Cañada College Division of Science and Technology

CALSTEP Briefs

Issue 4: August, 2013

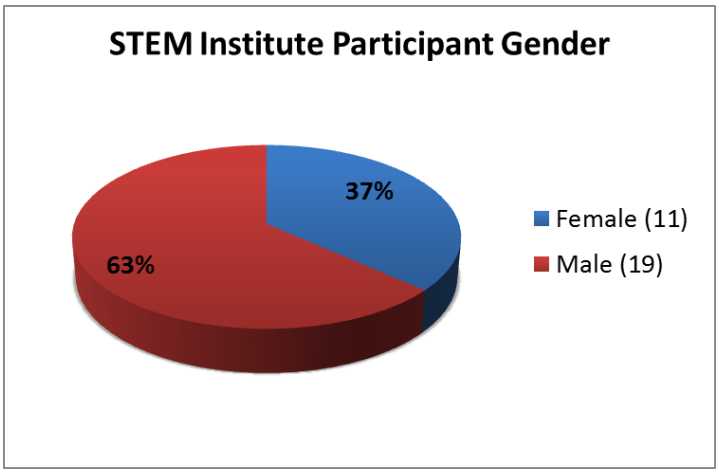
2013 STEM Institute Review

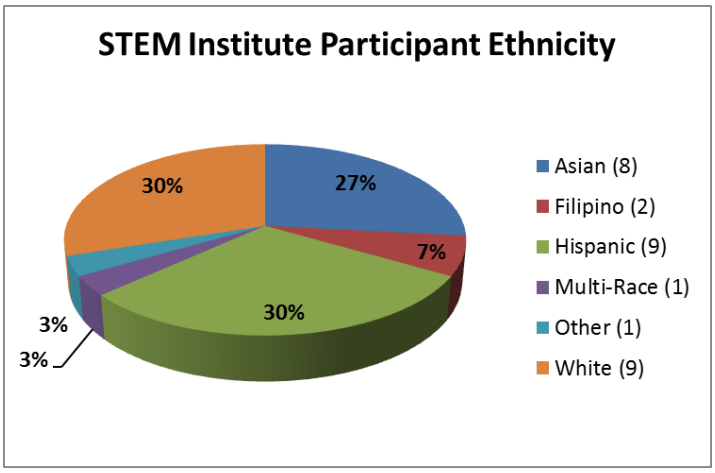
STEM Institute

The 2013 Cañada College STEM Institute was a 3 week program for current high school freshman and sophomores interested in exploring careers in Science, Technology, Engineering and Math (STEM). The program was funded by a United States Department of Education Hispanic Serving Institution Grant with the goal of increasing participant interest in the STEM field. Program activities included hands on projects, classroom/lab instruction, speakers, on campus field trips, and workshops in Chemistry, Computer Science, Earth Science, Engineering and Math. Participants engaged in activities involving individual and group projects, participated in recreational activities, and learned about on campus resources.

Participants

Students were nominated to participate in the program by teachers and counselors in area high schools. From those nominations, thirty students were selected to attend the institute which was held from June 17 to July 3, 2013. The majority of the participants were male (63%), and the overwhelming majority of the participants came from three ethnic groups, Asian (27%), Hispanic (30%), and White (30%).





Participant Perceptions

At the completion of the program students indicated they had increased their appreciation for computer science, chemistry, engineering, and earth science as a result of participating in the STEM Institute (Table 1.1). Participants also indicated that they gained increased knowledge and skills in each of these STEM disciplines as a result of participating in the STEM Institute (Table 1.1).

Table 1.1 - Participant Perceptions.

How much do you agree with the following?	***n***	**Mean**
I gained a greater appreciation for the study of mathematics.	29	3.83
I gained knowledge or skills related to the field of mathematics	29	3.90
I gained a greater appreciation for the study of computer science.	29	3.93
I gained knowledge and skills related to the field of computer science.	29	4.03
I gained a greater appreciation for the study of chemistry.	29	4.03
I gained knowledge and skills related to the field of chemistry.	29	4.24
I gained a greater appreciation for the study of engineering.	29	4.24
I gained knowledge and skills related to the field of engineering.	29	4.31
I gained a greater appreciation for the study of earth science.	29	3.62
I gained knowledge and skills related to the field of earth science.	29	4.00

Participant Satisfaction

At the completion of the program students were asked to indicate their level of satisfaction with a variety of program elements including the instructors, topics, food, staff, activities, and orientation. The results indicate that the participants were satisfied with all of the program elements. The highest mean satisfaction scores were for the instructors (4.41) and staff (4.79). The lowest mean satisfaction scores were for the lunchtime activities (3.79).

Table 1.2 - Participant Satisfaction.

Indicate your level of satisfaction with the following program elements. *5 = Extremely Satisfied - 1= Extremely Dissatisfied*	***n***	**Mean**
Speakers / instructors.	29	4.41
Topics covered in the program.	29	4.07
Quality of the food and refreshments.	29	4.41
Program staff.	29	4.79
Lunchtime activities.	29	3.79
Helpfulness of the orientation.	29	4.07

Table 1.3 - Participant Satisfaction.

	Yes	No
Was attending the STEM Institute beneficial to you?	29	0
Would you recommend participating in the STEM Institute to a friend?	29	0

Self Efficacy Study

One of the objectives of the STEM Institute was to increase participant self-efficacy, the participant's belief in their capability to complete specific tasks or goals. In order to examine the effect participation in the program had on student self efficacy, a self-efficacy instrument* was administered to the participants at the beginning and end of the program. On the first day of the program each participant answered an online survey which included fourteen questions designed to measure initial student self efficacy. The questions required students to indicate their level of agreement (Strongly agree (5), Agree (4), Neutral (3), Disagree (2), Strongly Disagree (1)) with statements related to their ability to be successful in STEM related courses and activities. After the 3 weeks spent exploring the different STEM disciplines, the participants were once again asked to complete an online survey which included the same fourteen questions related to STEM self-efficacy.

** The self efficacy instrument was adapted from the Baldwin Confidence Survey Form designed to measure self efficacy in STEM*

Sample

The sample included the 30 high school freshman and sophomores who participated in the 2013 Cañada College STEM Institute. Twenty-seven students completed both the pre and post-survey.

Data Analysis

The survey responses were exported into the Statistical Package for the Social Sciences (SPSS). A Wilcoxon signed-rank test (a non-parametric statistical test used when comparing repeated measurements on a single sample) was administered to compare the pre and post test responses for each of the fourteen self-efficacy questions.

Findings

The results indicated that:

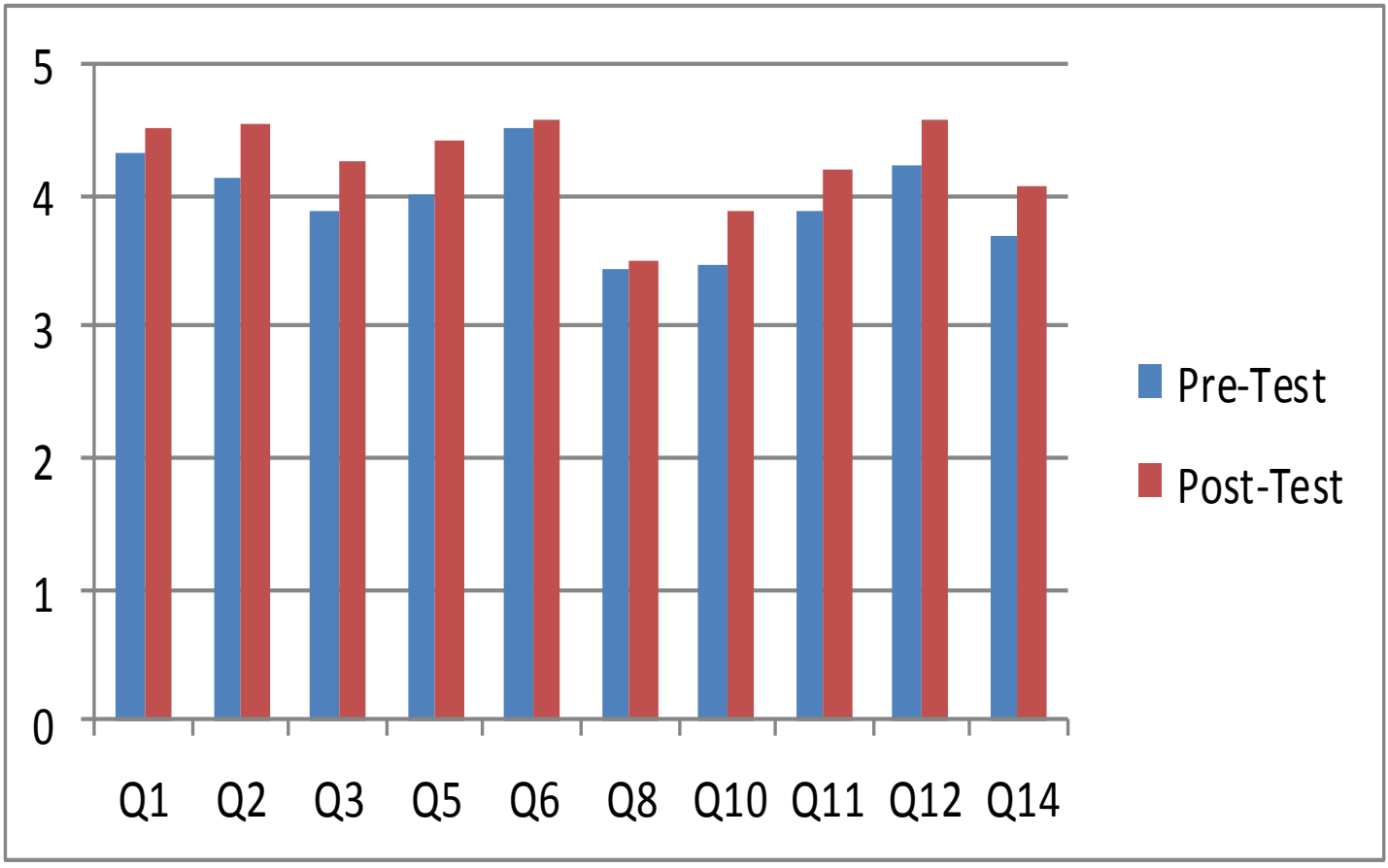
- Initial levels of participant self efficacy which were higher than expected (Table 1.4 & 1.5)
- The participants' mean self efficacy scores improved on 13 of the 14 self-efficacy related questions
- The increase in self efficacy was statistically significant on 6 of the questions. *

** Critical value for statistical significance was .05.*

Ten of the fourteen questions were worded in a manner in which higher scores indicated increased student self-efficacy. The mean score on each of these questions was higher on the students' post-test than their pre -test, suggesting that participation in the program had a positive effect on participant self-efficacy (Table 1.1).

Table 1.4 - STEM Student Self-Efficacy Results (Questions 1, 2, 3, 5, 6, 8, 10, 11, 12, 14)

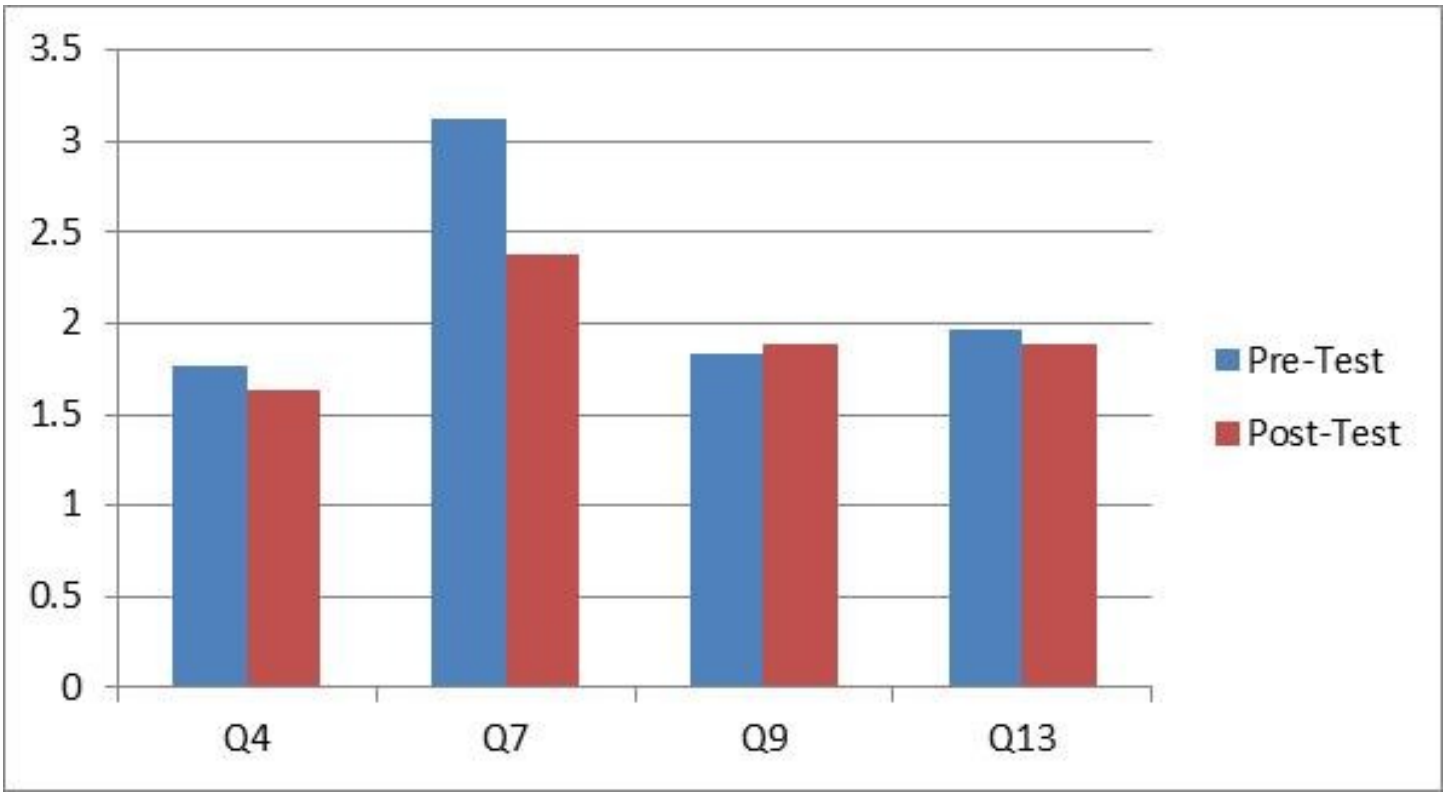
	n	Pre-Test	Post-Test	Change	P-Value
1. I am confident I have the ability to learn the material taught in STEM.	27	4.33	4.52	0.19	0.188
2. I am confident I can do well in STEM.	27	4.15	4.56	0.41	0.004
3. I think I will do as well or better than other students in STEM.	27	3.89	4.26	0.37	0.006
5. I am confident that I can understand the topics taught in STEM.	27	4.00	4.41	0.41	0.011
6. I believe that if I exert enough effort, I will be successful in STEM.	27	4.52	4.59	0.07	0.727
8. Compared with other students, I think I have good study skills.	27	3.44	3.52	0.08	0.591
10. I am confident I can do well on the lecture exams in STEM.	27	3.48	3.89	0.41	0.016
11.I am confident I can do well in the lab work for STEM.	27	3.89	4.19	0.30	0.055
12. I think I will receive a C or better in STEM courses.	27	4.22	4.59	0.37	0.066
14.I am confident that I could explain something learned in this program to another person.	27	3.70	4.07	0.37	0.018



Four of the fourteen questions were worded in a manner in which lower scores indicated increased student self-efficacy. The mean score on three of the four questions was lower on the students' post-test than their pre-test, suggesting that participation in the program had a positive effect on participant self-efficacy (Table 1.2).

Table 1.5 - STEM Student Self-Efficacy Results (Questions 4, 7, 9, 13)

	n	Pre-Test	Post-Test	Change	P-Value
4. I don't think I will be successful in STEM.	25	1.76	1.64	-0.12	0.336
7. I feel like I don't know a lot about STEM compared to other students.	26	3.12	2.38	-0.74	0.004
9. Compared with other students, I don't feel like I'm a good student.	24	1.83	1.88	0.05	1
13. I don't think I will get a good grade in STEM	25	1.96	1.88	-0.08	0.745



Summary

The students indicated that they had gained a greater appreciation for STEM disciplines and increased their knowledge related to STEM as a result of participating in the STEM Institute. All of the students indicated they had benefitted from participating in the STEM Institute and each of the participants indicated they would recommend the program to a friend. The results of the participant self efficacy study suggest that participation in the STEM Institute has a positive effect on student self-efficacy. However, the results also call into question if increasing participant self efficacy is a critical objective as the majority of the participants had high levels of self-efficacy prior to participating in the program.

Recommendations

- An additional direct assessment should be undertaken to describe student progress in meeting the objectives of the STEM Institute. (Faculty have already indicated interest in conducting a direct assessment using the student portfolios developed during the STEM Institute.)
- Participant recruitment strategies should be examined to determine if the current process yields the desired students (Should the program be enrolling students with lower self-efficacy?)

Recognition

Special thanks to Cañada College students **Ulises Castellanos, Kayla Chun**, and **Rene Parra** for their work developing and implementing the STEM Institute Self Efficacy Study.

About CALSTEP

The "California Alliance for the Long-term Strengthening of Transfer Engineering Programs" (CALSTEP) is sponsored by the US Department of Education through the Hispanic-Serving Institution Science, Technology, Engineering, and Mathematics (HSI-STEM) program. The CALSTEP project promotes an understanding and appreciation of STEM careers through outreach activities for middle school, high school, and community college students. It addresses the main barriers to the retention and success of students in Science, Technology, Engineering, and Mathematics (STEM) through a combination of intensive preparation for college-level work, multiple entry points and accelerated pathways for students into STEM education, and previously proven academic support strategies.

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