AC 2012-4474: A PRE-ENGINEERING SUMMER PROGRAM WITH EMPHASIS ON INCLUSION, DIVERSITY, AND INSPIRATION

Dr. Lelli Van Den Einde, University of California, San Diego

Lelli Van Den Einde is a tenure-track lecturer at UC, San Diego, and focuses mostly on undergraduate education in mechanics and design courses. Her past research was in the seismic design of bridge systems, but she is currently focused on assessing and improving engineering education pedagogy through technology. She has been the Faculty Advisor for UC, San Diego's Society of Civil and Structural Engineers (SCSE), a student chapter of the American Society of Civil Engineers, for the past two years. Additionally, Van Den Einde is also the Faculty Advisor for the ASCE Concrete Canoe competition team. She teaches a two-quarter technical elective course, which integrates not just the technical components of the concrete canoe project, but vital project management skills. Professionally, Van Den Einde is a member of ASCE and is currently the Secretary and Treasurer for the San Diego Earthquake Engineering Research Institute (EERI) chapter. Van Den Einde has her heart in the students' interests.

Mr. Terrance R. Mayes, University of California, San Diego

Terrance Mayes serves as Director, Student Life and Diversity, for the University of California, San Diego, Jacobs School of Engineering. In this role he founded, alongside the school's diversity advisory council, the IDEA Student Center, which promotes inclusion, diversity, excellence, and advancement amongst Jacobs School students, staff, and faculty. A central goal of the center is to increase the enrollment and retention of historically underrepresented minority and female students within the school of engineering. Mayes plays a vital role in ensuring that the Jacobs School develops and maintains a more diverse and inclusive student and faculty population. Prior to accepting his current leadership position, Mayes served as the Director of Student Affairs and Alumni Relations for the Jacob School's Department of Electrical and Computer Engineering. In that role, he oversaw the academic and career advising for the largest graduate program on the UC, San Diego, campus. He was also responsible for leading the undergraduate advising unit and the department's engagement with industry and alumni. In 2010, Mayes was honored by the Urban League of San Diego County with one of the inaugural "Forty Under 40" awards. The award introduces young leaders whom are playing critical roles in the community and professional arenas within San Diego County. Mayes, a native of Fresno, Calif., holds a B.A. degree in communications from California State University, Fresno, and a M.S. degree in organizational leadership from National University in La Jolla, Calif.. He is currently pursuing a doctorate in educational leadership with the UC, San Diego/CSU, San Marcos joint doctoral program.

Dr. Nathan Delson, University of California, San Diego

Nathan Delson's interests include mechatronics, biomedical devices, human-machine interfaces, and engineering education. He isCo-founder and Past President of Coactive Drive Corp., which develops novel actuators and control methods for use in force feedback human interfaces. Medical device projects include an instrumented mannequin and laryngoscope for expert skill acquisition and airway intubation training. He received his undergraduate degree in mechanical engineering from the University of California, San Diego, and then went on to get a doctorate in mechanical engineering from the Massachusetts Institute of Technology in 1994. He was a lecturer and Director of the Design Studio at Yale University for four years, and then returned to his alma matter, UC, San Diego, in 1999. He is now a tenured lecturer and Director of the Design Center in the Department of Mechanical and Aerospace Engineering. He teaches hands-on design courses, including an introductory design class, a mechatronics class, and a capstone design class. His interests in design education include increasing student motivation, teamwork, and integration of theory into design projects.

A Pre-Engineering Summer Program with Emphasis on Inclusion, Diversity, and Inspiration

Abstract

In 2010, the University of California, San Diego (UCSD) conducted self-examination in order to assess the climate, level of satisfaction and retention of their undergraduate students. Results of this assessment led to the creation of a student center to promote inclusion, diversity, excellence, and advancement across the Jacobs School of Engineering. During the summer of 2011 the center implemented its inaugural residential pre-engineering program (IDEA PrEP). The program's participants included 22 pre-freshman students all of whom were from historically underrepresented groups in engineering and/or first-generation to attend college. Funding constraints on the summer program required a tradeoff between academic preparation vs. motivational and social aspects. The Jacobs School decided to emphasize the motivational and social aspects while introducing students to existing academic resources on campus.

The goals of the program were to a) foster a sense of community b) build awareness of campus programs and resources, c) provide tools to aid in the transition from high school to college, and d) inspire students by exposing them to opportunities in engineering. Activities during the four-day program were designed to address these goals and included: social and team building activities, academic-themed workshops, and an introduction to campus academic resources. This paper summarizes the results of a pre- and post-survey designed to assess whether the program met its goals. Noteworthy survey results include a 50% difference in the students' awareness of campus resources, a 28% difference in feeling a sense of community with UCSD, a 20% increase in understanding what an engineer does and a 14% increase in preference for seeking assistance from others. First quarter GPA data for the students participating in the program was compared to those that did not participate. Underrepresented minorities who participated had a 10% increase in GPA, and students who were 1st generation in higher education had a 4% increase in GPA.

1 Introduction

The retention of historically underrepresented minority (URM) students in science, technology, engineering and math (STEM) fields is a significant challenge. These include students of African-American, Hispanic or Latino American, and Native American backgrounds. In engineering, only 39% of URM students whom enter as freshman are retained to graduation and receive an engineering degree. This is compared to 63% of all students who enter engineering programs and graduate in engineering [1]. President Obama's Council of Advisors for Science and Technology has recently argued for an intensified focus on science and engineering across the country, in order to remain competitive with other nations [2].

Academic institutions, working to address the STEM challenge, have found "summer bridge" programs to be a successful intervention tool in supporting the transition from high school into the highly competitive engineering field for URM students [3]. Bridge programs typically occur the summer leading into the students first year of college. Many academic institutions coordinate bridge programs each summer with the common goals of building community

amongst the cohort of URM students, integrating them into the larger community, and introducing them to resources available to support their academic, personal and professional development [3].

2 The Creation of an Engineering Diversity Center

In June 2010, the University of California, San Diego (UCSD) Jacobs School of Engineering held a faculty retreat to address issues of diversity, equity and inclusion. As a result of this retreat, a school of engineering Diversity Advisory Committee (DAC) was formed consisting of more than 40 students, faculty, staff and industry partners, all of whom volunteered. The committee was charged with providing strategic advice on the development of school-wide diversity, climate initiatives and resources. The DAC subsequently conducted an informal focus group assessment, which revealed the following:

1. The underrepresented minority student groups did not identify with being part of a larger, supportive community.
2. Many students, URM students in particular, felt that their level of preparedness coming out of high school and/or community college was insufficient for Jacobs School of Engineering's rigorous programs.
3. Campus academic enrichment and resources tailored towards engineering students and those students in the physical sciences were lacking.

As a result of these findings, the DAC outlined several initiatives to improve UCSD's culture of inclusion, excellence, and respect in order to affect the climate, level of satisfaction and retention of their undergraduate students. The most comprehensive effort resulted in the creation of the IDEA Student Center whose mission is to promote ***I***nclusion, ***D***iversity, ***E***xcellence, and ***A***dvancement across the School of Engineering. The center developed a suite of comprehensive programs with a focus on outreach, recruitment, retention, and graduation (refer to Figure 1).

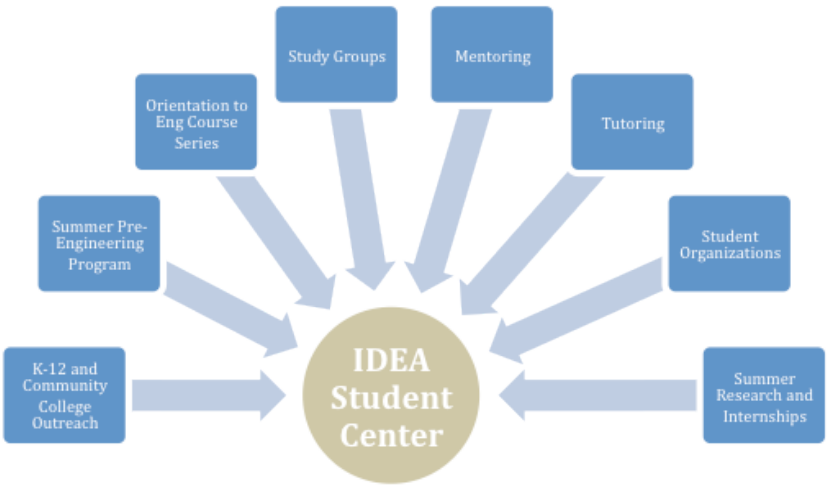

Figure 1: IDEA Center Comprehensive Programs

3 Summer Pre-Engineering Program (PrEP)

3.1 Program goals

During the summer of 2011, the IDEA Student Center piloted the "Summer Pre-Engineering Program (PrEP)" as part of its comprehensive URM and disadvantaged student retention strategy. The four-day residential program goals were to: a) foster a sense of community b) build awareness of campus programs and resources, c) provide tools to aid in the transition from high school to college, and d) inspire students by exposing them to opportunities in engineering.

3.2 Participant selection

Participants selected to participate in Summer PrEP were named "IDEA Scholars" in an effort to boost their self-efficacy. PrEP was marketed primarily to students from historically underrepresented backgrounds and/or first-generation to attend college. Each candidate was required to submit an application to be reviewed by the IDEA Student Center's faculty advisory committee. The application consisted of three short essay questions: *1) Why would you like to become an IDEA Scholar? 2) Why did you choose to major in engineering? Give examples of past experiences that may have led to your decision to become an engineer. 3) Describe how your cultural background and experiences will enhance the Jacobs School climate of diversity and inclusion.*

89 students applied to the program and 22 were selected to participate without any fee. Selected participants consisted of 11 female and 11 male incoming students. All of the participants came from traditionally underrepresented backgrounds and/or were first-generation to attend college. The participants had an average high school grade point average of 4.09 compared to a 4.06 average of all 89 students that applied. The average SAT Math score was 607 for participants and 613 for all applicants. While grade point average and SAT Math score were displayed on the applications, the review committee only took into consideration content from the three required short essays.

3.3 Program structure

Activities during the four-day residential program included, *academic support workshops*, *community building activities*, *engineering inspiration activities*, and an *introduction to campus resources*. The program began with separate orientations for the student participants and their parents. The student orientation focused on providing the 22 IDEA Scholars with an opportunity to meet and begin to build relationships with one another. The parent orientation included a presentation from UCSD's "Parent and Family Programs" office who discussed how the parents can support their sons and daughters through their college experience. The two groups joined together after the orientations for a targeted tour of the campus.

Engineering faculty members, department staff and students facilitated the academic support workshops. The workshops included the following topics:

Workshop 1: Successfully Adapting to College
Workshop 2: Creativity in Engineering

Workshop 3: How Engineering Students Learn
Workshop 4: Engineering Department and Major Overviews
Workshop 5: Engineering Student Panel on Successful Transition to College

Community building and bonding activities included a hiking excursion, a tour of the city and cultural museums, a networking reception with industry members, a beach BBQ and nightly team building activities in the residence halls. The scholars also participated in an engineering design competition in partner teams.

4 Assessment Methods

The techniques and procedures used to analyze the success of the summer PrEP program were based on a mixed method approach, where qualitative and quantitative assessment strategies were used concurrently. The strategy of quantitative inquiry used in this assessment included pre- and post-surveys [5], and first quarter GPA data collected for the 22 IDEA scholars, which were compared with a number of different comparison groups and is discussed further in the results section. In addition to the evaluation of free response questions from the surveys, qualitative case-study observations of the program were made.

5 Results

5.1 Surveys

Pre- and post-surveys were conducted of the 22 students using 16 standardized questions based on a 5 point Likert scale in order to assess the program goals. The results from the pre- and post-surveys and the percent difference between them are depicted in Table 1:

Additionally, the program educated the students about the common challenges first year students face in effectively managing the various aspects of their personal life such as interactions with family, friends and outside workload. Question 4 clearly demonstrated that the students did not entirely consider the various “distractions” that would compete for their time such as the social aspects of college life (6.94% decrease).

A final program goal was to expose the students to opportunities in engineering. After the program, students had a better sense of what an engineer does during their education and as a career (20% increase for Question 7), and almost all students plan to join an engineering student organization while at the university (4.35% increase for Question 16).

Questions 11, 12, 14, and 15 focused on assessing student confidence in their individual ability to succeed as an engineer at the university level. Students started at a lower level of confidence in their current study habits or routines but saw a 6.45% increase between surveys. However, it was interesting that despite already starting at a very high level of student confidence in being able to succeed and graduate from the school of engineering, there was still a significant increase in student confidence between the pre- and post-surveys (7.14% for Question 12, 2.17% for Question 14). More interesting are the results from Question 14, which targeted whether students were certain they “wanted” to graduate in engineering. Most of the students at

the start of the program were certain they were in the right major (engineering), but they still saw a 2.08% increase in this response after participating in the program.

Table 1: Survey Results and Comparisons

	Statement	Pre-Survey AVG*	Post-Survey AVG*	Difference (%)
1	I know other students in my major and feel part of the academic learning community at the University.	3.5	4.5	28.6%
2	I am aware of campus resources such as the Math lab, computer lab in my department, etc.	2.6	3.9	50%
3	I am aware of resources within the school of engineering such as tutoring, mentoring, etc.	3.8	4.5	18.4%
4	I effectively manage the various aspects of my personal life such as interactions with my family and friends, and outside workload.	4.3	4.0	-6.98%
5	I recognize the importance of goal setting and I have clear academic goals.	4.3	4.7	9.30%
6	I would give myself an A+ on the amount of time and energy I devote to my studies.	4.0	4.0	--
7	I feel I know what an engineer does.	3.5	4.2	20%
8	Studying in a group is better than studying by myself.	3.8	3.9	2.63%
9	I need to spend more time studying than I currently do.	3.9	4.1	5.13%
10	I prefer studying/working alone.	3.4	3.3	- 2.94%
11	I am confident about my current study habits or routine.	3.1	3.3	6.45%
12	I am confident that I will succeed in engineering study.	4.2	4.5	7.14%
13	I prefer to solve difficulties on my own, without seeking help from others.	2.9	2.5	-13.8%
14	I am certain that I want to graduate in engineering.	4.8	4.9	2.08%
15	I am certain that I will be able to graduate in engineering.	4.6	4.7	2.17%
16	I plan to join a student engineering organization.	4.6	4.8	4.35%

Results from questions targeting the five academic preparation workshops that were presented over the course of the four-day program are summarized in Table 2.

Question 1, which targeted the assessment of whether the program fostered a sense of community among the 22 participants, showed a 28.6% increase between the pre- and post-surveys demonstrating the success of the program in attaining this goal and ensuring that the new students feel part of the school of engineering academic learning community.

Questions 2 and 3 were designed to reflect on whether the program was successful in relating information about campus programs and building student awareness of the resources available to them such as math and computer laboratories, tutoring, and mentoring services in order to ensure success at the university level. These questions saw a significant increase between the pre-and post-surveys (50% and 18.4%, respectively).

Questions 5, 6, 8, 9, 10, and 13 were focused on evaluating whether the program was successful in conveying tools that would aid the students in the transition from high school to college. Specifically, this focused on tips to improve success in coursework such as encouraging students to set goals, work in teams, and devote ample time to their studies. Results from these questions demonstrated that the program was successful in conveying to the students that goal setting was important (9.3% increase for Question 5), and that they need to work together in teams (2.63% increase for Question 8) rather than trying to study alone (2.94% decrease for Question 10) and (13.8% decrease for Question 13). Although most students gave themselves an A+ for how much time they devote to studying (0% change between the two surveys for Question 6), the students realized they need to spend more time studying than they currently do (5.93% increase for Question 9).

Table 2: Academic Preparation Workshop Results

Workshop	Topic	Average Rating
1	Managing expectation vs. reality and the adjustment to college life	4.36
2	Effective note taking and class preparation	4.45
3	Learning styles and study skills	4.64
4	Meeting with the Undergraduate Advisors	4.41
5	Student panel	4.23

All academic preparation workshops were extremely well received achieving above 4.2 out of a 5-point Likert scale. Students particularly enjoyed Workshop 3, which enthusiastically focused on educating students on good study habits such has asking questions and working with others, as well as how students process information that professors lecture about and how they can improve their learning environment.

Although the participant pool was small, the results and trends (increases or decreases) from pre- to post-survey clearly demonstrate attainment of the PrEP program goals.

5.2 Qualitative Responses from Students

In addition to the quantitative results from the surveys, quotations from the 22 IDEA scholars supporting accomplishment of the summer PrEP goals are summarized below:

5.2.1 Goal: Foster a sense of community

"I realized in this discussion that students who don't surround themselves with other engineer majors will want to facilitate their lives and might not feel the same extra push; making study groups with students who are in the same area of study is a better idea because we are all seeking to accomplish the same 4-year plan and will be likely to be in more classes together. Also, one has to find partners who are willing to work with each other and not against each other. Success in college requires union and comprehension."

"The program was simply amazing. I really liked how all the students and RA's connected so easily. And all the classes and trips to the parks were very educational. The team building exercises made it easy for me to talk to people and become more social."

"This experience was amazing!!! The undergrad advisers were incredible and easy to feel comfortable with. They were always very helpful. The programs were all very interesting and

there was no time we were not out and about doing productive work/ community building activities. I got to know many new friends I will surely stay in touch with and I am sure the memories we made together will forever tie us together as the first IDEA scholars. I loved getting to know UCSD, San Diego, and going to the beach. Memorable 4 days. No negatives."

5.2.2 Goal: Build awareness of campus programs and resources

"It was nice hearing from students that were highly involved in student organizations that also majored in engineering. It was most helpful to me when I realized that studying abroad would be very difficult to fit into my summer plans. This discouraged me for a little bit, but I've found this realization to be somewhat enlightening. I've been searching the internet for summer research opportunities outside of California and have found a way to travel while still concentrating on research and my studies. This is in turn has also helped me to look up the websites of the Triton Engineering Student Council and Society of Women Engineers among other student organizations."

"The IDEA Scholar Program has really showed me many wonderful resources that I probably would have never found on my own. This guidance we had for that period of four days was very interacting and has made me feel more comfortable with my major and my plans on finding an internship soon. I am very appreciative of all the hard work and commitment all the R.A's and IDEA Center staff put into making this one very useful and memorable experience. I am even more excited about starting school now. Thank you!!!"

5.2.3 Goal: Provide tools to aid in the transition from high school to college

"It was interesting to get Dr. [xx] advise on how to manage my classes and make some time to relax and enjoy college life."

"The workshop gave me a different perspective of how I viewed information presented to me, which is helpful because I can now think in several views. I enjoyed listening to the benefits of Cornell notes and how efficient they can be during lecture. However, listening to the professor is just as important. I enjoyed the interaction Professor [xx] had with us during the presentation."

"Professor [xx] effectively conveyed the importance of studying in groups and sleep when it comes to learning, both of which I often do not include in my study habits. I also learned to talk to my Professors if I have any questions."

"I had so many questions answered with my department advisor and am no longer confused on how my 4-year plan is arranged. I am glad to have been able to sit in a conference room with my advisor along with the other Bioengineer IDEA Scholars because we were able to help each other and clarify questions. I felt so reassured with how I planned out my first quarter classes and am confident that I will excel very well."

5.2.4 Goal: Inspire students by exposing them to opportunities in engineering.

"The explanation of how different fields of engineering overlap helped to ease my mind in that I now know that even though I have interests in other fields other than my major, there are opportunities to extend and learn within those different depths of study."

"This workshop was informative. I learned about new things that I did not think about before as an engineering major and about the research that we would work on in our departments. The

comment that caught my attention was that at UCSD, we are here to create new ideas, not regurgitate what is printed in a textbook that we need for class."

"The reception held to meet companies was very informative. I learned what different companies look for in an intern and what types of engineers they hire to work for them. I know this program will be a huge benefit towards my education at UCSD because I can already tell that I will receive the support and opportunities offered to continue towards my success in education."

5.3 Quantitative GPA Comparisons

The grade point averages (GPA) for the 22 IDEA Scholars who participated in the Summer PrEP program were collected following their first quarter at the university (Fall 2011) and were compared with GPA data from non-IDEA Scholars based on several classifications such as whether the IDEA Scholar is a first generation college student or part of the Underrepresented Minority (URM) group. Results from these GPA comparisons are summarized in Table 3.

Table 3: GPA Comparisons

Student Group	# of Students in Sample	1st Quarter GPA	Difference (%)
All IDEA Scholars	22	3.08	1.96%
Non-IDEA Scholars	768	3.02	
1st generation IDEA Scholar	14	2.97	6.96%
1st generation non-IDEA Scholar	230	2.77	
Non-1st generation IDEA Scholar	8	3.25	4.08%
Non-1st generation non-IDEA Scholar	538	3.12	
URM IDEA Scholar	15	2.93	10.03%
URM non-IDEA Scholar	152	2.65	
Non-URM IDEA Scholar	7	3.39	8.61%
Non-URM non-IDEA Scholar	616	3.11	

This data demonstrates that the IDEA Scholars performed better, academically, than their comparison groups in each metric used. While the IDEA Scholars performed only slightly better than the freshman student population as a whole, the difference is significantly greater when examining the URM and First-Generation GPA results at 10.03% and 4.08% respectively. Strong performance during the IDEA Scholar's first quarter seem to indicate that the Summer PrEP was successful in accomplishing its goal to 'aid in the transition from high school to college'. It is too soon to determine whether or not the current design of the Summer PrEP program, with a focus on social and motivational components, will improve retention statistics across the Jacobs School of Engineering. It does, however, look promising. As mentioned, after the first quarter, IDEA Scholars had an average GPA of 3.08. The school's internal assessment shown in Table 4 reflects that students that receive between a 2.9 and 3.1 GPA during their first year have a 47% chance of receiving their degree in engineering. If the URM IDEA Scholars maintain this GPA through the end of their first year the likelihood of them graduating in engineering increases by up to 14% from the current rate of 33%.

Table 4: URM Graduation in Engineering New Freshman Admits 2001-2006

First Year GPA	# Engineering Degree	% Engineering Degree
Less than 2.0	3/50	6%
2.0-2.2	16/87	18%
2.3-2.5	31/91	34%
2.6-2.8	47/98	48%
2.9-3.1	46/98	47%
3.2-3.4	37/60	62%
3.5+	23/35	66%
Total	203/519	39%

6 Beyond Summer PrEP

As mentioned, Summer PrEP is one part of a larger strategy the IDEA Student Center has developed with the aim of promoting the retention of URM and disadvantaged students in their engineering major. To that extent, the IDEA Scholars were given a four-year supplemental education plan designed to retain the students in a cohort throughout their undergraduate programs. The supplemental education plan includes the freshman-year "Orientation to Engineering" course series and leadership, project and design courses during the subsequent years. The plan also includes monthly social "get-togethers" which allow the scholars an opportunity to reconnect and network with invited faculty and staff. The scholars also participate in the Jacobs (School) Undergraduate Mentoring Program (JUMP), which matches them and other URM and disadvantaged freshman with older students in their major. The IDEA Scholars uniquely benefit from also receiving mentoring from the faculty members who sit on the IDEA Student Center's advisory council.

7 Discussion of Limitations

It should be noted that all IDEA Scholars experienced interventions in addition to and beyond Summer PrEP. As mentioned, the scholars receive academic, personal and professional support beyond their initial summer experience and throughout their educational program. While this poses no threat to the authenticity of the qualitative data, the fall quarter interventions could have contributed to the scholars' first-quarter grade point averages. It is also possible that individuals in the comparison groups experienced similar interventions.

Another limitation may be selection bias. Students who took initiative to apply to the program may have been more motivated than those who did not apply. Of those that applied the selected 22 students did not have higher GPAs, but their essays may have demonstrated greater motivation or verbal skills.

8 Future Work

Overall the qualitative results from the participant survey demonstrated overwhelming approval of the summer PrEP program. However, the participant surveys from the 22 IDEA scholars raised some general areas of improvement as well as specific feedback on some of the

workshops. Generally, students felt that there was too much down time spent waiting for a variety of reasons. Furthermore, students requested that a detailed map with directions be sent electronically to them before the start of the program to ensure they could locate the check-in/registration area. One final recommendation was to make the program longer in order to facilitate the peer building process (four days was too rushed). Finally, a student expressed concern that the program overlapped with the freshman priority enrollment time. The student could never fully relax during the program because he/she was worried about not getting the classes of his/her choice.

Feedback from the participants about the various workshops consistently reported not having enough question and answer (Q&A) time. Students were left with lingering thoughts and questions about each workshop, especially Workshop 5, the student panel, where additional time would have provided the IDEA scholars with more insight into the UCSD experience.

A topic that the IDEA Scholars identified as lacking during the PrEP program was information about what to do when dealing with different types of classes. For example, how to handle a difficult or unapproachable professor, how to approach courses with extensive reading and writing requirements, and how to schedule studying to better fit in with different work loads and learning styles.

From lessons learned during the first year, which were identified in the *future work* section, and the feedback provided by the participants, the following improvements to the program will be addressed in subsequent years:

- Continued improvement to selection process such as implementing phone interviews, and an expanded application. This will allow the selection committee to learn more about the candidate and offer the candidate an opportunity to learn more about the program.
- Increase duration of program, by one day to allow for more bonding time and additional Q&A
- Add workshop on how to deal with different types of classes and professors they will come across
- Include IDEA scholars in undergraduate research or technical project opportunities.

Referring back to the assessment found in Table 4, if we are able to support the IDEA Scholars in achieving a 3.2 or higher GPA during their first year, their retention rates will exceed the school-wide retention rate which is currently 55%. To achieve this goal, perhaps the UCSD Summer PrEP should include academic preparation as a means of bridging the skills gap between high school and college.

9 References

[1] Jones, M. T., Barlow, A. L., & Villarejo, M. (2010). Importance of Undergraduate Research for Minority Persistence and Achievement in Biology. *Journal of Higher Education*, 81(1), 82-115. Retrieved from EBSCOhost.

[2] PCAST President's Council of Advisors on Science and Technology. (2010). *Prepare and inspire: K-12 Education in science, technology, engineering, and math (stem) for America's future* (Rep.). Retrieved from http://www.whitehouse.gov/ostp/pcast
[3] Murphy, T. E., Gaughan, M., Hume, R., & Moore, S. G. (2010). College graduation rates for minority students in a selective technical university: Will participation in a summer bridge program contribute to success? *Educational Evaluation and Policy Analysis, 32*(1), 70-83.
[4] Ohland, M. W., & Zhang, G. (2002). A study of the impact of minority engineering programs at the FAMU-FSU College of Engineering. *Journal of Engineering Education, 91*(4), 435-440.
[5] Creswell, J., (2003). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. Sage Publications, Inc., Thousand Oaks, CA.