Executive Summary

Prepared for:
Center for Dark Energy Biosphere Investigations (C-DEBI)

Prepared by:
Beth E. Rabin, Ph.D.
2064 Balmer Dr.
323-663-1617
bethrabin@sbcglobal.net

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INTRODUCTION

The Center for Dark Energy Biosphere Investigations (C-DEBI) NSF Science and Technology Center offered a three-week summer program at USC and the Wrigley Marine Science Center on Catalina Island: the Global Environmental Microbiology (GEM) program. From early to late June of 2019, 16 undergraduates attended lectures and lab classes, conducted hands-on research, and participated in field trips and social activities. The instructors for the class were Professors John Heidelberg and Eric Webb, the program coordinator was Gwen Noda, and the TA was Gerid Ollison.

Methodology

A few weeks before they arrived for the program, students completed an online pretest survey, designed in conjunction with GEM program staff; questionnaire completion took an average of 55 minutes. Questions included goals and concerns about the upcoming summer course, career plans, and familiarity with the course content, including 12 short-answer science concept questions.

At the end of the course, students completed an online posttest survey, also designed with the GEM program staff. Questionnaire completion took an average of 38 minutes. Questions included satisfaction with the course, course impact on knowledge and career goals, knowledge of course content, and suggestions for course improvement.

Responses to the 12 short-answer science concept questions were coded by the course TA for level of understanding. Pretest and posttest questions were coded at the same time, and the TA did not know if each answer was from the pre- or the posttest, nor did the TA know the identity of the student responding.

Participant Demographics

All 16 participants completed both the pre- and posttest surveys, for a completion rate of 100%. Participant demographics were as follows:

<table>
<thead>
<tr>
<th>Ethnicity</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>62%</td>
</tr>
<tr>
<td>Male</td>
<td>38%</td>
</tr>
<tr>
<td>African American</td>
<td>19%</td>
</tr>
<tr>
<td>Alaskan Native</td>
<td>--</td>
</tr>
<tr>
<td>Asian</td>
<td>38%</td>
</tr>
<tr>
<td>Hispanic</td>
<td>31%</td>
</tr>
<tr>
<td>Native American</td>
<td>--</td>
</tr>
<tr>
<td>Native Hawaiian/Pacific Islander</td>
<td>--</td>
</tr>
<tr>
<td>White</td>
<td>44%</td>
</tr>
<tr>
<td>Other *</td>
<td>6%</td>
</tr>
</tbody>
</table>

*(students could choose more than one ethnicity)*

**“Hmong and Indian”**
Colleges and universities represented by the students include:

**2-year colleges:**
- Antelope Valley College, Lancaster, CA
- College of the Desert, Palm Springs, CA
- East Los Angeles College, Monterey Park
- El Camino College, Torrance, CA
- Georgia St. University Perimeter College
- Honolulu Community College, HI
- Mount San Antonio College, Walnut, CA
- Roane State Community College, TN
- Santa Barbara City College, CA

**4-year colleges:**
- SUNY Binghamton, NY
- Cal State Polytechnic University, Pomona
- Cal State University, Fullerton
- Hawaii Pacific University, Honolulu
- Interamerican Univ., Aguadilla, Puerto Rico
- Swarthmore College, PA
- University of Pikeville, KY

Most of the students (88%) had already declared an undergraduate major—all declared majors were in a STEM field, and all related to the biological or earth sciences. All say they may (7%), probably (20%), or definitely (73%) hope to have a career in science.

This document provides a summary of the responses. Complete data for both the pre- and posttest surveys are provided in the Appendix. Participant comments were copied directly from the online survey and were lightly edited for spelling and punctuation.
SUMMARY OF FINDINGS

Overall, this ninth summer of the GEM program was again a success, with appreciative participants who felt the program impacted their educational and career paths.

1. Satisfaction with the GEM program

- Almost all students felt the course was a worthwhile experience and would recommend it to others.

- Hands-on research experience that they couldn’t get at their home institution was a huge benefit.

- Interpersonal connections with mentors and colleagues was another benefit. Students learned collaboration skills and had fun, too.

Suggestions:

- Many students wanted even more lab experience.
  - Some complained about too much down time that could have been spent in the lab.
  - It should be made clear how the lab work ties in to the topics the students are learning.

- A day trip to Avalon would be appreciated by the students—it was one of the most common suggestions for program improvement.

2. Impact on participants’ career goals

- For the majority of students, the program impacted their educational and career goals. Although all began the program with an interest in a scientific career, for some this program cemented that interest and gave them direction as to how to achieve that goal.

- For other students, the program confirmed that they do not want to pursue a science research career. Medicine, engineering, and conservation are other alternatives for them.

Suggestions:

- C-DEBI should continue to follow-up with program alumni to track their career progress and determine how the GEM program continues to influence their educational and career choices.
3. Impact on knowledge of course content
   - As in previous years, student’s understanding of most of the relevant scientific concepts grew significantly as a result of the course.

   **Suggestions:**
   - The program should examine the content areas in which students have only a simplistic understanding, to see if the curriculum should be modified.

4. Inclusion and diversity
   - Students valued the program’s focus on diversity and inclusion, and felt GEM was very respectful of a variety of kinds of diversity.
   - About half the students already had some diversity training before arriving at the program.

   **Suggestions:**
   - A few students experienced microaggressions due to race or sexual orientation. There is still more work to be done.
COMPARING THE GEM PROGRAM TO STUDENTS’ EXPECTATIONS

Most students said the program either “met” (38%) or “exceeded” (56%) their expectations. Only one student (6%) said that the program “did not live up to their expectations.”

Many students said they learned more than they expected, both in lab and from the additional programming.

→ “I expected to be talking to scientists about the work they have done but I actually got to do things I have never done before like take samples and staining DNA which I will actually use in the future.”

→ “I thought it was going to be a program to gain lab experience, but also taught us things that we necessarily didn't know and provided us with a new perspective of microbiology for some of us.”

→ “I was very pleasantly surprised to hear from panels and to be exposed to the in-depth lectures and hands on lab.”

→ “Supporting environment for bettering yourself at different skills like presenting research.”

→ “I learnt the importance of work ethic and connecting with people. I also found new things to love in science especially after a hard semester of doubting my place and future in the field. It definitely made me fall even more in love with research and STEM in general and wouldn’t trade this experience for anything.”

Some students, including the one for whom the program did not meet their expectations, said they expected more lab work experience.

→ “I thought it was going to be lab after lab but there was a lot of lecture and not a lot of free time early.”

→ “I expected the program to be more focused on research and labs than the lectures and other activities. There were labs and a lot of learning experience to grow, however I thought it would have been nice to work on individual or group projects that were different and then present our findings at the end of the experiment.”

→ “I expected more lab/research based program. I found that a lot of the time I had free time that I could have used this time to be in the lab leaning different lab techniques. I found the lectures to be too long--we could have been in lab during much of that time.”
MOST SIGNIFICANT PART OF THE COURSE FOR STUDENTS

Students derived a variety of benefits from the GEM course.

• Making **interpersonal connections**—with faculty, staff, and colleagues—was a valuable aspect of the experience.

  → “Collaborating with people with different perspectives than me taught me about how diverse everyone’s minds are and how helpful that is especially in the stem fields.”
  → “Playing games with the group was fun.”
  → “Getting to know and learn about the professors and mentors as they provide a lot of insight for future potential careers.”
  → “Being able to network and meet others with similar interests and career goals.”
  → “The relationships I gained from working with people who had similar goals but different ideas. I definitely learnt a lot not just in science but also in connecting and communication.”

• **Learning hands-on research skills** was also a benefit of the GEM course. Several said they would not have access to these skills at their home institution.

  → “The part of the course that was most significant to me was the time spent in lab learning new techniques and utilizing equipment I had never been exposed to. I feel it was beneficial to understanding where I want to take research in the future, and gain experience in a lab using equipment I would’ve not had the benefit to use at my home institution.”
  → “Lab work. I learned and gained experience from new techniques that I was introduced into.”
  → “I definitely loved the hands-on lab and the research experience. I was in love with the techniques we learnt and practiced.”
  → “The most significant part of this course was working in the lab. The lab has more technology than back at my college.”

• The **career panels** were also a benefit of the GEM course.

  → “I thought the careers panels were very significant to me because I got to hear others individuals experience and how they came over struggles in their career.”
  → “Career panels and networking.”
PROGRAM RATINGS: EDUCATIONAL CONTENT

<table>
<thead>
<tr>
<th></th>
<th>Mean (0-10)</th>
<th>% 8,9, or 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academic Course/Lectures</td>
<td>9.1</td>
<td>94%</td>
</tr>
<tr>
<td>Research Experience (lab &amp; field)</td>
<td>8.4</td>
<td>69%</td>
</tr>
</tbody>
</table>

Most students were quite satisfied with the educational content of the GEM program.

- The **academic course** received very strong scores; most students (94%) rated it an “8” or higher on a 10-point scale and over one-third gave it a perfect “10.” The professors and the TA were engaging, informative, and explained the content well. Note that a few students commented that the lectures felt rushed.

  → “The professors were amazing and the lectures were very informative.”
  → “They were more in-depth and covered more material that’s I thought, which I enjoyed.”
  → “Very interesting but at times a bit fast.”
  → “I thought they were informative and welcoming. Some of the times they felt rushed, and some of the times it was challenging to follow if you were unfamiliar with some of the underlying concepts. Overall they were informative, and in the future taking additional science classes I feel I will benefit from the exposure to the topics presented in the lectures.”
  → “I love the professors, the lectures are a little long but I understand since the course is pretty heavy and advanced especially for those who have no background in science. However at one point I felt super rushed and had zero time to process any of the information that was trying to come across.”

- Students appreciated the **research experience**, with two-thirds (69%) rating it an “8” or higher on a 10-point scale, and one-third rating it a perfect “10.” Students said they learned new techniques. A few mentioned that lab instructions could have been clearer.

  → “I got to explore new techniques and gained experience from them.”
  → “Gerid really explained everything well, even if it was a couple of times.”
  → “I loved the techniques and the research I just wish we did a little bit more.”
  → “The basics were good but I felt it had no relevance to what we did.”
  → “The labs were very short and there wasn't that much difficulty in terms of the activities we had to do. Discussing lab more in detail and perhaps doing more difficult or challenging labs would have been better.”
  → “I learned a lot but it was disorganized and sometimes I did not understand why I was doing certain things.”
  → “Things for lab were often not ready, a lot of sitting around and a LOT of time wasted, sometimes instructions were unclear.”
**PROGRAM RATINGS: COORDINATION AND SUPPORT**

<table>
<thead>
<tr>
<th></th>
<th>Mean (0-10)</th>
<th>% 8,9, or 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Program Coordinators</td>
<td>9.6</td>
<td>94%</td>
</tr>
<tr>
<td>Mentoring</td>
<td>9.2</td>
<td>94%</td>
</tr>
<tr>
<td>Pre-program Information</td>
<td>8.8</td>
<td>81%</td>
</tr>
</tbody>
</table>

- The “welcoming” and “helpful” **program coordinators** received very positive ratings; almost all students rated them an “8” or above, with 75% rating them a perfect “10.”
  - “Gwen is amazing, and all the staff was very welcoming and accommodating.”
  - “They were friendly and helpful regarding questions or concerns with the program, and overall just very accommodating.”
  - “They were nice, informative, and willing to help.”

- The **mentoring** that students received was “amazing” and “useful.” Almost all students rated it an “8” or higher, with half giving it a perfect “10.”
  - “Great advise from the instructors and the constructive criticism is very helpful.”
  - “The professors and TA and other guest speakers had great advice regarding academia and navigating college.”
  - ”The mentoring was amazing. The people really care about the GEM students.”
  - “I gained a lot of different perspectives that were extremely helpful to me at this time in my life.”

- The **pre-program information** received mostly positive ratings; most participants rated it an ‘8” or higher. Many students found it informative and detailed.
  - “Very specific/detailed and organized.”
  - “It was descriptive and held up its end with what was provided.”
  - “Very informative and gave me a good overview of the program.”
  - “The stipend in the original brochure was not very direct. Many were under the influence that we get an additional stipend to the 200$. Also there needs to be more direct information about working with marine microbes more so than aquatic.”
PROGRAM RATINGS: OVERALL, SOCIAL/EXTRACURRICULAR ACTIVITIES, AND CAREER PANELS

<table>
<thead>
<tr>
<th></th>
<th>Mean (0-10)</th>
<th>% 8.9, or 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social/Extracurricular activities</td>
<td>9.2</td>
<td>88%</td>
</tr>
<tr>
<td>Career Panels</td>
<td>8.9</td>
<td>94%</td>
</tr>
<tr>
<td>Overall Program</td>
<td>8.7</td>
<td>88%</td>
</tr>
</tbody>
</table>

- Students were very pleased with the “exciting” and “fun” social/extracurricular activities in the program. Most students (88%) rated them an “8” or higher, and 63% rated them a “10.”

  → “Extracurricular activities were fun. Got to explore a place I’ve never been to and met so many great people.”
  → “It was a great experience gaining knowledge through snorkels, kayaking, and hikes. Interacting with people here at GEM has made me excited to join the STEM community.”
  → “Extracurriculars were exciting and very fun. I do wish we were able to go to Avalon though.”

- Students appreciated the “insightful” career panels; almost all students (94%) rated them an “8” or higher, with over half rating them a perfect “10.” Two students mentioned that some of the guests had little to do with science.

  → “They were definitely super helpful because I had no idea what the other careers that came with science. We were able to get a good view of what it was like to be a successful scientist well into their career and also a good view of what it was like to be a grad student.”
  → “Very insightful and great advice.”
  → "They were helpful, however many of the career panelists weren’t scientists or working in the scientific community doing research, which is fine but many of them were doing administrative work which doesn't pertain to us as students pursuing research/grad school.”
  → “The graduate student panel was excellent but the career panel at USC had unnecessary guests who did not have much to do with science.”

- The program overall scored very well—all but two students rated it an “8” or higher and six students rated it a “10.” It was a “great” experience.

  → “I made changes to my future plans and focused my goals because of this program which is more than I could have wanted or expected. The program was fantastic overall and I will be talking about my experience here for year to come.”
  → “Great program. Lab time could be more organized, but other than that an amazing experience.”
“I enjoyed my time here at GEM, and feel it was a great first exposure to life working in the STEM field. I have gained knowledge that I otherwise wouldn’t have been exposed to, as well as made friends I would’ve never gained.”

“One of the best experiences I’ve had.”
ATTITUDES TOWARD THE PROGRAM

<table>
<thead>
<tr>
<th></th>
<th>Mean (1-5)</th>
<th>% Agree</th>
<th>% Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Worthwhile way to spend summer</td>
<td>4.6</td>
<td>25%</td>
<td>69%</td>
</tr>
<tr>
<td>Would recommend to others</td>
<td>4.6</td>
<td>31%</td>
<td>63%</td>
</tr>
<tr>
<td>Help me get ahead in my career</td>
<td>4.4</td>
<td>38%</td>
<td>50%</td>
</tr>
<tr>
<td>Introduced me to new career options</td>
<td>4.4</td>
<td>38%</td>
<td>50%</td>
</tr>
</tbody>
</table>

Most students' attitudes toward the program were extremely positive.

- Almost all students agreed (most of them, strongly) that the GEM program was a worthwhile way to spend their summer. Just one student disagreed that GEM was worthwhile.

- Almost all students would recommend the program to other students. One student was neutral on this item.

- Most students agreed that the GEM program would help their future career. Two students were neutral on this item.

- Most students agreed that the program introduced them to new career options. Two students were neutral on this item.
Students’ responses were coded by the TA, based on a rubric created by the course instructors, as follows:
0=“I don’t know,” “Not sure”
1=Incorrect answer
2=Aspects correct and incorrect
3=Correct information, simplistic
4=Correct information, understanding of complexities

<table>
<thead>
<tr>
<th>Students’ responses were coded by the TA, based on a rubric created by the course instructors, as follows:</th>
<th>Pretest</th>
<th>Posttest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean (0-4)</td>
<td>% 3 or 4</td>
<td>Mean (0-4)</td>
</tr>
<tr>
<td>Bioluminescence and quorum sensing</td>
<td>0.5</td>
<td>12%</td>
</tr>
<tr>
<td>Protocol to define microbial diversity</td>
<td>0.3</td>
<td>6%</td>
</tr>
<tr>
<td>Microbial diversity vs. abundance</td>
<td>1.1</td>
<td>19%</td>
</tr>
<tr>
<td>How oxygen affects microbial community structure</td>
<td>1.5</td>
<td>31%</td>
</tr>
<tr>
<td>Nitrogen/nitrogen fixation in the ocean</td>
<td>1.1</td>
<td>6%</td>
</tr>
<tr>
<td>Anthropogenic nutrient inputs and water quality</td>
<td>1.1</td>
<td>6%</td>
</tr>
<tr>
<td>Prokaryotic vs. eukaryotic phytoplankton</td>
<td>1.6</td>
<td>44%</td>
</tr>
<tr>
<td>Cyanobacteria in the carbon cycle</td>
<td>1.9</td>
<td>--</td>
</tr>
<tr>
<td>Compare lytic viruses and bacteria</td>
<td>1.4</td>
<td>31%</td>
</tr>
<tr>
<td>Bacterial growth mechanism/rate</td>
<td>2.4</td>
<td>63%</td>
</tr>
<tr>
<td>pH and ocean acidification</td>
<td>2.2</td>
<td>19%</td>
</tr>
<tr>
<td>DNA/RNA structure and function</td>
<td>2.3</td>
<td>31%</td>
</tr>
</tbody>
</table>

See the Appendix for complete question wording. Table sorted high to low by pre-post change.
*Pre-post change significant at p<.10. **Pre-post change significant at p<.05.

Students showed a more sophisticated understanding of targeted science concepts after completing the course. Note that by the end of the course, more than half the students had at least a simplistic, if not complex, understanding of almost all the targeted content.

- Students came to the course with little exposure to course material, with the exception that about one-third to two-thirds of students knew some microbiology/molecular biology basics (bacterial growth, DNA/RNA structure & function, prokaryotic vs. eukaryotic phytoplankton, comparing lytic viruses and bacteria, and oxygen’s effect on ocean microbes). While students showed improvement in most of these basic areas, change was not statistically significant for DNA/RNA structure & function and comparing lytic viruses and bacteria.

- Students demonstrated statistically significant learning of all other course concepts. Knowledge gain was largest for content for which most students had no previous exposure: bioluminescence and quorum sensing, a protocol to define microbial diversity, microbial diversity vs. abundance, nitrogen fixation in the ocean, anthropogenic nutrient inputs, cyanobacteria and ocean acidification.
**PROGRAM IMPACT ON EDUCATIONAL/CAREER PATHS**

<table>
<thead>
<tr>
<th>“Which of the following do you hope to do in the future?”</th>
<th>Pretest</th>
<th>Posttest</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean (1-5)</td>
<td>% Probably/Definitely</td>
</tr>
<tr>
<td>Take more science classes in college</td>
<td>5.0</td>
<td>100%</td>
</tr>
<tr>
<td>Apply to a 4-year college (if currently at a 2-year)</td>
<td>5.0</td>
<td>100%</td>
</tr>
<tr>
<td>Graduate with a major in science at a 4-year college</td>
<td>5.0</td>
<td>100%</td>
</tr>
<tr>
<td>Have a career in science</td>
<td>4.7</td>
<td>93%</td>
</tr>
<tr>
<td>Pursue a science education beyond a 4-year college</td>
<td>4.7</td>
<td>88%</td>
</tr>
<tr>
<td>Work, receive credit, or volunteer to do research in a professor’s lab</td>
<td>4.9</td>
<td>100%</td>
</tr>
<tr>
<td>Conduct scientific lab-based research in my career</td>
<td>4.4</td>
<td>94%</td>
</tr>
<tr>
<td>Conduct scientific field research in my career</td>
<td>4.4</td>
<td>94%</td>
</tr>
<tr>
<td>Teach science at the college level</td>
<td>2.5</td>
<td>13%</td>
</tr>
<tr>
<td>Teach K-12 science</td>
<td>1.6</td>
<td>0%</td>
</tr>
</tbody>
</table>

See the Appendix for complete question wording and response distribution.

**Pre-post change significant at p<.05.**

Even before entering the program, most or all of the GEM students had planned to continue with their science education. All planned to take more science classes in college and apply to a 4-year college if currently at a 2-year college, and all planned to major in science at a 4-year college. Most planned to have a career in science and to pursue a graduate degree in science. These plans did not change significantly as a result of the GEM program.

- Students’ interest in lab and field research dropped after participation in the GEM program, including working in a professor’s lab, and conducting lab and field research in their career. Perhaps the program showed some that they were not that interested in research; this is supported in some of the comments on the next page.

- The program did not influence students’ interest in teaching K-12 science or teaching science at the college level.

- See the next page for students’ comments on how the program influenced their educational and career plans.
**IMPACT ON EDUCATIONAL GOALS**

<table>
<thead>
<tr>
<th>&quot;How much has this program influenced your educational goals?&quot; (posttest)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-100, 0=&quot;none&quot;, 90=&quot;new goal&quot;</td>
<td></td>
</tr>
<tr>
<td>100</td>
<td>12%</td>
</tr>
<tr>
<td>71-99 (90=&quot;New goal&quot;)</td>
<td>25%</td>
</tr>
<tr>
<td>51-70 (70=&quot;Significant changes&quot;)</td>
<td>38%</td>
</tr>
<tr>
<td>31-50 (50=&quot;Some changes&quot;)</td>
<td>25%</td>
</tr>
<tr>
<td>&lt; 30 (30=&quot;Very little&quot;)</td>
<td>--</td>
</tr>
</tbody>
</table>

(Mean impact score = 80, “significant changes”)

All students felt that the GEM program impacted their educational goals at least somewhat, and more than one-third (37%) said the program has given them a new goal. For some, the program ignited or strengthened their interest in a research science career. For others, the program confirmed that their career path lies elsewhere, for example, engineering or medicine.

Students’ educational impact ratings are indicated in parentheses after their direct quote below.

**“New Goal”:**

→ “This program has influenced my career goals by wanting to do research in a lab and try to find new discoveries in science.” (100)
→ “It really showed me that I will definitely pursue a career in medicine.” (90)
→ “It has caused me to focus my aspirations in a different direction with an engineering focus rather than in soft science.” (90)
→ “Gave me a greater insight as to what new careers are out there and have some experience.” (85)

**“Significant Changes”:**

→ “I have reconsidered what I want to do in the future because of the things I have learned being in this program. It taught me that I want to do conservation work regarding climate change.” (70)
→ “I realized that I really like research but it might not be a passion of mine, even though I enjoy it. I have a better idea of what to do but it's hard to tell if it's in my future.” (70)
→ “This program has exposed me to see microbiology from a different perspective as I had before. Now I'm more curious about microbiology than initially.” (70)
→ “I definitely have a clearer idea on what research would be like in the future. Before this course I had very minimal idea but the work required and expectations that needed to be met certainly gave me a feel of what a science career would be like. It's definitely reignited a larger flame in me to pursue the sciences.” (70)
“Some Changes”:

→ “Before the program I was already interesting in pursuing education beyond my bachelors degree. However, listening to the stories of the professors and other guest speakers I realized that the process to get to my end goal may not be as straightforward as I thought, and to explore more options and interests I may have.” (50)

→ “It has helped me by helping me realize I want to keep doing biology in some shape or form while still doing engineering.” (50)

→ “I now know that I do not want to pursue a career in marine microbiology. On the other hand, I have met and spoken with people who have made me realize that it is not going to be a smooth ride and that I will have to try things out and decide what it is I want.” (40)
SENSE OF DIVERSITY/INCLUSION

<table>
<thead>
<tr>
<th></th>
<th>Mean (0-10)</th>
<th>% 8,9, or 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respectful of Diversity and Inclusion</td>
<td>9.5</td>
<td>100%</td>
</tr>
</tbody>
</table>

All students felt the GEM program provided a learning environment that is respectful of diversity and inclusion. Students appreciated the many kinds of diversity of the program participants and felt the program worked hard to be mindful of inclusion.

→ “The program actively worked to address the issues of inclusion and diversity in the STEM field, and lack thereof currently at the professional level. They also stressed the importance of understanding that everyone comes from diverse backgrounds, to be respectful of their situations, and look to one another as equals.”

→ “In this program I interacted and developed friends not just from different parts of the country, which I would probably not get to know otherwise, but with different backgrounds, beliefs, feelings, ethnicity, and different cultures.”

→ “I have felt included and respected among a diverse group of students.”

→ “The students were diverse and it was a big point to be respectful to others and their ideas.”

Most students did not experience any racial tension or discrimination. However, there were a few moments of discomfort for a few students.

→ “I didn’t feel any racial tension per se but I did feel singled out sometimes by other members of the program. There was definitely a clear separation of groups and although I’m sure it was racially based, it was definitely uncomfortable.”

→ “Only a little.”

→ “I may have felt a bit of singled out due to my sexual orientation but that may have been just a joke, but this was not GEMs fault.”

Several students felt that the GEM program is more respectful of diversity and inclusion than is their home institution; for the rest, their home institution is comparable to GEM.

→ “At my college there is definitely diversity and inclusion, probably more than in this program, but I don't necessarily interact with people from different cultures and background as I did here with the program. This program has inspired me to get involved and interact with more people than I used to do back at my college.”

→ “GEM challenges people and helps builds connections and confidence.”

→ “There is definitely a large divide in my current college community and it’s become a competition based program where everyone seems to have to outcompete to be recognized along with the idea that background and status is a part of the competition, in this program not only did I feel that we didn’t need to compete, I definitely felt that I wasn’t at a disadvantage or at an advantage- I just had a different experience. It wasn’t about my privilege or my lack of, it was just that what I had gone through was different from others. This program definitely played out the strengths in diversity rather than highlighting status which I think is very important.”
→ “My institution has diversity but not inclusion. The GEM course allowed me to be diverse and included in lab work and lecture.”
→ “My school is highly diverse and being at the GEM program hasn't been a stark contrast.”
→ “Not so different, there's a lot of diversity in CPP.”
ADDITIONAL CONTENT STUDENTS WOULD HAVE LIKED IN THE COURSE

Students were asked if there was anything else they would have liked to learn as part of the GEM course.

- Some students requested more information that would **broaden the scope** of the course.
  - “I would have like to learn about more different fields of science that other students may have expressed interest in their applications.”
  - “More about microbes beyond the marine environment.”
  - “I would have liked to learn more labs skills and procedures.”
  - “I would have liked to learn about other microbiology techniques in lab and how they are used in combination with other scientific experiments.”
  - “More about other environments.”
  - “Although I loved the ocean microbiology centered talks I do wish we had more general environment talks like soil microbes. It was very very briefly touched upon but this would have been an interesting addition to the class structure.”
  - “More about the microbiome.”
  - “More about bioinformatics.”

- A few students wanted to learn more **lab skills and techniques**.
  - “I would have like to learn more labs skills and procedures.”
  - “I would have liked to learn about other microbiology techniques in lab and how they are used in combination with other scientific experiments.”
STUDENTS’ SUGGESTIONS FOR IMPROVING THE GEM COURSE

Several students suggested a **day trip to Avalon**.

→ Trip to Avalon.”

→ “1 free day/trip to Avalon.”

→ “Next years course should have at least one free day to go to Avalon.”

→ “A day for the cohort to explore the island or LA.”

Others would have liked **more time devoted to lab work**.

→ “Involve more laboratory experience and exercises.”

→ “More hands on work.”

→ “More independent labwork.”

→ “Do less lectures and MUCH more lab work.”