

Texas Research Experience Program: A Model for Undergraduate Research Programs

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Abstract

In 12 years, the Texas Research Experience (TRES) Program at The University of Texas at Austin has produced valuable research opportunities during the academic year for more than 285 undergraduate minority engineering students. TRES provides 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. This paper captures lessons learned over the years and describes how to create a successful undergraduate research program on your campus. Along with an overview of the TRES program and its benefits, the following program components are covered in detail: funding and expenditures, the application and selection process, student placement, program management, assessment, and participant feedback.

Introduction

The Texas Research Experience (TRES) Program was created at The University of Texas at Austin in 1992 to provide technical learning experiences for African American, Hispanic, and Native American undergraduate students enrolled in the College of Engineering. Hosted by the Equal Opportunity in Engineering (EOE) Program for more than 12 years, TRES has produced valuable research opportunities during the academic year for more than 285 undergraduate minority engineering students.

The EOE Program at UT Austin was created to recruit and retain African American, Hispanic, and Native American students interested in pursuing careers in engineering. EOE supports students historically underrepresented in engineering and strives to increase the number of minority engineering graduates from UT Austin through comprehensive support programs that address outreach, recruitment, academic enrichment, leadership, and professional development. EOE builds a support network for advancement by creating opportunities that encourage minority engineering students to interact with peers, faculty, alumni, and corporate representatives. As a result of EOE and programs such as TRES, the minority student enrollment in the College of Engineering has increased substantially over the past 33 years. In Fall 2004, minority students represented 17.6 percent (n=890) of the total undergraduate enrollment¹ in the College of Engineering. In 2003-2004, 16 percent (n=147) of the undergraduate engineering degrees from UT Austin's College of Engineering were awarded to African American, Hispanic, and Native American students.

TRES was initiated to address the following challenges: (1) lack of African American, Hispanic, and Native American students pursuing graduate degrees in engineering; (2) large percentage of African American, Hispanic, and Native American engineering students with limited exposure to and involvement in research projects on campus; (3) large percentage of African American,

Hispanic, and Native American engineering students with limited knowledge about career opportunities in research; and (4) lack of mentor/mentee relationships between faculty and students. The TREX Program provides students with the opportunity to establish strong links with faculty, gain hands-on laboratory experience, and develop an appreciation for research careers in academia and industry.

The program objectives for TREX include the following: (1) provide a hands on learning experience for minority engineering undergraduates; (2) expose minority engineering undergraduates to research techniques and get them involved in the College's research community; (3) enhance the students' technical background and communication skills in their chosen field; (4) increase students' interest and knowledge regarding graduate education; and (5) encourage minority engineering undergraduates to attend graduate school and increase the number who receive graduate degrees.

Over the past 12 years, many TREX participants have presented the results of their research projects at national conferences, including the National Conference for Undergraduate Research, the SHPE National Technical Paper Competition, the NSBE Graduate School Conference, the Graduate Engineering Council Conference, and the UT System LSAMP Conference.

Program Overview

Through the TREX Program, minority engineering undergraduates have the opportunity to experience and contribute to ongoing research at The University of Texas at Austin. Research topics range from vehicle crash tests to fire dynamics. 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 monthly group meetings and prepare a poster and oral presentation.

Participant Feedback

While participating in the TREX Program, students gain an appreciation for careers in research and academia as well as receive individual mentoring from faculty members and graduate students. Through these relationships, TREX participants learn about opportunities that may be available to them during and after a graduate education. This experience builds their confidence and convinces them that pursuing a graduate degree is both valuable and feasible. TREX participants provided the following testimonials about their personal experience in the 2002-2003 TREX Program.

“My TREX experience has been fascinating to date. I am honored to be working in one of the best optics labs in the country. I have learned so much in the last month and would definitely recommend this experience to everyone.” – Oluseye Aliu, Senior Electrical Engineering, “Polarization Sensitive Optical Coherence Tomography (PS-OCT) for Glaucoma Detection”

“The TREX program has definitely been a positive experience that has led me to consider graduate school and possible a career centered on research.” – Christina Castanon, Junior Civil Engineering, “Environmentally Friendly Sulfonated Hydrocarbons”

“The TREX Program has been a great experience. To actually get an opportunity to apply what I’ve learned over the past couple of years and to take a glimpse at what I might be doing for the rest of my life is almost too good to be true.” – Eddie DeGracia, Senior Mechanical Engineering, “Microscale Laser Materials Processing”

Program Funding and Expenditures

The program cost per TREX participant is approximately \$3,000. The budget for each participant is allocated as follows: (1) 90 percent – research stipend; (2) 5 percent – supplies; and (3) 5 percent conference participation and travel. The primary challenge faced while implementing TREX is securing adequate funding to support the program. Over the past 12 years, the TREX Program has been funded by several grants from the National Science Foundation and corporate foundations such as: Ford Motor Company, Applied Materials, and The Boeing Company. Table 1 details the final expenses from the 2002-2003 TREX Program.

Table 1. TREX Program Expenses for 2002-2003 academic year.

Item	Expense
Research Stipends (13 Participants @ \$2,600 each)	\$33,800.00
Supplies, Copies, & Postage	\$1,062.00
National Conference Registration & Travel	\$1,715.00
TOTAL	\$36,577.00

Planning and Preparation

The administrative aspect of the TREX Program is 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 2 details the project timeline for TREX.

Table 2. TREX Program – Project timeline.

	Time Period	Phase	Task
Program Start Up	April	Application Process	<ul style="list-style-type: none"> • Prepare application materials & website
	May - July	Recruit Applicants	<ul style="list-style-type: none"> • Email sent to invite students that qualify for program
	August	Selection & Placement Process	<ul style="list-style-type: none"> • August 1st - Deadline for submitting applications • Evaluate applications & select TREX participants • Letters & emails sent out to prospective TREX students • August 15th - Students confirm participation & submit requests for faculty mentors • August 28th - Secure research assignments

	September	Fall kick-off	<ul style="list-style-type: none"> • Host fall orientation meeting • Require first meeting with faculty advisor • Sept 27th - submit research plans
Program Management	October - December	Monthly meetings	<ul style="list-style-type: none"> • 15th of each month – progress reports due
	January	Spring kick-off	<ul style="list-style-type: none"> • Host spring orientation meeting • Present guidelines for final report & oral presentation
	February-April	Monthly meetings	<ul style="list-style-type: none"> • 15th of each month – progress reports due
	April	Presentations	<ul style="list-style-type: none"> • April 30th - TREX poster presentation & oral presentations
	May	Final Report & Evaluations	<ul style="list-style-type: none"> • May 5th - Final reports due • End of year faculty & student evaluations due

Application and Selection Process

Between April and July, the EOE program coordinator actively recruits prospective TREX participants for the upcoming academic year. In order to be eligible for the TREX Program, students must have completed 30 credit hours with a 3.00 cumulative GPA. In addition, candidates must have completed Calculus II, Physics II, and Physics Lab II. Students who meet the minimum qualifications receive an email and letter from the EOE program coordinator, inviting them to apply for the TREX program.

Prospective TREX participants can access all program details and the application packet online at: http://www.engr.utexas.edu/eoe/tx_res_experience.cfm. In order to apply for TREX, students must submit the following items: (1) a completed application form; (2) a one-page statement outlining the student's interests and goals; (3) an official academic transcript; and (4) a letter of recommendation from a faculty advisor.

Completed TREX applications are evaluated by the EOE program coordinator using a combination of objective and subjective criteria. The four components of the TREX application are weighted as follows: (1) 15 percent - application form; (2) 25 percent - personal statement; (3) 35 percent - official transcript; and (4) 25 percent – faculty recommendation letter. Table 3 details the criteria and point system used to select TREX participants.

Table 3. TREX Program – Criteria for Candidate Selection.

Objective Criteria (maximum 45 points)		
Category	Division	Points
Cumulative GPA (maximum 10 points)	=4.0	10
	>3.9	9
	>3.8	8
	>3.7	7
	>3.6	6
	>3.5	5

	>3.4	4
	>3.3	3
	>3.2	2
	>3.1	1
	>3.0	0
Physics Lab (maximum 20 points)	A	20
	B	15
	C	10
Classification (maximum 15 points)	Senior	15
	Junior	10
	Sophomore	5
Subjective Criteria (maximum 50 points)		
Category	Division	Points
Letter of Recommendation (maximum 25 points)	Very High	25
	High	20
	Average	15
	With Hesitation	10
Personal Statement (maximum 25 points)	Clarity	Up to 10
	Reasoning	Up to 10
	Language & Grammar	Up to 5

TREX Program Start Up

In August, students selected for the TREX Program are notified by mail. Once the student has reviewed TREX Program conditions, they are required to sign and return the TREX award contract enclosed in the TREX award packet. During the fall orientation meeting, the TREX program coordinator reviews the award contract and program conditions with the TREX participants. Program conditions for each participant include but are not limited to the following: (1) must enroll in 12-15 hours of classes and labs each semester; (2) must spend an average of 10-14 hours a week on his/her research project; (3) must attend TREX orientation meetings and monthly group meetings; (4) must submit a research plan, monthly progress reports, and final technical report; and (5) prepare an oral presentation and poster presentation. In addition, TREX participants are encouraged to search the College of Engineering website to learn more about the numerous research programs on the UT campus. TREX research assignments are driven by the students' research interest. The EOE program coordinator strives to accommodate students' requests to work with specific faculty members.

TREX Program Management

During September through April, TREX requires on going program management. Initially, TREX participants prepare and submit a three page research plan, developed with assistance from the sponsoring faculty member, which clearly defines the project and scope of work. The research plan ensures that expectations for all stakeholders (student, sponsoring faculty member, and EOE staff) are met at the end of the research project. In order for the EOE program coordinator to monitor the progress of student research projects, TREX participants are required to maintain a research journal with daily entries describing research activities as well as submit monthly progress reports. In addition, the EOE program coordinator hosts monthly group meetings that provide students with the opportunity to discuss research challenges, receive

information regarding engineering research careers, and benefit from presentations made by faculty and industry representatives.

TREX Program Close Out

At the conclusion of the research experience, TREX participants summarize the results of their research project with a 15-minute oral presentation and poster presentation. TREX participants are also required to write a 10 page technical report describing the results of their research project.

In an effort to maintain a high quality undergraduate research program, student and faculty evaluations are administered four times throughout academic year (mid-semester and end of semester during the fall and spring). Feedback is collected to evaluate the overall TREX program as well as student performance. Student performance is assessed using the following: (1) evaluation of research plan; (2) meeting participation and attendance; (3) evaluation of monthly progress reports; (4) evaluation of poster and final technical report; and (5) feedback received from faculty and graduate student mentors. Program evaluation is assessed using the following: (1) end of semester surveys; and (2) focus groups.

Program Results

During my service as Director of the Equal Opportunity in Engineering Program, 28 students participated in TREX. Table 4 provides a breakdown of career paths taken by these students after completing their TREX assignment.

Table 4. TREX Participants – Career paths post TREX assignment.

	2001-2002	2002-2003	2003-2004	2004-2005
Total TREX Participants	8	13	7	11
Still enrolled in COE	0	2	2	11
Graduated from COE	8	11	5	n/a
Entered workforce	5	6	4	n/a
Entered graduate school	3	5	1	n/a

Opportunities for Future Enhancements to Program

The TREX Program has generated positive results over the past 12 years. However, there is always room for improvement. Opportunities to enhance the existing program include the following: (1) immediate development of research plans to avoid delay in student research activity; (2) continuous effort to make sure that TREX participants are working in an active research environment; (3) limited ability to track career paths for TREX participants after they graduate from The University of Texas at Austin; and (4) partnering with faculty to generate funding to support TREX.

References

1. The University of Texas at Austin, Office of Institutional Studies, Website URL [http://www.utexas.edu/academic/oir/], site visited January 4, 2005

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