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## **AC 2011-915: SUMMER BRIDGE PROGRAM: A JUMPSTART FOR ENGINEERING STUDENTS**

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# **Summer Bridge Program: A Jumpstart for Engineering Students**

## *Introduction*

The mission of the Summer Bridge (SB) program is to support entering students in making a successful transition into the life and community of the university. The intensive two week SB program, developed as an additional support for incoming, first year students, provides a high-impact, high-touch experience to bridge the academic gap between high school and college. Since the inception of the program, students participating in Bridge have been retained and graduate at a higher rate than students who do not participate in the program. Although the program is marketed to first generation, low income, and underrepresented students, campus wide participant GPAs continue to be statistically higher and DFW rates remain statistically lower than the general student population.

This paper will explore the success of the SB program as well as share information about the unique teaching methodology and innovative practices used during the program to specifically retain engineering students. It will present quantitative and qualitative data that demonstrate the various reasons for success of the program and show evidence of the program as a best practice for first year engineering programs. Survey data of recent SB participants who are engineering majors will show the importance of specific activities on the students' academic lives both during the freshman year and beyond. GPA data and engineering retention rates will be examined, comparing SB participants to other engineering majors and the campus in general.

## *Background*

Indiana University-Purdue University Indianapolis (IUPUI) is an urban college campus. Although IUPUI boasts enrollment from 122 countries around the world and all 50 states, most students come to IUPUI from within the state of Indiana and more than 60% are first generation college students.<sup>3</sup> IUPUI has traditionally been known as a commuter campus, but the demographic is rapidly changing. With a total undergraduate enrollment of close to 23,000, most students attend IUPUI on a full-time basis. A staggering number of IUPUI students work a significant amount of time, with some campus estimates showing that close to 70% of IUPUI students work 30 hours a week.<sup>3</sup> The average age of incoming students has also quickly dropped so that currently 90% of first time, full time students are 19 and under.

Because of many of the factors above, our campus has prioritized developing first year initiatives intended to improve the experience for incoming students as well as to improve retention rates for the campus as a whole. Without question, retention is a complex issue, impacted in part by the following variables: pre-college factors and preparation, background characteristics, students' intentions, students' expectations, students' needs, students' financial issues, institutional factors, and external environmental factors.<sup>5</sup>

There are two student populations that are especially critical in regards to retention at IUPUI: first generation students and underrepresented students. While a clear-cut definition of first generation is not always evident, first generation students are generally the first in their family to pursue a postsecondary education. Research has shown that first generation students receive less college preparation, perceive less support, and feel a lower sense of belonging than students attending college who are not first generation.<sup>7</sup>

### *The Summer Bridge Program Background*

At IUPUI the Summer Bridge program grew out of the learning community (LC) program which has been ingrained in the university since the mid-1990s. Learning communities were developed to address several components of the retention issue, including student intentions, student needs, and institutional factors. Over time, participation in a LC has become one of the main factors at IUPUI related to academic success.<sup>5</sup> LCs are required for all first semester students. The main focus of the LC is to give students the skills to be successful in a college environment. Students report numerous benefits received from enrollment in a LC. Most notably, they report the following<sup>5</sup>:

1. Making connections with other students, peer mentors, faculty, and advisors,
2. Academic advising (e.g., knowledgeable, available when needed assistance),
3. Experiencing environment that promotes and respects diversity,
4. Becoming familiar with campus and academic support resources,
5. Deciding on a major or future career,
6. Adjusting to college.

The Summer Bridge (SB) program is a specific type of LC intended to bridge the gap between high school and college. The intensive 2 week SB program, developed as an additional support for incoming, first year students, provides a high-impact, high-touch experience to students in a major specific class. All engineering majors enroll in the same section and explore engineering-specific curriculum as well as issues more generally related to college success. The stated mission of the SB program is to support entering students in making a successful transition into the life and community of our university.<sup>10</sup> Since the inception of the program, students participating in Bridge have been retained and graduate at a higher rate than students who do not participate in the program.

Summer Bridge programs have traditionally been a response by institutions of higher education to provide additional support for low socioeconomic status students and those in underrepresented groups.<sup>6</sup> This is due in part to various studies completed that demonstrate positive indicators for success and retentions of these populations in connection with a Bridge experience.<sup>1</sup> However, IUPUI bucks the trend by enrolling a mixture of students who participate by choice as well as students who are from these targeted backgrounds.

Summer Bridge programs have been shown to improve overall retention when compared to a control group even when the program is specifically geared toward low socioeconomic status students and underrepresented populations.<sup>9</sup> As stated previously, IUPUI still allows general enrollment in the Summer Bridge program. Although the program continues to reserve part of the bridge program for first generation and low income students, GPAs are also continually statistically higher and DFW rates remain statistically lower than the general student population.

The SB program was established to help entering students achieve the following learning goals or objectives<sup>10</sup>:

1. Develop a comprehensive perspective on higher education,
2. Experience a safe and supportive learning environment,
3. Develop communication skills,
4. Develop critical thinking skills,
5. Develop mathematics skills,
6. Understand and use information technology,
7. Develop life skills to support academic goals,
8. Understand and use university resources,
9. Develop understanding of requirements for academic majors.

### *SB Program History*

Summer Bridge started at IUPUI in the summer of 2001 with under 20 participants, consisting of traditional age students who lived within driving range of the university, in addition to being conditionally admitted to the university based on previous poor academic experience.<sup>10</sup> Even though participants demonstrated poor academic performance in high school, by the end of the first semester following the bridge program, half of the participants had a 3.0 GPA or higher on a 4.0 grading system, and a quarter of the total participants achieved a 3.5 GPA or higher.<sup>10</sup>

Although the program has grown tremendously since 2001, it continues to have the following characteristics: free for student participants; limited to 25 students per section; sponsored in coordination with University College (the gateway unit for new students at IUPUI); linked to a first-year seminar in the fall semester; and taught by an instructional team, consisting of a faculty member, an academic advisor, a librarian, and a student mentor. By summer 2010, close to 500 students were served by SB. The School of Engineering and Technology noticed the success of the SB program and offered the first Engineering section of Bridge in summer of 2007. Engineering and Technology has continued to offer the engineering program every summer since then, expanding its offerings in 2008 to add a section focused on technology majors and then again in 2010 to add a section focused on educating minority groups in the Science Technology, Engineering, and Mathematics (STEM) disciplines. The SB program meets

during the two weeks prior to the beginning of the official academic year, giving the students in the program a head start over other new college students taking a traditional LC.

### *Target Population and Recruitment*

The SB program strategically targets specific groups of students for participation, including first generation students, low-income students, and underrepresented populations. Over the course of the program, many efforts have been attempted to increase enrollment for these hard to attract student populations. A scholarship called the First Generation Scholarship was offered in 2006 which attracted and allowed greater numbers of first generation students to participate. Later, in order to increase the number of participants from student populations that traditionally have the greatest academic risk factors, the bridge program worked with other offices on campus to provide funding as an incentive to encourage 21<sup>st</sup> Century Scholars to participate in the SB program. 21<sup>st</sup> Century Scholars are identified early, between 6<sup>th</sup> and 8<sup>th</sup> grade, as coming from low- to moderate-income families. As long as they fulfill the eligibility requirements, 21<sup>st</sup> Century Scholars receive a scholarship from the state of Indiana that covers full undergraduate tuition. Thus, this particular group can be identified upon entrance to any Indiana institution of higher education and gives a marker for low-income status. Both scholarship strategies ultimately helped to increase the numbers of first generation and underrepresented students but did not increase enrollment to target numbers. Personal contact and additional funding packages have been offered to those students to encourage their participation. Although the program administrators have never been satisfied with minority participation numbers, the percentage of students from under-represented populations has closely mirrored the percentage of those students in the freshman class.<sup>10</sup>

As part of “making connections,” the SB program also provides a chance for students to create a network at IUPUI since bridge consists of an instructional team involved that includes a faculty member, academic advisor, librarian, and peer mentor. Each part of the instructional team acts as an expert in their area during the two weeks of bridge and also into the semester. Tinto explains the importance of student engagement and networking on campus, “The frequency and quality of contact with faculty, staff, and other students have repeatedly been shown to be independent predictors of student persistence.”<sup>8</sup>

The establishment of a LC like the SB program also acknowledged the importance of structured classroom engagement as a contributor toward student retention. This important shift also admitted realistically that many times a classroom is the only place on campus where students can be engaged.<sup>8</sup> The bridge program aims to get students involved from the beginning, before their official college career even begins. At a campus like IUPUI, where many students commute to school, in addition to having work and family commitments, the academic classroom is the one guaranteed prolonged contact point with students.

## *The Engineering Bridge*

The School of Engineering and Technology has hosted an Engineering section during the SB program since 2007, but does not have extensive data for the first year. Like all SB classes offered at Indiana University-Purdue University Indianapolis, the Engineering section meets during the two weeks prior to the beginning of the fall semester. It is only offered for new students entering the university in the fall with full time enrollment. The curriculum of the Engineering section of the SB program consists of three primary topic areas: 1) college survival skills, 2) orientation to campus resources, and 3) introduction to the field of engineering. While each year's schedule changes slightly, many components remain the same. A sample schedule which is representative of the activities of the SBP every year is included in Appendix A.

*College survival skills.* During the SBP, the Engineering students are exposed to a number of survival skills. Students participate in a discussion of reasons to attend college, how college is different than high school, study skills, time management skills, goal setting, and other necessary skills. Each year, a panel of upper-class engineering students speak with the SB students to share the wisdom of their experience. They are guided to develop a meaningful and cohesive academic plan for their college career. Students are also asked to understand their strengths and weakness through a review of personality profiles and learning styles.

*Orientation to campus resources.* Over the course of the program, students are introduced to various resources on campus that are designed to help them succeed. Especially vital to engineering students is the Math Assistance Center and the Writing Center. Each Center works with the students throughout Bridge to get ready for fall classes by brushing up their skills in these areas. Bridge structures the experiences in a classroom setting to simulate a college class. This exposure also allows these resource offices to introduce themselves to these incoming students. In addition to these two offices, students are exposed to many different offices on campus during a campus scavenger hunt, in which students familiarize themselves with campus with a list of offices, a camera, and a mission to photograph their visit to each location. Finally a session on Critical Inquiry/Critical Reading is included during the program in which students learn how to read college level scholarly articles. Additional components are included as time permits, including connections with other bridge sections and a "Big, Scary Lecture," given by a Biology faculty member to introduce students to the large lecture setting they may have in several introductory courses.

*Introduction to the field of engineering.* During the course of the Bridge program, the students learn about the field of engineering in a variety of ways. Through traditional lecture and discussion, students learn about the history of engineering, receive an introduction to the different disciplines, and study the idea and process of engineering design. Students are also asked to give a very short presentation about an engineering field, invention, gadget, or famous engineer. This One Minute Engineer presentation is designed to give students an opportunity to show what they are interested in and to get used to speaking in front of a class. Students each

year are given a design project and a research paper. The design project has always been a group project to enforce the importance of teamwork in engineering and give students a chance to work in groups. Topics of the design project have been unique each year, with topics ranging from designing a racing team’s garage, to designing a “green” home system, to designing a solution to cleaning up the BP oil spill. The research paper has been a group paper based on the design project, except for 2010 when the paper was changed to a different topic and made an individual paper which was related to engineering careers. On the last day of the two week SB students give a presentation surrounding their design project giving details, sketches, and concepts to the other students in the class. In addition, the SB program engineering students also participate in a Pumpkin Drop project during the fall semester just as the traditional engineering LCs students do. Students complete the Pumpkin Drop project in a team as well.

The summer bridge program is followed into the first semester with five class meetings throughout the fall semester. Continued contact with the students allows the instructional team to continue to serve students as they face the challenges of adjusting to college life. It also allows continued development of each cohort and a chance for students to reflect on their college experience with each other.

*The Engineering Bridge Survey*

To gauge the importance of the different activities during the Engineering section of the SB program, students that attended this section in 2008, 2009, and 2010 were given a survey to show which activities during the Bridge program were the most important to them. The full survey is included in Appendix B. Students were asked to rate the importance of 22 different activities. In each case the students were asked these questions at least several months after the program itself, once they had some distance and perspective. The 2008 students were asked to complete the survey during the fall semester of 2009. The 2009 and 2010 students were asked to complete the survey at the end of their first semester in school. A total number of 43 students responded to the survey out of a total possible of 75, giving a response rate of 57%. A statistical analysis of each academic year was conducted to see if there was a statistical difference. There was no difference between any of years for any of the items on the survey at the  $p=0.05$  confidence level. Student responses were then combined together and simple averages were taken. A score of 5 was assigned to items that students identified as Very Important, 4 to items students identified as important, 3 to items students identified as Neutral, 2 to items students identified as not important, and 1 to items students identified as not important at all. Table 1 below shows a summary of the average ratings reported by the Engineering Bridge students.

<b><i>Table 1: Average Ratings of Engineering Bridge Students(2008-2010) of the Importance of Activities of the Bridge Program</i></b>	
<i>Activity</i>	<i>Average Rating</i>
Giving a Presentation	4.53

Contact with other students in my major or career area	4.53
Working in Teams	4.49
Engineering Design	4.49
Time Management	4.47
Presentation Skills Session	4.44
Study Skills	4.44
Contact with instructional team	4.42
Differences between High School and College	4.37
Contact with peer mentor	4.37
Group Design Project	4.28
Pumpkin Drop	4.12
Career Services Presentation	4.07
One Minute Engineer	4.07
Schedule Tour	4.07
IUPUI Scavenger Hunt	3.86
Myers Briggs Personality Profile	3.86
Math Sessions	3.84
Personal Development Plan	3.81
Critical Inquiry session	3.67
Writing Sessions	3.60
Library Sessions	3.53

The most important topics that students identified in this survey were: 1) Giving a presentation (4.53), 2) Contact with other students in my major or career area (4.53), 3) Working in teams (4.48), 4) Engineering design (4.48), 5) Time management (4.47).

The least important items identified by the students in the survey were: 1) Library sessions (3.53), 2) Writing sessions (3.60), 3) Critical Inquiry session (3.67), 4) Personal Development Plan (3.81), 5) Math sessions (3.83). It is important to note that the lowest rated session in the survey was rated at 3.83, just below the rating of “Important”.

Interestingly, engineering design was rated highly in the list, while both the Pumpkin Drop project and the SB design project were rated somewhere in the middle of the pack, meaning that students found the knowledge of design important, but the practice of the design not as important. This could be attributed to the depth of the project due to the short two week duration of the SB program. Perhaps a longer term design project which extends into the fall semester might further engage the students and find the design experiences more worthwhile.

In addition to the Likert scale questions reported above, students were asked two open ended questions to delve deeper into their thoughts on the SB program. Responses are detailed below.



When asked to comment on the items they found important the students expanded on some of their previous answers. 11 of the students responded that they found meeting new people at the most important part of Bridge. Four of the students thought that the introduction to the field of engineering was the most important part of the program. One student's response is fairly representative of this group of responses:

One of the most valuable things I did during bridge was meeting all the people. Also learning more about what it really means to be an engineer. It was very valuable to me because it is harder to live in a school setting like this not knowing anyone, and telling us what is really entailed with being an engineer helps people decide if it is for sure what they want to do.

Three students believe that the "most valuable part would be the project presentations. Everyone worked as a group." Two students found the time management exercises most helpful. One said "The time management was the most important to me. You can still use it today to help you." 15 of the students stated that they found that Bridge was most valuable because it familiarized them with college and the campus itself. One student stated, "I thought Bridge was helpful because once classes were started I wasn't lost like other Freshmen were."

By far, meeting new people and becoming familiar with campus were the most frequently reported aspects of Bridge that students saw as important to them. This tells us that these Engineering students were just like other First Year students in that they felt anxious about beginning college.

Students were finally asked about their overall impression of the Bridge program, if it was an overall valuable experience, and why. The answers were unanimously positive toward the program. Some representative statements about the program are:

"[At] first I was mad that I had to go to school two weeks early but looking back I really enjoyed it and thought it was very helpful."

"I liked the Bridge program very much and think it should be required of more students that apply. It helped me make friends, learn about the campus, understand what is required, and helped me map out the campus and what was available."

"The bridge program was great with meeting new people and getting to know the school more. I thought it was going to be a waste of time but I was wrong."

"It was a fun way of getting acclimated to college."

*Retention and the Engineering Bridge Program*

The SB program in general has shown a great ability to retain its students at a higher level than the student body as a whole. A review of enrollment revealed that one year retention rates in engineering majors vary wildly between the two years studied. In 2008, only 36% of the students in the Engineering section of SB were still engineering majors a year later. In 2009, that number was 78.6%. The reasons for this particular difference are unclear with the data presented. It is possible that changes in the recruitment of students and the requirements of certain scholarships for recipient students to attend SBP in 2008 affected this outcome. What we do know is that each group is still attending college at a similar rate as illustrated in Figure 2.

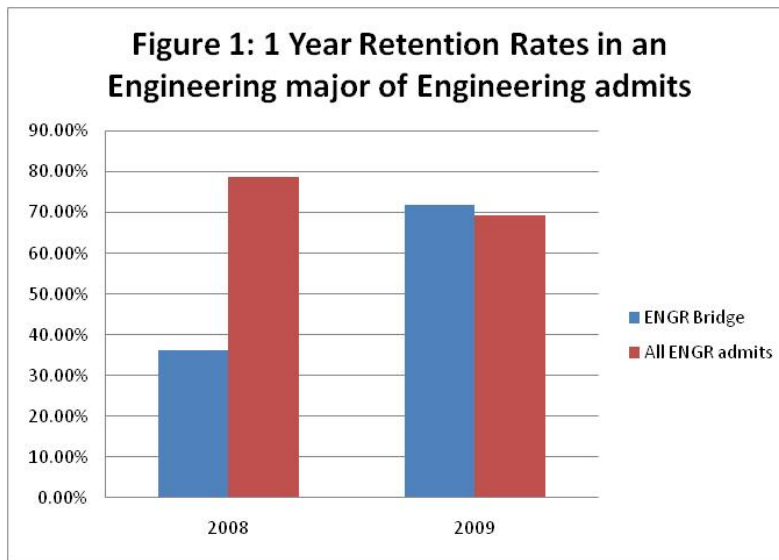
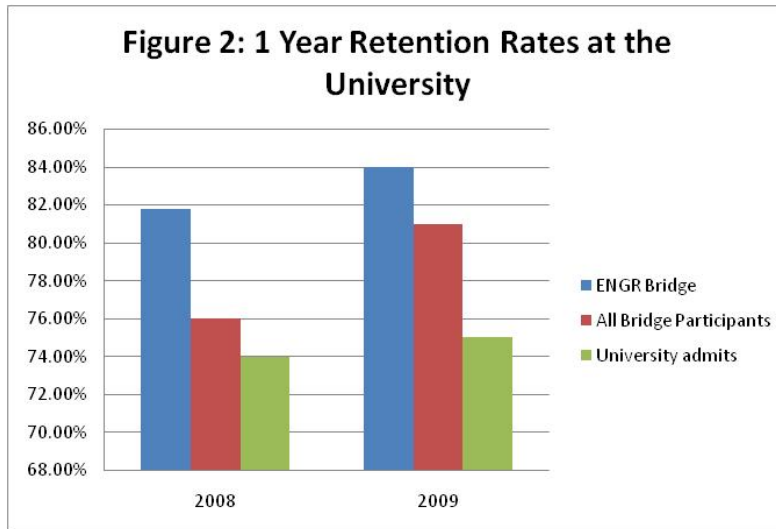
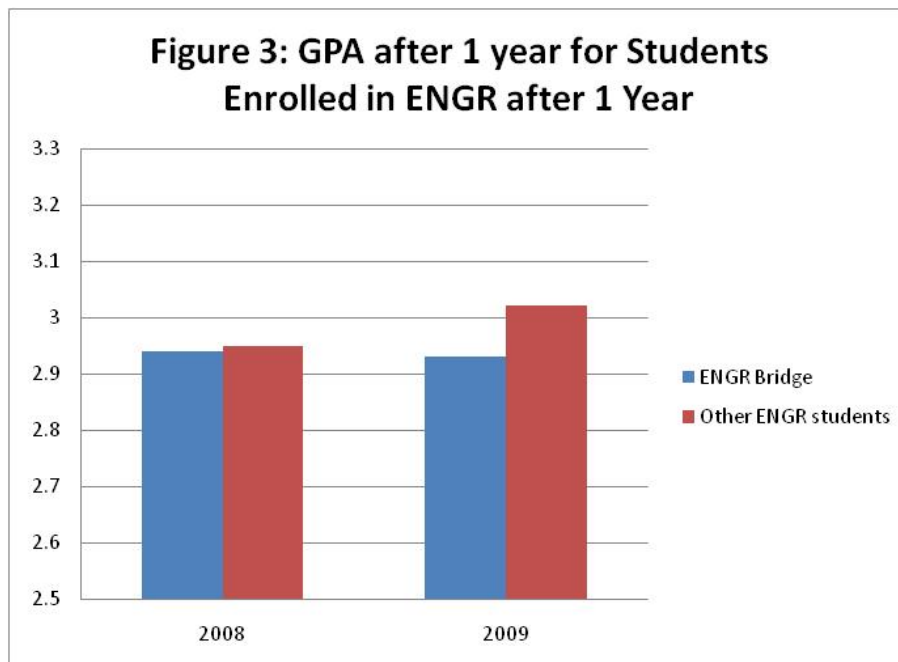


Figure 2 below shows the retention rate of students at the university itself. The 2008 and 2009 Engineering Bridge student retention are 81.8% and 84.0% respectively. In both cases, the Engineering Bridge rates are higher than that of Bridge students in general. Both of those sets of retention rates are higher than that of the campus as a whole.



In summary, these two years show similar trends in the retention of Engineering SB participants in relation to other SB participants and the university as a whole. The same cannot be said for the students' retention as engineering majors a year after starting college. Time will tell if either of these years are an anomaly or if other intervening factors are more important.

A review of Grade Point Average (GPA) of Engineering Bridge students and other engineering students shows no difference either. As can be seen in Figure 3 below, there is little to no difference between the GPAs of Bridge students and those not enrolled in Bridge.



As Engle and Tinto<sup>2</sup> suggested, one might expect retention rates and GPAs of the students targeted for Bridge to be lower than that of their peers not attending Bridge, since first generation, low income, and students from underrepresented populations tend to be retained at a lower rate and generally have lower GPAs than their peers. This has not been the case with the Engineering section of Bridge. In fact, these students are retained in college at a rate similar to their engineering peers and those Bridge students that stay in engineering have similar GPAs after one year to the engineering students who did not attend bridge.

### *Limitations and Further Study*

Because of the short time that the Engineering section of the SB program has been running, limited data exists on long-term persistence of these students in engineering or in college in general. This short period of time also presents a challenge in generalizing our findings because of the small number of students that have experienced the program so far. Future studies should be conducted to determine whether these students are able to graduate at a greater rate, at what rate they attend graduate school, or to determine even longer-term career outcomes.

Additionally, since recruitment for Bridge changed over the years of our study, it could have had a major impact on the retention of students, most notably, the large unexplained change in retention between 2008 and 2009. While the campus was still pushing recruitment for underrepresented populations, the scholarship requirement changed between the two years, possibly explaining the difference. This study would need more information to be able to explain the differences in retention.

Within the current study, several factors such as ethnic background, math ability, SAT scores, and number of hours worked outside of school were not examined and could shed a significant amount of light on the SB program and the Engineering section in particular. Future study should focus on some of these issues to determine their influence on the participants and restructure the program to make it stronger.

### *Conclusion*

The SB program has succeeded in its mission of preparing students for their first semester of college and has given students a solid introduction to their major. Data shows that students are retained at similar rates and have similar GPAs as their counterparts who do not participate in the SBP even though the targeted background of these students suggest that each should be lower. Students acknowledged that they felt a closer connection to campus as a result of participating in the program and had more confidence in their ability to maneuver the campus environment than if they had not attended the program at all. Students who attended the Engineering Bridge program have a generally very high opinion of the program.

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## Appendix A

### Sample Schedule

#### Monday, 1<sup>st</sup> week

9:00-9:15am	Bridge Kickoff	All Bridge Sections
9:25-10:25am	Icebreakers and Introduction to course	
	Review Syllabus	
10:35-11:35am	Difference Between High School and College	
11:45-12:30am	Lunch(Campus Center)	
12:40-1:40pm	Technology available on campus	
1:50-2:50pm	Campus Resources	
3:00-4:00pm	Engineering Student Panel	
	Introduction to Research/Design project	

#### Tuesday 1<sup>st</sup> week

9:00-9:15am	Icebreakers/Team Building
9:25-10:25am	Writing Session I
10:35-11:35am	Personal Development Plan(Introduction)
11:45-12:30am	Lunch
12:40-1:40pm	What is Engineering?
1:50-2:50pm	Library Session I- Using Online DB's
3:00-4:00pm	IUPUI Scavenger Hunt

#### Wednesday 1<sup>st</sup> week

9:00-9:15am	Icebreakers/Team Building
9:25-11:35am	Engineering Lab tours (or Field Trip)

11:45-12:30am Lunch(Campus Center)  
12:40-1:40pm Math Session I  
1:50-2:50pm Work on projects  
3:00-4:00pm Engineering Design Process

Thursday 1<sup>st</sup> week

9:00-9:15am Icebreakers/Team Building  
9:25-10:25am Library Session I  
10:35-11:35am Writing Session II  
11:45-12:30am Lunch – sponsored by the Dean’s office  
with other Eng and Tech sections  
12:40-1:40pm Work on projects  
1:50-2:50pm Presentation Skills  
3:00-4:00pm Math Session II

Monday 2<sup>nd</sup> week

9:00-9:15am Icebreakers/Team Building  
9:25-10:25am Writing Session I II  
10:35-11:35am Work on projects  
11:45-12:30am Lunch  
12:40-1:40pm Math Session III  
1:50-2:50pm College- Level reading/Critical Inquiry  
3:00-4:00pm Myers Briggs Type Indicator

Tuesday 2<sup>nd</sup> week

9:00-9:15am Icebreakers/Team Building  
9:25-10:25am Math Session IV

10:35-11:35am Time Management in College  
11:45-12:30am Lunch  
12:40-1:40pm RISE, Principals of Undergraduate Learning, and  
Accreditation  
1:50-2:50pm Work on projects  
3:00-4:00pm Team Work

Wednesday 2<sup>nd</sup> week

9:00-9:15am Icebreakers/Team Building  
9:25-10:25am Unequal Resources(Diversity session)  
10:35-11:35am Work on projects  
11:45-12:30am Lunch  
12:40-1:40pm Academic Integrity and the Student Code of Conduct  
1:50-2:50pm Work on projects  
3:00-4:00pm Learning Styles and Study Skills

Thursday 2<sup>nd</sup> week

9:00-9:15am Icebreakers/Team Building  
9:25-10:25am Schedule Tour(find your classrooms)  
10:35-11:35am Math Session V  
11:45-12:30am Lunch  
12:40-2:15pm Design presentations  
2:15-2:50pm Closure/Wrap Up, Evaluations  
3:00-4:00pm Bridge Closing Convocation All Bridge Sections



## Appendix B

### Bridge Survey

Please rank the following topics covered in Bridge or activities during Bridge as to their importance to you since the program has concluded:

5: Very Important; 4: Important; 3: Neutral; 2: Unimportant; 1: Very Unimportant

	Very Important	Important	Neutral	Unimportant	Very Unimportant
Differences between High School and College	5	4	3	2	1
Library Sessions	5	4	3	2	1
IUPUI Scavenger Hunt	5	4	3	2	1
Myers Briggs Personality Profile	5	4	3	2	1
Working in Teams	5	4	3	2	1
Engineering Design	5	4	3	2	1
Presentation Skills Session	5	4	3	2	1
Giving a Presentation	5	4	3	2	1
One Minute Engineer	5	4	3	2	1
Study Skills	5	4	3	2	1
Time Management	5	4	3	2	1
Schedule Tour	5	4	3	2	1
Writing Sessions	5	4	3	2	1
Math Sessions	5	4	3	2	1
Critical Inquiry session	5	4	3	2	1
Personal Development Plan	5	4	3	2	1
Career Services Presentation	5	4	3	2	1
Pumpkin Drop	5	4	3	2	1
Group Design Project	5	4	3	2	1
Contact with instructional team	5	4	3	2	1
Presence of a student mentor	5	4	3	2	1
Contact with other students in my major or career area	5	4	3	2	1

Please comment below on what you thought was the most valuable part of the Bridge Program? Why was it so valuable to you?

What is your overall impression of the Bridge program now that some time has passed? Was it a valuable experience to you? Why?

### Demographics

Gender: Male    Female

Major: \_\_\_\_\_

Year attended Bridge:    2008    2009    2010