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Engineering Bright Futures: A College Mentorship Program for Title I Public High Schools

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Engineering Bright Futures: A College Mentorship Program for Title I Public High Schools (Other)

Abstract:
This paper discusses creating and establishing an engineering mentorship program for high school students from Austin Title I public schools supported by NSF grant EEC-2217741. This program aims to provide high school students of underrepresented backgrounds exposure to engineering fields, the necessary support to navigate financial and accessibility obstacles posed by the college application process, and a role model and mentor. Typically, students from lower-income high schools do not receive the resources to be familiar with engineering areas and careers, nor the college application process, so this program aims to address these gaps. The goal is that students who participate in this program feel encouraged and confident to apply to engineering programs, resulting in increased applications and potential enrollment of students from low-income high schools. In this program, student mentors (current undergraduate engineering students) are responsible for helping second-year high school students find an engineering major based on their interests, discussing the college application process at a fundamental level, and connecting the student with various financial and academic resources. Weekly mentoring sessions are held over Zoom during the students' school day in compliance with school district and university regulations. The program lasted five weeks, covering topics such as an overview of the University of Texas' engineering program, the different engineering fields and careers, a thorough overview of the application process, and financial aid. This project was evaluated with an anonymous survey administered to the high school students after the completion of the program to gauge engagement, whether they felt the program was beneficial, and interest levels in engineering, all of which helped determine the program's effectiveness.

Motivation for Study:

In the Austin regional area, there are significant disparities in pursuing higher education between high schools. A Texas report containing the number of high school graduates and those who went to an in-state public four-year university demonstrates these differences. For example, around 51 percent of students from Westlake High School, located in a more affluent area, ended up attending a major university in Texas, where those not included either did not opt into college reporting, went out of state, or chose not to attend. In contrast, 24 percent of students from Eastside High School, a designated Title I school in the same region, fit into this metric [1]. In general, most Title I schools have a significantly lower proportion of students who pursue higher education for various reasons, including insufficient resources, socioeconomic factors, and a lack of exposure to the college process. Reflecting this, a Post-Secondary Executive Summary published by Austin Independent School District found that students who submit at least four college applications and fill out the FAFSA enroll at higher rates than those who do not [2].

Therefore, increasing familiarity with the college application process and financial aid could reflect these statistics and bolster applications and college attendance from Title I schools.

Programs such as the TRIO Upward Bound Math and Science program provide mentorship for students academically and professionally by exposing students of underrepresented groups to STEM fields and majors, research, and higher education, all under the guidance of university faculty and graduate students [3]. Several Austin Independent School District Title I high schools participate in the TRIO program, where students can take short-term college courses, receive academic and college/financial aid advising, and learn about colleges and careers [4].

Another program implemented by the Georgia Institute of Technology achieved similar objectives with peer-to-peer mentorship that undergraduate engineering students primarily led. This was known as the Pre-College Initiative (PCI) and STEP programs involving partnerships between Georgia Tech's NSBE chapter and Atlanta high schools with majority African American student populations, establishing NSBE Jr. chapters for students in grades 6-12. GT NSBE members provided mentoring services, college preparation, and financial resources. Over five years, it was found that 20% of students involved with NSBE Jr. ended up attending Georgia Tech, and 75 African American students from three primary Atlanta high schools decided to pursue STEM/engineering degrees [5]. The mentorship program had a significant impact on increasing enrollment in Georgia Tech and its engineering programs.

The University of Texas at Austin does not currently have a program mirroring the above efforts specifically for increasing enrollment in the Cockrell School of Engineering with a focus on the college application process geared towards Title I schools.

Research Questions:
Below are the primary research questions that shaped the development of the program.

- What are some key obstacles Title I school students face in pursuing higher education, and how can this program help students overcome these challenges?

- How can the concepts be effectively implemented into a short-term, virtual program to enhance student's interest and understanding of engineering fields, the college application process, and financial aid?

- To what extent would a virtual program improve the students' understanding of engineering disciplines, college applications, and financial aid?

Design and Implementation:

This was a five-week program hosted on Zoom during the school day. The original intent was that the program would be geared towards 11th and 12th graders approaching the college application season, however, for this pilot semester, we hosted a Cybersecurity class from Northeast Early College High School for 9th and 10th-grade students from a pre-college program. School faculty decided that this program would be most beneficial for their 9th and 10th-grade students. Each session was approximately an hour during their Cybersecurity class period, with students and faculty individually joining the Zoom meeting from their devices with cameras on while physically in the classroom, facilitating participation and interaction. Usually, four to five student volunteers from various engineering majors took turns to present during each seminar. They interacted directly with the students and faculty using Zoom's chat feature or through voice. The virtual meetings allowed student volunteers to join the sessions from any quiet location and present the materials.

Typically, each session consisted of a brief icebreaker to foster student engagement and participation. Then, the week's designated topic was covered for the remaining 45-50 minutes. As this first cohort consisted of younger high school students, the content was primarily geared toward the engineering disciplines and painted a general image of the college application process. An example lesson plan showing the structure of a seminar (from the first meeting) is shown below, with subsequent meetings following a similar format.

Topic	UT Austin Engineering Program Overview
Learning Objectives:	After this session, students will: ● Get to know their Cockrell School student mentors. ● Recall important facts about UT Austin's Engineering Program. ● Become familiar with engineering facilities/buildings. ● Become familiar with their mentor(s)'s first-hand experiences as an engineering student. ● Recall reasons and motivations for studying engineering.
Materials	Slideshow Presentation
Activities	**Beginning of Session:** Introduction: (5 min) ● Mentor introduction to the mentee(s) - name, major, class standing, hobbies, interests.

	● Mentee introduction. ● Share the objective of the program: “During this program, you will learn about UT engineering, the different engineering majors that you can study, the college application process, and the many scholarships and financial aid resources available!” Icebreakers (5-10 min): ● Pictionary - 3-4 rounds, 60 second draw time ● Mentee questionnaire: ○ What do you already know about engineering? ○ Have you done any engineering-related activities or clubs? ○ What interests you about engineering? Present Meeting Objective: ● “In this session, we will be discussing everything about Texas Engineering and look at some of the cool things engineers do!” **PRESENTATION (45 min):** SLIDE 1: Discussion with mentees about knowledge of engineering, engineering careers, majors, etc. SLIDE 3: Stats & Rankings SLIDE 6: Engineering Buildings and Facilities SLIDE 10 - 17: Technical Organizations SLIDE 18: Affinity Organizations SLIDE 21: Research SLIDE 23: So why engineering? SLIDE 25: Informational videos.

	SLIDE 26: Engineering and industries. SLIDE 27: Mentor experiences - choosing engineering and a specific major, navigating engineering school, careers. SLIDE 29: Next session introduction.

Table 1: Sample Lesson Plan

The following tasks were fulfilled leading up to the sessions.

- Securing funding: The program received approximately four thousand dollars from a SEED grant award sponsored by the Cockrell School of Engineering and supported by the National Science Foundation (NSF) grant EEC-2217741.

- Receiving YPP approval: Since this program involved minors, we needed approval from UT Austin's Youth Protection Program (YPP) office to proceed. In adhering to their guidelines, undergraduate student volunteers received background checks, and the logistics of the Zoom meetings were revised to streamline the approval process. Instead of one-on-one Zoom meetings requiring an adult advocate for the student present on each call, the sessions were held in a single meeting room with all students, volunteers, and teachers using separate devices.

- Receiving IRB approval: As per university policy, an IRB approval form was filled out with the specifics of the data collection, procedure, and usage (minimal/no risk associated, no identifiable information collected, results to be strictly internal and for program improvement purposes only). The IRB office assigned the program a "Non-Human Research" determination for non-generalizable program evaluation.

- Creating program materials: Slide presentations, lesson plans, and other supplemental documents were developed for mentor sessions and to be provided to students. A program website is currently being developed for use in future semesters.

- Reaching out to local Title I Schools: First, we identified local Title I high schools using information published by the local school district. Then, we established communication with high school faculty and staff and held informational Zoom sessions for those interested. This phase was the most time-consuming and greatly affected the project timeline.

- Recruiting volunteers: Current undergraduate engineering students of most engineering disciplines and class standings from professional, affinity, and academic organizations were recruited to participate in the weekly sessions. Each volunteer received a grant-funded stipend between $50 and $100, depending on their level of involvement in the program. All volunteers were required to present at one or more sessions and contribute to creating presentation materials relevant to their area of choice, with those who met this minimum commitment requirement receiving $50. However, those who attended and presented in at least three sessions in addition to developing student materials received the $100 stipend for their exemplary contributions to the program.

- Scheduling: Volunteer availability was coordinated alongside school faculty and student schedules. The volunteers were then assigned to a specific week and time. School scheduling involved allocating one hour of class time weekly for the program.

- Developing the final survey: To determine the program's effectiveness, a Google Forms survey was created to be administered to the students during the final mentor session. The survey consisted of multiple-choice and optional free-response questions.

The table below delves into the details of each weekly meeting.

Week	**Topic**
Week 1: Week of 10/9	Topic: Overview of UT Austin's Engineering School Subtopics: ❖ Introductions and icebreakers. ❖ Overview of "Engineering Bright Futures" program. ❖ Statistics and rankings. ❖ Engineering buildings and facilities. ❖ Technical, affinity, and academic engineering organizations. ❖ "Why engineering?"
Week 2: Week of 11/1	Topic: Engineering Majors Part 1 Subtopics: ❖ Summary of common engineering majors. ❖ Computer Engineering and Q&A. ❖ Software Engineering and Q&A. ❖ Aerospace Engineering and Q&A. ❖ Mechanical Engineering and Q&A.

	❖ Video showcase.
Week 3: Week of 11/8	Topic: Engineering Majors Part 2 Subtopics: ❖ Recap of the previous week's session. ❖ Civil Engineering and Q&A. ❖ Electrical Engineering and Q&A. ❖ Biomedical Engineering and Q&A. ❖ Chemical Engineering and Q&A. ❖ Petroleum Engineering and Q&A. ❖ Conclusion of engineering majors.
Week 4: Week of 11/15	Topic: College Application Process Overview Subtopics ❖ Volunteers' insights and experiences. ❖ College Application site options. ❖ Navigating college application websites. ❖ Ways to begin preparing for the college application process. ❖ Fee waivers and how to claim them. ❖ Standardized testing (SAT and ACT), and preparatory tools. ❖ Finding extracurriculars and clubs of interest. ❖ Taking pre-college or AP courses for college-level course experience and credit.
Week 5: Week of 11/29	Topic: Financial aid/Scholarships & Final Survey Subtopics: ❖ All about the FAFSA and how to apply. ❖ Examples of federal and state grants. ❖ The differences between grants and scholarships. ❖ Merit or background-based scholarship opportunities. ❖ How financial aid is determined and using the net-price calculator. ❖ Where to look for scholarships.

Table 2: Weekly Breakdown of Topics Covered

Findings:

The results in Figure I were derived from our initial correspondence with school faculty and staff.

Four of the seven schools demonstrated significant interest in the mentorship program, and informational meetings were held with teachers and administrators. These results show a need to implement a college mentorship program at Title I schools in Austin.

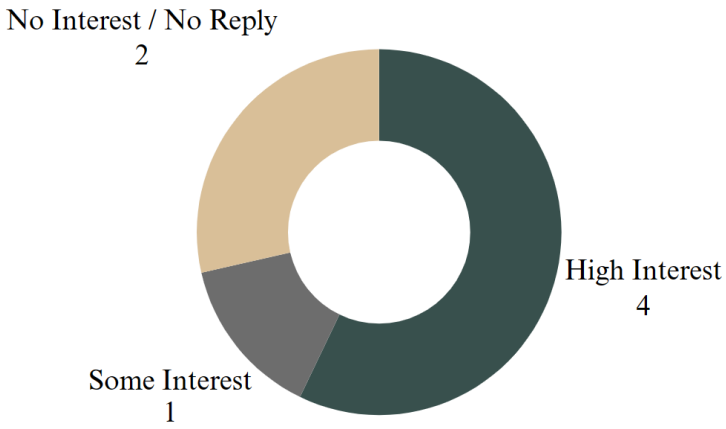


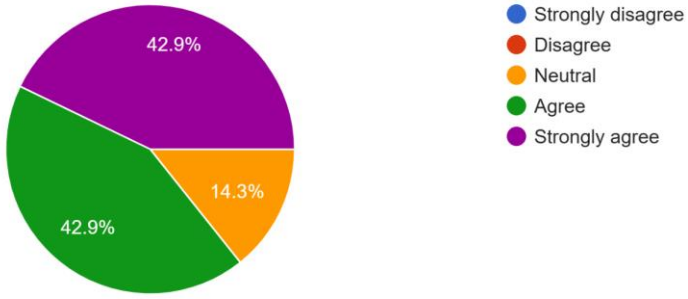
Figure 1: Program Interest Levels of Title I School Faculty/Staff

After the program's successful completion at one of the Title I high schools - with a sizable pre-college and STEM program - a student survey was administered to determine the program's efficacy in addressing each "pillar" of the program's goals. Despite each session consistently containing about 15-20 students, including the final meeting, only seven completed the survey. The reason for the low response rate is unclear as around 25 minutes were allocated for the survey, and school faculty oversaw student completion of the survey in class. We look forward to continuing this program and accommodating more students.

First survey section: Multiple-choice questions.

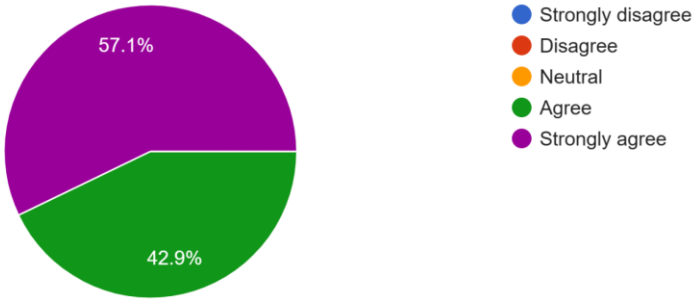
I have become more knowledgeable about the college application process.

7 responses



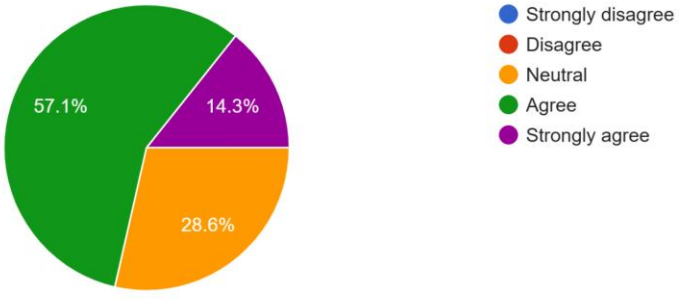
This program has taught me about the different engineering majors such as electrical, aerospace, computer, software, biomedical engineering, etc.

7 responses



I am familiar with the financial aid and scholarship options available for college.

7 responses



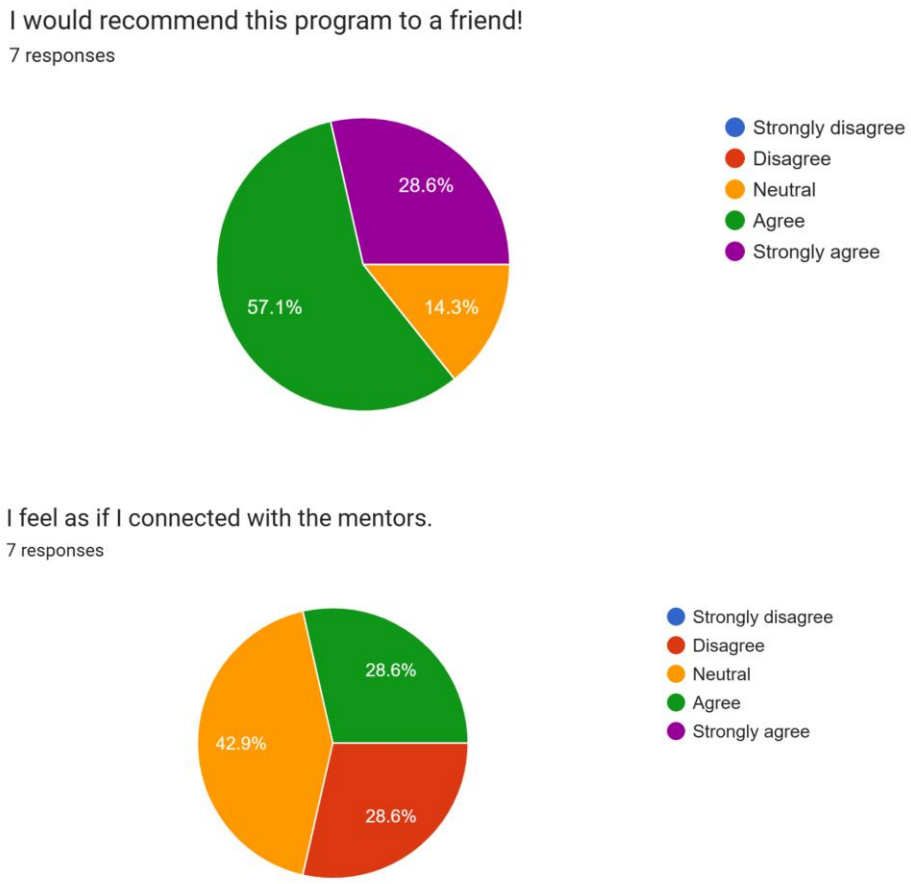


Figure 2: Survey Responses (Multiple Choice)

From these responses, it is apparent that most students (of those who participated in the survey) believe that the program increased their knowledge of engineering disciplines, the college application process, and financial aid. Most students (57.1%) strongly agreed that the program improved their understanding of engineering majors, while the other results were more varied. This could be attributed to the topic of engineering disciplines receiving two full sessions of coverage. At the same time, only a week was spent on the college application process and financial aid topics.

Additionally, many students responded that they did not connect with the mentors. Unfortunately, this was due to the "seminar" style of the program meetings for compliance with Youth Protection Program (YPP) protocols. Having one-on-one meetings would have allowed for a stronger mentor-to-student connection, but this was not feasible due to Youth Protection Program (YPP) protocols, as mentioned earlier.

Since most students agreed that they would want to recommend this program to a friend, this likely indicates that the program was effective at keeping students engaged while being informative.

Second survey section: Open-ended questions.

Is there an engineering major you are most interested in and why?

6 responses

- mechanical engineering
- civil engineering
- Most likely computer engineering because I feel like that one would motivate me to major into it
- Biomedical engeneering, seems fun but very dificult.
- N/A
- right now no

Were you interested in engineering before this program?

If yes, are you still interested in pursuing engineering?

If no, has this program made you more interested?

6 responses

- yes
- no and yes this has made me more interested
- I was but I was contemplating whether to go but now I'm considering joining
- I wasnt really intrested because i didnt know any of the majors, but biomedical seems interesting but difficult.
- maybe im thinking
- no and it made it sound more interesting

What is something new you learned about engineering?

6 responses

- how much people make
- its used in many different ways
- That there are different aspects to engineering
- all the majors
- The different types of engineering and how much jobs there are for engineering
- idk

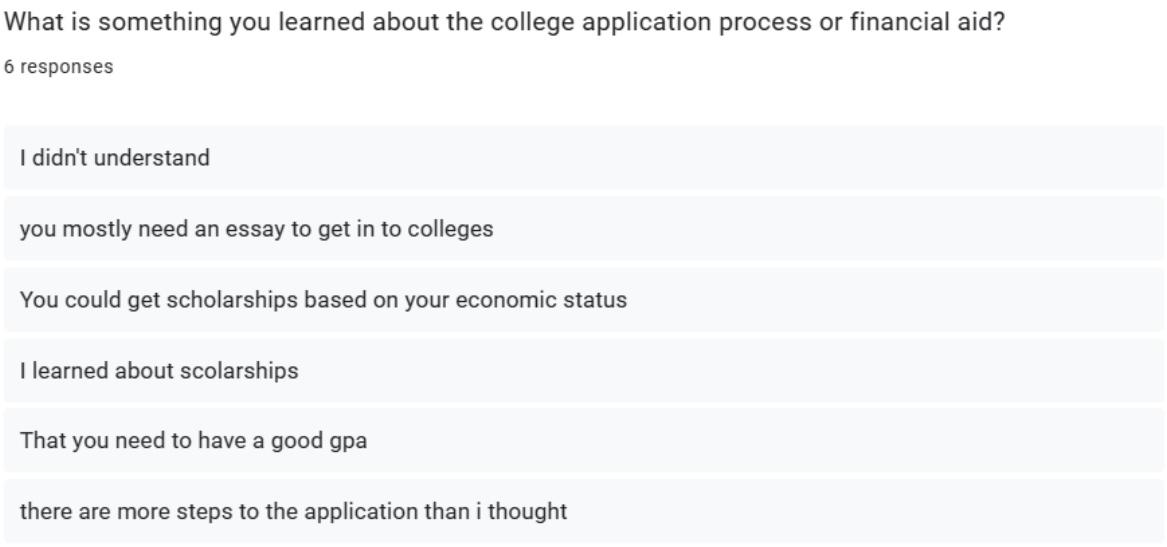


Figure 3: Survey Responses (Open-ended)

These open-ended questions provide further insight into the multiple-choice results. The program increased student interest levels in pursuing engineering, and students could take away many different pieces of information relating to the different disciplines and career paths. Students also demonstrated engagement with the college application and financial aid content, but most likely not to the same depth of understanding due to less time spent on each topic.

In conclusion, this program proved effective in accomplishing its main objectives.

Future Work:

Future stages of this program will involve the following:

- Implementing the program for 11th and 12th graders as originally planned.
- Expanding the program's bandwidth to reach high schools in other school districts and other regions of Texas.
- Extending the duration of the program to 8-10 weeks and sorting out logistics with the Youth Protection Program (YPP) to host one-on-one sessions.
- Following up with participating students in their senior year to determine the proportion of students who applied to college and/or pursued an engineering discipline.

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