Mentoring is a Full Contact Activity in Engineering Education

Dr. Dan G. Dimitriu, San Antonio College

Dan G. Dimitriu has been practicing engineering since 1970 and taught engineering courses concurrently for more than 20 years at various institutions. In 2001, he joined San Antonio College full-time as the Coordinator of its Engineering program. He has been involved with several engineering societies and became a member of the Two-year College Division of ASEE in 2002. His research interests are in engineering graphics, 3-D Visualization, fuel cells, plastics, and engineering education.

Diana Carmen Dimitriu, University of Texas at San Antonio

Diana Dimitriu is a senior at the University of Texas at San Antonio, UTSA. She will be graduating with two bachelors' in both Computer and Electrical Engineering and a minor in Mathematics in the Fall of 2018. She has mentored students through the Early Development of General Engineering, EDGE, Program at San Antonio College, the Roadrunner Transition Experience, RTE, at UTSA, and the Toyota Ambassadors program at UTSA. She is a Lead Mentor at RTE and is responsible for 60+ mentees and all the data on the back end, i.e. a datasheet that keeps track of over 600 students involved in the program. She also manages the YouTube channel for RTE. In addition to school and work, she is a College of Engineering Ambassador, Public Relations Chair for Tau Beta Pi, and mentor a robotics team at STEM Early College High School in San Antonio. This past summer she completed a 10-week internship at Kennedy Space Center for the National Aeronautics and Space Administration, NASA.

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Abstract

San Antonio College located in San Antonio, Texas is an urban, state-supported college and the engineering program at this institution has been instrumental in providing educational opportunities for under-represented groups of minorities. In a society that becomes more and more dependent on technology the engineering schools must be focused on providing a strong education to students in technical fields. Our college takes this issue seriously by providing students with a very strong foundation of engineering education that allows them to transfer successfully to any four-year engineering programs.

Engineering students in an academic setting do not have the environment, the responsibilities, the demands, or the interactions with other members of an engineering team, nor do they face the real-life situations and challenges that a practicing engineer faces every day. Therefore, our program decided that our mentorship initiative must have as many professional engineering aspects as academic ones. We built the mentoring role to be part coach, which is preparing students for their big game after graduation, part advisor, which will help them choose the right courses for their career path, part trainer, which is meant to improve their skills, part counselor, which will help them in hard times, part cheerleader, to celebrate their successes and, above everything else, to be a role model.

Since most of our students transfer to the engineering program at University of Texas at San Antonio, it would be extremely beneficial to observe how the mentoring helps the transfer student succeed at a four years institution.

The paper will present the details, the actions, and the results of this initiative as a work in progress that is continuously adapting and improving as required by the new generations of students arriving at San Antonio College.

Introduction

The Oxford Dictionary of Current English defines "mentor" as "*an experienced person in an organization or institution who trains and advises new employees or students*". This is a very brief and concise definition of a much more complex concept. If we take into consideration the particularities of the field of engineering the concept grows even more complex due to the nature of this profession. An engineer needs a combination of knowledge, experience, and good judgment together with problem solving skills, creativity, and courage, to have a successful career. From this point of view, it appears that there are two kinds of mentoring, academic and professional, and they are not clearly separated nor examined in the existing literature.

Numerous colleges and universities have extensive mentoring programs that pair students with qualified faculty who will help them succeed, and the available literature provides extensive information about them. The vast majority of schools offer broad academic support across curricula[1, 2, 3], some are field specific[4], some are race or gender specific[5, 6, 7] and some focus primarily on graduate students[8, 10] while other programs focus on first year experience[10] and other specialized mentoring programs are geared for engineering and science students[11, 12].

The abundance of information shows the importance of the subject. However, the fact that few students choose Engineering as a career compared to other fields shows the urgency of improving mentoring skills of engineering faculty to increase attraction and retention of students in the field of Engineering.

My mentoring philosophy

I had a unique chance to be shaped by excellent mentors both in my schools and early in my career, as well as upon my arrival in U.S., and I can say that I accumulated quite a wide range of experience. In school and in my profession, I could observe firsthand what worked for me and for most of my colleagues, and when I look back now I can understand why. Everybody is born with the strong desire to leave a mark of his or her passing through the world. It is in our genes. When a real mentor comes along, with enthusiasm and experience, and shows a youngster how much he or she can change the world and make a difference forever, that mentor leaves an indelible mark on the mentee. Above all other professions, engineering has the power to change the world on a large scale.

Since I started to take my mentorship duties seriously, and I started reading about mentoring and visiting websites dedicated to mentoring, I realized that my vision and my philosophy are similar in some ways to other mentors, but in some ways, they also are quite unique. Upon discussing them with other faculty, I could see that when people ***write*** about mentoring they make it appear more institutionalized and well regulated but when they ***talk*** about it, mentors emphasize the personal touch and the relationships that they develop individually with their students. It is not one-size-fits-all and every student needs a particular type of interaction. Being a designer at heart, I approach every mentee following a problem-solving approach by evaluating the personality, the background, and the needs. Then I select a number of activities and interactions that seem appropriate for that particular mentee. After a while, I review the results and select the best course of action to implement what works the best. I perfected my system so well that my mentees never feel that they are under a magnifying glass or even observed. Everything happens so naturally that the entire relationship grows continuously without any apparent effort to steer it in the desired direction. Having constantly their success in mind is the major driving force in this entire process.

Engineering students in an academic setting do not have the environment, the responsibilities, the demands or the interactions with other members of an engineering team, nor do they face the real-life situations and challenges that a practicing engineer faces every day. Therefore, I decided that my mentorship must have as many professional engineering aspects as academic ones. I built my mentoring role to be part coach preparing students for their big game after graduation, part advisor to help them choose the right courses for their career path, part trainer to improve their skills, part counselor to help them in hard times, part cheerleader to celebrate their successes and, above everything else, to be a role model. I had to make them look up to me, to want to be like me, to strive to be better and eventually to surpass me.

I believe that if I hold my students up to the highest standards and if I expose them to a wide variety of experiences that prepare them to be leaders of industry and society in general, I can create a solid foundation for outstanding future engineers. I build an engineer from the ground up, starting on the first day of college engineering classes, and never let go until the student is ready to fly. It has been extremely rewarding to discover that I share many of my

ideas with the participants in the workshop that produced the Report on the Mentoring Workshop for Underrepresented Minority Undergraduate Engineering Students and Faculty/Staff Advisors[12]. At the same time, I am proud to say that my personal touch and the infusion of my extensive and unique industry experience make my approach exceed the expectations for most faculty in similar positions.

Notable Mentoring Activities

I always enjoy bringing to my classes real engineering experience, to prepare my students for real life. With a work history spanning about 25 years, many industries, and two continents, I come to class with a rich story to tell. I have made a PowerPoint presentation that shows students my journey, both how I obtained my degrees and all the types of engineering work I have done along the way, with photos of machines we put into mines in Romania and tractors in North Dakota, and schematics of combustion engines and gynecological devices. It ends with the collapsible fluid storage tank I helped develop at NASA as a visiting researcher in the summer of 2010 and the two research projects we tested on the Zero G simulator at NASA's Johnson Space Center in the fall of 2013. They get to see what an exciting and varied life an engineer can live and this makes them gravitate to a source with direct knowledge of how is real life out there and choose me as a mentor.

Every semester I select from my introductory classes a group of **10 to 15 students** who show determination and an intense desire to pursue an engineering career. I form groups of these students to lead the other students in a multitude of projects that help them understand what it is like to be an engineer. They join our clubs – the Mexican American Engineering Society (MAES), the Society for Chicano and Native Americans in Science (SACNAS) and the Society of Women Engineers (SWE), participate in service learning projects, enter local, regional and state competitions, and obtain internships or attend NASA's summer Aerospace Scholars Institute. Since 2010, some of my students have been offered research experiences directly on our campus (see more below).

I initiated all of these activities with the assistance and dedication of three other passionate educators, STEM counselor Rosa Maria Gonzales, astronomy/physics professor Alfred Alaniz, and adjunct professor Klaus Bartels. Together we have built an amazing mentorship and support system for our engineering students. **When I started working here full-time in 2001 there were only 164 students with a declared major in engineering. By 2016 we reached 698 students making our program the fifth largest in our college.** During the same period, engineering **graduates have gone from one or two a year to fifty in 2015-2016.** SAC is a Hispanic-Serving Institution, and **during the last 13 years over 65% of SAC engineering students have been underrepresented minority students.**

Being the coordinator of the engineering program and the only full time engineering faculty member here at SAC, I serve all of our engineering majors as advisor, mentor, instructor and everything in between. I not only help my mentees to get started, but I convince them to set goals, to choose the right courses to reach their goals and to start thinking of themselves as engineers.

Clubs

Of all the retention strategies, I have used to help our engineering students at San Antonio

College, probably the most powerful has been the establishment of student chapters of national STEM organizations. As a sponsor and mentor for MAES, SACNAS and SWE chapters at SAC, I have encouraged and supported club members to enter local and national competitions where they have consistently won prizes and scholarships in direct competition with four-year institutions.

Sustained Academic, Financial and Social Support

I have aggressively pursued grant funding to provide academic, financial, and social support to my students, as well as enrichment and research or practical experience opportunities. I have been the **PI and Co-PI for grants received from NSF, NASA and the Department of Education amounting to over $5 million to develop the engineering program and award CSEMS/S- STEM** (Science, Technology Engineering and Math) **scholarship**s to students at San Antonio College. An NSF discretionary grant from Engineering Education I obtained in 2003 allowed me to initiate the **EDGE (Early Development of General Engineering) [13] a summer program, designed to attract and retain high school students into the engineering field**. The program continued through 2015 with help from Department of Education MSEIP funding. A majority of my mentees have participated in these programs.

MSEIP funding also allowed me to expand the **Math Engineering and Science Achievement (MESA) Center** that I had established, without funding, in a classroom in 2007[14]. In this Center, SAC's student chapters of our STEM clubs meet and tutoring and supplemental instruction are offered. Most of my **mentees also study together there, which is one of the keys to their success.** For minority students at a commuter college, this "place to belong" is crucial to their formation of an identity as engineers.

CSEMS/S-STEM scholarships have allowed my low-income mentees to progress faster through their coursework, taking more classes and working less, which is important for retention, especially among Hispanics, who are less likely than other groups to take on debt for schooling.

Service Learning

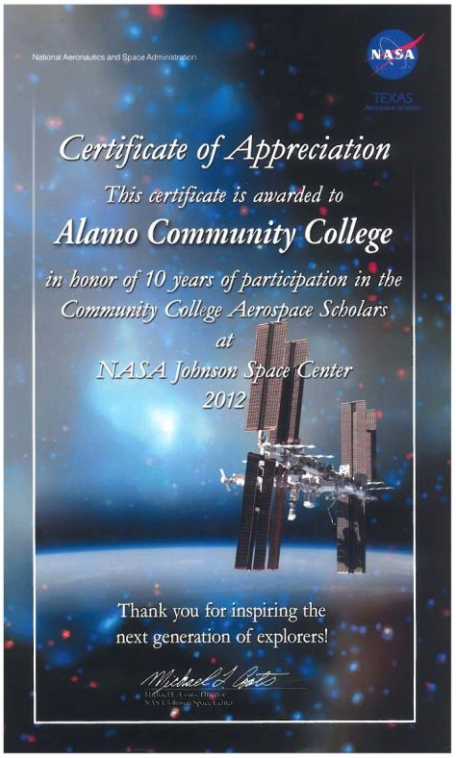
For the last eight years, I have conducted a service-learning project with my Introduction to Engineering students with the San Antonio Children's Museum that presently is named DoSeum[15]. Each year, student teams develop exhibits for children that demonstrate engineering concepts, which are judged by children at the museum. The museum then adds the winning projects to their interactive museum exhibits.

Internships

Using my numerous connections in industry (I was elected vice president of the Society of Plastics Engineers-Central Texas Section in 1998 and 2000), I have been able to create partnerships between the Alamo Community College District and private companies from San Antonio, helping students find internships, scholarships and even jobs.

Companies' positive experiences with our graduates and interns have helped us obtain these positions. During the last ten years about 17 of our students, five of them my mentees, have found internships with local companies.

NASA Community College Aerospace Scholars Program



Since 2002, I have coordinated NASA's **Community College Aerospace Scholars Program** for SAC and been NASA's point of contact for the entire Alamo Community College District. The program exposes students to projects simulating NASA activities.

Students have to complete several modules and projects online and have them evaluated by NASA engineers. Then I select the best projects and take these students to NASA for three days. At NASA, students learn scientific concepts, get experience with the way that engineers invent and solve problems together, and learn how the aerospace industry works. Almost all of my mentees participated in this program.

Undergraduate Research

SAC partnered with the University of Texas at San Antonio to obtain a NASA CIPAIR grant in 2009. NASA accepted four students and one faculty member in summer 2010 for a 10- week internship at the Johnson Space Center (JSC), and 10 students were accepted to receive stipends to perform undergraduate research projects at SAC under the supervision of two SAC faculty members.

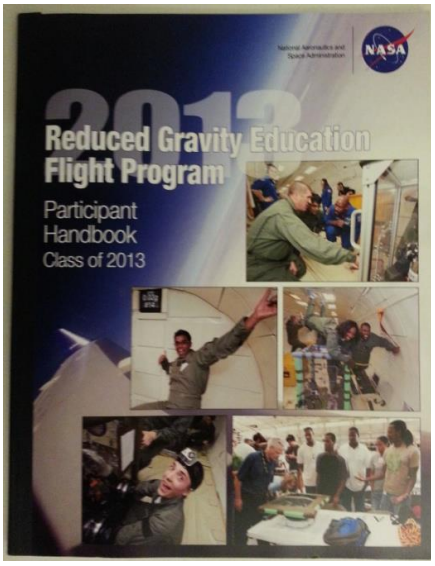
Of the SAC students selected as interns at JSC, two of my mentees were recommended for outstanding student intern and one of them, Elaina Lopez, a SAC sophomore, was selected for one of five Outstanding Intern 2010 Awards at NASA for helping design, manage and implement software for the JSC Chief Technologist to manage JSC's technology portfolio. For the CIPAIR research projects conducted on our college campus, the 10 students formed three teams based on topics of common interest and each team submitted a research proposal. One team studied the efficiency of photovoltaic solar panels under different conditions, using three donated panels from a local solar energy consortium to conduct their research. They designed and constructed directionally adjustable frames for the panels and completed their research during the summer. Another team selected a topic that might be helpful to future lunar farming: hydroponics. They designed and built the racks, containers and irrigation system in the Biology Department's greenhouse, and planted several types of vegetables, monitoring their evolution with respect to different feeding formulas and growing conditions. A third team designed and built a stationary bicycle exercise machine and used it to monitor the energy output of riders in three different pedaling positions.

After the fall 2010 school semester started, in conjunction with a site visit from the NASA Program Manager, a two-day public "Symposium" was held at SAC's MESA Center. Students presented the results of their research experiences to fellow students, faculty and attending NASA officials, and local press and radio stations. Our relationship with NASA continued in 2011, when two students and one faculty were accepted for ten-week summer

internships at Johnson Space Center and four students participated in solar panels research at our college.

The success of this program and funding provided by several other grants helped us institute a Summer Undergraduate Research Program on our premises[16]. The fundamental idea behind this program is that our students get to experience the entire research discovery process and the scientific method from A to Z, rather than acting as assistants for someone else's research. We formed a team of three professors (one a Physics professor, one an Electrical Engineer, and me, a Mechanical Engineer) who review proposals submitted by the students. We invite teams of science and engineering students to submit research proposals that interest them and we select the ones that show potential from multiple points of view such as potential to lead to further research, potential to interest companies in our area, and potential to attract more students to our program. At completion, the teams submit a research paper and make presentations during career days and Engineering Week at SAC. Since 2010, we have engaged about 90 students directly in our grass-roots research program, and many of my recent mentees have been involved in at least one project.

During the second half of 2013, two teams of four students each, both initially advised by me, submitted two undergraduate research proposals for NASA's Zero Gravity Program[17]. Both proposals were accepted and for the first time in the program's history two teams from the same community college participated simultaneously in the Zero G flights with their experiments built and tested by themselves. Three of the participating students were my mentees.



Two previous ASEE papers [18, 19] described a new partnership, called "Re-Energize," that is expected to help several two-year colleges develop their own research capabilities in renewable energy in collaboration with Texas State University. One team of students developed a project to research hydroponics methods of growing plans and another one developed a solar electric car and the next year a hydrogen fuel cell vehicle.

The hydrogen fuel cell vehicle team

The hydrogen fuel cell vehicle team participated in the 11th annual Shell Eco-marathon 2017 in Detroit and won the third place.

Throughout the 3-year Re-Energize program the excellent collaboration between San Antonio College and Texas State University resulted in strengthening our capacity to use renewable energy technologies and activities to support efforts to increase recruitment and retention of students, especially minorities and females, in STEM programs offered at our institution. In the future, SAC will continue to use the knowledge and experience gained during the Re-Energize program to further advance STEM education and outreach, especially to underrepresented minority students.

Demonstrated innovations that are replicable on a national level:

It is hard to determine which of my methodologies has had the most effect on the success experienced by my engineering mentees. One thing is for sure. Enthusiasm and passion is the key to any innovation attempted. The mentor must have enthusiasm and passion for the engineering profession, enthusiasm for passing the torch to the next generation, enthusiasm in upholding the highest professional standards, and enthusiasm in believing in the unlimited potential of his/her mentees!

Of the services and activities, I have initiated at SAC, the teacher-guided, student-led undergraduate research is probably the most important **innovative best practice that could be replicated on a national level**. I also believe that providing students with mentors that have **extensive experience as practicing engineers** can underpin the core of each experience that an undergraduate receives, and better prepare them to be engineers, both mentally and academically. Retention rates, grade point averages and graduation and transfer rates for engineering majors who have been nurtured in our experience-centered "nest" are much higher than the rates for SAC students as a whole.

Publications

After witnessing for several years a continuous decrease of students' 3-D visualization skills I decided to develop a series of exercises to help the correct the situation. The exercises were collected in a book "A, B, See in 3D"[20] published in 2015 and a second one "Counting Bricks from Ancient Ruins"[21] published in 2017. The results from these exercises were published in an ASEE paper presented at the 2016 annual conference in New Orleans [22].

Awards and Recognitions

I am proud to say that various institutions and agencies have recognized my work with awards and certificates, such as:

- 2006 National Award for excellence in Teaching presented at NISOD in Austin, TX
- Certificate of Recognition presented for Outstanding Contributions to the "Tuning Texas" Initiative by the Texas Commissioner of Higher Education in Austin, TX on November 21, 2013
- Certificate of Appreciation in honor of 10 years of participation in the Community College Aerospace Scholars at NASA Johnson Space Center in 2012

- Certificate of Recognition presented by Alamo Community College District in 2006 for being named "San Antonio's Top Professor" by *Scene* in the *San Antonio Monthly Magazine*
- Certificate of Appreciation in recognition of personal contribution to the advancement of science among young people, by Harmony Public Schools in 2014
- 2017 Mentorship Award, from Texas State University

Quantitative information on the impact of the mentoring

Not everyone is cut out to be a champion. I am hard on my mentees because I have to be or they will not succeed in engineering. However, of the approximately 150 students that I have reached out to mentor during the last sixteen years, **I consider that I have succeeded in mentoring at least 82 students intensively, with the following diversity:**

Mentees	**Total**		**Hispanic**		**African American**		**Anglo**		**Other**	
	#	%	#	%	#	%	#	%	#	%
Male	51	62%	26	51%	2	4%	22	43%	1	2%
Female	31	38%	17	55%	1	3%	12	39%	1	3%
Total	82		43		3		34		2	

Of these 82 intensively mentored students, **13 are still at SAC in engineering, at least 38 have graduated with an associate's degree in engineering and at least 64 have transferred into engineering-related four-year programs**. **Of the transfers, at least 32 have graduated with bachelor's degrees, seven are attending or have completed graduate school and about 29 are already employed successfully in engineering careers.**

During the last seven years **over 25 of my mentees were accepted for research internships** at the University of Texas at San Antonio, the University of Texas at El Paso, NASA, Lawrence Livermore, Sandia National Laboratories and H-E-B. Since 2010 to of my students received Intern of the Year awards from NASA's Johnson Space Center.

Tracking data of those mentored, including success rates, graduation rates, percentage matriculating to the next educational level, papers published, retention, promotion, etc...

Tracking students at the community college level is extremely difficult. SAC is a commuter college, where most students, many of whom already have families, must work. Many also "stop in" and "stop out" because of family, work issues, and often take a long time to finish their associate's degree or transfer. Our state and national systems are just beginning to track transfers; SAC belongs to the National Student Clearinghouse, but reports are not easy to obtain by major, and are incomplete; the state only tracks students who attend public institutions in Texas, and only in the aggregate. It can be very labor-intensive to find students by mail, e-mail or phone, and contact information changes rapidly among SAC's student population.

Through several grants I have obtained I have been able to get clerical support to track students in the grant programs, at least as long as they attend SAC. However, in most cases, my knowledge of the results of my mentoring has come from students' continued contact with me, usually via e-mail, to tell me where they have ended up studying or working.

Results for Mentees (n=82) who have been tracked			
Mentees	**# Number**	**% Percent**	**% Underrepresented minority or female**
Still attending SAC in Engineering (retained)	13	16%	74%
Obtained Internships and/or participated in Undergraduate Research	25	30%	66%
Graduated with AS in Engineering	38	46%	68%
Transferred to four-year program (and/or AS in Engr.)	64	78%	72%
Obtained Bachelor's Degree in Engineering/STEM	32	39%	78%
Attended/Now in graduate school	7	9%	71%
Employed in Engineering or STEM careers	29	35%	76%

The successes of mentees in pursuit of degrees or professional objectives and the quality of academic or job performance:

I am very proud of my students' **success upon transfer.** The fact that community colleges are focused solely on the first two years of engineering education has helped me provide our students with a solid foundation in engineering science on which they can build a successful engineering career upon transfer to a four-year institution. As a result of my mentoring efforts, a performance survey of SAC engineering students transferring to University of Texas at San Antonio (UTSA, the primary four-year program attended by SAC transfers) showed the positive effects of our program. I**n the third and fourth years of engineering studies, students who completed their first two years at San Antonio College were twice as likely to have a GPA between 3 and 4 as those who started directly at UTSA. SAC students were also half as likely as the UTSA "natives" to have GPA's in the lowest quartile.**

I addition to UTSA, my mentees have been accepted into and attended Kettering University, Baylor University, the University of Texas at Austin, Texas A&M Universities at College Station, Corpus Christi and Kingsville, St. Mary's University and Texas Tech. One African-American mentee studied aerospace engineering at a military academy. Three of my mentees have completed graduate school, and four are getting their master's degrees (five are Hispanic and two are Anglo).

Students I have mentored are succeeding in the workplace. Four Hispanic students are employed in engineering careers with ExxonMobil, Carestream Health, Toyota Gosei, Southwest Research Institute, and Baker Hughes, and one Anglo student is employed at Precision Molding. A married Hispanic female with children who obtained an AS in Engineering at SAC obtained work at San Antonio's Toyota plant as a quality control specialist; she was the only applicant

who scored 100% on the test they were given. At least three others are employed locally in various engineering positions.

Mentorship from the Perspective of a Student

Mentorship is an ongoing activity, one that doesn't end when a student has graduated and left the university. This student may send an email or reach out in any manner and seek advice once again when in need of it. Once you are a mentor to a student you are a mentor for life.

I graduate from SAC this Spring with an Associate's in Engineering and next fall I will be graduating from the University of Texas at San Antonio, UTSA, with two Bachelors' in Computer and Electrical Engineering, but this journey began many semesters ago while I was a student in high school. I have earned credits through various ways, dual enrollment classes, AP exams, two years of summer EDGE Program, and evening classes. All throughout this journey I was guided by mentors that served as examples, support groups, and role models. I want to take time now and explain what effect the mentorship of a faculty member has on a student from my first-hand experience.

As a STEM student you are always hearing about the difficulty of the courses ahead of you. These "rumors" grow even larger when you try to enter the field of engineering. When I finally decided on perusing an education in engineering, I wanted to tell everyone of my new-found passion. Rather than the usual "sounds like you have a plan" that I heard my fellow classmates get, I was met with a lot of "well that's a tough discipline" and even more "so you don't want a social life". From my point of view now, I can see that these were simply jokes but at the time they weren't viewed as jokes. At the time, I started to doubt my choices and began to think that engineering may not be for me. It wasn't until I went to a professor's office hour and discussed my concerns with him that I finally heard what would eventually lead to clearing any uncertainty from my mind. He informed me that while engineering is a rather difficult field, it isn't impossible. This professor would become a mentor to me in more ways than one. When I was faced with deciding between staying home for college or moving away, he helped me learn how to make these decisions. He taught me about persistence and learning from my mistakes and failures. When I earned an internship with the National Aeronautics and Space Administration, he cheered me on and helped clear any insecurities I had. And just like these examples, there are hundreds more to show how important and valuable his mentorship and guidance was to my growth. I know that if it wasn't for mentors like this professor in my life, I would have thrown the proverbial towel in a long time ago and given up on the field of engineering. That is why having faculty that are versed in all the roles and responsibilities of being a mentor is crucial for any institution that would like to have a high retention rate of their engineering students.

I have been fortunate to have several wonderful mentors in my life, most of which started out as just professors in my classes but became so much more. It is because of them that I wanted to become a mentor myself. In my second semester at UTSA I decided to become a peer mentor. I wanted to use the knowledge that my mentors gave me and pass it onto others who may be in the same shoes I was in. Peer mentors at universities and colleges throughout the world help bridge the gap between faculty and students. It is the happy middle that some students need when faced with the intimidating task to talk to a faculty member. I, myself, had no problem going up to a professor and asking for help but many students feel as though they are being a bother when approaching a faculty member, so peer mentorship programs are crucial in reaching out to these individuals. This is the second of many reasons why having outstanding faculty mentors is

important for all institutions. Mentorship is a trait that is passed down through practice. Students who have a great mentor in turn become amazing mentors to their peers and to others. This propagates throughout the university and creates an environment where students can flourish and reach their full potential.

My first mentoring experience was during my time in the EDGE, Early Development of General Engineering, program that I got my first taste of what it meant to be a mentor. My first year in the program, I took classes and participated in a robotics sumo competition. Because I had gone through the program already, when I returned to the program a second year I became a mentor to the robotics teams. I helped guide them with my experience. This is where I began to shape my style by learning that it is important to had the tools to the student but let them do most of the building, metaphorically speaking. I learned that students get more out of the experience if they are given advice from which they then make their own decisions. They learn nothing when the mentor steps in and completes the project for them.

I work for the Roadrunner Transition Experience (RTE) at UTSA. We assist students who are "non-traditional". Non-traditional means students who either transferred from another university or college, are veterans, international, or readmitted. We assign each student to a peer mentor that is typically in their major. This allows the student to ask for advice and guidance from someone who was in their shoes not too long ago. I have been doing this for a little over 4 semesters. I have been managing about 60 students and of that about 15 are active mentees, meaning they attend workshops, socials, and meetings I hold for them. My meetings are one-on-one with each of my mentees and in these meetings, I help solve any questions they may have. Questions range from simple "how should I manage my time better" to more complex questions like "I am having second thoughts about the field of engineering and would like help learning more about what I'm getting into". My mentorship has seen sad times when mentees chose to leave the university, but it has also seen some wonderful times when mentees have gotten their dream internship or got accepted into the student organization they have been trying so hard to get into. My personal style of mentorship is one of guidance and openness. This means that I am very upfront with my mentees. I don't try to put myself on this high pedestal and lecture them on "what it is to be a good student". Instead I let them know about my flaws and mistakes. This lets them learn from my mistakes and lets them know that I'm just like them. It helps open them up and they seem to become more comfortable coming and asking me for help. I use the same mentoring styles my mentors have used on me.

In addition to RTE, I have been mentoring a FIRST Tech Challenge robotics team out at STEM Early College High School for the past two years. A couple years ago I became a College of Engineering ambassador and I was placed in charge of the students who were conducting outreach to Harlandale ISD as part of a pilot program in partnership with Toyota. I took the initiative to focus our resources on STEM High School because these were students who had an interest in engineering and other STEM fields. Toyota really liked what we were doing with the students in the high schools involved in the program so they decided to continue the partnership. This semester I go out with two other UTSA students twice a week and help mentor high school students program and build robots to compete in weekend competitions. As of right now my duties have been to assist in creating an autonomous program, build components of the robot, and get students to practice driving the robot. In this setting my mentoring philosophy remains the same, I provide guidance. Being a mentor in no way means doing the work for them. Therefore, when my team gets stuck I simply sit down with them and discuss the problem at

hand and help them come up with solutions. This allows for creativity and independence to flourish.

As I have said throughout my portion of this document, the mentors I have had at SAC and throughout my education have shaped me into the student and person I am today. They have also shaped my own mentoring styles and techniques. They have shown me the importance of good mentorship and inspired me to become an amazing mentor to others. Because of them, I am accomplishing my dreams, outshining my classmates, and in turn mentoring my peers to reach their full potential as well.

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APPENDIX

Results for Grant Supported Scholarship Recipients

Degrees awarded to previous SAC CSEMS/S-STEM (2002-2012) Recipients (N=282) as documented in National Student Clearinghouse (NSC) Database	**# of Students**
# of META Scholars receiving Associate of Science Degree (AS)	54
# of META Scholars receiving Associate of Applied Arts and Sciences Degree (AAS)	43
# of META Scholars receiving Bachelor of Science Degrees (BS)	90
# of META Scholars receiving Bachelor of Applied Arts & Science (BAAS)	6
# of META scholars receiving Master of Science (MS) Degrees	7
# of META Scholars receiving Doctor of Pharmacology Degrees	2
# of META Scholars receiving Doctor of Philosophy degree	1

National Student Clearinghouse (NSC) data included only a handful of major descriptions for the degrees awarded above. These included four BSs in Electrical Engineering, three in Mechanical Engineering, two in Chemical Engineering, and one in Computer Science.

Student Status for SAC S-STEM (2013-2017) Recipients (N=52*) as per NSC Database	**# of Students**
# of META Scholars receiving Associates Degree	36
# of META Scholars receiving Associate of Science Degree	18
# of META Scholars currently enrolled in 4-year Engineering Program	18
# of META Scholars currently enrolled in 4-year program in Other STEM Field	4
# of META Scholars retained at least one year in 4-yr STEM Program to date	12
Current average GPA for META Scholars (SAC-wide average GPA is X.XX)	3.21

** One student duplicated from previous S-STEM grant.*