

AC 2009-516: TEXAS RESEARCH EXPERIENCE (TREN) PROGRAM: A PROGRESS REPORT ON SUCCESSES, CHALLENGES, AND ONGOING IMPROVEMENTS

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Texas Research Experience (TREX) Program: A Progress Report on Successes & Challenges + Ongoing Improvements

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Abstract

Paper Overview

This paper provides an update on the progress of the Texas Research Experience (TREX) Program offered by the Equal Opportunity in Engineering (EOE) Program at The University of Texas at Austin. TREX is a formal program designed to expose undergraduate minority engineering students to research and encourage them to pursue graduate studies. Over the past six years, we have collected post TREX career path data for former research assistants. In this paper, I present a summary of our results, challenges, and collaborative efforts with corporate partners such as Intel Corporation. In addition, this paper outlines recent updates to our selection criteria and program structure. Implemented in the last two to three years, these enhancements are designed to increase the percentage of TREX research assistants who pursue graduate studies.

Background

The Texas Research Experience (TREX) Program was created at The University of Texas at Austin in 1992 to provide technical learning experiences for diverse undergraduate students enrolled in the Cockrell School of Engineering. Hosted by the Equal Opportunity in Engineering (EOE) Program for more than 15 years, TREX has produced valuable research opportunities during the academic year for more than 325 undergraduate engineering students. The Texas Research Experience (TREX) Program provides undergraduate students with a unique opportunity to establish strong links with faculty, gain hands-on laboratory experience, and develop an appreciation for research careers in academia and industry. TREX participants receive a \$2,600 research stipend (\$1,300 per semester) and are required to spend an average of 10-14 hours per week on his/her research project throughout the fall and spring semesters. In addition, TREX participants are required to submit: (1) a research plan; (2) monthly progress reports; (3) a daily research journal; and (4) a final written report. Finally, TREX participants are expected to attend weekly seminars/group meetings and prepare a poster and oral presentation.

Since Fall 2001, 97 students have participated in TREX. The retention rate in engineering for TREX participants is ninety-nine percent (n=96 out of 97). Twenty nine are currently enrolled in our undergraduate engineering program. Sixty-seven have graduated from our undergraduate engineering program. One graduated from an undergraduate program at UT other than engineering. Thirty nine percent of TREX participants enrolled in graduate school after completing their undergraduate degrees (n=26 out of 67).

Organization Background

The Cockrell School of Engineering established the Equal Opportunity in Engineering (EOE) Program in 1970 to promote the recruitment, retention and academic development of African American, Hispanic, and Native American students interested in pursuing careers in engineering. Since that time, EOE has expanded its goals and now seeks to increase the diversity of its student body by supporting students who come from historically underrepresented population groups in Texas or students who have backgrounds or experiences that will contribute to the overall diversity of the Cockrell School of Engineering.

Introduction

The Texas Research Experience (TREX) Program provides a unique opportunity for successful upper division students to: further enhance their academic experience with undergraduate research; learn about careers in research and product development in an academic setting; learn about the benefits of obtaining a graduate engineering degree; and use the experience to become a competitive graduate school applicant. TREX participants receive a \$2,600 research stipend (\$1,300 per semester) and are required to spend an average of 10-14 hours per week on his/her research project throughout the fall and spring semesters. TREX participants are required to submit: (1) a research plan; (2) monthly progress reports; (3) a daily research journal; and (4) a final written report. In addition, TREX participants are expected to register for the TREX weekly course, which includes group/one-on-one meetings, roundtables & workshops. Finally, TREX participants participate in Longhorn Research week and complete a research poster and oral presentation.

TREX industry sponsors may recommend faculty members for the students to work with, who are conducting research on campus sponsored by their company. This partnership ensures that TREX participants are not only exposed to industry-sponsored university research but also acquire technical experience that can be applied during a summer internship program.

Currently, the TREX Program is designed to meet the following objectives: (1) Increase students' confidence level in their ability to conduct research at the graduate level; (2) Provide a hands on learning experience for minority engineering undergraduates; (3) Expose minority engineering undergraduates to research techniques and get them involved in the Cockrell School of Engineering's research community; (4) Enhance the students' technical background and communication skills in their chosen field; (5) Increase students' interest and knowledge regarding graduate education; (6) Encourage minority engineering undergraduates to attend graduate school and increase the number who receive graduate degrees.

Current metrics to measure success of the TREX program include the following: (1) Increased applicant pool to TREX; (2) Student Research Plans, Progress Reports, & Final Reports; (3) Student evaluations; (4) Faculty evaluations; (5) Matriculation of TREX participants (a.) Graduated from Cockrell School of Engineering, (b.) Entering workforce, (c.) Entering graduate school.

Since 1992, TREX has produced valuable research opportunities during the academic year for more than 325 undergraduate engineering students. In 2001, we began tracking career paths for

students participated in TREX. Since then, 39 percent of TREX participants enrolled in graduate school after completing their undergraduate degrees (n=26 out of 67). In addition, the retention rate in engineering for TREX participants is 99 percent (n=96 out of 97). Table 1 provides a summary of the Career Paths Post TEX.

Table 1. Student Career Paths Post TREX.

	2001- 2002	2002- 2003	2003- 2004	2004- 2005	2005- 2006	2006- 2007	2007- 2008	2008- 2009
TREX participants	8	12	7	10	14	15	17	14
Still enrolled in CSE	0	0	0	0	0	3	12	14
Graduated from CSE	7	12	7	10	14	12	5	0
Graduated from UT (another college)	1	0	0	0	0	0	0	0
Entered Workforce	6	6	7	6	10	4	3	n/a
Entered Graduate School	2	6	0	4	4	8	2	n/a
% in Graduate school after completing BS degree	25%	50%	0%	40%	29%	67%	40%	n/a

Enhancements to Texas Research Experience (TREX) Program

The following information builds on a paper called *Developing an Appreciation for Careers in Research Through the Texas Research Experience Program*¹ authored by Andrea Ogilvie and published in the Proceedings of the 2004 American Society for Engineering Education Annual Conference & Exposition. The paper “Developing an Appreciation for Careers in Research Through the Texas Research Experience Program” provides Program Overview which includes: (1) General information; (2) Participant Feedback; (3) Program Funding and Expenditures; (4) Planning and Preparation; (4) Application and Selection Process; (5) TREX Program Start Up; (6) TREX Program Close Out. In addition, the paper documents Program Results, and Opportunities for Future Enhancements as of March 2004. Since then, we have continued to identify opportunities for improvement as well as implemented solutions to overcome challenges along the way. Table 2 highlights challenges and solutions. This paper is designed to provide an update on various segments of the TREX Program that have been enhanced since 2004.

Table 2. TREX Program – Solutions implemented between March 2004 through March 2009.

	Challenge	Solution	For specifics, refer to:
1.	Late start date for research activity (October vs. August)	Move up recruiting & placement timeline.	<i>Planning and Preparation</i>
2.	Drop in % of TREX participants enrolling in Graduate school after completing BS degree	Update application criteria and selection process	<i>Application and Selection Process</i>
3.	Gap in expectations & communication between students & professors	Use contract to define communication plan.	<i>TREX Faculty Mentor & Student Contract</i>
4.	Student schedule conflicts with status meetings and workshops.	Set up class & require student registration in Fall/Spring	<i>Weekly Seminar</i>

Planning and Preparation

Since 2004, the program coordinator has moved up the recruitment, selection, and placement process on the project timeline from May to April. The administrative aspect of the TREX Program continues to be managed by staff from the Equal Opportunity in Engineering (EOE) Program at UT Austin. The EOE program coordinator promotes the TREX program to students, selects the candidates, works with faculty to place students on research assignments, distributes the research stipend, monitors student progress on research projects, and collects program evaluations. Table 3 details the updated project timeline for TREX.

Table 3. TREX Program – Project timeline for 2008-2009 academic year.

	Proposed Due Date	Task
Program Start Up	March	<ul style="list-style-type: none"> Preparation of application materials & website
	April 1	<ul style="list-style-type: none"> Email sent to invite students that qualify for program
	May 15	<ul style="list-style-type: none"> Deadline for submitting applications
	June	<ul style="list-style-type: none"> Evaluate applications & select TREX participants
	July	<ul style="list-style-type: none"> Letters & emails sent out to prospective TREX participants Students confirm participation Students submit requests for faculty mentors
	August 1	<ul style="list-style-type: none"> Faculty assignments completed
Program Management	September	<ul style="list-style-type: none"> Program begins w/ Fall orientation meeting First meeting with faculty member Submit research plan Submit TREX Faculty Mentor & Student Contract
	Monthly	<ul style="list-style-type: none"> 15th of each month – progress reports due
	December 16	<ul style="list-style-type: none"> End of semester faculty & student evaluations due
	January	<ul style="list-style-type: none"> Spring orientation meeting Present guidelines for final report & oral presentation
	April	<ul style="list-style-type: none"> TREX poster presentation & oral presentations
	May 5	<ul style="list-style-type: none"> Final reports due End of year faculty & student evaluations due

Application and Selection Process

In Summer 2006, the application criteria and selection process was enhanced in an effort to identify and serve TREX candidates who were better prepared and more likely to pursue graduate studies in the future. Currently, students who apply for the TREX Program must meet the following qualifications: (1) Be a US Citizen or Permanent Resident; (2) Be enrolled in the Cockrell School of Engineering during Fall 2009 & Spring 2010; (3) Have completed at least 45 credit hours by Sept. 1, 2009 with AT LEAST 30 hours completed at UT Austin; (4) Receive an A or B in any/all of technical labs taken; (5) Have a cumulative GPA of 3.0 or better; (6) Attend mandatory training prior to the first day of the Fall semester; (7) Enroll in a one hour course that meets weekly for both semesters (GE 027M).

In order to apply for TREX, students must submit the following items: (1) a completed online application; (2) two letters of recommendation; (3) two essay responses related to student's interests, goals, and preparation; (4) and a professional resume. Current essay questions include the following:

1. The Texas Research Experience (TREX) program is an opportunity for successful upper division students to further enhance their academic experience with undergraduate research, learn about the benefits of obtaining a graduate engineering degree, and ultimately use the experience to become a competitive graduate school applicant. Selected participants demonstrate exceptional academic competence, leadership skills, independence and ingenuity, and the ability to balance multiple responsibilities without sacrificing the quality of their output. Submit a one page personal statement that describes why you are interested in TREX and how getting involved with this program will help you meet your career goals. Describe any past experiences that have led to your interest in research and/or graduate school that might be helpful in evaluating your application. You are welcome to share aspects about your background that have not been reflected elsewhere in your application.
2. TREX gives participants a chance to experience all aspects of research within the realm of academia. As a graduate student in such an environment, one is expected to take initiative on specific research projects and produce results with limited supervision or instruction from an advisor. Submit a one-page essay in which you describe an experience you have had where you received an assignment/project with little instruction. Comment on how you addressed this situation. This should include your initial assessment of the situation, your internal reasoning, and subsequent action/inaction. Your response should also include the outcome, positive or negative, and your analysis of the outcome as it relates to your personal experience/growth.

Completed TREX applications are evaluated by the EOE program coordinator using a combination of objective and subjective criteria. Table 4 details the updated criteria and point system used to select TREX participants.

Table 4. TREX Program – Criteria for Candidate Selection.

Objective Criteria (maximum 64 points)	
Overall UT GPA	Max 15 points (distributed based on GPA 3.0-4.0)
Basic Sequence GPA	Max 15 points (distributed based on GPA 2.0-4.0)
Enrollment in Major Sequence	Max 10 points
Classification	Max 10 points (distributed based Sophomore- Senior)
Fathers Highest Education Level	Max 5 points (distributed based on No HS – Grad Degree)
Mothers Highest Education Level	Max 5 points (distributed based on No HS – Grad Degree)
Participation in EOE initiatives	Max 4 points (distributed based on level of involvement)
Subjective Criteria (maximum 56 points)	
Letter of Recommendation #1	Max 10.5 points
Indication of Motivation	5 points
Skill/Attitude Comparison	3.5 points
Summary	2 points
Letter of Recommendation #2	Max 10.5 points
Indication of Motivation	5 points
Skill/Attitude Comparison	3.5 points
Summary	2 points
Personal Statement Prompt #1	Max 15 points
Writing Composition	5 points

Content	10 points
Personal Statement Prompt #2	Max 20 points
Writing Composition	5 points
Content	15 points

TREX Faculty Mentor & Student Contract

Upon acceptance into the TREX program, students are placed on a research project under the supervision of a TREX Faculty Mentor. The TREX Faculty Mentor has the option of delegating some supervisor duties to a graduate student mentor, who will be the student's immediate supervisor. The supervisor is responsible for assigning research work, lab duties and signing the student's timesheets and monthly progress reports. Students are responsible for keeping track of their work hours for each semester.

In summer 2006, the TREX Faculty Mentor & Student Contract was implemented to close the communication gap between the TREX Faculty Mentor and Student. The purpose of the contract is to: (1) Foster lines of communication between student and TREX Faculty Mentor; (2) Enable student to receive guidance and any other necessary information on research project; (3) Enable student to secure Faculty signature on mandatory biweekly timesheets and monthly progress reports. Within one week of the Fall TREX Orientation Session, students are required to meet with the Faculty Mentor to complete and sign the TREX Faculty Mentor & Student Contract. The contract is kept on file with the TREX Coordinator for future reference.

Sample text from the TREX Faculty Mentor & Student Contract includes the following:

1. Select which of the following is most appropriate for meeting regularly with your Faculty Mentor. Fill in appropriate day and time.
 - a. I will meet with my TREX Faculty Mentor weekly/biweekly as a part of my lab's regular weekly/biweekly meeting. These are held weekly/biweekly on _____ (day) at _____AM/PM.
 - b. I will meet with my TREX Faculty Mentor 1-on-1 every _____of each month at _____AM/PM.
2. My immediate supervisor (or graduate student) will be: _____
3. The best way for me to contact my TREX Faculty Mentor is (select appropriate):
 - a. E-mail: _____
 - b. Phone: _____ *office*
 - c. Phone: _____ *lab*
 - d. Phone: _____ *home*
 - e. Phone: _____ *other*
 - f. Other: _____

Ultimately, the contract lays the foundation for a mutually beneficial, open environment for the student and their TREX Faculty Mentor. The contract assists with setting up bi-weekly meetings and identifying preferred methods for communication to ensure the student is receiving guidance on their research project throughout the academic year. In addition, the contract also indicates the dates and times of scheduled events for the academic year, including roundtable discussions and final presentations. Attendance by the supervisor is encouraged but not required.

Weekly Seminar

In Fall 2008, the TREX Program Coordinator instituted a TREX weekly course to eliminate student schedule conflicts with the group/one-on-one meetings, roundtables & workshops. TREX participants are required to register for the course in the Fall and Spring Semesters. The weekly course reserves times for the following: (1) Status Meetings; (2) Roundtable Discussions; (3) Workshops; (4) Final Oral Presentations.

Status Meetings bring the TREX Coordinator and participants together to touch base, keep up to date with TREX information, and discuss upcoming events. Special guest speakers are invited to join TREX participants for interactive Roundtable discussions. Roundtables are designed to enhance the research experience and inform students about the opportunities available to those who obtain a graduate degree. Table 5 provides a summary of Roundtable Discussions offered during the 2008-2009 academic year.

Workshops, offered through “Considering Graduate School: An EOE Workshop Mini Series”, address various topics and are designed to appeal to students who are considering graduate school and to those in the process of applying to graduate school. The workshops are open to all students in the Cockrell School of Engineering. Table 5 provides a summary of workshops offered through “Considering Graduate School: An EOE Workshop Mini Series” during the 2008-2009 academic year. Finally, oral presentations are set to take place during the TREX weekly course meetings in April.

Table 5. Line up for TREX Weekly Course during the 2008-2009 academic year.

Date	Topic	
Aug. 22	Status Meeting	Fall TREX Orientation/Training
Sept. 8	Roundtable Discussion	Ethics in Research
Sept. 22	Roundtable Discussion	Careers in Academia
Oct. 6	Status Meeting	Status Meeting #1
Oct. 13	EOE Workshop Mini Series	Is Grad School Right for Me?
Oct. 27	EOE Workshop Mini Series	Paying for Graduate School: GEM
Nov. 10	Roundtable Discussion	Grad School Application: Tips from the Insiders
Dec. 1	Status Meeting	Status Meeting #2
Jan. 21	Status Meeting	Spring TREX Orientation/Training
Jan. 28	Status Meeting	Status Meeting #3
Feb. 11	Roundtable Discussion	Getting Recognized (& Publishing Research)
Mar. 4	EOE Workshop Mini Series	Demystifying the GRE
Mar. 25	EOE Workshop Mini Series	Writing a Personal Statement
Apr. 15	Presentations	Oral Presentations
Apr. 22	Presentations	Oral Presentations
Apr. 30	Presentations	TREX Poster Session & EOE Excellence Awards Banquet

TREX Program Funding

Over the past 15 years, the TREX Program has been funded by multiple grants from the National Science Foundation and corporate foundations such as: Intel Corporation, Ford Motor Company,

Applied Materials, and The Boeing Company. Securing TREX Program funding is an ongoing challenge that is overcome with creative partnerships and solutions. Preparing TREX Program descriptions that can be integrated into Faculty NSF proposals has proven to be a winning approach to secure supplemental funding for undergraduate research assistants. The National Science Foundation and Intel Corporation have been the most significant investors in the Texas Research Experience Program.

During the 2007-08 academic year and summer 2008, 21 students participated in the TREX program. 43 percent of TREX participants (9 research assistants) were funded by the Intel Undergraduate Research Grant. During the 2008-09 academic year, 14 students are participating in the TREX program. Five TREX participants were funded by the Intel Undergraduate Research Grant and an additional five will be supported in summer 2009.

Intel's Perspective on Sustaining Undergraduate Research Programs with Private Sector Funds
Intel's involvement in education is long-standing and spans K- graduate school. Intel, through the Intel Teach to the Future program is interested in teaching K-12 teachers how to effectively use Technology in the classroom. Intel's Undergraduate Research program engages students directly in ongoing research at their university to provide them with "hands on" research experience in their chosen field. Finally, Intel's sponsored research and student fellowship programs support graduate students in the US and worldwide in their pursuit of graduate degrees. This long-standing support of education comes from the belief that Innovation starts with Education and every high technology company needs a strong pipeline of well educated, technical talent to ensure future growth.

The Undergraduate Research Program has been supported from the Intel Foundation since October 2005. During that time, over 800 students across multiple university campuses have been given the opportunity to do at least 1 research project. These projects are supplemented with mentoring and various workshops including how to apply to graduate school, why consider graduate school, taking the GRE, presenting research results and technical writing. Retention rate of students in the Intel Undergraduate Research Program is just over 95% nationally and approximately 59% of the students who graduate in STEM-related disciplines go onto graduate school. Looking forward, Intel is looking to create additional partnerships with other companies and other agencies to continue to grow the scope of this program.

Opportunities for Future Enhancements to Program

The University of Texas at Austin ranks third in the nation in producing undergraduate engineering degrees for underrepresented groups.² As a result, UT Austin has direct access to a large pool of undergraduate minority students and the opportunity to influence many of them to pursue graduate studies in the STEM field. The Texas Research Experience (TREX) Program will continue to serve as one of our formal programs designed to expose undergraduate minority engineering students to research and encourage them to pursue graduate studies. We continue to have a number of ideas on the drawing board for future consideration and implementation. The following provides a brief summary of opportunities to enhance TREX in the future.

TREX Program – Student Recruiting

1. Continue Building Relationships between TREX Coordinator & Faculty Members
 - a. Empowers & encourages faculty members to recruit high potential students to apply for TREX each year
 - b. Enables faculty to proactively recruit undergraduate research assistant with prior knowledge of the research area.
2. Actively promote the option to claim course credit for participating in TREX Program
 - a. Since the process varies in each of our eight engineering departments, the TREX coordinator needs to guide students through the process of registering for an independent research study course.
3. Actively promote the opportunity for students to present research findings at national conferences
 - a. TREX Coordinator will need to set budget limit for each trip
 - b. Top performing TREX participants will be eligible for this opportunity
 - c. Top performing TREX participants will be identified by faculty at the end of year presentation and poster session.

TREX Program – Faculty Involvement

1. Use the EOE Faculty Committee to close gaps and proactively recruit TREX participants for UT Austin's Graduate School
2. Increase the number of Roundtable Discussions between Faculty and TREX participants to assist with exploring career path options in academia and research
3. Initiate a faculty led workshop to:
 - a. assist students with developing technical and organizational skills
 - b. address expected student performance in the research lab
 - c. explain how students can be an asset to the lab

Closing the Gap – Converting More Undergraduates into Graduate Students

1. Work with Cockrell School of Engineering (CSE) to offer guaranteed fellowship offers to students who have successfully completed TREX and have been admitted to UT Austin's Graduate School
2. Build relationships with CSE Graduate Advisors and Coordinators
 - a. Showcase TREX participants to CSE Graduate Advisors and Coordinators
3. Continue building relationship with the GEM Program Coordinator
 - a. Showcase TREX participants to GEM Program Coordinator
 - b. Encourage TREX students to apply for GEM fellowships
4. Provide a financial incentive to TREX participants who complete all of the following:
 - a. Take the Graduate Record Examination
 - b. Apply to UT Austin's Graduate School
 - c. Complete the National GEM Consortium Fellowship application

References

1. Developing an Appreciation for Careers in Academia through the Texas Research Experience. ASEE Annual Exposition & Conference, June 2004. Salt Lake City, Utah.
2. Top 100 Degree Produces 2008, Total Minority Undergraduate Degree in Engineering. Diverse Issues in Higher Education. http://diverseeducation.com/top08/top100_listing.html