

## **A Preliminary Evaluation of the Tulane Science Scholars Summer Program through Quantitative and Qualitative Self-assessment (Work in Progress)**

**Katherine Nicole Elfer, Tulane University**

Kate Elfer is a Ph.D. Candidate in Biomedical Engineering at Tulane University. She received an internal fellowship for community engagement and works year-round to promote STEM education. She is also on the board of two New Orleans STEM Education non-profits. After graduation, she will seek positions that allow her to continue mentoring and teaching STEM at all education levels.

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*Introduction:* For the 2016 Tulane Center for Public Service Graduate Community-Engaged Fellowship Program, a preliminary evaluation was drafted and executed for the Tulane-Community partnership, the Tulane Science Scholars Program (TSSP). While both academic year and summer programs have been available for several years through TSSP, at the time this evaluation was undertaken no analysis of the entirety of the program's performance had been conducted. Analysis allows for continual improvements within the program so that it can better meet its goals and provides an avenue for promotion to future donors to better determine the impact program has on students compared to similar programs nation-wide.

*Tulane Science Scholars Program:* This selective, academic program enrolls high school students during the summer and academic year. Students enrolled during the academic year take part in Saturday courses to supplement their current coursework. Summer students can receive college credit, depending on performance, towards a degree at Tulane University and other select colleges that acknowledge the credit. Enrollment and admittance preference is given to students who are rising seniors or juniors, with rising sophomores and freshmen making up a smaller percentage of enrollments. In 2016, the course enrolled students from 16 different states and 2 different countries, allowing for a mixture of cultural and education levels. Each course is a period of 2-3 weeks where the students attend lessons Monday-Friday. Students have the option of enrolling in multiple courses as scheduling of the courses permits. Each course costs \$1,250 which pays for the instructor's time, laboratory supplies, teaching assistants, and a fee to the programs maintenance and support.

The 2016 summer program has a total of 8 courses being offered with a maximum enrollment of 16-20 students depending on the course:

- CENG 1015: Principles of Chemical Engineering with Lab
- CMPS 1005: Python Programming: Introduction to Computer Science
- EBIO 1231: Exploring Animal Behavior
- ENGP 1005: Introduction to Electronics with Laboratory
- NSCI 1015: Basic Neuroscience with Laboratory
- Physics 1015: Materials Science and Engineering Summer Class
- PSYC 1100: Exploring Psychology
- SCEN 1015: Computers and Musical Creativity

Students also have the option of living on campus during the course period for additional fees and many extracurricular educational activities are planned outside of the courses to introduce the students to each other and opportunities available at universities.

*The Purpose of Evaluations:* This program offers a unique opportunity in the New Orleans area for high-achieving students. However, the cost associated with the program is prohibitive to many Greater New Orleans area residents. While course instructors have the option to waive their instruction fee for select student, students will still have to pay fees associated with the lab

materials and board. Donors willing to provide scholarship funds, particularly for minority students, have approached TSSP in the past years and several are on the Tulane K-12 Board of Directors. Many donations are contingent upon the program's ability to provide on-going documentation of the benefits students receive from TSSP. A standing evaluation determining the impact the program has on students; self-perception, interest in majoring in science, and interest in attending Tulane in particular appeal to the goals of many of these donors. Long-term demonstration that the program provides a comparable introduction to college to students who might not have an opportunity to experience college life prior to high school graduation may provide justification for alternative fee plan for students from financial adverse backgrounds.

Furthermore, prior to this work no review of the program has been conducted in its five years of existence. Without criticism the program cannot know what and where to improve. The program needs to make sure that it fulfills its goals and that the students are gaining the knowledge and experiences that the program advertises. A pilot evaluation was created to test out a survey as an evaluation method and to prepare the study coordinators for any modifications as a future.

## **Methods**

The evaluation was created and analyzed by a fourth-year Biomedical Engineering doctoral candidate with the assistance of the Tulane staff in charge of TSSP, the faculty running the individual TSSP courses. By reviewing other evaluations used in K-12 science workshops and academic programs, such as The Perry Initiative for women in Orthopedics and Biomedical Engineering, a pre- and post- survey were created. The major consideration was to include as much quantifiable feedback as possible to create statistical models for the impact the program has on students. A secondary consideration was the fact that the major stakeholders, donors and TSSP staff, consider qualitative feedback in the form of testimonials as particularly interesting for their reports. Finally, the K-12 Board of Directors indicated a wish to see tangible "proof of learning," which took the form of course-specific knowledge and experience based questions. With these factors in mind, a four-part pilot evaluation was created. The evaluation was delivered in two parts: on the first day of class (pre-survey) and on the last day of class (post-survey).

A total of 95 surveys were evaluated from students entering 9<sup>th</sup>-11<sup>th</sup> grade the coming fall from 8 lab-based courses, which were offered in two-three week sessions over a total five-week period. The results of the both the pilot study and proposed modifications on its design and implementation are presented.

*Anonymous Identifier Code:* In order for this to be considered a pilot study, and therefore not subject to Internal Review Board procedures, an anonymous identifier code was needed in order to both protect the student's identities and allow for matching of the pre- and post- evaluations.

*Demographic Information:* While the program's application requests numbers on race, gender, age, and hometown, the survey analysis included demographic information to see if disparities developed between groups based on age, race, ethnicity, home address, and prior exposure to college-level coursework. Additionally, the K-12 Board of directors were interested in if the students had prior exposure to STEM role-models, how they learned about TSSP, and whether they intended to apply to Tulane upon graduation from high school.

*Likert-Scale Impact on Self-Perception and STEM Engagement:* The primary goal of the evaluation was to determine what impact the program has on their self-perceived ability and desire to succeed in a scientific field. A secondary goal was whether the student felt more confident in their ability to succeed in college and whether their comfort in a collegiate environment increased after the program. A six-point likert scale system was developed for eleven questions. The scale ranged from 1 (strongest agreement) to 6 (strongest disagreement). Students were asked to circle the number they most identified with during the first day of the course (pre-survey) and the last day of the course (post-survey). The choices for questions co-written with the help of a research psychologist who specializes in self-esteem and the role of self in perspective-taking.

*Qualitative Feedback:* As much as statistical analysis can reveal about a program's impact upon a collective group, individual qualitative feedback can just be as important for improvement and promotion of the program. Feedback where an item is repetitively emphasized may also signal that the coordinators of the program may need to look more closely at that item in the future. The qualitative assessment on the pre-survey asked the students to state what they were most looking forward to regarding the class and the program. It also asked students to rank what they had brought them to the program. The qualitative assessment on the post-survey asked students to describe their favorite parts of their course and favorite parts of TSSP. It also asked what could be improved in TSSP and if TSSP altered their college plans.

*Proof of Knowledge:* For almost all courses, one to two questions were asked at the end of the survey that was course-specific. Instructors of the courses were asked to provide their own questions based on what new experiences the students should gain in their course.

## **Results**

Of the 94 participants, two of the evaluations were from 9<sup>th</sup> Graders, 20 of the evaluations were from 10<sup>th</sup> Graders, 28 of the evaluations were from 11<sup>th</sup> Graders, and 49 of the evaluations were from 12<sup>th</sup> Graders.

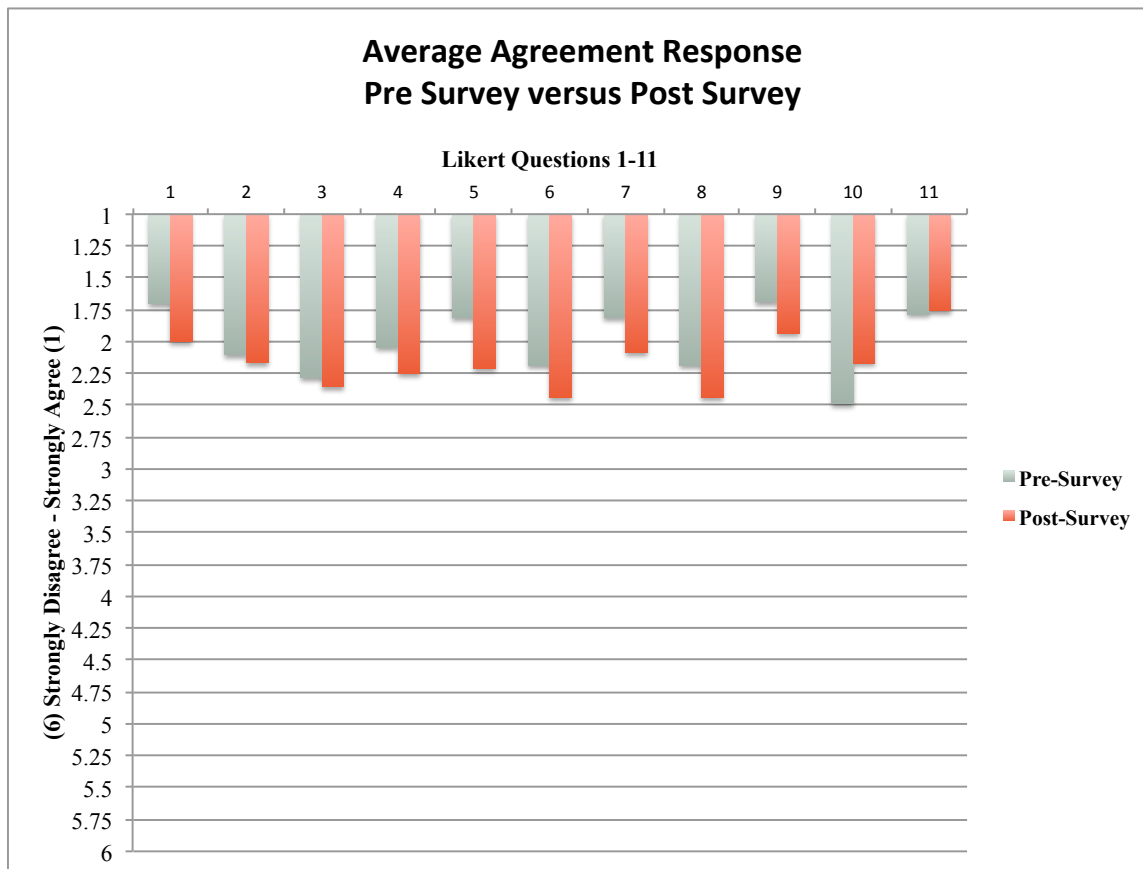
*Likert-Scale Impact on Self-Perception and STEM Engagement:*

Statistical significance was analyzed in a paired student-T-test with significance levels of  $p=0.05$  using MATLAB. All results for each question is provided below:

1. I am excited to take college-level STEM classes.  
(SD=4.033)  $t(7)=-2.36$ ,  $p=(0.0498)$
2. I feel confident that I can succeed in a college level STEM course similar to the one I will take this summer class.  
(SD=4.16)  $t(7)=-.85$ ,  $p=(0.4242)$
3. I feel confident working in a college laboratory.  
(SD=3.20)  $t(7)=-1.11$ ,  $p=(0.3052)$
4. I feel comfortable working with my peers in a college classroom/laboratory.  
(SD=6.16)  $t(7)=-1.50$ ,  $p=(0.1792)$
5. I can see myself majoring in a STEM field in college.  
(SD=3.24)  $t(7)=-3.27$ ,  $p=(0.0136)$

6. I feel confident in my ability to choose a college major that will help me with my job after college.  
(SD=3.14)  $t(7) = -2.82, p = (0.0259)$
7. I am interested in a career in a STEM field.  
(SD=3.52)  $t(7) = -1.71, p = (0.1318)$
8. I am knowledgeable about the variety of STEM career opportunities available to me.  
(SD=3.81)  $t(7) = -3.90, p = (0.0059)$
9. I feel confident that my time in college will let me explore things I am interested in.  
(SD=4.38)  $t(7) = -1.29, p = (0.2371)$
10. I feel knowledgeable about the different opportunities available to me in college (ex: honors colleges, study abroad, undergraduate research).  
(SD=2.93)  $t(7) = 2.93, p = (0.0222)$
11. I believe the skills/knowledge I will gain at TSSP will be useful later in life.  
(SD=6.3)  $t(7) = -.28, p = (0.7871)$

Only five questions met requirement for a p-value of 0.05 or lower. Negative T-values indicated a decrease in agreement from the pre- and post-surveys, while a positive T-value indicated an increase in agreement. Students indicated increased knowledge in the different extracurricular opportunities available to them in college. Students indicated decreased confidence in majoring in a STEM field, choosing a major, knowledge about career opportunities, and excitement to take a college-level STEM course.



Individual course analysis did not provide enough respondents for an in-depth analysis, but they did indicate trends in how factors external to TSSP's design may influence the students' experiences. The ENGP Circuits course, for example, had five students, but all five reported an increase in interest in pursuing a STEM career, knowledge about STEM careers and confidence in choosing a major. When paired with the qualitative feedback that the instructor of the course took time each day to explain how the lesson plan related to careers in the field, the difference in this course's responses from their peers appears to be instructor-related.

## **Conclusions**

*Positive Outcomes of the Preliminary Survey:* The cohort of 96 students was large enough to provide statistical information on the program. The students were responsive in feedback and genuinely interested in providing both positive and negative commentary on their experiences. Course instructors were helpful in the design and implementation of the survey. The demographic, likert scale, and qualitative feedback provided a comprehensive view on each student.

*Recommendations for the Future:* In the future, this survey should be assigned outside of class via an online module. Demographic questions on a student's minority status (race, gender, sexuality) might be asked pending IRB approval to better track specific types of students. Additionally, students can answer more numerical questions resulting in a greater chance of statistical significance in answers upon review. A downside to out-of-class completion is the lack of motivation for a student to log-in to complete the survey, so incentive or requirement must be taken into account. Full IRB approval for both the immediate survey and possible longitudinal evaluation will be submitted.

*Conclusion:* This pilot evaluation provided the needed data to install a long-term study into the TSSP summer courses. It successfully provided some promotional materials in the form of quotes and documented changes in interest in Tulane for college. It also provided feedback on the organization and administration of the program which can be instituted for the next year.