

## **Board 257: Engineering BRIDGE Program to Enhance Transfer Students' Sense of Belonging**

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My name is Jinsung Cho, an associate professor of Civil Engineering Department in California State Polytechnic University Pomona. I have had more than 20 years in both academia and Civil and Construction Industry. My specialty is the behavior of underground infrastructure, Trenchless and Tunneling Technology, as well as 3D Virtual Construction Design & Management. I am a reviewer or member of several professional organizations, such as ASCE, NASTT, and ASC.

# **Engineering BRIDGE (Bridging Institutions to Decrease Gaps in Engineering Education) Program to enhance transfer students' sense of belonging**

## **Abstract**

The State of California, which has the largest four-year public university system in the United States, does not have an associate degree for transfer (ADT) in Engineering. Therefore, most engineering students who transfer from community colleges do not take lower-division engineering courses and, on average, transfer students must attend two to three additional years of college to obtain a degree at four-year institutions. To identify the gaps in engineering education for transfer students and to increase their success, the research team will focus on a “transfer-ready” curriculum and a faculty learning community. The BRIDGE team, including three partnering institutions, collaborates on identifying the critical success factors (CSFs) for the transfer student’s success, the development of the transfer pathway program, and the Engineering BRIDGE Program to enhance academic preparations for transfer students. This paper summarizes the findings from the Engineering BRIDGE Program during the Summer of 2023 from August 7 - 11, 2023 (five days). A total of 22 incoming transfer students (to Civil Engineering and Mechanical Engineering) participated in this program, assisting in the transition and ensuring academic/career success by enhancing transfer students’ sense of belonging, and addressing course content gaps between institutions. From the analysis of the pre-/post-surveys of the Engineering BRIDGE Program, the program significantly improved—in terms of transfer readiness—students’ conceptual understanding, technical communication, and higher-order cognition.

## **Introduction**

In the U.S., approximately 47% of graduating engineering students received their university degree after transferring from a community college [1]. However, the State of California, which has the largest four-year public university system in the United States, does not have an Associate Degree for Transfer (ADT) in Engineering. Therefore, most engineering students in California who transfer from community colleges do not take lower-division engineering courses and require extra college years after transferring to obtain their degree at a four-year institution. In 2016, the California State University (CSU) System launched the Graduation Initiative (GI) 2025 to raise graduation rates. The CSU GI 2025 set goals to increase the two-year transfer graduation rate to 45.0% and the four-year transfer graduation rate to 85.0% by 2025 across all 23 CSU campuses with allowances for variation across campuses including California State Polytechnic University, Pomona (Cal Poly Pomona, CPP) [2]. Spending more than two years after transfer adds to the financial burden for transfer students, as they must pay additional tuition and expenses.

Because transfer students comprise approximately half of the CPP student population, this project, BRIDGE (Bridging Institutions to Decrease Gaps in Engineering Education, 2023-2026) funded by the National Science Foundation (NSF), focuses on success for engineering transfer students from three partnering institutions: Mt. San Antonio College (Mt. SAC), Citrus College, and Victor Valley College, by establishing mutually beneficial collaborations and applying three elements: recruitment activities, retention activities, and faculty development activities.

### **Planned Major Activities for the BRIDGE Project**

The BRIDGE project plans three primary categories of activities.

#### 1) Recruitment activities

The Transfer Pathway program will be implemented to address the transfer process and produce “transfer-ready” students. If a prospective transfer student completes a list of courses defined by each institution (Mt. SAC, Citrus College, and Victor Valley College), then the prospective transfer student will receive admission bonus points from Cal Poly Pomona.

#### 2) Retention activities

To identify what factors impact the transfer student’s academic success at Cal Poly Pomona, the project will conduct a survey of transfer students. The findings from this survey will be shared with the university for their future implementation. In addition, the Engineering (Summer) BRIDGE Program is planned to enhance the incoming transfer student’s sense of belonging, to prepare their career development (resume writing, interview), and to review the bottleneck course contents (Surveying and Statics).

#### 3) Faculty development activities

To help in developing and offering more lower-division engineering courses at the three partnering institutions, the project hosts the Faculty Learning Community (FLC) with the faculty from Cal Poly Pomona and community colleges. Then, the faculty from Cal Poly Pomona shares teaching materials (lecture notes, assignments, quizzes, and exams) with the other faculty for their reasonable amount of workload to develop and offer lower-division courses.

### **Engineering BRIDGE Program**

The program offers three different activities for the incoming transfer students’ success: 1) to ensure academic success by addressing course content gaps of the bottleneck courses (Surveying and Statics), 2) to enhance the sense of belonging through cohort activities such as activities and

field trip, and 3) to help career development with the industry professionals. Table 1 provides the program schedule.

**Table 1.** Schedule of the Engineering BRIDGE Program

	<b>Mon (8/07)</b>	<b>Tue (8/08)</b>	<b>Wed (8/09)</b>	<b>Thu (8/10)</b>	<b>Fri (8/11)</b>
Morning (9:00 am – 11: 30 am)	Cohort activity	Overview of Project Management	Review of Surveying (Lab)	Review of Statics	Labs Tours (CE/ME)
Afternoon (1:00 pm – 4:00 pm)	Review of Surveying (Lecture)	Peer Mentoring (Current students, faculty)	Review of Statics	Career workshop (resume writing)	Site Tour (Construction/ Manufacturing)

A total of 22 students (13 majoring in civil engineering (CE), three majoring in Construction Engineering and Management (CEM), five majoring in Mechanical Engineering (ME), and one majoring in Industrial and Manufacturing Engineering (IME) at Cal Poly Pomona) participated in the Engineering BRIDGE Program.

### 1) Review of the bottleneck courses

The BRIDGE Project team selected two bottleneck courses (Statics and Surveying) to enhance the academic readiness of incoming transfer students. About 40% of the incoming transfer students (civil engineering or mechanical engineering programs) completed the Statics course from their previous institution. However, prior to taking an advanced course such as Mechanics of Materials, Cal Poly Pomona faculty review the key information from the course so that the transfer students have a similar level of understanding equivalent to first-time freshman students. Also, the Cal Poly Pomona faculty reviewed the surveying course materials because the incoming transfer students need to have experience with cutting-edge surveying equipment. which is not available in most of the community colleges.

### 2) Career development

Since the campus hosts the university-wide career fair in September (within a month of the Fall semester), incoming students need to prepare for the upcoming career fair. The BRIDGE Project invites two industry professionals (Operations Manager and Senior Project Manager) from a construction company and a manufacturing company to share their insights about resumé writing and the interview.

### 3) Cohort activities

In order to enhance the incoming transfer students' sense of belonging, the Engineering BRIDGE Program invited the current students from different competition teams plus the student club board members. Incoming transfer students learned about different extra-curricular activities and joined a team/club if the group aligned with their interest.

Moreover, there were a couple of team-building activities to get to know each other and build relationships using the in-class exercises.

The BRIDGE Team assessed the students' experience through the pre-survey and the post-survey. A total of five categories were assessed: 1) conceptual understanding, 2) technical communication, 3) higher-order cognitive skills, 4) confidence, and 5) satisfaction. There was no registration fee for the Engineering BRIDGE Program. A light breakfast and lunch were provided each day.

## Findings

Some of the activities during the Engineering BRIDGE Program with 21 incoming transfer students are illustrated in Figure 1.



**Figure 1.** Activities during the Engineering BRIDGE Program

Each student assessed their experience/opinions using a 5-point Likert scale: 1) Strongly Disagree, 2) Disagree, 3) Neutral, 4) Agree, and 5) Strongly Agree. The options assigned a point value of 1.0 for Strongly Disagree and 5.0 for Strongly Agree. The analysis of the survey responses are summarized in Table 2.

**Table 2.** Summary of the Pre-/Post-Survey Responses

Category	Questionnaire	Pre-Survey	Post-Survey
Conceptual Understanding	I know the definitions of basic engineering concepts very well.	3.29	4.10
	I feel confident when I interpret graphs/charts related to engineering.	3.06	3.70
	I can link the contents among different engineering concepts and establish the relationships between them.	3.29	4.00
	I am able to comment on presentations made by my classmates in engineering class.	3.18	3.90
	<b>Average</b>	<b>3.20</b>	<b>3.93</b>
Technical Communication	I am able to use what I have learned in engineering classes to discuss with others.	3.47	4.10
	I am able to clearly explain what I have learned to others.	3.29	4.00
	I feel comfortable discussing engineering content with my classmates.	3.35	4.10
	In engineering classes, I can clearly express my own opinions.	3.47	4.20
	<b>Average</b>	<b>3.39</b>	<b>4.10</b>
Higher-order Cognitive Skills	I am able to critically evaluate the solutions of engineering-related issues.	3.24	3.90
	I am able to propose many viable solutions to solve an engineering-related problem.	2.94	3.80
	When I come across an engineering-related problem, I will actively think over it first and devise a strategy to solve it.	3.71	4.10
	I can link my old knowledge with the new learning content.	4.06	4.30
	<b>Average</b>	<b>3.48</b>	<b>4.03</b>
Confidence	How confident are you about your ability to achieve your academic success at CPP?	3.82	4.40
	How confident are you about your ability to handle the process and requirements for transferring to a 4-year college or university?	-	4.00
	<b>Average</b>	<b>3.82</b>	<b>4.20</b>
Satisfaction	Overall, I was satisfied with the BRIDGE program.	-	4.90
	I was satisfied with the peer mentoring support I received through the BRIDGE program.	-	4.70
	I was satisfied with the field trips provided through the summer bridge program.	-	4.80
	<b>Average</b>	-	<b>4.80</b>

From this analysis, the Engineering BRIDGE Program improved the incoming transfer students' academic and career preparations and enhanced their sense of belonging at Cal Poly Pomona. The students also shared their positive feedback, including: 1) The feeling of support and community and 2) The best part was getting to know my possible classmates and learning strategies to succeed.

### **Acknowledgments**

This material is based upon work supported by the National Science Foundation under the Award No. 2225128.

### **Reference**

- [1] J. Sislin, and M. C., Mattis, Enhancing the Community College Pathway to Engineering Careers. Washington, DC: National Academies Press, 2005.
- [2] Cal Poly Pomona (CPP). Cal Poly Pomona's Graduation Rates and Goals, retrieved from the CPP Tableau Dashboard, 2022 [Last accessed: February 19, 2024].