AC 2012-4254: DUAL MODEL SUMMER BRIDGE PROGRAMS: A NEW CONSIDERATION FOR INCREASING RETENTION RATES

Dr. Jeff M. Citty, University of Florida

Jeff Citty, Ed.D., is an Assistant Director of Engineering Student Services at the University of Florida. His scholarly interests include first year student success and student leadership development.

Dr. Angela S. Lindner, University of Florida

Angela Lindner received a B.S. degree in chemistry from the College of Charleston in South Carolina in 1983 and an M.S. degree in chemical engineering from Texas A&M University in 1987. Her master’s thesis work, funded by the Texas Transportation Institute, involved use of phosphogypsum, a byproduct of phosphoric acid production, in road construction, and this work began her environmentally focused career path. She served as a Chemical Engineer at the Office of Mobile Sources of the U.S. Environmental Protection Agency in Ann Arbor, Mich., from 1987-1989 and as a Senior Project Leader in International Regulations at General Motors Corporation in Warren, Mich., from 1989-1991. She subsequently pursued her Ph.D. in civil and environmental engineering at the University of Michigan from 1991-1998, under the mentorship of Dr. Peter Adriaens and Dr. Jeremy Semrau, and her dissertation topic focused on bioremediation and oxidation of polychlorinated biphenyls (PCBs) by methane-oxidizing bacteria. Lindner began her academic career at UF in 1998 in the Department of Environmental Engineering Sciences. Since 1998, she has taught undergraduate- and graduate-level courses in green engineering and sustainability, life cycle assessment, environmental organic chemistry, groundwater restoration, and bioremediation. Her students are currently pursuing research projects in bioremediation and sustainable engineering, both areas in which she is active internationally. She currently serves as the Chair of the Advisory Committee of the Center for Sustainable Engineering, a consortium composed of Carnegie Mellon University, Arizona State University, and University of Texas. Among her many activities in EES, she has served on the Curriculum Committee, as an Undergraduate Advisor in EES since 2000, as Faculty Advisor of Engineers Without Borders-UF, and in a variety of K-12 and undergraduate mentoring roles. In Jan. 2008, she assumed the role of Associate Dean of Student Affairs in the College of Engineering at the University of Florida and continues to serve the College’s approximately 5,600 undergraduate students in this capacity.
Dual Model Summer Bridge Programs: A New Consideration for Increasing Retention Rates

Abstract

Research on engineering undergraduate retention shows that a few programmatic solutions, such as the summer bridge programs that focus primarily on underrepresented populations, can significantly improve college retention rates. Although summer bridge programs are a common solution to engineering colleges’ retention and diversity issues, more initiatives that enroll students of all demographics are needed to combat high engineering student attrition rates. Therefore, the development and institutionalization of retention solutions that can offer a larger population of undergraduate students a more effective solution is the next evolution in contributing to increased engineering retention.

The dual model summer bridge program includes a traditional summer bridge program designed for underrepresented populations and a summer bridge program open to all students. The programs run simultaneously during the summer semester and are both comprised of the same components; however, some differences do exist due to funding issues. The six-week programs are comprised of supplemental instruction in chemistry and calculus, courses on the fundamentals of engineering design, AutoCAD, and Labview and a course designed to foster student success. Additionally, both programs involve assigned peer mentors to assist transitioning incoming students into the engineering student role throughout the students’ first year. Other support provided includes corporate presentations, a final design competition, and a poster presentation.

This paper will discuss the dual model summer bridge program that is currently offered to all entering engineering students at the University of Florida, a large public land grant institution located in the southeast. Additionally, quantitative results of the programs, including improved retention, which is the primary objective of the dual model programs, will be presented. Further, the less tangible benefits of the programs, such as involvement, independence, leadership and community, will be discussed.

Introduction/Background

Retaining engineering students: essential for the engineering profession

In the coming years, the engineering profession and engineering education are unlikely to produce enough engineers in the United States; the U.S. Bureau of Labor Statistics has projected a need for 12,200 more engineering positions over the 10-year period between 2008-2018\textsuperscript{26}, which does not include the replacement of many retiring engineers. The number of engineering bachelor degrees awarded in the U.S is also contributing to this problem. In 2010, the U.S. produced 79,000 new engineering bachelor’s degrees. Undergraduate engineering enrollment in 2010 grew by 5.3\% from 427,503 to 450,685 (a notable improvement from the 1\% growth from 2005-2009\textsuperscript{11}), but weakening interest in studying engineering among graduating high school students lends credence to growing concerns of a decrease in engineering degree production in the future. Compounding this concern, only 50\% of the students entering U.S. universities as
engineering majors complete their engineering degree requirements.\textsuperscript{8,27} Since studies have concluded that no difference exists in academic status but rather by negative perceptions and attitudes between students staying in engineering and students that choose to leave for other majors,\textsuperscript{5} the high student attrition rates cannot be attributed to lack of academic ability.

Loss of students majoring in engineering affects institutions in two primary areas: revenue and loss of human potential represented by student dropouts.\textsuperscript{14, 20, 25} Studies in this area have yielded various initiatives to address the problem.\textsuperscript{2,18,23,26} For example, engineering colleges and employers have partnered to develop programs aimed at improving the retention of historically underrepresented students in engineering. However, new initiatives are still sought to further enhance retention of engineering students, as longitudinal studies have reported that retention has not improved over time.\textsuperscript{4, 15} Studies do suggest significant factors influencing student retention, including, among others, inadequate preparation, high school GPA, SAT Math score, misconceptions about the engineering profession, and classroom dynamics. Students who exit higher education voluntarily before receiving their degree usually leave for one of three reasons: (1) a lack of psychological and social support,\textsuperscript{3} (2) a lack of institutional fit and campus integration,\textsuperscript{24} and (3) financial hardships associated with increases in college tuition and fees.\textsuperscript{19} In spite of current research on retaining engineering students and programmatic solutions, attrition remains stable. Evidence supports that pedagogies of engagement, such as cooperative learning, problem-based learning, student feedback, and supplemental instruction, may enhance student persistence and learning.\textsuperscript{23}

Summer bridge programs that focus primarily on underrepresented populations have shown to improve college retention rates of the target population of students.\textsuperscript{10} Although summer bridge programs are a common solution to engineering college’s retention and diversity issues, little empirical evidence has been reported to aid other institutions in developing effective programs of this kind.\textsuperscript{1,9,10,13,21,22} Most studies offer details on the critical and non-critical factors surrounding retention or models and indicators for retention (e.g., gender, race, high school rank, SAT scores, university cumulative grade point average) and lack programmatic solutions that can be institutionalized.\textsuperscript{12,5,7,6} This study will seek to investigate the factors that contribute to the outcomes of a first-year engineering summer bridge program offered to all students entering engineering, regardless of background characteristics, to determine if it improves student retention.

\textit{History and vision of an inclusive summer bridge program}

The all-inclusive program studied herein was developed as a sister initiative of a freshman bridge program that was started earlier to target underrepresented students in engineering. The original bridge program was created as part of the Southeastern University and College Coalition for Engineering Education (SUCCEED) initiative from the National Science Foundation’s Education Coalitions. The limited population of underrepresented students in the engineering majors and the limited student enrollment of the underrepresented program could not offer a substantial positive effect on retention of the college’s entire engineering student population. Thus, this sister freshman bridge program named the Engineering Freshman Transition Program or EFTP was developed to attract more engineering students to enroll in a bridge program to make a broader impact on first-year retention in the college. This program was introduced in 2003 and repeated in 2004 as a one-week program offered to all incoming engineering freshmen and was designed to offer support to incoming students in calculus, chemistry, design, student
success, and career decisions. Over the following two years, the program was expanded to six weeks, with an additional design component and a total of three academic credits covering all elements of the program. In 2007, the program added three more components (classes in AutoCAD, computer programming, and introduction to engineering) to encompass a full six-credit academic program that has continued through 2010.

The initial and subsequent programs were shaped around the same basic assumptions that formed the basis of the underrepresented program. These assumptions are as follows:

1. Every student accepted into the university/college has the potential to successfully pursue an engineering degree.
2. Students are motivated to succeed and will do so if provided the proper support system.
3. The focus of the design of the program is to enhance, not remediate. Because of stringent admissions requirements at this university, each student has successfully established a basic foundation in math (calculus) and the sciences (chemistry, physics) prior to their admission into the university.
4. The primary stakeholders—the university, the college, faculty, the student’s family, the student, and corporate practitioners—will make the necessary investments to ensure the success and sustainability of the program. Investments into this program include, but are not limited to, financial resources, individual/collaborative time contribution, and recognition that each student’s needs are a priority.

Objectives

Today, the U.S. is placing a large focus on mathematics, science and engineering education, not simply because of their critical importance in creating jobs but also because these are the sectors in which American education is believed to be largely failing, thus affecting this country’s ability to be innovative that, in turn, negatively impacts job creation and our economy. As this program targeting the general engineering student population approaches its tenth year, it serves as a direct response to the growing concerns of U.S. education by striving to increase the number of students majoring in engineering. The primary objective of this paper is to present a detailed description of the administration and operation of a freshman bridge program that is offered to general incoming student population. Furthermore, this paper seeks to compare backgrounds and retention of engineering student participants and non-participants in this program using data taken between 2007-2010 and to conclude, based on these results, effectiveness of delivering such a program to the general student population.

Detailed elements of EFTP

Over the past four years, the all-inclusive bridge program has provided a six-week freshman summer experience for freshmen that introduces them to the engineering through six principal courses that include classes in calculus and chemistry offered at different levels, AutoCAD, computer programming, engineering design, student success, and introduction to engineering. Each student is assigned an upper-division engineering student peer mentor who meets with them during the design class during the summer and on a weekly basis during the fall and spring semesters to provide tailored academic and professional support.
Staffing resources

The success of the dual model freshman bridge programs is dependent on the roles played by the faculty, professional and student staff. To ensure quality and proper execution of the programs, two professional staff members, one for the program targeting underrepresented students and one for the program targeting the general student population, are assigned to administer the programs. Two engineering faculty members are assigned to develop and deliver the AutoCAD (Autodesk, Inc., San Rafael, CA, USA), design, and programming courses. Graduate students are hired to develop and deliver the various levels of calculus and chemistry courses. Finally, one professional staff member is assigned to develop and deliver the student success course.

Under the direction of the program directors, teams of peer mentors are selected during the spring semester prior to the summer program beginning. Peer mentors apply through a web application that includes short essay on skill, attributes, and desire to work as a peer mentor. The current-year peer mentors select approximately 20-25 applicants to interview, and these applicants are interviewed by a panel composed of the program director and the current-year mentors. After selection and position acceptance, all peer mentors are required to attend five sessions conducted by the program director to provide training on various aspects of the program, including the following: history, philosophy, definition of a mentor, parts of the program, design project, computer programming, team building, university academic policies, student success, and goal setting. The trained peer mentors are subsequently expected to participate in the student orientation. Peer mentors are required to meet with their assigned students every day during the design class to facilitate the design project and build a relationship that will extend through the fall and spring terms.

Recruiting & application

The University’s Office of Admissions provides the College of Engineering a spreadsheet of students approximately a week after freshman admission decisions are announced to students in mid-February. All incoming freshmen who have indicated engineering as their major on their application for admission are invited via letter from the Associate Dean of Engineering Student Affairs to participate in either freshman bridge program. Interested students complete an online web application and are sent contract and release forms to compete with their parents and return to the college. The open enrollment nature of this program targeting the general student population is currently in place because demand has yet to exceed capacity limits. The program is currently designed to enroll up to approximately 120-130 students a year; however, enrollment has exceeded 120 students only once in the 2007-2010 time period of this study.

Once accepted, the student is sent a letter of congratulations from the college with details on how to sign up for the freshman bridge program courses during the University’s orientation. Once the student registers for the courses, they are sent a final letter with instructions to attend the freshman bridge program orientation held the weekend before the program begins in the university’s six-week second summer session. At the orientation, students are introduced to the staff, administration, instructors, and their peer mentor, and they are given an overview of the program. Students participating in this program are responsible for paying for six course credits, books and supplies, housing, meals, and any related summer semester expenses since funds to reduce costs from scholarships and donor gifts are currently unavailable. However, the College
of Engineering provides salary support for all instructors and peer mentors and covers the costs of operational expenses for the entire summer portion of the program.

Summer residential program

During the summer session, the participants can choose to live in any residence hall on campus; however, because of the positive effects of co-housing students in the program targeting underrepresented students, efforts are underway to house them all in one residence hall to further encourage a learning community experience. Figure 1 provides a comparison of the characteristics of both summer programs. Once the program begins, the students attend six required courses and the student success seminar throughout the six-week summer semester. Table 1 shows for the summer course schedule for this program. The calculus and chemistry courses are designed in partnership with their faculty from the respective departments at the university with the goal of providing students the opportunity to not only transition to the style, and delivery of college instruction but also to strengthen traditionally weak skills and learn concepts often not included in Advance Placement (AP), International Baccalaureate (IB) and Dual Enrollment (DE) programs. The intention of the calculus and chemistry courses is to prepare the students for these respective courses in which they will enroll in the fall term, achieving the goal of giving the students a genuine experience of the university-level calculus and chemistry class in which they have already placed during the University’s orientation. All students in this program are classified as “undecided engineering” majors regardless of their certainty of major, and the introduction to engineering course, involving a presentation and hands-on activities presented by each department in the college, provides them a better grounding in their final choice of major. The AutoCAD and computer programming classes support the engineering design element of the program, which culminates at the end of the semester with a design poster presentation and competition. The six courses each offer one credit hour that is graded with a letter grade.

Table 1: Daily schedule of the EFTP program targeting the general student population

<table>
<thead>
<tr>
<th>Period</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
</tr>
</thead>
<tbody>
<tr>
<td>1(8:00-9:15)</td>
<td>Chemistry</td>
<td>Chemistry</td>
<td>Chemistry</td>
<td>Chemistry</td>
<td>Chemistry</td>
</tr>
<tr>
<td>2(9:30-10:45)</td>
<td>Calculus</td>
<td>Calculus</td>
<td>Calculus</td>
<td>Calculus</td>
<td>Calculus</td>
</tr>
<tr>
<td>3(11:00-12:15)</td>
<td>Succ. Skills</td>
<td>Comp. Prog.</td>
<td>AutoCAD</td>
<td>Comp. Prog.</td>
<td>AutoCAD</td>
</tr>
<tr>
<td>4(12:30-1:45)</td>
<td>Lunch</td>
<td>Lunch</td>
<td>Lunch</td>
<td>Lunch</td>
<td>Lunch</td>
</tr>
<tr>
<td>5(2:00-3:15)</td>
<td>Design</td>
<td>Design</td>
<td>Design</td>
<td>Design</td>
<td>Design/Speaker</td>
</tr>
<tr>
<td>6(3:30-4:45)</td>
<td>Intro to EG</td>
<td></td>
<td>Intro to EG</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7(5:00-6:15)</td>
<td>Intro to EG</td>
<td></td>
<td>Intro to EG</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Other aspects of the program are grounded on peer mentoring, team-building, networking with industry representatives, and campus resources. As the design class is taking place, the peer mentors work with their assigned teams to facilitate the project and develop a rapport via team-building activities. Additionally, on Friday’s during the design course, engineers from government and corporate organizations give presentations regarding their company, current projects, and internship and employment opportunities. These presentations have included engineers from companies, such as Intel, Neilson, General Electric, Harris Corporation, CH2M Hill, ExxonMobil, and Geosyntec.

The six-week summer component of this program ends with a celebratory brunch. Attended by the students and all of their instructors and peer mentors, this event is a celebration of the hard work and learning that the students have accomplished in the previous six weeks, and the instructors give awards to those students who have distinguished themselves positively through their excellence, hard work, and perseverance. Instructors often also offer direction and wisdom for the upcoming fall semester.

Once the summer semester is completed the participants are required to meet with their peer mentors on a weekly basis throughout the fall and spring semesters. Mentors submit a weekly report on all assigned students to the program director. The weekly reports outline the students’ progress on academics and social and professional integration. If any problems are reported, the student receives additional attention from the peer mentor and program director as needed. Additionally, fall and spring social events are held to reunite all students in the program and discuss registration for the following semester. The program concludes after final exams at the end of the spring semester, and the mentors send their students off to their sophomore year with a firm development goal for the next year.

**Figure 1.** Dual model engineering freshman bridge program

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*Population* | *Models* | *Characteristics of Models*  
--- | --- | ---  
Incoming Beginning Engineering Students | Underrepresented Students SBP | • Focused on underrepresented students  
 | All Students SBP | • Live in a common hall  
 | Traditional Model (Non-participants) | Corporate tours on Friday’s  
 |  | Eat Meals Together  
 |  | Pay $750 for housing, food, tours  
 |  | 1 Credit  
 |  | Open to all engineering students  
 |  | Live anywhere on campus  
 |  | Classes on Friday  
 |  | Eat meals anywhere  
 |  | Pay for housing, food, books, etc.  
 |  | 6 credits  
 |  | Begin classes summer or fall semester
**Fall and spring non-residential programs**

During their first fall semester, the students enroll in the calculus and chemistry course equivalents of those taken during the summer residential component of the program. Additional courses may include general education classes, First Year Florida (a freshmen introductory course), courses to complete a minor, and other introductory courses offered by the College. Weekly peer mentor meetings with assigned students are scheduled at the beginning of each semester. All students must attend and participate in weekly meetings with their assigned peer mentor. Through the weekly meetings, peer mentors write reports on all members of their assigned students and report on their academic, personal and professional development. Reports from the peer mentors are delivered to the program coordinator on a weekly basis. The reports are read for thoroughness and to help peer mentor troubleshoot any potential issues that come up during the weekly meetings. Students who earn a 3.0 or higher GPA after the fall semester have to meet with their mentor only on a monthly basis during the spring semester. All students who earn a 2.99 GPA or below must continue weekly meetings with their peer mentor through the spring semester. A mid-semester community activity is also planned both for the fall and spring semester to encourage the students to continue their relationship with their teams as well as the entire learning community. In addition, students are encouraged to discuss their next semester course plans to foster students enrolling in the same or similar courses.

Students are also prepared to participate in a large career fair in the fall (well-attended by potential employers and hosted by the University’s Career Resource Center) as a means of identifying potential internship opportunities for the summer after their first academic year. Preparation for the career fair involves developing their resume, refreshing their skills in introducing themselves to potential employers, and guiding them through a job interview. The peer mentors lead the students to the career fair and assist in assimilating them into the career fair culture.

During the students’ first spring semester, program requirements are the same as those in the fall. (weekly/monthly peer mentor meetings, attendance at mid-semester activity and attendance at the career fair). As students’ progress further into the semester, they are encouraged to schedule visits with their engineering departmental advisors and faculty to learn more about their specific major of interest and to seek admission into the department if applicable.

**After the program**

Upon completion of the year-long experience, the graduates are always welcome to contribute their knowledge to the following incoming class. Some of the students decide to return and become mentors for the program later in their undergraduate career since these peer mentor positions have become highly regarded by employers. They value the transferable skills sets that are developed such as good interpersonal communication skills. Since being encouraged to become involved in engineering student organizations, several students decide to begin this process during their first year and beyond and often become officers in organizations and/or are offered internships just after their first year due to their design, programming, AutoCAD experience gained in the summer.
Persistence results and discussion

The setting for this study was a four-year public research and doctoral degree-granting institution in the southeast between the 2007-2010 academic school years. This university serves approximately 50,000 graduate and undergraduate students with approximately 6,400 incoming freshman each year. The university has a comprehensive curriculum that includes the liberal arts curriculum as well as science and engineering. The engineering college enrolls approximately 5,000 undergraduate students and 2,710 graduate students with approximately 1,100 incoming freshmen each year.

The data were catalogued in the College of Engineering’s Data Warehouse. Access to the data warehouse was granted to the researcher from the Associate Dean of Student Affairs whose responsibilities includes oversight of the engineering freshman programs facilitated by the Engineering Student Affairs office. Secondary data for this study was provided by the University’s Engineering’s Data Warehouse. This data warehouse utilizes data from the University’s Registrar office, which houses the official records for undergraduate education in a hierarchical database. This database allows interaction through the Conversational Interactive Content Systems known as CICS. Participants were identified through the completion of an online application. The data provided by the University’s Registrar office were used in aggregate form.

Data Analysis

Data analysis for this study was conducted on the freshman bridge program targeting the general engineering incoming freshman student population between 2007-2010. The preliminary analysis included a secondary data analysis with a descriptive analysis and chi-square tests for the student data. The data were analyzed using IBM SPSS 19® statistical software package.

A total of 4,166 students were included in this study. Of the students included in the sample, the freshman bridge program participants represented 9.9% (n=415) of the total population studied, while the non-participating students represented 90.1% (n=3751). Male students consisted of 74.5% (n=3104), while female students represented 25.5% of the sample. White students made up the largest percentage of the race/ethnicity with 65.8% (n=2728), whereas Native American students represented the smallest percentage of race/ethnicity with 0.4% (n=15). The freshmen cohorts in the studied years of 2007-2010 ranged in size from 892 in 2007 to 1163 in 2010, with each year containing 21.4% to 27.9% of the total sample size.

Table 2 displays the results of Chi-Square analyses that were performed to determine any significant differences between the groups based on gender and race. Descriptive statistics for categorical variables were explored on both groups. Both groups had similar gender representation with 77.1% (n=320) male and 22.9% (n=95) female in the participant group, compared to the 74.2% (n=2784) male and 25.8% (n=967) female in the non-participant group. Some notable differences existed between the two groups in the Race category. The participant group had 5.1% Asian students (n=21), compared with the non-participant group with 11.2% Asian students (n=421). Additionally, the participant group possessed 9.0% more white students (71.8%, n=298) than the non-participant group (64.8%, n=2430). Most notable was a significant difference between the two group frequencies existed on race, with $\chi^2 (6, N = 4166) = 26.75, p =
0.000. Regarding gender, no significant difference was found between frequencies of the groups, with $\chi^2(1, N = 4166) = 1.64, p = 0.200$.

**Table 2.** Comparison of participants and non-participants on categorical variables

<table>
<thead>
<tr>
<th></th>
<th>Participants</th>
<th></th>
<th>Non-participants</th>
<th></th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Percentage</td>
<td>Count</td>
<td>Percentage</td>
<td>Count</td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>77.1</td>
<td>320</td>
<td>74.2</td>
<td>2784</td>
<td>0.2</td>
</tr>
<tr>
<td>Female</td>
<td>22.9</td>
<td>95</td>
<td>25.8</td>
<td>967</td>
<td></td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asian</td>
<td>5.1</td>
<td>21</td>
<td>11.2</td>
<td>421</td>
<td>0.000*</td>
</tr>
<tr>
<td>African American</td>
<td>6.5</td>
<td>27</td>
<td>4.4</td>
<td>165</td>
<td></td>
</tr>
<tr>
<td>Hispanic</td>
<td>13.7</td>
<td>57</td>
<td>16.2</td>
<td>607</td>
<td></td>
</tr>
<tr>
<td>American Indian</td>
<td>0.7</td>
<td>3</td>
<td>0.3</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>71.8</td>
<td>298</td>
<td>64.8</td>
<td>2430</td>
<td></td>
</tr>
<tr>
<td>Non-Resident Alien</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unknown</td>
<td>2.2</td>
<td>81</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Mean difference is significant at the $p< 0.000$ significance level

The statistics of the participants and non-participant groups of average age, high school grade point average (HS GPA), SAT Quantitative scores, and first-year-in-college grade point average were also compared (Table 3). The results from the descriptive analysis for these continuous variables indicated that the mean high school GPA for the participant students was 4.07 (SD = 0.35) and the mean high school GPA for the non-participant students was 4.13 (SD = 0.52). The mean SAT Quantitative score for the participant students was 656.46 (SD = 62.95), and the mean SAT Quantitative score for the non-participant students was 682.0 (SD = 63.69). The mean first-year-in-college GPA for the participating students was 3.28 (SD = 0.55), and the mean first-year-in-college GPA for the non-participating students was 3.33 (SD = 0.58).

**Table 3.** Comparison of continuous variables of participants and non-participants

<table>
<thead>
<tr>
<th>Sample Characteristics</th>
<th>Participants</th>
<th></th>
<th>Non-participants</th>
<th></th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>(SD)</td>
<td>Mean</td>
<td>(SD)</td>
<td></td>
</tr>
<tr>
<td>HS GPA</td>
<td>4.07</td>
<td>0.354</td>
<td>4.13</td>
<td>0.523</td>
<td>0.012*</td>
</tr>
<tr>
<td>SAT Quantitative</td>
<td>656.46</td>
<td>62.95</td>
<td>682</td>
<td>63.69</td>
<td>0.000*</td>
</tr>
<tr>
<td>First-Year-in-College GPA</td>
<td>3.28</td>
<td>0.552</td>
<td>3.33</td>
<td>0.581</td>
<td>0.120</td>
</tr>
</tbody>
</table>

Examining frequency data on students that were retained as engineering majors after completing their first year in engineering showed a difference between the program participants and non-participants groups. Students who completed the freshman bridge program retained at 88% ($n = 365$) while non-participants retained at 84.1% ($n = 3154$). A chi-square test of independence was performed to examine the relationship between the two student groups (participants and non-
The relationship between these variables was significant, $\chi^2(1, N=4164) = 4.17, p=0.04$. Participants were more likely to be retained than non-participants students (Table 4).

Table 4. Frequency of retention of engineering students after first year

<table>
<thead>
<tr>
<th>Student Classification</th>
<th>Frequency</th>
<th>Percentage</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participants</td>
<td>365</td>
<td>88</td>
<td>0.04*</td>
</tr>
<tr>
<td>Non-participants</td>
<td>3154</td>
<td>84.1</td>
<td></td>
</tr>
</tbody>
</table>

Conclusions

The results presented here provide evidence of the success of the EFTP program that targets the general population of incoming freshmen engineering students. Previous results of many underrepresented engineering freshman programs have already proven significant results, and now these data support the addition of bridge programs such as described herein to further increase overall engineering retention numbers. Here, this student population participating in EFTP from 2007-2010 had a relative similar demographic as in the non-participant pool. The male and female gender ratios were similar and not significantly different. Additionally, with the exception of the Asian students, all other races were represented proportionally. With respect to high school GPA, SAT quantitative scores, and first-year-in-college GPA, the non-participants have a significantly higher high school GPA and SAT quantitative score, but a similar first-year-in-college GPA as the participants.

Despite the participants of the freshman bridge program targeting the general student population having lower average high school GPA, lower SAT quantitative scores, and similar first-year-in-college GPA values, these students exhibited a higher first-year retention than students who did not participate the EFTP program. Put another way, the EFTP program enrolls less-prepared students as measured by these well-accepted performance standards and retains them at significantly higher rates than the non-participants. Alongside the already positive results of the underrepresented engineering freshman bridge programs, the EFTP program targeting the general student population has provided positive results in retention and thus supports the dual engineering summer bridge program model.

References


