


## HSI STEM: Research Opportunities to Improve Retention and Increase the Pipeline to Graduate School

Alvaro Monge

### Related papers

[Download a PDF Pack](#) of the best related papers 



[Geoscience Diversity Enhancement Project: Student Responses.](#)

Suzanne Wechsler

[Building national capacity for research mentor training: an evidence-based approach to training the tr...](#)

Christine Pfund, Sarah Miller, Pamela Asquith

[The Latino Healthcare Professionals Project: responding to the diverse needs of the 21st century](#)

Janice Frates

# **HSI STEM: Research opportunities to improve retention and increase the pipeline to graduate school**

**Gino Galvez, Eric Marinez, Alvaro Monge  
California State University Long Beach**

## **Abstract**

This paper describes the summer and winter research experience programs that are part of the Hispanic Serving Institution (HSI) STEM grant awarded to the California State University Long Beach (CSULB). While the grant has several components, this paper's focus is on The Summer Bridge to the Beach and the Winter Research Experience programs. Both of these programs match Latino students seeking a STEM degree with faculty mentors in their chosen majors. The summer program fills a critical need that exists in transitioning Latino students from community colleges to a 4-year university to complete their baccalaureate STEM degree. Among the program's goals are to facilitate the transfer students' transition to the CSULB campus, to engage them in projects in their major, and to provide mentorship from faculty. The Winter Research Experience provides Latino students an opportunity to engage in research with faculty in their major. This program is meant for academically strong students who have little to no experience in research. The goals of this program are to ignite students' interest in research which can then increase motivation to persist and complete their STEM degree. This paper presents preliminary results from two years of implementing both programs. The results show that students have a higher appreciation and understanding of research and will seek other research opportunities in the future as a result of their participation.

## **Introduction**

In 2011, California State University Long Beach (CSULB) successfully received a Hispanic Serving Institution STEM grant from the US Department of Education. The grant serves Latino students from the College of Natural Sciences and Mathematics and the College of Engineering and its focus is to increase retention and graduation of underrepresented Latinos in the STEM fields. To meet the goals, a multi-pronged approach is used to increase academic performance and retention of Latino students. While the grant has several components, this paper will present the two programs that engage Latino students in research: the Winter Research Experience and the Summer Bridge to the Beach.

## **Background**

The two programs described in this paper place students in an active research project with a faculty mentor and ideally other peers. Such strategy is one that has been shown to be effective in improving students' sense of belonging and in increasing the relevance of the knowledge

acquired in STEM courses. Hurtado et al.<sup>1</sup> report on the significant impact that the relevance of such knowledge has on a student's life on campus. Both programs provide such relevance by immersing the students in a research environment where they are taught about research techniques and where they are expected to apply their own knowledge. That same study also reports on reasons why underrepresented racial minority (URM) students leave the sciences. Among the factors is "the lack of social value or relevance to improving conditions for their communities", something also reported by Bonous-Hammarth<sup>2</sup>. The research experiences can make those connections that will motivate URM students to persist in their STEM major.

Another of the goals of the research experience programs is to increase the number of Latino students who seek and complete a graduate degree in STEM. It is research experiences like these programs that have been shown to be effective at increasing students' chances of completing a STEM degree and to pursue a graduate degree<sup>3,4</sup>.

It is clear from the literature<sup>1</sup> that finances play an important part in the degree to which URM students participate and succeed in college. The financial stipend or scholarship offered to participating students in both programs can help to reduce the financial stresses that Latino students have, thus freeing them to focus on their academic endeavors.

### **The Summer Bridge To The Beach**

It is imperative for HSI STEM at CSULB to address the Latino Educational Pipeline and it does so through its "Summer Bridge to the Beach Program." The literature reveals that the majority of Latino students attend a community college versus a 4-year university following high school graduation. Additionally, 33% of all California Community College students in 2006 were Latino students and this population represents a growing proportion of California Community College students. In California, 75% of all first time Latino college students attend a community college with 40% of them aspiring to transfer to a four-year institution. Of the 75 percent that attend community college only 7 will transfer to a four-year university. Interestingly, six out of the seven who transfer will attend a CSU.<sup>5</sup>

In order for Latino students to graduate from four-year institutions, it is critical that universities increase the number of Latino students who transfer to and persist in these institutions. Although many community college students desire to transfer to a four-year institution, the dismal transfer rate has been associated with transfer institutional neglect. Transfer institutional neglect fails both at the community college and the four-year institution, where most universities do not provide an adequate number of resources for transfer students to be successful. One way to mitigate institutional neglect is to connect the student prior to attending the university with a faculty member in their department, enrich them with the services offered at the institution, and provide them with the social network to assure them they are valued members of the institution. Rivas et al. suggest a list of recommendations to increase the number of Latino students who transfer to a four-year institution and ultimately pursue a graduate degree<sup>6</sup>. Several of these recommendations have been built into the Summer Bridge to the Beach Program and include an

effort to develop an institutional transfer culture by offering a transfer-specific summer research program.

The HSI STEM “The Summer Bridge to the Beach Program” provides transfer Latino STEM students with an understanding and appreciation for research, while facilitating their transition to the CSULB campus. This is accomplished by engaging them in active projects in their major, providing mentorship from faculty, and enhancing their professional development by offering specific workshops targeted toward their research experience and to facilitate their transition into an existing minority program or internship. Specific objectives of the program are to increase:

1. each student’s ability to apply content and skills learned in the classroom to research,
2. their understanding of the research process,
3. the notion that science is a creative process that advances further knowledge,
4. their knowledge of ethical conduct in their field, and
5. their ability to interpret results in research and draw conclusions.

The Summer Bridge to the Beach is a program that closely resembles the National Institutes of Health “Bridges to the Baccalaureate” program, which CSULB has had since the 1990s<sup>7</sup>. The NIH program targets community college students who are currently students from two partner institutions, Cerritos College and Long Beach City College, and who are majoring in either chemistry, biochemistry, or biological sciences. A major mission of the program is to prepare the students to transfer and earn a bachelors degree from a 4-year institution and ultimately increase the number of minority students who earn a doctoral degree in the biomedical sciences.

To be considered eligible for the Summer Bridge to the Beach program, the transfer student needs to be currently enrolled at either a 2-year or 4-year institution upon applying, have been accepted and enrolled at CSULB for the fall semester following program participation, and declared a STEM major in either the College of Engineering or Natural Sciences and Mathematics once at CSULB. In addition, the student must be Hispanic/Latino and should be available during program dates. Some of the benefits for the student are hands-on research with a faculty from their major, opportunity to build a network and research community with faculty and other students, professional development workshops, opportunity to travel to a STEM-centered conference, and a \$4,000 stipend.

The Summer Bridge to the Beach is a 9-week program for incoming Latino STEM transfer students. In the program’s first week, students attend an intensive one week orientation, which includes a brief introduction to the CSULB campus and to a multitude of student services offered by the Learning Assistance Center, the Career Development Office, campus library, and college specific academic resource centers — “Student Access to Science” (SAS) Center and “Engineering Student Success Center” (ESSC). In addition, students are provided with research-focused trainings that include laboratory safety, professional responsibility and ethical conduct in research, and how to properly keep a laboratory notebook. The academic development workshops include time management, study skills, understanding a scientific article, library use, and preparing a poster and a presentation. The professional development workshops offered are

Resume Writing, Latino Leadership in STEM, Leadership Skills and Development, and Careers in STEM. In the second week students start researching with their faculty mentor. A program requirement is that students attend weekly brown bag workshops throughout the 8 weeks to further connect them, facilitate their transition to the campus, and to foster a Latino student research culture. Brown Bag workshops include Scientific Writing, Abstract Preparation, Graduate School Preparation, Oral Presentations, Scientific Computing, and an Introduction to Minority Programs and Opportunities to be Involved at CSULB. At the conclusion of the program, the students present their research and experiences at a recognition event to which both the faculty mentors and parents are invited.

### **The Winter Research Experience**

The Winter Research Experience Program (WREP) matches Latinos seeking a STEM baccalaureate degree with research-active faculty who engage and mentor them in research in the student's respective major. The program originated as a concerted effort by the Physics department to recruit students into the major. The goal was to immerse students in a positive research experience that fostered strong mentoring from faculty who engages and encourages students to apply their academic knowledge to research projects. This idea evolved into the Winter Research Experience.

While there are similarities with The Summer Bridge To The Beach, the WREP started as a three-week intensive experience to take place during the break between fall and spring semesters. This program is tailored for CSULB Latino students who are enrolled at CSULB and have completed most of their lower-division course requirements. The program presented challenges in the three-week format, one of the most impactful being that many interested faculty were not available during the time the program takes place. Due to changes in the academic calendar leading to a shorter break, the success of the summer program, and considering feedback from faculty mentors, effective Winter 2014, the WREP is being reorganized as a two-month commitment that starts in the winter break. These changes will provide students and faculty more time to strengthen their working relationship. A future publication will consider the effects that such changes have on the outcomes of this program.

The WREP application process starts with a marketing campaign in the Fall semester to try to reach as many CSULB Latino STEM students as possible. Announcements are distributed by CSULB's course management system, Facebook, and the HSI STEM website<sup>8</sup>. In addition, faculty who have participated in the HSI STEM program have been effective in identifying strong candidates. In the application, students provide demographic and academic information; they also include transcripts and a personal statement. In the personal statement, students describe why they selected a STEM major, their career goals, and how the program can help them reach their goals. Applicants are first evaluated according to their academic strengths and weaknesses by reviewing their academic standing and the grades earned in STEM courses. In the academic information submitted, students need to demonstrate their research readiness and in

their personal statement, students provide additional information regarding how a research experience fits in their educational and professional goals.

The WREP reaches out to STEM faculty from both participating colleges to submit an interest form in which they indicate the research experience they can offer the students. To be considered, the program looks for faculty who have an active research project and who have shown an interest in serving as research mentors to the participating students. Ideally, the program also looks to find faculty members who already have a research team of other students or who can mentor two of the WREP students. Preference is given to such faculty as this places the WREP students in a dynamic environment with other collaborators, possibly even peers in the same research project, thus minimizing the possibility of a student working in isolation.

Much like the summer program, the WREP starts with orientation sessions where students are presented with workshops on responsible and ethical conduct in research, keys to professional resumes and effective personal statements, research literature search in the library, careers and internships in STEM. Icebreakers and other activities are part of the orientation and they are meant to create bonds with the cohort of students with the objective of increasing students' sense of belonging. Finally, the orientation ends with a panel discussion about the research experiences from students who have previously participated in the program.

The Winter Research Experience has two major objectives. The first is to increase the success of Latino students in STEM courses by engaging them in a research experience where they apply knowledge acquired through their completed courses. The second is to increase retention of Latino students in STEM fields by participation in the research experience and by connecting them to a faculty mentor and other students in their major.

## **Methodology**

Both programs utilized a pre- and post-program survey design. The surveys contained demographic variables, variables to aid long-term follow up, and items from validated scales<sup>3</sup> to assess learning gains and aspects of the programs (e.g., evaluation of program and mentors). Pre- and post-program surveys were administered online using Qualtrics software. Web page links for the pre-survey were sent via email by program staff to students prior to the start of either program. Similarly, a link for the post-survey was sent out to students following their participation in the programs (within one day from last day of the program). Responses for all surveys were downloaded and analyzed using SPSS by the evaluator. Datasets for each program were merged across study years for each program. Open-ended responses were read and categorized. The sections below report on the 2013 Winter Research Experience and on two occurrences of the Summer Bridge To The Beach program in 2012 and 2013.

## **Winter Research Experience Results**

A total of 21 students enrolled in the 2013 Winter Research Experience program, the majority were female (66.7% female and 33.3% male). Most of the students reported living in a parent's

home (85.7%) and being first-generation educated (85.7%). Seventeen of the students reported seeking a degree from the College of Natural Sciences and Mathematics (CNSM), two reported the College of Engineering (COE), and two reported both CNSM and COE (e.g., chemical engineering and mathematics). All but one were full-time students.

The majority of students reported that they did not possess any prior research experience (76.2% or 16 students), while three students reported possessing a prior research experience in the summer (14.3%), 1 student reported prior research experience during a previous academic semester (4.8%), and another student reported having prior research experience throughout multiple academic semesters. At pre-program, students reported their future plans that involved post-undergraduate education in a science-related field. Almost all students reported plans for pursuing post-graduate education (95.2%). Specifically, 42.9% reported master degree, 33.3% reported doctoral degree, 19.0% medical degree. At post-program, there were no discernible changes to future plans.

Table 1 displays mean and median for some questions regarding **students' motivation to conduct research**. A series of paired sample t-test were conducted to compare research motivation to conduct research at pre- and post-program. Results indicate that no significant differences were observed in any of the questions, the table shows just a sample of these questions.

Table 1

*Mean responses for motivation to conduct research (N = 21)*

	Pre	Post
	Mean (Median)	Mean (Median)
I want to do research to:		
gain hands-on experience in research	4.8 (5)	4.9 (5)
clarify whether graduate school would be a good choice for me	3.7 (4)	4.0 (4)
clarify whether I wanted to pursue a science research career	3.8 (4)	3.9 (4)
work more closely with a particular faculty member	3.8 (4)	4.2 (4)
get good letters of recommendation	4.3 (5)	4.5 (5)
have a good intellectual challenge	4.6 (5)	4.8 (5)

*Note:* Strongly disagree = 1, Disagree = 2, Neither Disagree or Agree = 3, Agree = 4, Strongly Agree = 5

Similarly, students provided responses to several questions regarding **research and academic goals**. In most cases, there is general agreement with the statements at pre-program and higher levels of agreement are reported at post-program; 17 out of 21 items indicate post-program responses on average were higher than pre-program responses, some of these are highlighted below. Noteworthy are the increases in responses to items about their ability to interpret results, readiness for more demanding research, understanding the research process, and understanding

of career opportunities. Table 2 displays averages for these responses.

Table 2

*Mean responses for research knowledge (N = 21)*

	Pre	Post	
	Mean	Mean	t-test
I have a clear career path	3.8	3.9	0.525
<b>I have skill in interpreting results</b>	<b>3.8</b>	<b>4.2</b>	<b>3.286**</b>
I have tolerance for obstacles faced in the research process	4.1	4.3	1.164
<b>I am ready for more demanding research</b>	<b>3.8</b>	<b>4.3</b>	<b>2.586*</b>
I understand how knowledge is constructed	3.8	4.2	2.007
<b>I understand the research process in my field</b>	<b>3.2</b>	<b>4.2</b>	<b>4.264***</b>
<b>I have the ability to integrate theory and practice</b>	<b>3.6</b>	<b>4.1</b>	<b>2.911**</b>
<b>I understand how scientists work on real problems</b>	<b>3.3</b>	<b>4.1</b>	<b>3.074**</b>
I understand that scientific assertions require supporting evidence	4.5	4.5	0
I have the ability to analyze data and other information	4.4	4.2	0.826
I understand science	4.3	4.3	0.326
<b>I have learned about ethical conduct in my field</b>	<b>4.3</b>	<b>4.8</b>	<b>2.447*</b>
I have learned laboratory techniques	4.3	4.7	2.007
I have an ability to read and understand primary literature	4.1	4.2	0.719
<b>I have skill in how to give an effective oral presentation</b>	<b>3.6</b>	<b>4.2</b>	<b>3.081**</b>
I have skill in science writing	3.2	3.5	1.156
<b>I have self-confidence</b>	<b>4.1</b>	<b>4.4</b>	<b>2.5*</b>
I understand how scientists think	3.8	4.1	1.919
I have the ability to work independently	4.3	4.4	0.623
I am part of a learning community	4.7	4.6	0.271
I have a clear understanding of the career opportunities in science	3.9	4.4	2.007

Note: Strongly disagree = 1, Disagree = 2, Neither Disagree or Agree = 3, Agree = 4, Strongly Agree = 5  
 Note: \*p < .05 \*\* p < .01 \*\*\*p < .001;

**Students' perspectives of the Winter Research Experience.** In terms of the research environment, most students worked with a team of other students. Specifically, 57.1% reported working on projects with other undergraduate students, 28.6% reported working with both undergraduate and graduate students on projects, 9.5% reported working only with graduate students on projects, and 4.8% reported working individually. Students were asked to evaluate their expectations regarding the Winter Research Experience program. Most of the students



(80.9%) reported that the research experience either **met or surpassed their expectations**. Specifically, 38.1% reported that the experience was “much better” than expected, 28.6% reported that the experience was a “little better” than expected, 14.3% reported the experience met their expectations, and lastly 19.0% reported that the experience was “a little worse” than expected. In terms of skills or research-related experiences gained from the program, results varied greatly between students (i.e., from “none” to “a great deal”) with most responses indicating that students gained “a fair amount” of experience in many research-related domains. Table 3 displays averages for these responses.

Table 3

*Mean responses for experiences gained from WRE (N = 21)*

	Post
	Mean (Median)
During your research experience, how MUCH did you:	
Engage in real-world science research	3.9 (4)
Feel like a scientist	3.8 (4)
Think creatively about the project	3.9 (4)
Try out new ideas or procedures on your own	3.5 (4)
Feel responsible for the project	3.6 (4)
Work extra hours because you were excited about the research	3.8 (4)
Interact with scientists from outside your school	1.8 (1)
Feel a part of a scientific community	4.0 (4)

*Note:* None = 1, A Little = 2, Some = 3, A Fair Amount = 4, A Great Deal = 5.

**Students’ evaluation of their supervisor(s).** The majority of students reported that their primary supervisor was a CSULB professor (76.2%). Only 5 students reported that their primary supervisor was a graduate student (23.8%). In terms of performance, more than half reported that their supervisor was an outstanding mentor and teacher (57.1% ), some reported that their supervisor was “above average” (14.3%), some reported that their supervisor was “about average” (9.5%) and some reported that their supervisor was “below average” (14.3%). In addition, students reported on various questions regarding their working relationship with their mentor and time spent engaged in research. Again, responses varied between students with some reporting mostly “fair” to “excellent” experiences. “Poor” ratings (a frequency of 3) were only observed for the last item regarding advice given about careers or graduate school. These results indicate an opportunity to improving the mentoring provided by faculty, increasing the pool of faculty mentors, and to try to determine the links between these responses and the responses provided by students on other surveys. Average responses are presented in Table 4.

Table 4

*Mean responses regarding working relationship with mentor and research engagement (N = 21)*

	Post
	Mean (Median)
My working relationship with my research mentor	3.6 (4)
My working relationship with research group members	3.7 (4)
The amount of time I spent doing meaningful research	3.5 (4)
The amount of time I spent with my research mentor	3.2 (3)
The advice my mentor provided about careers or graduate school	3.2 (4)

*Note:* Poor = 1, Fair = 2, Good = 3, Excellent = 4.

**Implications** regarding the Winter Research Experience. Students reported on various questions regarding their future research plans. Most students (90.5%) reported that the research experience confirmed their interest in their respective fields of study. However, two students strongly disagreed with this statement. In terms of the research program impacting their preparation for advanced coursework or thesis work, the responses varied. Almost half of the students agreed (“strongly agree” and “agree”) with the statement (47.6%), less than half reported “neither agree nor disagree” (47.6%), and few reported disagreement (9.5%). Similarly, almost equal number of students felt that the experience prepared them for graduate school while others did not. Another similar trend was observed for the research experience preparing them for a job. Responses are presented Table 5 for each item.

Table 5

*Mean responses for outcomes related to the research experience (N = 21)*

	Post
	Mean (Median)
Doing research confirmed my interest in my field of study	4.3 (4)
Doing research clarified for me which field of study I want to pursue	3.9 (4)
My research experience has prepared me for advanced coursework or thesis work	3.6 (4)
My research experience has prepared me graduate school	3.3 (3)
My research experience has prepared me for a job	3.5 (3)

*Note:* Strongly disagree = 1, Disagree = 2, Neither Disagree or Agree = 3, Agree = 4, Strongly Agree = 5

Students’ **overall evaluation** of the Winter Research Experience program was assessed. Overall, students had a positive experience. More than half reported the program was

“excellent” (57.1%), “good” (28.6%), and “fair” (14.3%). None of the students selected “poor” as a response. In terms of satisfaction, half of the students reported that they were “very satisfied” (50%), more than one-third reported “mildly satisfied” (35.0%), and less reported feeling “neutral” (15.0%) about the experience. Lastly students were asked if they would choose to have another research experience. All but one student reported that they would likely seek out another research opportunity (95.2%); one student reported “not applicable”.

**Summer Bridge to The Beach program results**

**Demographics.** A total of 19 students enrolled in the Summer Bridge to The Beach program. The majority were male (68.4% male and 31.6% female), most indicated living in a parent’s home (78.9%), and reported being first-generation educated (83.3%). In terms of the college associated with their degree program, 36.8% reported the College of Natural Sciences and Mathematics (CNSM), 57.9% reported the College of Engineering (COE), and 5.3% reported other. Of those that answered (n = 11), all were full-time students.

**Pre- and post-program surveys.** The majority of students reported that they did not possess any prior research experience (78.9%). However, some students reported possessing a prior research experience in the summer (15.8%), and prior research experience throughout one academic semester (5.3%).

At pre-program, students reported their future plans that involved post-undergraduate education in a science-related field. Almost all students reported plans for pursuing post-graduate education (94.4%). Specifically, 55.6% reported master degree, 33.3% reported doctoral degree, 5.6% medical degree, and 5.6% reported not considering post-undergraduate education. At post-program, changes to future plans were observed. Specifically, there was a substantial shift in interest from a master degree (44.4%) towards a doctoral degree (50.0%), while there was no change in interest for medical degree (5.6%).

Table 6 displays mean and median for some of the questions regarding students’ motivation to conduct research. A series of paired sample t-test were conducted to compare research motivation to conduct research at pre- and post-program. While scores tended to be lower at post, results indicate that no significant differences were observed with the exception of exploring interest in science,  $t(18) = -2.535$ ,  $p < .05$  which decreased at post-program.

Table 6

*Mean responses for motivation to conduct research (N = 19)*

	Pre	Post
I want to do research to:	Mean (SD)	Mean (SD)
gain hands-on experience in research	4.9 (0.2)	4.7 (0.6)
clarify whether graduate school would be a good choice for me	4.1 (1.0)	3.9 (0.9)

clarify whether I wanted to pursue a science research career	3.6 (1.4)	3.7 (1.1)
work more closely with a particular faculty member	4.0 (1.2)	3.6 (1.2)
get good letters of recommendation	4.5 (0.6)	4.2 (1.1)
have a good intellectual challenge	4.8 (0.4)	4.7 (0.7)

Note: Strongly disagree = 1, Disagree = 2, Neither Disagree or Agree = 3, Agree = 4, Strongly Agree = 5

Similarly, students provided responses to several questions regarding research and academic goals. In most cases, there is general agreement with the statements at pre-program and higher levels of agreement are reported at post-program (i.e., 12 out of 21 items indicate post-program responses on average were higher than pre-program responses, some of these are highlighted below). Table 7 displays averages for these responses and t-test statistics.

Table 7

*Mean responses for research knowledge (N = 19)*

	Pre	Post	
	Mean	Mean	t-test
I have a clear career path	3.6	3.7	0.271
I have skill in interpreting results	3.9	4.1	1
I have tolerance for obstacles faced in the research process	4.4	4.3	0.697
I am ready for more demanding research	4.0	4.1	0.524
I understand how knowledge is constructed	3.8	4.1	1.564
I understand the research process in my field	3.6	4.0	1.719
I have the ability to integrate theory and practice	3.9	4.2	1.837
<b>I understand how scientists work on real problems</b>	<b>3.5</b>	<b>4.2</b>	<b>2.585*</b>
I understand that scientific assertions require supporting evidence	4.7	4.5	0.9
<b>I have the ability to analyze data and other information</b>	<b>4.4</b>	<b>4.0</b>	<b>2.388*</b>
I understand science	4.1	4.1	0.294
I have learned about ethical conduct in my field	4.3	4.2	0.187
I have learned laboratory techniques	4.1	4.2	0.357
I have an ability to read and understand primary literature	4.1	4.1	0
I have skill in how to give an effective oral presentation	4.0	3.9	0.271
I have skill in science writing	3.7	3.5	0.566
I have self-confidence	4.3	4.2	0.825
I understand how scientists think	3.7	4.1	1.555

I have the ability to work independently	4.6	4.7	0.809
I am part of a learning community	4.2	4.5	1.837
I have a clear understanding of the career opportunities in science	4.0	4.2	1.166

Note: Strongly disagree = 1, Disagree = 2, Neither Disagree or Agree = 3, Agree = 4, Strongly Agree = 5  
Note: \*p < .05

**Students’ perspectives of the Summer Bridge to The Beach program.** Students were asked to evaluate their expectations regarding the program. Most of the students (83.3%) reported that the research experience either met or surpassed their expectations. Specifically, 44.4% reported that the experience was “much better” than expected, 22.2% reported that the experience was a “little better” than expected, 16.7% reported the experience met their expectations, and lastly 16.7% reported that the experience was “a little worse” than expected. In terms of skills or research-related experiences gained from the summer program, experiences varied greatly between students (i.e., from “none” to “a great deal”) with most responses indicating that students gained “a fair amount” of experience in many research-related domains. Table 8 displays responses for these items.

Table 8

*Frequency and percentage of responses to students’ engagement with research (N = 19)*

	None	A Little	Some	A Fair Amount	A Great Deal	Total Responses
Engage in real-world science research	2 (11.8%)	1 (5.9%)	0	6 (35.3%)	8 (47.1%)	17
Feel like a scientist	1 (5.6%)	2 (11.1%)	5 (27.8%)	2 (11.1%)	8 (44.4%)	18
Think creatively about the project	0	1 (5.6%)	0	7 (38.9%)	10 (52.6%)	18
Try out new ideas or procedures on your own	0	1 (5.3%)	2 (10.5%)	7 (36.8%)	9 (47.4%)	19
Feel responsible for the project	0	0	2 (10.5%)	5 (26.3%)	12 (63.2%)	19
Work extra hours because you were excited about the research	2 (10.5%)	1 (5.3%)	3 (15.8%)	6 (31.6%)	(31.6%)	18
Interact with scientists from outside your school	11 (61.1%)	2 (11.1%)	2 (11.1%)	1 (5.6%)	2 (11.1%)	18
Feel a part of a scientific community.	0	4 (22.2%)	2 (11.1%)	3 (16.7%)	9 (50%)	18

Students’ evaluation of their supervisor(s). The majority of students reported that their primary supervisor was a CSULB professor (66.7%). Only 3 students reported that their primary

supervisor was a graduate student (16.7%) and 1 student reported a “postdoc”. In terms of performance, over one-third reported that their supervisor was an outstanding mentor and teacher (36.8%), an equal number reported that their supervisor was “above average” (21.1%) or “about average” (21.1%), some reported that their supervisor was “below average” (15.8%), and 1 reported that their supervisor was “not a good teacher and mentor.” In addition, students reported on various questions regarding their working relationship with their mentor and time spent engaged in research. Again, responses varied; some reported mostly “fair” to “excellent” experiences. “Poor” ratings (a frequency of 3) were only observed for the last item regarding advice given about careers or graduate school. As with the WREP, the program recognizes the critical role of faculty mentors in the experience students receive and steps may need to be taken to provide faculty mentors with best practice mentoring techniques that the “outstanding mentors” use. Average responses are presented in Table 9.

**Table 9**

*Mean responses regarding working relationship with mentor and research engagement (N = 19)*

	Post
	Mean (Median)
My working relationship with my research mentor	3.1 (3)
My working relationship with research group members	3.5 (4)
The amount of time I spent doing meaningful research	3.2 (4)
The amount of time I spent with my research mentor	2.7 (3)
The advice my mentor provided about careers or graduate school	3.1 (3.5)

Note: Poor = 1, Fair = 2, Good = 3, Excellent = 4.

**Implications regarding the Summer Bridge to The Beach.** Students reported on various questions regarding their future research plans. Most students (84.2%) reported that the research experience confirmed their interest in their respective fields of study. However, three (15.8%) students disagreed with this statement. In terms of the research program impacting their preparation for advanced coursework or thesis work, the responses varied. More than half of the students agreed (“strongly agree” and “agree”) with the statement (63.2%), less than one-quarter reported “neither agree nor disagree” (21.1%), and less reported disagreement (15.8%). Almost half of the students felt that the experience prepared them for graduate school (47.3%) while others did not. The majority reported that the research experience prepared them for a job (68.5%). Responses are presented in Table 10 for each item.

Table 10

*Mean responses for outcomes related to the research experience (N = 19)*

	Post
	Mean (Median)
Doing research confirmed my interest in my field of study	3.7 (4)
Doing research clarified for me which field of study I want to pursue	3.5 (4)
My research experience has prepared me for advanced coursework or thesis work	3.8 (4)
My research experience has prepared me graduate school	3.3 (3)
My research experience has prepared me for a job	3.8 (4)
<i>Note: Strongly disagree = 1, Disagree = 2, Neither Disagree or Agree = 3, Agree = 4, Strongly Agree = 5</i>	

**Students' overall evaluation of the Summer Bridge to the Beach program was assessed.** In terms of satisfaction, more than half of the students reported that they were "very satisfied" (68.4%), "mildly satisfied" (5.3%), feeling "neutral" (15.8%) about the experience, and 2 students were mildly dissatisfied (5.3%) or very dissatisfied (5.3%). Lastly students were asked if they would choose to have another research experience. Most students reported they would likely seek out another research opportunity (82.3%) while 3 students reported "unlikely."

## Conclusions

There have now been two successive years of each of the research experience programs. This paper has reported some of the preliminary results from pre and post surveys used to measure the effectiveness of these programs. As is the case with research opportunities, the two research programs rely heavily on the faculty hosting the students to provide a positive experience. As evident from the responses, most of the students do not have prior research experience, yet, their expectations of the program and of a research experience may not be consistent with those of the faculty mentors. While many of the students had a positive experience, more may be needed at the start of each program to recalibrate the expectations of students and of faculty mentors.

While it is still early to draw strong conclusions, there are early signs that the programs make a positive impact on students and faculty mentors. For example, there were gains in (a) the research skills acquired, (b) ability to work independently, (c) understanding how knowledge is constructed, and (d) readiness for more demanding research. There was even an increase in interest in doctoral degrees. Further analysis is needed to determine if these indicators of success are specifically linked to the type of mentoring relationship students had with their faculty mentor and research peers. As these research experience programs continue to be offered, more student participants will provide additional data that can be analyzed. Future analysis needs to link this data with the pre and post participation data on academic performance of the participants.

## Acknowledgements

The CSULB HSI STEM program is supported by a grant from the US Department of Education through the FY 2011 Title III, Part F, Hispanic Serving Institution (HSI) STEM and Articulation Programs (Award No. P031C110151). <http://www2.ed.gov/programs/hsistem/index.html>

## Bibliography

1. Hurtado, S., Newman, C. B., Tran, M.C., & Chang, M. J. (2010). Improving the rate of success for underrepresented racial minorities in STEM fields: Insights from a national project. In S. R. Harper & C. B. Newman (Eds.), *New Direction in Institutional Research*, 148, pp. 5-15, Wiley Periodicals.
2. Bonous-Hammarth, M. Pathways to Success: Affirming Opportunities for Science, Mathematics, and Engineering Majors. *Journal of Negro Education*, 2000, 69(1/2), 92–111.
3. Lopatto D. Survey of Undergraduate Research Experiences (SURE): First Findings. *Cell Biology Education*. 2004;3:270–277
4. Barlow, A.E.L., and Villarejo, M. Making a Difference for Minorities: Evaluation of an Educational Enrichment Program. *Journal of Research in Science Teaching*, 2004, 41(9), 861–881.
5. California Postsecondary Education Commission. 2004. Transfer Pathways: Student Profiles. Sacramento: California Postsecondary Education Commission. From <http://www.cpec.ca.gov/OnLineData/TransferPathway.asp>.
6. Rivas, M. A., Perez, J., Alvarez, C. R., and Solorzano, D. G. 2007. Latina/o Transfer Students Understanding the Critical Role of the Transfer Process in California's Postsecondary Institutions. CSRC Research Report No. 9. Los Angeles: UCLA Chicano Studies Research Center Press.
7. California State University Long Beach. NIH Bridges To The Baccalaureate Program. <http://www.csulb.edu/colleges/cnsm/sas/bridges/>
8. California State University Long Beach. Hispanic Serving Institution STEM website. <http://csulb.edu/programs/hsi-stem/>