challenges, Staying in contact with current and past cohort students, and Additional direct teaching experience opportunities for Mt. SAC students. These areas are presented on the following pages.

I.B.1. UCI teacher preparation course for STEM TP^2 cohort students

For the second cohort of STEM TP^2 students, there was no mention of the difficulties with cross-enrollment in the UCI course that were experienced by the first cohort. A scheduling change was implemented from Cohort 1 to Cohort 2 in which the class offering for Mt. SAC students was moved from Monday nights to Thursday nights with the goal of easing their commute, because Mt. SAC students generally do not have Friday classes. The main cross-enrollment difficulties noted by the instructors (II. Student Participant Experiences, II.C.2. Main course challenges) was the delay in the fieldwork placement of the cohort students and logistical aspects of integrating the students into the online course component. Despite these issues, the instructors indicated that the cohort students made strong contributions to the course (see II.C.3. UCI course activities that should continue).

With respect to the field experience component of the course, the representatives from the school site (Collegewood Elementary in Walnut Valley) provided strongly positive feedback regarding the contributions of the cohort students. The Mt. SAC students were helpful in leading some lessons and when working with small groups of students during lessons taught by the teacher. The school is looking forward to the next group of Mt. SAC cohort students.

The PAC offered two main suggestions for future scheduling and sustainability of the course. First, if a long-term goal is to create a Mt. SAC course that would be articulated with the UCI course, the project leadership team could explore teaching the Mt. SAC course as a pilot or experimental course that can be taught immediately, prior to submission of a full course proposal for review through the curriculum approval process at Mt. SAC. Second, if a goal is to bring together students from multiple campuses, consider the possibility of using Zoom video conferencing for decentralized class meetings.

I.B.2. Implementation of research experiences for STEM TP^2 cohort students

Despite the challenges in providing research experiences for the Mt. SAC cohort students, the project leadership team was able to implement a valuable and meaningful research experience for Cohort 1 and Cohort 2 students (see III. RESEARCH EXPERIENCES). As an additional pathway for summer research opportunities, the PAC members suggested the project leadership team seek collaborations with existing summer research programs, such as bridge programs between 2-year and 4-year campuses that provide research opportunities for community college students at the 4-year campus.

I.B.3. Recruitment challenges

The project leadership team noted that the applications from Cohort 1 to Cohort 2 decreased substantially. Despite the two project directors (Dr. Iraj Nejad and Dr. Charles Newman) visiting more than 50 classes and having the assistance of Cohort 1 students, the application numbers decreased from 30 applicants for Cohort 1 to 9 applicants for

Cohort 2. For Cohort 1 recruitment, the directors brought printed (hard copy) application materials, and the Mt. SAC homepage had a link to the program. For Cohort 2 recruitment, the STEM TP2 website was active and included online application materials, so the directors did not bring printed application materials to their class visits. In addition, the Mt. SAC website changed between the recruitment cycles, and the direct link on the homepage to STEM TP2 was removed.

The PAC offered several suggestions to increase the success of the recruiting efforts. First, train the Mt. SAC academic advisors to ask students if they have any interest in teaching and direct interested students to the program. Second, create and display posters that show previous cohort students teaching, so that fellow students might recognize or know the student in the poster and decide to apply to the program. Third, contact Mt. SAC students that express an interest in teaching when they enroll at Mt. SAC and check the relevant information box (e.g., Education Pathway). Potentially, the Mt. SAC Teacher Preparation Institute could be involved in this outreach approach. Fourth, have previous cohort students create a YouTube video presentation about the program and ask STEM professors if the video can be shown on a silent, running loop during the start of class. The video would intentionally not have sound, but instead, have text superimposed over the images.

I.B.4. Staying in contact with current and past cohort students

The project leadership team noted difficulties with staying in contact with current (Cohort 2) and past (Cohort 1) students, and the PAC offered several suggestions for improving the situation. First, for current students, utilize phone-based communications beyond email, specifically text messages and messages posted to a Facebook page because of the high use of cell phones by students. Second, host a reunion event for past cohort students, for example, an annual awards ceremony when current cohort students complete the program. Third, create a Facebook page for the program and update the site with information showcasing past and current cohort students' activities and successes. Fourth, consider tracking students through the State of California credential database. Fifth, have students sign a contract when they begin the program that includes an agreement to stay in touch for five years after finishing program.

I.B.5. Additional direct teaching experience opportunities for Mt. SAC students

With the goal of sustaining the program, the PAC examined potential approaches for providing Mt. SAC students with additional direct teaching experience opportunities. Several suggestions were offered. First, adopt or adapt the Colorado Learning Assistant model in which students receive academic credit for tutoring fellow college students. Second, seek opportunities at K-12 schools, such as instructional aide or substitute teacher positions that have minimal requirements; after school tutoring and teaching opportunities, particularly ones with existing programs (e.g., AVID tutoring program) that already have the logistical and legal issues resolved; and partner with specific schools, including middle or high schools (e.g., Chaparral Middle School).

Lessons learned: The PAC members have a strong desire to support the program, and they offered general advice and numerous suggestions and provided positive feedback and support. The main lesson was the significant positive impacts that the Mt. SAC students and the program were having on the local community, including individual school children and their parents, a local elementary school and its teachers and students, and the regional 4-year institution (UCI) teacher preparation efforts, and the value of Mt. SAC building these meaningful and rich connections with its surrounding community.

Recommendations: The main recommendation is to continue the STEM TP^2 partnerships with the community and sustain the program and its contributions to the community.

I.C. Cohort enrollment at Mt. SAC

Findings: The enrollment of Mt. SAC cohort students was through the acceptance of currently enrolled Mt. SAC students into the STEM TP^2, which mainly consisted of participation in the Summer Science Exploration Experience (S^{2}E^2), the teacher preparation course at UC Irvine, and the research experience (see II. STUDENT PARTICIPANT EXPERIENCES).

Lessons learned: Enrollment of the third cohort of Mt. SAC students yielded more students this year as compared to last year (see I.A. Advertising and recruiting), potentially due to the intensive personal recruiting through class visits by the project leadership, as well as their outreach to the Mt. SAC Teacher Preparation Institute (TPI) and Transfer Math Activities Resource Center (TMARC).

Recommendations: The cohort enrollment process was straightforward and successful for the third cohort of students, and the recommendation is to continue the intensive recruiting efforts to obtain a suitable number of applicants in the future.

I.D. Cross-enrollment at UC Irvine

Findings: The project leadership team and UCI Cal Teach Directors worked together to enroll the second cohort of Mt. SAC students in the foundational course taken by undergraduates in the UCI teaching credential program. This UCI teacher preparation course counts toward the teacher certification requirements at UCI. The course, *Physical Science 5 / Biological Science 14: Introduction to Elementary Math and Science Teaching,* is one of the two introductory courses required in the UCI Cal Teach program. These courses also count toward the 4-year blended credential program at UCI, which is one of only two campuses (UC Berkeley is the other) with a 4-year blended credential program that enables students to earn their Bachelor's degree and teaching credential in four years. Ten cohort students were enrolled in the Fall 2016 course (see II.C. Teacher preparation course).

Lessons learned: The process for cross-enrollment for Cohort 2 appears to be much improved from the process for Cohort 1. The challenge of the course being taught at UCI,

instead of Mt. SAC, has been partially resolved by making use of an existing undergraduate cross-enrollment agreement between UCI and partner community colleges, reserving enrollment seats in the course for the cohort students, and scheduling the course section for cohort students on Thursday evening, instead of Monday evening.

Recommendations: Although the cross-enrollment process was improved from Cohort 1 to Cohort 2, the logistics of taking the course at UCI, rather than at Mt. SAC, may still negatively impact the students in terms of attendance and course performance (see II. STUDENT PARTICIPANT EXPERIENCES). As opportunities arise, the project leadership team and UCI collaborators should revisit the cross-enrollment procedures to identify potential changes to improve implementation of this project component, e.g., such as the change they made to move the section for Mt. SAC students from Monday to Thursday evenings.

II. STUDENT PARTICIPANT EXPERIENCES

The student participant experiences in STEM TP^2 to prepare them to become effective STEM teachers are reported in three parts:

II.A. Teacher training sessions
II.B. Summer science exploration experience (S^2E^2)
II.C. Teacher preparation course
II.D. STEM TP^2 research experience
II.E. Overall STEM TP^2 student participant experience

Findings for all parts of this section are reported first. Lessons learned from all parts are reported next. Recommendations derived from all parts of the student participant experiences are reported at the end of this section.

FINDINGS (Student Participant Experiences)

II.A. Teacher training sessions

The teacher training sessions for the third cohort of Mt. SAC students was similar to the training last year. Beginning with an orientation on 6/21/17, the third cohort met 5 times for 2-hour teacher training sessions through 7/10/17. During these sessions, students learned about numerous teaching career topics and skills, including the Common Core standards, California science standards, role modeling, discipline issues, and career opportunities. Current (in-service) teachers led some of the sessions. In addition to providing teacher training, the training sessions were intended to establish a team culture and to prepare cohort students to teach the science enrichment sessions during the summer science exploration experience (S^2E^2).

II.B. Summer science exploration experience (S^2E^2)

<u>II.B.1. S^2E^2 impact on cohort students</u>

The Cohort 3 students practiced and taught nine 1.5-hour science enrichment sessions for middle school kids as part of the summer science exploration experience (S^2E^2) July 11 – July 27, 2017 at Mt. SAC. The nine sessions were:

1. Building a Strong Card Structure
2. Making Slime & Silly Putty
3. Fuel Cells
4. Build a Solar Cell
5. Thermodynamics
6. Frog Dissection
7. Floating Pennies
8. Cow Eye Dissection
9. Math Bingo

For each session, three or four cohort students were designated as the primary instructors while the remaining cohort students assisted.

As a group, the cohort students who completed the survey were strongly and positively impacted by their teaching experience and indicated that the experience increased their interest, ability, and confidence in being math and science teachers (Figure 1).

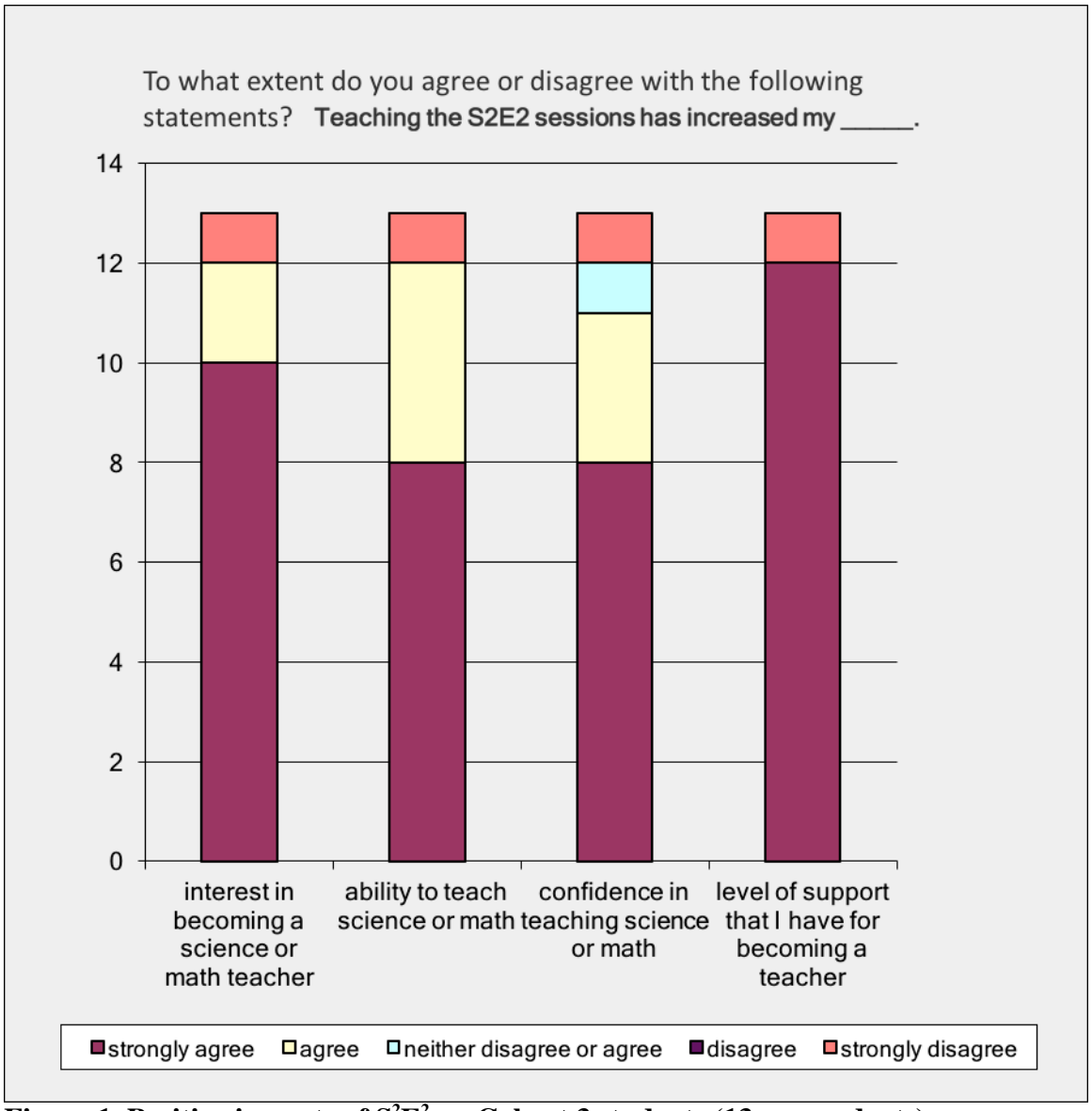


Figure 1. Positive impacts of S^2E^2 on Cohort 3 students (13 respondents).

Note: one respondent began with very high interest, ability, confidence, and support in teaching before starting the S^2E^2 and was less impacted than the other cohort students.

Twelve respondents provided opened-ended comments describing specific examples of how their interest, ability, and/or confidence increased because of teaching the S^2E^2 sessions. Three sample responses appear below.

Sample response 1: "This has impacted me greatly as I have the opportunity to become something I have only considered as a dream. I never thought I could be a teacher, but this program has given me a push into the field I desire."

Sample response 2: "I have seen how great it is to work in a learning environment, with young minds. I learned many techniques on how to guide people to discovery, rather than just give them the answers with no understanding. I have learned to work with people who have different teaching methods and gain from them. This whole program has been nothing but a great experience and has benefited me more than I ever would have thought."

Sample response 3: "I was greatly impacted by the interactions I have had with my cohort [fellow Mt. SAC students]. They were amazingly supportive and encouraging towards my concerns in my ability to properly instruct our middle school students. My instructors and fellow cohort were instrumental in the learning process in my S2E2 experience."

II.B.2. S^2E^2 support for cohort students

All Cohort 3 students who completed the survey rated the leadership team as being very supportive during their participation in the S^2E^2, and the average of 13 ratings was 5.00 on a 5-point scale. The cohort students provided opened-ended responses with specific examples that indicated the high level of support provided by the leadership team, such as sharing teaching advice, giving positive reassurance, and solving problems. Three sample responses appear below.

Sample response 1: "I received tremendous amount of support from these three leaders. I cannot thank them enough for giving me the confidence to teach others and open doors for new opportunities. I am forever grateful I met them."

Sample response 2: "They are all involved in making sure we are well and that we have what we need in order to succeed in this program. They are great mentors and I feel very lucky to have them there looking after us. They encourage us to do all that we can and have been extremely supportive through it all."

Sample response 3: "All three of the professors would always ask how I was doing, how I felt about the specific activity my group was working on, making sure I was all set to teach and had everything that I needed. They always gave complements on how I taught or how I worked well with the kids. The three of them really helped me be more confident in myself when I teach. Being in this program with them leading us has really solidified how much I want to teach and it's because of having such amazing teachers/professors/supervisors like them."

II.B.3. S^2E^2 activities cohort students believe should be done again next year

Thirteen Cohort 3 students provided opened-ended responses describing the S^2E^2 activities that worked well and should be done again next year (Table 3).

Table 3. S^2E^2 activities that cohort students believe should be done again next year.

Categories of open-ended responses	Response count
Teaching opportunity for cohort students.	7
Field trips and hands-on activities were engaging for kids.	6
Training and practice sessions to prepare cohort students.	4
Working with fellow cohort students.	2
Enthusiastic presenters and professors.	1
Making kids feel at home, not just in a classroom.	1

Similar to the Cohort 1 students in 2015, the Cohort 3 students reported as their most common response that the teaching opportunity within the S^2E^2 program should continue. Similar to the previous two cohorts, the 2017 cohort students also frequently reported the field trips and hands-on activities for engaging the middle school kids and the training and practice sessions for the cohort students as S^2E^2 activities that work well and should continue.

II.B.4. S^2E^2 improvements suggested by cohort students

Twelve Cohort 3 students provided suggestions for improving the summer program experience (Table 4). Although the suggestions varied greatly in nature, most often the cohorts expressed a desire for more training on the activities and more opportunities to take the lead in teaching activities. Three responses specifically indicated the program needed no improvement.

Table 4. S^2E^2 improvements suggested by cohort students.

Categories of open-ended responses	Response count
More training for cohort responsibilities, including training on all activities not just some (3 responses).	4
More opportunities to teach or facilitate in a lead role.	2
More reflection meetings for cohort students.	1
Provide visual examples and aids for the kids, not just verbal explanation of how to do the activities.	1
Better time management for the Animal Farm activity.	1
Better gender balance in kids' groups, specifically, too many boys in one group led to behavioral issues.	1
Avoid accepting kids forced into the program by their	1

parents, which led to behavioral issues.	
Program is successful as is, no need for improvement.	3

II.C. Teacher preparation course

In Fall 2016, ten Cohort 2 students completed the UCI teacher preparation course, *Physical Science 5 / Biological Science 14: Introduction to Elementary Math and Science* Teaching. Seven of these students completed an exit survey to provide their feedback on their course experience, and the two instructors completed phone interviews to provide their perspective regarding the participation and contribution of the Mt. SAC students in the course. The course had an enrollment of 32 students, 10 Mt. SAC students and 22 UC Irvine students.

II.C.1. UCI course impact on cohort students

As a group, the seven students who completed the survey were positively impacted by their course experience and indicated that the experience increased their interest, ability, and confidence in being math and science teachers (Figure 2, next page).

Their opened-ended responses provided more specific reasons for the positive impacts, specifically that the in-class teaching experience clarified their understanding of and developed their ability in how to lesson plan, interact with students, and manage a classroom. For example:

> *Example response 1: "The course has given me many insights and experiences as a teacher. From the fieldwork, I was able to see how a classroom is operated and gain hands on experience. During class, I learned new ways to teach and challenges that help me improved when I was working with the students."*

> *Example response 2: "This course showed how much work is required in becoming a teacher and making lesson plans."*

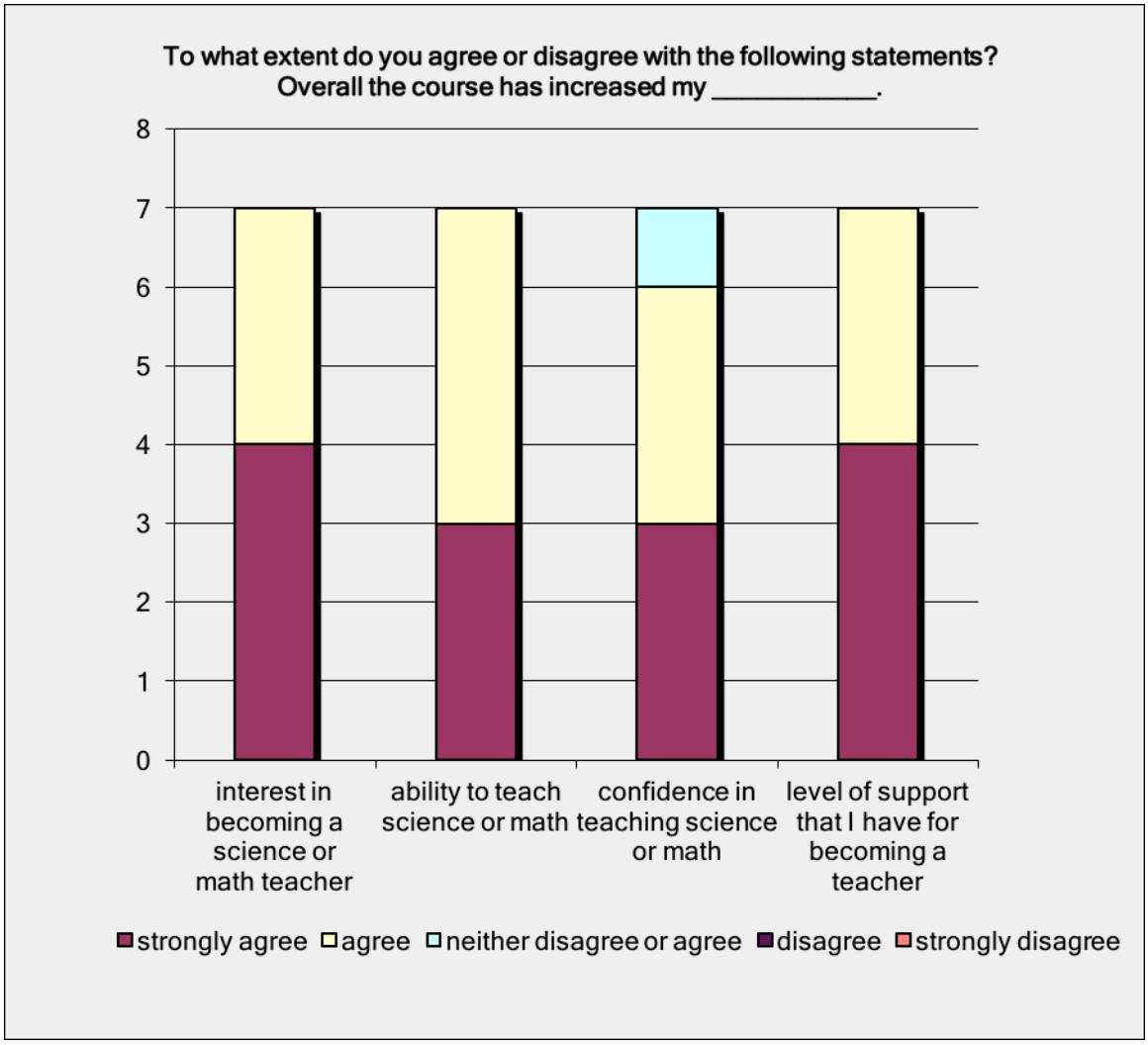


Figure 2. Positive impacts of UCI teacher preparation course on cohort students (7 respondents).

II.C.2. Main course challenges identified by cohort students

All seven cohort students who completed the survey provided open-ended responses describing the main course challenges, which essentially were allocating time for the course and developing the lesson plan (Table 5).

Table 5. Main course challenges identified by cohort students.

Categories of open-ended responses	Response count
Creating the lesson plan, including coming with the idea for the lesson (3 responses) and writing down the details of the lesson (1 response).	6
Time commitment required for course, including time needed for other classes and work, feeling rushed to complete fieldwork, and personal issues (1 response	4

each).	

The course challenges appear to be more typical challenges (i.e., time, challenging assignment) for completing a course as compared to many of the challenges identified by the previous cohort that were more related to the interaction between the Mt. SAC students and the UCI professors (unclear/insufficient instructions, feelings of being treated less equally, disconnect between UCI professors' and Collegewood teachers' expectations). However, the five students who did not respond to the survey may have a different perspective.

From the instructor perspective, the main challenges were related to the process and lateness of the fieldwork placement for the Mt. SAC students and logistical aspects of integrating the students into the online course component. For the fieldwork placement, a different placement procedure was used for the Mt. SAC students, as compared to the UCI students, which caused a late start for the Mt. SAC students on their fieldwork. The late start meant the Mt. SAC students had to rush to finish their fieldwork and did not have as much time to build a teacher-student relationship with the K12 students they were teaching.

For the online course management component, the Mt. SAC students needed to obtain and activate their UCI email addresses to have access to the online course management system, which includes an automated message system that uses UCI email addresses. Although the instructors would send messages to Mt. SAC and personal email addresses, this process added a manual step for each message.

Other challenges included the scheduling of the trip to Washington, D.C., having students spend so much time to drive to UCI, and the generally weaker writing skills of the Mt. SAC students. Although the writing in assignments by Mt. SAC students was markedly lower than the writing by UCI students in general, the instructors did not grade assignments based on writing, and they provided feedback after each assignment. By the end of the course, the Mt. SAC students showed tremendous progress in their writing skills.

II.C.3. UCI course activities that should continue

Four of the seven cohort students completing the survey provided opened-ended responses describing the course activities that worked well for them and should continue in future course offerings (Table 6).

Table 6. UCI course activities that cohort students believe should continue.

Categories of open-ended responses	**Response count**
Doing fieldwork by teaching in a classroom under the mentorship of K12 teachers to understand the challenges.	1
Doing the 5E lesson plan assignment to start thinking	1

both like the teacher and the student.	
Providing course content that taught how to create a lesson plan.	1
Receiving advice from K12 teachers.	1

These activities were also generally identified by the previous cohort students. Although many additional activities were identified by the previous cohort but not by this current cohort, many of those previous activities (practicing lessons with peers, flexibility in course pace and assignment deadlines, email access, once a week scheduling, carpooling) did take place.

From the instructor perspective, the instructors indicated that the course appeared to be working well in nearly all aspects, several of which were a direct result of the participation by the Mt. SAC students. The instructors noted that the Mt. SAC students had good attendance and enthusiasm during class, despite the lengthy commute time to reach the UC Irvine campus, and the Mt. SAC students did an excellent job of being proactive, participating in class discussions, and asking for clarification. The instructors also found that the Mt. SAC students were equally prepared, if not more so, for success in the course as the UCI students.

In addition, the instructors found that the Mt. SAC students possessed a greater maturity and confidence about themselves and their career goals, as compared to their UCI classmates. The Mt. SAC students were more willing to speak up, participate, and offer differing opinions in class, and they brought a different perspective on education than the typical UCI student. Also, the Mt. SAC students had an advantage over the UCI students, because of their greater understanding of teaching, and lesson planning, likely a result of their prior training in the S^2E^2 component of the STEM TP^2 program.

> *Sample instructor response: "In class, the Mt. SAC students had an advantage over UCI students in their understanding of how kids learn, greater participation, eagerness to learn, and lots of ideas of what to do in a classroom. Just in how to deal with students and situations, and teaching, and being really creative in lesson plans. They [Mt. SAC students] seemed to be more focused on engineering than UCI students, who were more focused on biology and chemistry lesson plans."*

Overall, the Mt. SAC students demonstrated great participation, eagerness to learn, and sharing of many ideas of what to do in a classroom. At the same time, the interactions between the Mt. SAC students and UCI students were positive and mutually beneficial. They learned from each other, shared ideas, and engaged in rich discussions about their fieldwork teaching experiences.

Finally, the instructors observed that the Mt. SAC students enjoyed the fieldwork and learned from their field experiences, the carpooling benefitted students by providing time for them to discuss the course and share their insights and advice with each other, and attending a course on a 4-year campus was motivation for them to work toward their 4-year degree.

II.C.4. UCI course support by UCI professors and Collegewood teachers

Because the previous cohort identified challenges related to the interaction between Mt. SAC and UCI professors and generally felt they received more support from the Collegewood teachers, the current cohort was specifically asked about the level of support from UCI professors as compared to the support from the Collegewood teachers and to explain any differences. Essentially, all seven students completing the survey felt supported by both their UCI professors and Collegewood teachers. Three indicated equal support and offered no further comment. The remaining four students elaborated on how they felt supported by their course instructors and mentor teachers. Generally, they found the UCI professors provided more support in the theoretical and lesson design possibilities, whereas the K12 teachers provided more support in the practical and hands on implementation of the lesson, which is not surprising.

> *Response 1: "UCI helped me learn by exposing possibilities, the teacher at the elementary school helped with hands on exposure."*
>
> *Response 2: "At UCI, the professors taught us about the 5E lessons and how to structure them and how to plan them. The teachers at Collegewood were great at teaching us how to actually be a teacher. My mentor teacher helped a lot during my lesson plan and gave me a lot of advice and feedback after."*
>
> *Response 3: "Because my mentor [teacher] had the opportunity to observe me in the classroom, he was able to offer constructive feedback in terms of real life student interaction. My professors at UCI also did this but in a more general sense, where it applied to mostly everyone."*
>
> *Response 4: "Both groups were very supportive."*

From the instructor perspective, the instructors tried to provide specific additional support for the Mt. SAC students. For example, recognizing that Mt. SAC students have more limited time due to juggling multiple responsibilities (e.g., jobs) and the commute time to the UCI campus, the instructors were flexible with assignment deadlines. The instructors also provided feedback on the writing in assignments, without basing assignment grades on writing, to help students improve.

II.C.4. UCI course improvements

The seven cohort students completing the survey provided suggestions for improving the UCI course (Table 7, next page), and the main suggestions related to more specific instruction on how to design the lesson plan and being assigned to a mentor teacher sooner.

Table 7. UCI course improvements suggested by cohort students.

Categories of open-ended responses	Response count
More instruction on how to design the lesson plan, including discussing sources of creative ideas for lessons (1 response), providing more direction on structuring the lesson plan (1 response), and providing a sample IAP for review and discussion (1 response).	3
Assign mentor teachers sooner.	2
Have us share and discuss lesson plans with course instructors and classmates before we teach the lesson.	1
Discuss what does NOT work.	1
Bring in K12 STEM teachers for a Q&A panel.	1
Locate the course at Mt. SAC.	1

The previous cohort also made suggestions regarding more specific instruction in how to design their lesson plans. However, the previous cohort also wanted more clear course expectations, which did not appear to be an issue for the current cohort. From the instructor perspective, the instructors only suggestion for improving the course was that the fieldwork assignments take place much sooner, as early as the second week of classes, so that the students did not have to rush to finish their fieldwork and would have more time to build the classroom relationship and reflect on their experiences.

As a side note on potential course improvements, the instructors mentioned that the course is the first course in the UCI CalTeach program with specific goals of introducing students to the 5E instructional model, providing a teaching field experience, and introducing only general aspects of teaching as a profession. Often, the Mt. SAC students would ask that various topics, such as classroom management, be covered in more depth. However, the introductory course is not constructed with this curriculum because in the overall UCI CalTeach curriculum, subsequent courses are intended to address those topics.

II.C.5. Final thoughts on UCI course

Only one of the cohort students completing the survey provided a final thought on the UCI course, and the comment was mainly a reiteration of the suggestion to be assigned a mentor teacher sooner:

> *Response 1: "I thought it was a great program. Feedback from my classmates includes the belief that we needed more time for fieldwork. The fieldwork teachers should be available by the second week of class if possible."*

From the instructor perspective, both instructors were enthusiastic about the collaboration between Mt. SAC and UCI, as several sample responses indicate:

Sample instructor response: "Overall it's a great partnership, and it's an awesome opportunity to have Mt. SAC students with UCI students. They bounce ideas well off each other, they complement each other well, and they collaboratively can do more and better than either could do on their own."

Sample instructor response: "[The collaboration] is a super opportunity for both Mt. SAC and UCI students to interact. Mt. SAC brings in more diversity demographically, a positive, and in small group settings, they can share their diverse experiences. The K12 classrooms are low socioeconomic status and have elementary students who encounter different challenges, not just academic ones. The age and maturity of the Mt. SAC students is good for everyone involved, and the overall feeling I get when I hear the class discussions is that it feels positive on both sides."

Sample instructor response: "Charlie and Iraj are awesome! They sat in on many of our classes prior to the partnership between Mt. Sac and UCI, and I have interacted with them via email several times since then, and they are both wonderful, attentive, thoughtful, knowledgeable gentlemen. I know they care deeply about the students. I think this is a huge positive for the partnership!"

II.D. STEM TP^2 research experience

The first cohort of Mt. SAC students completed their STEM TP^2 summer research experience in Summer 2016, and the research was the last formal requirement for STEM TP^2 cohort students. The summer research experience included a research methods course taught by a UCI instructor, six weeks of research, and a final research presentation. Three students were unable to participate in the summer research because of financial need and resulting work obligations, and one student was unable to participate because of family care obligations. Of the remaining students, six completed their research at UC Irvine, and one student completed research at California State Polytechnic University, Pomona (Cal Poly Pomona). All students doing summer research were enrolled in the Mt. SAC course CHEM 99 Special Projects in Chemistry.

II.D.1. Research value to cohort students

Of the Cohort 1 students who completed at least one component of the research experience, all twelve students who completed the survey indicated their research was valuable to their training in the STEM TP^2 program (Figure 3).

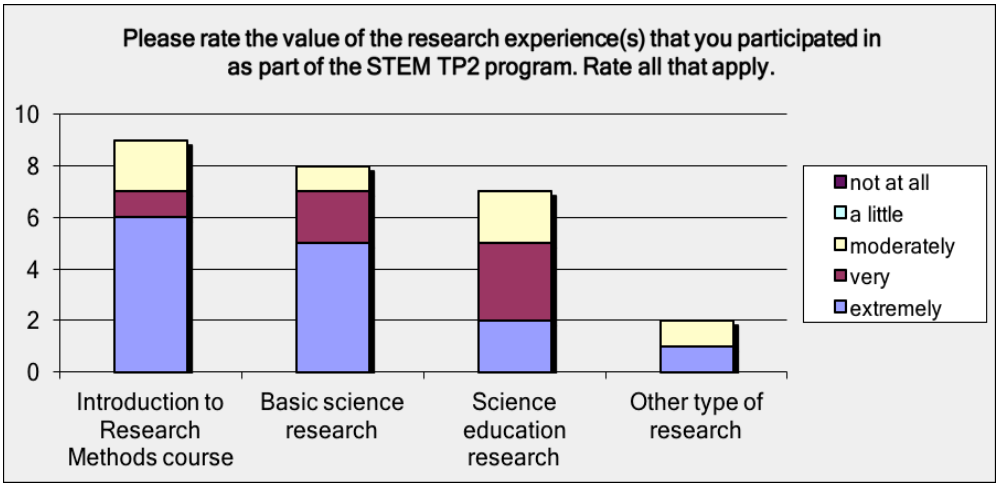


Figure 3. Value of research to Cohort 1 students (12 respondents).

II.D.2. Research impacts on cohort students

Of the Cohort 1 students who completed at least one component of the research experience and who completed the survey question, more than half indicated that the experience increased their interest in, ability in, confidence in, and level of support for being math and science teachers (Figure 4).

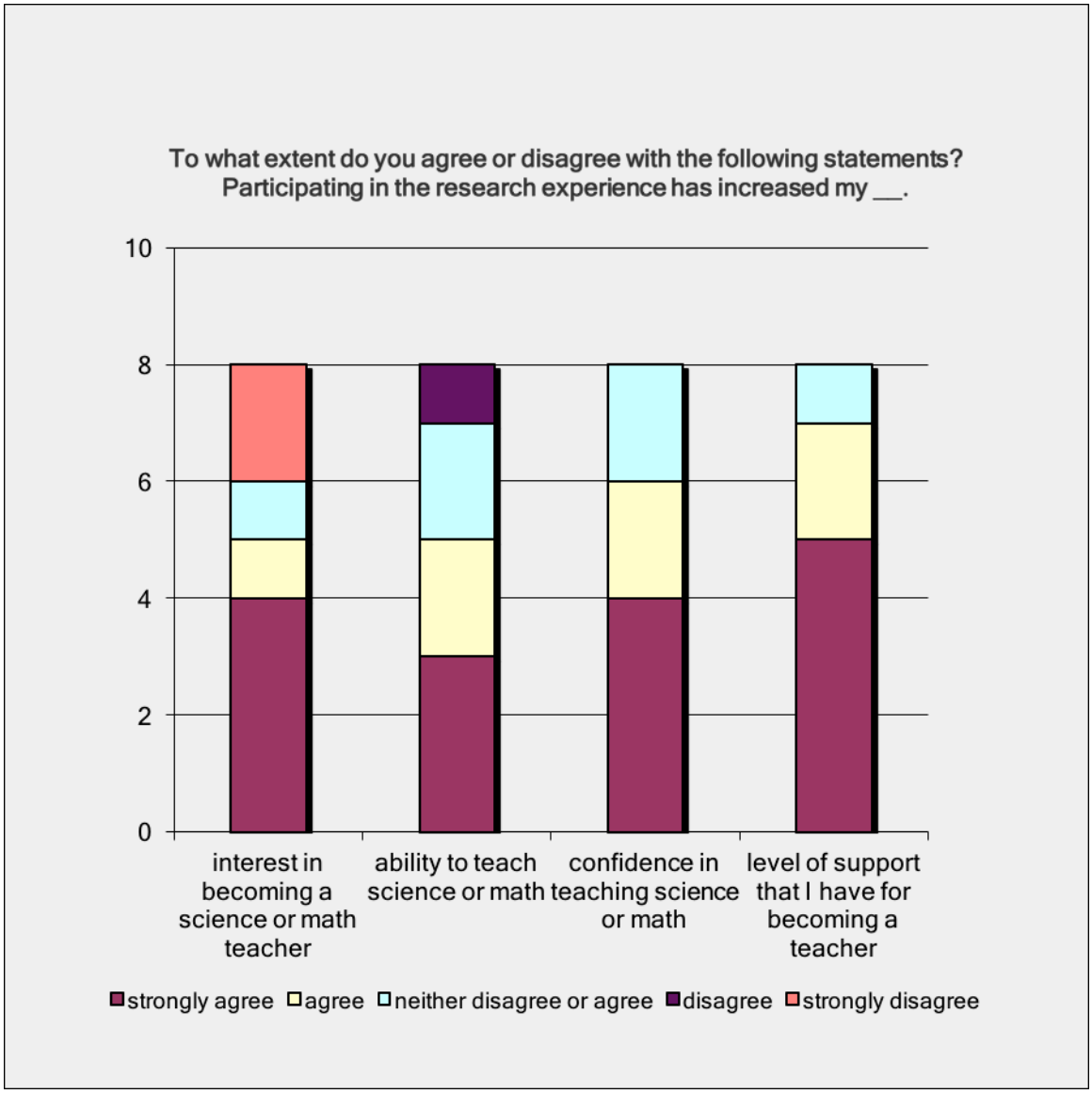


Figure 4. Positive impacts of research on Cohort 1 students (8 respondents).

The research experience most impacted cohort students in terms of their confidence in their teaching ability and the level of support they had for becoming a teacher. Because the cohort students had nearly completed two years of the STEM TP^2 program before starting the research experience, many of them already had very high interest, ability, confidence, and support in teaching prior to their research experience, and therefore this last program component likely had a lesser overall impact.

II.D.3. Research challenges experienced by cohort students

Ten Cohort 1 students completing the survey described the most challenging aspect of completing their research experience (Table 8), and the most common response was the inefficient procedure for starting research in a lab.

Table 8. Research challenges experienced by cohort students.

Categories of open-ended responses	Response count
Lack of efficient procedure for starting research, including lack of planning (2 responses), organization (1 response), and communication (1 response).	4
Not being assigned meaningful research tasks.	1
Having to learn a lot of content and laboratory skills and techniques in a short amount of time.	1
Time and effort needed to do research, including literature review.	1
Trying to identify a research topic and locate the relevant literature.	1
Having to work independently and set my own goals and deadlines.	1
Writing the research paper.	1

The challenges due to the inefficient procedure were likely due to the significant difficulties that had to be resolved before the initial implementation of the research experience for the Mt. SAC students, and the procedure was more efficient for the second cohort. Six Cohort 2 students enrolled in the UCI research methods course, and four are doing summer research (three at UCI, one at the University of Washington, Seattle). Data collection on these student participant experiences are still underway and will be reported in next year's evaluation report.

II.E. Overall STEM TP^2 student participant experience after S^{2}E program

After completing the S^{2}E^2 program in Summer 2017, the third cohort of Mt. SAC students provided their initial feedback on their overall STEM TP^2 participant experience. The cohort students described the primary program benefits they expected from their participation, concerns they may have about the program, and their overall thoughts about the program experience to this point.

II.E.1. Program benefits expected by cohort students from STEM TP^2 participation

Fourteen Cohort 3 students who completed the survey described up to three primary benefits they expected from their participation in the STEM TP^2 program (Table 9). Unsurprisingly, the cohort students most often expected to benefit by gaining teaching experience and knowledge about how to teach. Other expected benefits included developing a professional network, increasing content knowledge, and gaining confidence in their ability to teach.

Table 9. Program benefits expected by cohort students (each respondent reported multiple expected benefits).

Categories of open-ended responses	Response count
Gain experience, including specifically experience teaching K-12 students (10/16 responses).	16
Gain knowledge and training about how to teach, including classroom management skills (5 responses), specific instructional methods (4 responses), general lesson planning (1 response), and conflict resolution (1 response).	10
Develop a professional network, including colleagues (2 responses) and broader STEM education community (1 response).	3
Gain content knowledge.	3
Gain confidence in ability to teach.	3
Gain general work experience.	2
Gain knowledge about how to pursue a teaching career.	2
Complete requirements for obtaining teaching credential.	1
Gain exposure to positive and rewarding learning environment.	1

II.E.2. Program concerns expressed by cohort students regarding STEM TP^2 participation

Twelve Cohort 3 students provided open-ended responses about their overall concerns about the program (Table 10), however six students specifically stated that they had no concerns. Of the remaining six respondents, cohort students expressed few concerns about the program itself; only two respondents indicated concerns about the UCI courses in terms of scheduling and transferability.

Table 10. Program concerns expressed by cohort students.

Categories of open-ended responses	**Response count**
No concerns.	6
Unsure if teaching would be a suitable career fit.	2
Anxiety over interacting with middle school kids.	2
Scheduling difficulties with UCI courses.	1
Transferability of UCI courses to other institutions.	1
Difficulty of content in some S^{2}E^2 activities.	1

II.E.3. Final comments by cohort students regarding STEM TP^2 participation

Seven Cohort 3 students offered final comments about their STEM TP^2 participation so far, and all were strongly positive. Three sample responses appear below.

Sample response 1: "I have enjoyed the [S^{2}E^2 program] whole-heartedly and love that this program exists. I don't think I would have been that serious in becoming a teacher if not for this program. Thank you for the experience and I hope to make you all proud."

Sample response 2: "This experience has been so beneficial being only 2 years into my college career and on the path to becoming a teacher. After participating in a program like this it has made me more confident and sure of what I want to do and what kind of teacher I want to be or will strive to be in the future."

Sample response 3: "Thank you so much for the experience. I have enjoyed the last 3 weeks [of the S^{2}E^2 program] so much. I cannot wait to continue this process. Thank you for giving me the support and confidence that I need. I hope to work again next summer with the kids again! I will never forget this summer."

II.F. Final STEM TP^2 student participant experience after entire program

After completing STEM TP^2 at the end of Summer 2016, the first cohort of Mt. SAC students provided their final feedback on their overall STEM TP^2 participant experience. The cohort students described the value of the various program components, the program benefits they gained from their participation, suggestions for improving the program, final concerns they had about the program, and their overall thoughts about the program experience after completing the program.

II.F.1. Value of STEM TP^2 components to cohort students

Eleven Cohort 1 students rated the various STEM TP^2 program components regarding the value of each component in their becoming a science or math teacher (Table 11).

Table 11. Average value of each STEM TP^2 component to cohort students.

STEM TP^2 component	Average rating (max = 4)
S^{2}E^2 program	3.5
Peer mentoring by fellow cohort students	3.5
Mentoring by STEM TP^2 directors	3.2
Other (primarily after school tutoring)	3.1
UCI teaching course	3.0
Research experience	3.0

All formal training components (S^{2}E^2, UCI teaching course, research experience) and informal training activities (peer mentoring, mentoring by project directors, tutoring) were rated between 3.0 (very valuable) and 4.0 (extremely valuable) on a 4-point scale. In short, the cohort students find high value in all components of the program.

Nine Cohort 1 students provided open-ended comments to elaborate on the most valuable program component, and they most frequently commented on the UCI teaching course (n=5) and the S^{2}E^2 program (n=4), with the remaining two respondents stating that the overall program with its multiple components was responsible for the value of the program. Three sample responses:

> *Sample response 1: "[T]he most valuable experience … was participating in the UCI course. I think having that hands-on experience of both learning to put together and then executing a lesson plan was an eye-opening experience."*

> *Sample response 2: "The S2E2 experience was a great kick start, it allowed us to work together and become more familiar with fellow cohorts. Sharing ideas on what our lesson would be, and then how we would plan it out."*

Sample response 3: "[T]he program is very detailed and well-built for students who want to become a teacher ... Overall this program should be the ideal program structure for future students."

When asked specifically to identify the program components that should be continued for the benefit of future cohorts, ten cohort students provided open-ended responses, with the most common response being that all components should continue (n=5). The next most common responses were to continue the S^{2}E^2 program (n=4) and the UCI fieldwork teaching experience (n=2), with one student citing both of these components. Three sample responses provide further detail:

Sample response 1: "I think all activities, courses and independent research are wonderful to keep in the program. It all truly makes a huge difference and definitely helps in setting whether or not we want to continue on the path to becoming a teacher. Each part of the program serves a critical and beneficial role."

Sample response 2: "The content of the program such as S2E2 camp, UCI course, tutoring opportunity, community college level research experience and UCI research experience are all very helpful in getting an understanding of being a teacher."

Sample response 3: "The summer S2E2 program is a great aspect of the program, it benefits the kids and the cohort. The cohort is able to try their hand in teaching, and it helps figure out if teaching is really what they want to do."

II.F.2. Final benefits gained by cohort students from STEM TP^2

Ten Cohort 1 students described up to three main benefits they gained from their participation in the STEM TP^2 program (Table 12), and given the structure of the program, all cohort students unsurprisingly indicated that they gained teaching experience and knowledge about how to teach.

Table 12. STEM TP^2 benefits gained by cohort students.

Categories of open-ended responses	**Response count**
Gained teaching experience and knowledge, including experience creating lessons (2 responses).	10
Gained a professional network of mentors, peer colleagues, and current teachers.	7
Gained knowledge of how to become a teacher.	3
Increased desire (motivation, enthusiasm, and appreciation) for becoming a teacher.	3
Gained confidence in becoming a teacher.	3
Gained experience doing research.	2
Increased communication skills.	1
Gained the knowledge that teaching was a career pathway in the student's degree major.	1

Obtained a job in the teaching field as a tutor and instructional aide.	1
Completed steps for obtaining teaching credential.	1

Of note is that 70% (7/10) of respondents said that a main benefit of the program was that they gained a professional network, including mentors, peers, and current teachers, that supports them in pursuing a teaching career. Although some cohort students expect to gain a professional network, many more explicitly identify this support as a main program benefit when they finish the program. Other commonly reported benefits gained from the program include increased knowledge about and/or progress in becoming a teacher, increased desire to become a teacher, and increased confidence in becoming a teacher.

II.F.3. STEM TP^2 improvements suggested by cohort students

Nine Cohort 1 students provided suggestions for improving the STEM TP^2 experience (Table 13), and the most common suggestion was to improve the communication and planning throughout the program, particularly the communication of information related to the timeline and specific dates for program activities.

Table 13. Program improvements suggested by cohort students.

Categories of open-ended responses	**Response count**
Improve the communication and planning, including being given scheduling and other information in a timely manner (6 responses).	8
Add more directors or similar personnel to the project leadership team to help organize and implement program components.	1
Add more directors or similar personnel to the project leadership team to increase variety of mentors.	1
Expand the program to serve more school districts.	1
Have UCI provide a parking pass for taking the UCI course, instead of us paying $10 for each class.	1
Replace the UCI course with a Mt. SAC course that works with the Mt. SAC Child Development Department.	1

Because the respondents were the first cohort of students to participate in the program, they undoubtedly were affected by the challenges that the project leadership team had to resolve during the initial implementation of all program components. Likely, when the second cohort completes the program, the communication and planning will not need as much attention. Other suggestions indicate that the cohort students see a potential benefit to themselves and the current project directors to having more directors or similar persons in positions of responsibility in the program.

II.F.4. Final concerns expressed by cohort students regarding STEM TP^2

Nine Cohort 1 students provided open-ended responses about their final concerns about the program (Table 14), however three students specifically stated that they had no concerns.

Table 14. Final program concerns expressed by cohort students.

Categories of open-ended responses	Response count
No concerns.	3
Lack of communication, including after the S^{2}E^2 component (1 response) and during the research experience (1 response).	3
Time commitment for UCI course.	1
Unable to continue program due to other responsibilities.	1
Suitability of some cohort students for program.	1

Of the remaining six respondents, cohort students most commonly expressed concerns related to lack of communication, an area most frequently identified as needing improvement (II.F.3. Program improvements suggested by cohort students). Aside from not being given timeline information early enough, some cohort students interpreted decreased communication from the project directors as receiving less support for their success in completing the program and becoming teachers. Possibly some prior or more detailed explanations regarding the purpose of each program component and the support being provided during each component could alleviate the feelings of being less supported during a particular component.

II.F.5. Final comments by cohort students regarding STEM TP^2

Of the ten Cohort 1 students completing the survey, nine students report that their participation in STEM TP^2 has significantly increased their preparation and motivation for becoming a teacher. Final thoughts from three students give more detail.

> *Student 1: "This program has helped me see how strongly I want to become a teacher. We have been given many opportunities to interact with children and be their mentors. This program has been wonderful to me, and I cannot say enough times how appreciative I truly am."*

> *Student 2: "By participating in the program, it helped me determine what I need to become a teacher and what I should improve ... to reach my goal of being a teacher."*

> *Student 3: "Being a part of the program has truly solidified my goal of becoming a teacher ... And I am confident enough to know that I can do great things for students [in] science and math courses."*

LESSONS LEARNED (Student Participant Experiences)

The student participant experiences have significantly impacted the cohort students, and the impacts are potentially life changing for the students in terms of their desire to pursue a teaching career and their level of preparation to become highly effective teachers. Particularly for students who were unsure about a teaching career or less confident in their ability to be a teacher, participation in STEM TP^2 can be seen as a transformative experience. The teacher training activities and teaching opportunities provided by STEM TP^2 have increased their interest, ability, confidence in being math and science teachers, as well as their level of support through a professional network of colleagues and mentors.

The first component of STEM TP^2, the Summer Science Exploration Experience (S^{2}E^2), was a highly positive and valuable initial program experience for the STEM TP^2 cohort students. The experience successfully provided general teacher training and experience in teaching middle school kids in a summer program environment.

The second component of STEM TP^2, the teacher preparation course, was also a positive and valuable program experience, and the concerns regarding instructor support and course expectations expressed by the first cohort of students were not raised by the second cohort. The second cohort expressed a desire for more efficient placement into their fieldwork, as well as concerns more typically experienced by any student (completing assignments time commitment). Overall, the course successfully provided valuable training in lesson planning and design and provided actual teaching experience in a formal classroom setting.

The final component of STEM TP^2, the research experiences, also positively impacted the STEM TP^2 cohort students, though less so than other program components likely because the research was at the end of the program and there were diminishing impacts as the students progressed through the program.

Although the first cohort experienced the challenges associated with the initial implementation of program components, the project leadership team overcame the challenges to successfully provide the students with all the major training experiences (Summer Science Exploration Experience, teacher preparation course, and research experience). The key factor throughout the program and its specific components in producing successful student outcomes is the project leadership team and their efforts in recruiting students, organizing and implementing program components, identifying resourceful approaches to overcome implementation difficulties, and providing high levels of support for the students.

RECOMMENDATIONS (Student Participant Experiences)

Based on the student participant experiences, the main recommendation is to continue the current program activities, which are providing teacher training and teaching opportunities, as well as the general support and mentorship provided by the project

leadership team. The cohort students expect to receive teacher training and gain teaching experience, and overall, these experiences are increasing their interest, ability, and confidence in being math and science teachers.

Recommendations for sustaining or improving the student participant experience through the summer science exploration experience (S^2E^2) include:

1. Continue with the current successful format of providing general teacher training and having cohort students teach.
2. Continue with the current successful pre-selection of the activities to be taught by the cohort students for the enrichment sessions.
3. Improve the training of the cohort students for all the S^2E^2 activities. Potentially, students from a prior cohort could train students in the subsequent cohort.

Recommendations for sustaining or improving the student participant experience through the teacher preparation course include:

1. Continue to reexamine ways in which the scheduling of the course can be modified to best serve the cohort students, such as the change from Monday evenings for the Fall 2015 course to Thursday evenings for the Fall 2016 course. A possible approach is to consider again whether the course can be taught at Mt. SAC, perhaps by adjunct professors.
2. Continue the successful collaboration with Collegewood elementary school.
3. Continue the successful process for enrolling Mt. SAC students into the UCI course, including pre-course meetings with course instructors regarding course expectations.
4. Improve the process in the UCI course for placing Mt. SAC students into the fieldwork site. Cohort students experienced delayed placement, which limited their time in the classroom with the teachers and students and time for implementing their lesson plans.

Recommendations for sustaining or improving the student participant experience through research include:

1. Continue the research experience and the current approach in which cohort students complete a research methods course prior to beginning research in a lab.
2. Improve the procedures (organization, planning, and communication) for cohort students to start research in a lab.

Overall recommendations for sustaining or improving the student participant experience throughout the program include:

1. Improve the communication to cohort students throughout the program, particularly timelines and specific dates for program components.
2. Potentially provide more detailed explanations regarding the purpose of each program component just before cohort students begin the component, as well as discussing the support being provided during each component (e.g., who is providing the support and to what extent) so that students have more clear expectations.

III. RESEARCH EXPERIENCES

The project leaders worked with the UCI director for undergraduate research to implement the first iteration of the research experience in the STEM TP^2 program in Summer 2016. Cohort 1 students completed a summer research methods course taught by a UCI instructor and a summer research experience during their second summer in the program. The research areas included biochemistry, biology, education, environmental sustainability, and mathematics. Six students completed their research at UC Irvine, and one student completed research at California State Polytechnic University, Pomona (Cal Poly Pomona). All students doing summer research were enrolled in the Mt. SAC course CHEM 99 Special Projects in Chemistry.

The project leaders have modified the second iteration of the research experience by altering the timeline of the activities for Cohort 2 students. The research methods course taught in summer for Cohort 1 was taught for Cohort 2 in Spring 2017 at Mt. SAC, and then students entered into their summer research experience in Summer 2017. Six Cohort 2 students enrolled in the UCI research methods course, and four are doing summer research, three at UC Irvine and one at the University of Washington, Seattle. Data collection on these student participant experiences are still underway and will be reported in next year's evaluation report.

FINDINGS

Despite the challenges with implementation of the research experiences for STEM TP^2 students, the project leaders, with support from the UCI undergraduate research director, successfully provided the cohort students with a research experience as part of their teacher training.

The cohort students report that their research was valuable in preparing them to become teachers, with more than half indicating that the experience increased their interest in, ability in, confidence in, and level of support for being math and science teachers (See II.D. STEM TP^2 research experience). The research experience most impacted cohort students by increasing their confidence in their teaching ability and the level of support they had for becoming a teacher. As with any first iteration, there were some procedural difficulties with having students start their research in a lab, but the procedure was more efficient for the second iteration. See II.D. STEM TP^2 research experience for further details of student participant experience.

LESSONS LEARNED

The project leaders have been able to resolve the challenges with implementing the research experience by working with the UCI undergraduate research director and by identifying additional summer research opportunities at locations other than UCI. The flexibility and resourcefulness of the project leaders have been critical to meeting the project goal of providing an authentic research experience for the STEM TP^2 students.

RECOMMENDATIONS

The main recommendation is to continue the current research activities and refine implementation as needed, e.g., the project leaders adjusting the timeline in the second iteration. The research is positively impacting cohort students and providing them with valuable teacher training.

Recommendations for sustaining or refining the research experience include:

1. Continue to have cohort students engage in research experiences as a component of their teacher training experience in STEM TP^2.
2. Seek potential collaborations with existing summer research programs at 4-year institutions, particularly bridge programs between 2-year and 4-year campuses.
3. Possibly contact PAC members from industry or community organizations about internship opportunities.
4. Possibly contact Mt. SAC faculty by direct communication or survey in the summer or fall term prior to them becoming a potential research mentor the following summer.

IV. OVERALL PROGRAM PROGRESS

The overall program progress for STEM TP^2 in designing and implementing program components and efforts to recruit, retain, and transfer cohort students into a four-year science teacher preparation program is reported in four parts:

IV.A. Summer science exploration experience (S^2E^2) progress
IV.B. UCI teacher preparation course experience progress
IV.C. STEM TP^2 research experience progress
IV.D. Overall STEM TP^2 progress

Findings, lessons learned, and recommendations for the specific program components are reported within those specific sections that appear earlier in this report.

IV.A. Summer science exploration experience (S^2E^2) progress

The summer science exploration experience (S^2E^2) is successfully providing teacher training opportunities for the cohort students (see II. STUDENT PARTICIPANT EXPERIENCES). Through the S^2E^2 program, the cohort students are actively pursuing their desire to become a teacher; starting a structured teacher training pathway that leads to a teaching credential; gaining initial teaching experience; developing their interest, ability, and confidence in teaching; and developing a professional network of colleagues.

In addition, the middle school kids and parents involved in the S^2E^2 confirmed the success of the summer experience in serving their needs. Their feedback and related issues are presented in the following sections:

IV.A.1. Middle school kids feedback
IV.A.2. Parents feedback
IV.A.3. S^2E^2 selection process for middle school kids
IV.A.4. S^2E^2 participation fee and potential scholarships

IV.A.1. Middle school kids feedback

The 28 middle school kids who provided feedback regarding their summer experience gave strong positive feedback. In their overall evaluation of their summer experience, most respondents (21/28) gave highly positive ratings of 9 or 10 on a 10-point scale, and the remaining responses consisted of three ratings of 8, three ratings of 7, and one rating of 5. Nearly all respondents (25/28) indicated that the S^2E^2 met (n=7) or exceeded (n=18) their expectations, and the remaining respondents said the S^2E^2 only somewhat (n=2) or slightly (n=1) met their expectations.

With respect to specific components of their summer experience, the respondents were in nearly unanimous agreement with the following statements:

1. The class sessions led by professors were taught at an appropriate level for me (Yes for 26/28).
2. The enrichment sessions led by college students were taught at an appropriate level for me (Yes for 26/28).

3. The teachers and other people leading the different sessions provided a supportive learning environment (Yes for 27/28).

Over the three years of the S^2E^2 program, a very high proportion of kids found that the class sessions led by professors were taught at an appropriate level (92% this year for Year 3, 97% Year 2, and 90% Year 1). A similarly high proportion also found that the enrichment sessions led by the cohort students were taught at an appropriate level (92% Year 3, 100% Year 2, and 95% Year 1). Similar to previous years, nearly all respondents agreed that they found the learning environment to be supportive (96% Year 3, 100% Year 2, and 100% Year 1). Similarly, a very high proportion of kids said they would recommend the summer experience to a friend, sibling, or other family member (27/28 = 96% this year for Year 3, 100% Year 2, and 91% Year 1).

With respect to the enrichment sessions led by the cohort students, the open-ended comments from the kids were extremely positive, and similar to the comments from last year. Most of the kids (18/28) indicated that they enjoyed the interaction and communication with the college students (cohort students) and found the college students to be kind, friendly, engaging, encouraging, and funny. Several (9/28) also indicated they enjoyed the hands-on and interactive nature of the activities, and one (1/28) indicated the projection during the dissection activities made the activities easier.

For improving the enrichment sessions, the open-ended comments this year as compared to last year were more focused on the enrichment sessions, with very few comments unrelated to the prompt (Table 15).

Table 15. Improvements for S^2E^2 enrichment sessions suggested by kids.

Categories of open-ended responses	Response count
No need to improve, enjoyed sessions as they are now.	10
Incorporate more humor and fun in some of the sessions, including more games (2 responses).	5
More time skydiving.	4
Make some sessions more hands-on with less talking, specifically the BioDiesel activity (2 responses).	4
More dissection activities.	3
Fewer dissection activities (1 response) or alternative activity for someone terrified of dissections (1 response).	2
Do less math or no math.	2
Provide more food choices for lunch.	2
Provide more food, specifically snacks and bigger lunch.	1
Do more field trips.	1
Do more art activities.	1
Do more activities with explosions.	1

Do more activities that are step-by-step and working together.	1
Have a prize that can be earned at the end of camp.	1

The kids most commonly responded that they had no suggestions because they enjoyed the activities so much and did not think they needed to be improved. Also, the most common response in previous years was to provide better food choices (not related to the enrichment sessions), and this year, only three kids made suggestions about food. The main suggestions related to the enrichment sessions were essentially the kids asking for more of everything they enjoyed about the activities; in other words, they are basing their suggestions on what is already working well for them and asking for more, and therefore the suggestions may not be necessary or feasible improvements.

In the third year of implementation, the project leadership team's organization, planning, choice of components and personnel (professors and cohort students), and specific improvements responding to feedback from the kids in previous years have all contributed to the class sessions and enrichment sessions being highly successful in positively impacting the kids.

IV.A.2. Parents feedback

For the summer science exploration experience (S^2E^2), 26 parents of the kids who participated in the experience provided feedback regarding their kids' participation in S^2E^2. Similar to last year, the parent feedback was overwhelmingly positive in ratings (nearly always 10 on a 10-point scale, with 10 being most positive and 1 being most negative) and comments. Parents' responses were strongly positive in all areas:

- sign up and registration process (20/26 responses were 9 or 10),
- ease and convenience in dropping off and picking up their kids (21/26 responses were 9 or 10),
- positive learning experience for their kids (26/26 responses were 9 or 10), and
- professional behavior of the S^2E^2 facilitators (23/26 responses were 9 or 10).

There was slightly less positive feedback regarding the ease and convenience of dropping off and picking up their kids, for which the non-9 or 10 ratings were 8, 8, 8, 6, and 2. There was also slightly less positive feedback regarding the ease and convenience of the sign up and registration process, for which the non-9 or 10 ratings were 8, 8, 8, 7, 7, and 4. The registration and access issue will likely always need to be managed as part of sustaining the S^2E^2 program, and this issue is directly addressed in IV.A.3. S^2E^2 selection process for middle school kids.

With respect to the cost of registration, the trend has been greater difficulty expressed by parents in paying the registration cost after the cost increased after the first year. In Year 1, most responses (16/19 = 84%) indicated little to no difficulty paying the cost of $130, by rating the difficulty as 1 or 2 on a 10-point scale where 1 means "Not difficult" and 10 means "Highly difficult". In Year 2, fewer responses (20/34 = 59%) rated the difficulty of paying $300 registration cost as 1 or 2, and this year, even fewer responses (14/26 =

54%) had these ratings. In Year 2, the other ratings had an average rating of 5.5 on the 10-point difficulty scale, and in Year 3, the other ratings had a similar average rating of 5.6. The higher registration cost is an issue for some parents, and it will likely always need to be managed as part of sustaining the S^2E^2 program. This issue is directly addressed in IV.A.4. S^2E^2 participation fee and potential scholarships.

Regardless of any difficulties with access or cost, every respondent (26/26) said they would recommend the S^2E^2 to other parents, and nearly all respondents added specific comments, which were uniformly enthusiastic in recommending S^2E^2 to other parents. In addition, nearly all (23/26) rated the value of the experience to their kids' education as 9 or 10 on a 10-point scale. The remaining three ratings were 8, 8, and 8, and these four respondents had provided ratings of 1, 5, and 7 with respect to the difficulty in paying the registration cost, which may have slightly reduced their enthusiasm for recommending the program.

In response to suggestions from some parents, the project leadership team will be considering a change to the current S^2E^2program schedule of 3 days of activities each week for 3 weeks (9 program dates) to a more condensed schedule of 4 days of activities each week for 2 weeks (8 program dates). The feedback from parents of the kids who participated in S^2E^2 this year was mixed regarding this potential change. Twelve (12/26) respondents preferred the current schedule, nine (9/26) preferred the proposed condensed schedule, and five (5/26) indicated no preference. Given the current success of the program, the split feedback does not by itself provide a clear reason for condensing the program.

Similar to last year, the respondents were overall enthusiastic in their support of the S^2E^2 program, and approximately one-third of the respondents (9/26) offered a variety of suggestions, which had no clear consensus (Table 16). Two responses this year provide insight into the parents' preference for the current schedule vs. a condensed schedule, and those responses are noted with * in the table.

Table 16. S^2E^2 improvements suggested by parents.

Categories of open-ended responses	Response count
*Make the program take place over more days per week for fewer weeks so more students can participate.	2
Increase the size of the program to 5 days of activities each week for 4 weeks.	1
*Do not increase the program to 4 days per week, because the program is already packed with activities and may become tiring and overwhelming for the kids.	1
Allow kids to attend twice if there is room or the program curriculum alternates every other year.	1
Inform the parents of the reception schedule when they register their kids for the camp.	1
Allow parents to be more involved in doing activities	1

with their kids.	
Have better coordination between scheduled events and related topics.	1
Delete the aquarium field trip.	1
Provide or suggest a long-term or follow-up program in math or science.	1

Notably, the one consensus suggestion from last year to increase access to the program was not a significant suggestion this year. This potentially ongoing management issue is directly addressed in IV.A.3. S^2E^2 selection process for middle school kids.

IV.A.3. S^2E^2 selection process for middle school kids

The registration and access issue will likely be a constant management issue facing the summer science exploration experience (S^2E^2) program as more parents learn about the program as more children participate over the years. The parental response to their kids' participation in the summer program has been extremely positive (see IV.A.2. Parents feedback), and as a result, more parents are likely to want their kids to participate. Last year, parents sought access for their children who were not invited, whether because they had another child who was invited or they had heard about the program from another parent. Similarly, parents last year requested expansion of the program to include school districts beyond the currently participating Walnut Valley Unified School District.

However, the main community goal of S^2E^2 is to serve middle school students who would not otherwise be eligible for or be given access to science enrichment activities. In other words, the goal is to reach students who do not typically receive the educational enrichment opportunities that other students do receive. To achieve this goal, the project leadership team is employing a careful selection strategy in which they directly contact middle school teachers to explain the purpose of the summer experience and asked the teachers to recommend students who would best fit that purpose. The parents of the recommended students are then contacted and invited to respond to the invitation from Mt. SAC for their children to attend the S^2E^2. This discrete selection process is successfully reaching those students who more greatly benefit from and appreciate the opportunity, as compared to those students more used to receiving enrichment experiences.

In order to continue to serve this specific group of middle school students as a sustainable high-quality program, project leaders, school administrators and teachers, and community leaders may need to communicate more directly the program goals and capacity (i.e., enrollment limits) in terms of being a science enrichment experience for students who have less opportunity than their classmates to participate in such experiences. This communication would require thorough discussions with school and community representatives to understand and balance school and community goals (e.g., desire for access for all), program goals (e.g., serving a particular student population), and individual privacy needs (e.g., how are students and families informed that the child is eligible or not eligible, why is the child eligible or not, etc.).

IV.A.4. S^2E^2 participation fee and potential scholarships

In addition to S^2E^2 access, the S^2E^2 participation fee will likely be another constant management issue for sustaining the summer program. With the higher fee, more parents have indicated that the fee was a burden, as compared to the first year when the fee was lower (see IV.A.2. Parents feedback). Although the fee issue was not discussed by the Program Advisory Committee, last year the PAC discussed the possibility of scholarships for deserving students for whom the fee would be a significant financial burden to their families.

To create scholarships, the summer program could generate funds through higher participation fees for some families to subsidize other families or obtain additional funds from other sources. In the event that scholarships become financially feasible, the project leaders would need to collaborate with school officials and possibly community leaders on how to communicate the scholarship opportunity and maintain family privacy regarding income status. In addition, scholarship application criteria and review procedures would need to be implemented.

IV.B. UCI teacher preparation course experience progress

The teacher preparation course for STEM TP^2 students is being successfully implemented (see I.D. Cross-enrollment at UC Irvine and II. STUDENT PARTICIPANT EXPERIENCES) despite initial challenges of having to change the course meeting location to UCI and the resulting scheduling, enrollment, and transportation issues. Through the course, the cohort students are completing formal teacher preparation requirements that lead to a teaching credential in the State of California, gaining theoretical and practical experience in lesson design, and gaining teaching experience in an elementary school classroom.

IV.C. STEM TP^2 research experience progress

The research experiences for STEM TP^2 students are being successfully implemented (see II. STUDENT PARTICIPANT EXPERIENCES and III. RESEARCH EXPERIENCES) despite the initial challenges stemming from lack of faculty mentors and the preparation level of the STEM TP^2 students. In the research experience, the cohort students are completing a preparatory research methods course and a subsequent authentic research experience, and these activities are particularly contributing to increasing their confidence in their teaching ability and the level of support they have for becoming a teacher.

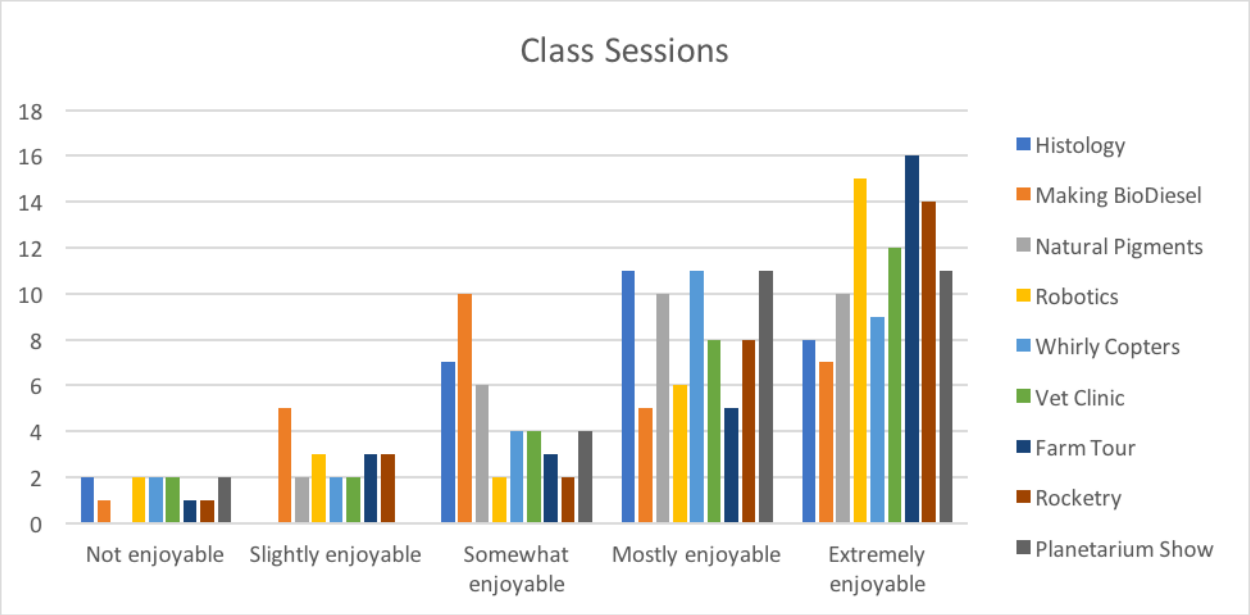
IV.D. Overall STEM TP^2 progress

The ultimate goal of STEM TP^2 is to address the need for more qualified STEM teachers in California by developing a sustainable training program to recruit and prepare Mt. SAC students to become highly effective middle and high school math and science teachers. The project leaders have implemented the major program components (summer science exploration experience, teacher preparation course, and research experience), to support this goal, and they are continuing to refine the implementation of specific aspects of these activities.

Overall the program is successfully advancing the teaching careers of the Mt. SAC students. Fourteen of the original 16 students in the first cohort transferred to 4-year universities in California in Fall 2016 as math or science majors. Four of the original nine students in the second cohort will complete the program after finishing their summer research experience in Summer 2017. Fourteen students were accepted into the program as the third cohort, and they have completed their Summer Science Exploration Experience and are enrolling in the Fall 2017 teacher preparation course.

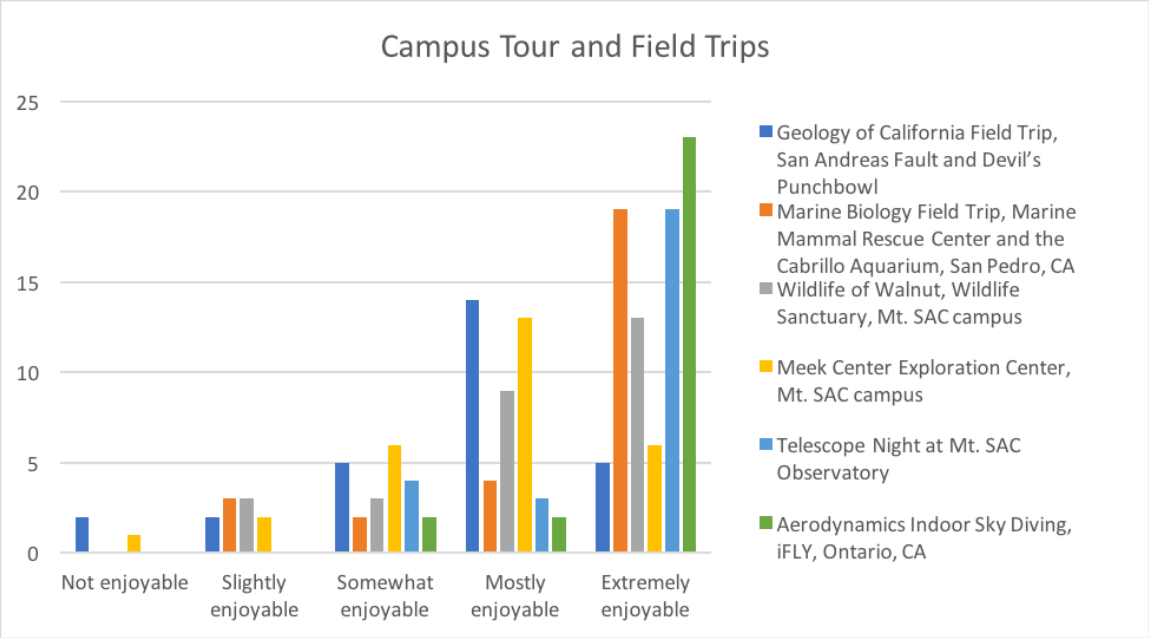
The project success will be determined by the number of Mt. SAC students who transfer into four-year programs and become STEM teachers, as well as the sustainability of the program beyond the duration of the grant award. The financial and personnel commitment from Mt. SAC plays a critical role in achieving sustainability, as does the continued commitment of partner academic institutions, such as UCI, other area 4-year universities, local K-12 schools, and industry and community partners.

Addendum: Tally of K-12 student responses for Summer 2017 S2E2 activities



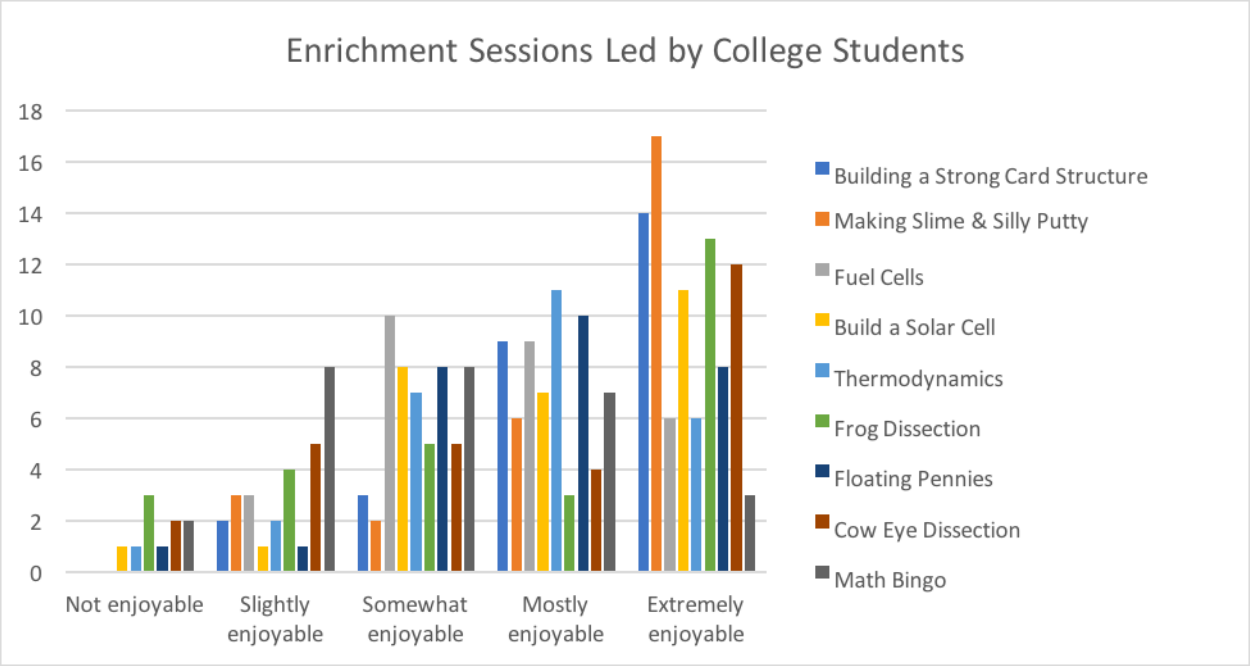
Date	Class session	Not enjoyable	Slightly enjoyable	Somewhat enjoyable	Mostly enjoyable	Extremely enjoyable
7/11 Tuesday afternoon	Histology	2		7	11	8
7/18 Tuesday morning	Making BioDiesel	1	5	10	5	7
7/18 Tuesday afternoon	Natural Pigments		2	6	10	10
7/20 Thursday afternoon	Robotics	2	3	2	6	15
7/20 Thursday afternoon	Whirly Copters	2	2	4	11	9
7/25 Tuesday morning	Vet Clinic	2	2	4	8	12
7/25 Tuesday morning	Farm Tour (Animal Farm)	1	3	3	5	16
7/25 Tuesday afternoon and 7/26 Wednesday afternoon	Rocketry	1	3	2	8	14
7/27 Thursday morning	Planetarium Show	2		4	11	11

Class session	Three most favorite votes	Rank
Histology	5	7
Making BioDiesel	2	8
Natural Pigments	10	4(t)
Robotics	**14**	**1**
Whirly Copters	6	6
Vet Clinic	10	4(t)
Farm Tour (Animal Farm)	**13**	**2(t)**
Rocketry	**13**	**2(t)**
Planetarium Show	9	5



Date	Campus Tour or Field Trip	Not enjoyable	Slightly enjoyable	Somewhat enjoyable	Mostly enjoyable	Extremely enjoyable
7/12 Wednesday all day	Geology of California Field Trip, San Andreas Fault and Devil's Punchbowl	2	2	5	14	5
7/19 Wednesday all day	Marine Biology Field Trip, Marine Mammal Rescue Center and the Cabrillo Aquarium, San Pedro, CA		3	2	4	19
7/20 Thursday morning	Wildlife of Walnut, Wildlife Sanctuary, Mt. SAC campus		3	3	9	13
7/20 Thursday morning	Meek Center Exploration Center, Mt. SAC campus	1	2	6	13	6
7/20 Thursday evening	Telescope Night at Mt. SAC Observatory			4	3	19
7/26 Wednesday morning	Aerodynamics Indoor Sky Diving, iFLY, Ontario, CA			2	2	23

Campus Tour or Field Trip	Three most favorite votes	Rank
Geology of California Field Trip, San Andreas Fault and Devil's Punchbowl	7	5
Marine Biology Field Trip, Marine Mammal Rescue Center and the Cabrillo Aquarium, San Pedro, CA	**21**	**2**
Wildlife of Walnut, Wildlife Sanctuary, Mt. SAC campus	9	4
Meek Center Exploration Center, Mt. SAC campus	4	6
Telescope Night at Mt. SAC Observatory	**16**	**3**
Aerodynamics Indoor Sky Diving, iFLY, Ontario, CA	**26**	**1**



Date	Enrichment session	Not enjoyable	Slightly enjoyable	Somewhat enjoyable	Mostly enjoyable	Extremely enjoyable
7/11 Tuesday morning	Building a Strong Card Structure	0	2	3	9	14
7/11 Tuesday afternoon	Making Slime & Silly Putty	0	3	2	6	17
7/13 Thursday	Fuel Cells	0	3	10	9	6
7/13 Thursday	Build a Solar Cell	1	1	8	7	11
7/13 Thursday	Thermodynamics	1	2	7	11	6
7/18 Tuesday morning	Frog Dissection	3	4	5	3	13
7/18 Tuesday afternoon	Floating Pennies	1	1	8	10	8
7/25 Tuesday afternoon	Cow Eye Dissection	2	5	5	4	12
7/27 Thursday morning	Math Bingo	2	8	8	7	3

Enrichment session	Three most favorite votes	Rank
Building a Strong Card Structure	**17**	**1**
Making Slime & Silly Putty	**13**	**2(t)**
Fuel Cells	1	8
Build a Solar Cell	10	6
Thermodynamics	3	7
Frog Dissection	**13**	**2(t)**
Floating Pennies	11	5
Cow Eye Dissection	12	4
Math Bingo	0	9