

A Comprehensive Program Assessment of the Persistence and Pursuance of Graduate Degrees of Undergraduate Research Students at the University of Texas at El Paso

Benjamin C. Flores, Ann Darnell, Jana Renner Martinez, and Aida Rubio

**The Model Institutions for Excellence Program
The University of Texas at El Paso**

The University of Texas at El Paso (UTEP) is an urban, regional university that serves a primarily Hispanic student population. UTEP has developed an academic model that includes curricular and co-curricular activities. A major component of the project, the Research Experiences for Undergraduates (REU) program, is a centralized effort providing funding for selected science and engineering undergraduates to participate in research projects under the guidance of a faculty mentor. Program assessment includes qualitative and quantitative assessment and the longitudinal tracking of student participants. The results from this comprehensive study demonstrate that the large majority of students who have participated in this program persist and graduate in Science, Technology, Engineering, and Mathematics (STEM) disciplines. To date, 88 percent of the 303 participants have graduated, 6 percent are still enrolled in either the College of Science or College of Engineering (undergraduate), and only 5 percent have stopped out. More than a third (37%) have either earned an advanced degree or are currently pursuing a graduate degree.

Introduction

The University of Texas at El Paso (UTEP) is an urban university located on the border of the United States and Mexico. The typical UTEP student is Hispanic (72%), is the first in his/her family to attend college, is employed (on or off-campus), and commutes to school each day. Many students (12%) are Mexican citizens who face the additional challenge of crossing an international bridge each day. Because the typical student has other commitments (family, work, etc.), it is not unusual for students to take 6 or more years to earn their baccalaureate degree. The 6-year graduation rate is approximately 25 percent.

The Research Experiences for Undergraduates (REU) program was implemented in 1995 as one component of the Model Institutions for Excellence (MIE) project at UTEP. Components of the project are based on Tinto's^[1] longitudinal model of individual departure that can be analyzed in terms of a student's pre-entry attributes, intentions, goals, and commitments, institutional experiences, and integration to academic and campus social life. The Research Experiences for Undergraduates (REU) component was envisioned to promote faculty-student interaction and academic integration through laboratory and field research. The funding provided by the program has allowed a select group of students the opportunity to work on campus, gain experience in their field, and receive encouragement to attend graduate school. Prior to the

implementation of REU in 1995, a small number of undergraduates did participate in research on campus; however, opportunities were relatively limited. Funding from this program allowed for the expansion and improvement of undergraduate research experiences on campus for students.

Like many REU programs at institutions throughout the nation, the primary focus of this program is to provide encouragement to under-represented minorities to attend graduate school through quality faculty mentoring and professional development for students interested in pursuing research as a career. Numerous programs have assessed the impact of research experiences on under-represented minority undergraduate students. Nagda et al^[2] investigated the impact of participation in the University of Michigan's Undergraduate Research Opportunity Program (UROP) on the persistence of 1,280 lower division (freshman and sophomore students) minority students. Participation in the program had a significant impact on the persistence of African American students. While the persistence rates of White and Hispanic students were higher for participants than for non-participants, the difference was not statistically significant.

Other studies have examined the effectiveness of undergraduate research experiences in terms of the number of participants that go on to pursue graduate degrees.^{[3],[4]} In an evaluation of the Spend a Summer with a Scientist (SaS) program at Rice University, Alexander et al^[5] tracked student academic outcomes and conducted interviews and surveys of student participants. Successful elements of the program were also identified. A high proportion of the participants did enroll, and persisted, in graduate programs. Qualitative analyses of some of the participants revealed that participation in the program did positively impact students' decisions to persist in their baccalaureate and graduate degree programs. Participants also reported that participation in the program did influence their decision to attend graduate school. Quality mentorship and role models were mentioned as being particularly effective for minority students.

Program Description

The REU program operates during the academic year (Fall and Spring). A unique aspect of this program is the fact that it is a centralized effort that crosses disciplines. Students and faculty from all departments in the Colleges of Engineering and Science participate in the program. A committee consisting of one faculty mentor from each department from the Colleges of Science and Engineering select the students each semester.¹

The majority of REU participants are Hispanic (53%). A significant number (21%) are International (primarily Mexican National). Caucasians comprise 21 percent while Asians (3%), African Americans (2%), and Native Americans (0.3%) are only a small percentage of the total number of participants.

In the early years of the program (1995-1998), approximately 20 students received funding per semester. In addition to a stipend of \$375 per month, students also received financial assistance for supplies and travel. The assessment and evaluation of MIE program components, which

¹ Until the Fall of 2003, participation in the program was competitive. Interested students submitted an application packet that included a resume, a short questionnaire detailing their research interests and future plans, and a letter of recommendation from a faculty member. Selection criteria included: 1) minimum of 3.0 GPA; 2) full-time status (minimum of 12 semester hours); and 3) science or engineering major.

include input from an external Advisory Board, resulted in a shift in focus and funding levels for some activities. In 1999, the REU component received an increase in funding in order to support more students. In addition, a Coordinator was hired to facilitate the growth of the program, to develop professional development activities for the participants, and to seek out summer research opportunities and internships. Under the Coordinator's direction, participation in the program grew to more than 50 students per semester. As the program grew and more students received funding, students received the stipend only. Travel and supplies funding was eliminated in order to support additional student stipends.

In 2003, funding for the program was decreased, and the application process was closed. The remaining funding has been used to provide support for the current participants until they graduate. An institutional endowment will now provide matching funds to support undergraduate research students in the College of Engineering.

The program also provides personal and professional development workshops and offers support to those students who are interested in graduate school. Students attend monthly meetings and workshops on topics including applying to graduate school, surviving graduate school, resume development, summer REU and internship opportunities, and presentation skills. Students that take the GRE are reimbursed for the exam fee.

Students are highly encouraged to participate in off-campus summer REU programs. Communicating the value of an external REU at another university or research center during the summer has been a challenging task. Many students feel uncomfortable leaving El Paso and their families, even for a summer. El Paso is geographically isolated, and many UTEP students have never traveled beyond the city limits. For a few years, participants were required to apply to at least three summer research programs and internships. Each summer, approximately one-fourth to one-third of the REU students attended off-campus research opportunities.

Program Assessment

Formative assessment and evaluation of the program includes persistence and graduation rates of student participants and post-graduation information. Since the Spring of 2004, a concerted effort has been made to track REU students beyond graduation. A number of REU students attend graduate school at UTEP after earning their BS degree; their enrollment status can be tracked through the university's student information system. Information on students not enrolled at UTEP was gathered by contacting the students through their mentors, making phone calls to the last phone number on file, and sending electronic mail to mentors and students whose email addresses were able to be obtained. To date, information has been gathered on nearly three-fourths of the students who have graduated.

Of the 303 participants who have participated in the program since 1995, 266 (88 %) have earned their baccalaureate degree, 19 (6%) are still pursuing their baccalaureate degree, and 18 (6%) have stopped out.² The evaluation team has obtained post-graduation information for 192

² The term "stopped out" refers to those not presently enrolled. Many students do return after one or two semesters off.

(72%) of the 266 participants that have earned their BS. Of these, 133, or 50 percent of those who have graduated, have either earned or are pursuing a post-baccalaureate degree:

- 54 earned Master's degrees
- 1 earned a Ph.D.
- 1 earned a Law Degree
- 42 are currently enrolled in a Master's Program
- 27 are currently enrolled in a Ph.D. Program
- 9 are currently enrolled in Medical School
- 75 are working (the majority in STEM)

Additionally, six students have applied and been admitted to graduate programs including dental school (two), MD/PhD program (two), PhD program (one), and an MS program (one). Two of these students are currently completing their baccalaureate degree. Many students who responded to our email stated they plan to enter a graduate program in the future after working for several years.

Student participants completed "Beginning of the Semester" and "End of the Semester" questionnaires regarding their REU experiences. "Beginning of the Semester" questionnaires were administered in Fall 2001 (n=39), Spring 2002 (n=71), Fall 2002 (n=40), and Spring 2003 (n=51). "End of the Semester" questionnaires were administered in Spring 2000 (n=39), Fall 2000 (n=30), Fall 2001 (n=40), Spring 2002 (n=57), Fall 2002 (n=43), and Spring 2003 (n=28). Topics addressed include:

- Passion for the research topic
- Likelihood of attending graduate school
- Likelihood of participating in an External Summer Research Experience
- Evaluation of the Research Coordinator
- Expectations of the program

Both "Beginning of the Semester" and "End of the Semester" questionnaires were administered in the Fall of 2001, Spring and Fall of 2002, and Spring of 2003, allowing for comparisons. On both questionnaires, students were asked to rank their "passion for your research topic" on a scale from one (low level of interest) to seven (high level of interest). In Spring and Fall of 2002 and the Spring of 2003, the proportion of respondents reporting a high level of interest in their research topic increased from the beginning to the end of the semester. In the beginning of each semester, all students ranked their interest at 5 or lower. On the "End of the Semester" questionnaires, students reported a higher level of interest in their research topic, with the majority reporting their interest at 6 or 7. In Fall 2001, students reported a slightly lower interest at the end of the semester than at the beginning of the semester. (Table 1).

Table 1
Passion for the Research Topic
Beginning of the Semester vs. End of the Semester

Level of Interest		1	2	3	4	5	6	7
Fall 2001	Beginning (n=39)					6 (15.8%)	8 (21.1%)	24 (63.2%)
	End (n=40)		1 (2.5%)	1 (2.5%)		6 (15%)	15 (37.5%)	17 (42.5%)
Spring 2002	Beginning (n=71)	1 (1.4%)	1 (1.4%)	9 (12.7%)	18 (25.4%)	42 (59.2%)		
	End (n=57)			1 (1.8%)	1 (1.8%)	7 (12.3%)	23 (40.4%)	25 (43.9%)
Fall 2002	Beginning (n=40)	1 (2.5%)		2 (5%)	15 (37.5%)	22 (55%)		
	End (n=43)			1 (2.3%)	2 (4.7%)	6 (14%)	19 (44.2%)	15 (34.9%)
Spring 2003	Beginning (n=51)		2 (3.8%)	5 (9.6%)	17 (32.7%)	28 (53.8%)		
	End (n=28)				1 (3.6%)	3 (10.7%)	9 (32.1%)	15 (53.6%)

Students ranked their “passion for research at this current time” similarly. In the Spring and Fall of 2002 and the Spring of 2003, students ranked their interest for research higher at the end of the semester than they did at the beginning. (Table 2). Students’ passion for research and their experience can also be seen in their responses to the question, “The research experience is like...” Responses included “golden opportunity,” “opening a window to science,” and “winning the lottery.”

Table 2
Passion for Research at this Current Time
Beginning of the Semester vs. End of the Semester

Level of Interest		1	2	3	4	5	6	7
Fall 2001	Beginning (n=39)				1 (2.6%)	4 (10.3%)	13 (33.3%)	21 (53.8%)
	End (n=40)		1 (2.5%)		3 (7.5%)	4 (10%)	12 (30%)	20 (50%)
Spring 2002	Beginning (n=71)		1 (1.4%)	7 (9.9%)	25 (35.2%)	38 (53.5%)		
	End (n=57)					4 (7%)	16 (28.1%)	37 (64.9%)
Fall 2002	Beginning (n=40)		1 (2.5%)	2 (5%)	10 (25%)	27 (67.5%)		
	End (n=43)	1 (2.3%)			1 (2.3%)	3 (7%)	15 (34.9%)	23 (53.5%)
Spring 2003	Beginning (n=51)		1 (2%)	2 (3.9%)	13 (25.5%)	35 (68.6%)		
	End (n=28)						9 (32.1%)	19 (67.9%)

Students were also asked to rank their “likelihood of attending graduate school” on a scale from 0 to 100 percent. An overwhelming majority of the respondents ranked their likelihood of attending graduate school positively. In Fall 2001, 90 percent of the respondents rated this item at 80 percent or higher at the beginning of the semester compared to 95 percent at the end of the semester. In Spring 2002, approximately the same proportion of respondents ranked their likelihood of attending graduate school at 80 percent or higher at the beginning (83%) and the end (84%) of the semester. In Fall 2002, there was a slight decrease in the proportion of respondents rating this item at 80 percent or higher (85% at the beginning and 81% at the end of the semester. (Table 3).

Table 3
Likelihood of Attending Graduate School
Beginning of the Semester vs. End of the Semester

		0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Fall 2001	Beg. (n=39)	1 (2.6%)			1 (2.6%)				2 (5.1%)	6 (15.4%)	9 (23.1%)	20 (51.3%)
	End (n=40)			1 (2.5%)			1 (2.5%)			5 (12.5%)	13 (32.5%)	20 (50%)
Spring 2002	Beg. (n=71)		2 (2.8%)		2 (2.8%)		4 (5.6%)	2 (2.8%)	2 (2.8%)	8 (11.3%)	19 (26.8%)	21 (45.1%)
	End (n=57)	1 (1.8%)					2 (3.5%)	1 (1.8%)	4 (7%)	8 (14%)	14 (24.6%)	26 (45.6%)
Fall 2002	Beg. (n=40)	1 (2.6%)					2 (5.1%)	2 (5.1%)	1 (2.6%)	3 (7.7%)	12 (30.8%)	18 (46.2%)
	End (n=43)	2 (4.7%)				2 (2.3%)	3 (7%)		2 (4.7%)	2 (4.7%)	5 (11.6%)	28 (65.1%)
Spring 2003	Beg. (n=51)	1 (2%)					2 (3.9%)	2 (3.9%)	1 (2%)	4 (7.8%)	10 (19.6%)	31 (60.8%)
	End (n=28)	This question was not included on this questionnaire.										

As mentioned earlier, students were highly encouraged to apply and participate in Summer REU programs at other universities. During the three semesters in which comparisons can be made between the beginning and end of the semester, 56 percent (Fall 2001), 62 percent (Spring 2002), and 59 percent (Fall 2002) of respondents reported their “likelihood of participating in an External Research Experience in Summer” at 60 percent or higher. With the exception of Spring of 2002, responses did not vary between the beginning and end of the semester surveys. At the end of each semester, 55 percent (Fall 2001), 42 percent (Spring 2002), and 56 percent (Fall 2002) reported their likelihood of participating in a Summer REU at 60 percent or higher. In the Spring of 2002, 18 students responded that their likelihood of attending a summer REU program was 0 percent compared to the four at the beginning of the semester. (Table 4). The reason for this change may be attributed to the fact that students knew whether they had been accepted to a summer program and were fairly certain of their summer plans at the time the survey was administered.

Table 4
Likelihood of Participating in an External Research Experience in the Summer
Beginning of the Semester vs. End of the Semester

		0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Fall 2001	Beg. (n=39)	5 (12.8%)	2 (5.1%)	2 (5.1%)		1 (2.6%)	7 (17.9%)	2 (5.1%)		4 (10.3%)	7 (17.9%)	9 (23.1%)
	End (n=40)	7 (17.5%)	2 (5%)		1 (2.5%)	2 (5%)	6 (15%)	1 (2.5%)	2 (5%)	3 (7.5%)	6 (15%)	10 (25%)
Spring 2002	Beg. (n=71)	4 (5.6%)	2 (2.8%)	4 (5.6%)	5 (7%)	1 (1.4%)	10 (14.1%)	2 (2.8%)	5 (7%)	7 (9.9%)	18 (25.4%)	12 (16.9%)
	End (n=57)	18 (31.6%)	2 (3.5%)	3 (5.3%)	1 (1.8%)	2 (3.5%)	5 (8.8%)	1 (1.8%)		3 (5.3%)	1 (1.8%)	19 (33.3%)
Fall 2002	Beg. (n=40)	5 (12.8%)	2 (5.1%)	3 (7.7%)	2 (5.1%)		4 (10.3%)		1 (2.6%)	4 (10.3%)	7 (17.9%)	10 (28.2%)
	End (n=43)	9 (20.9%)			1 (2.3%)	1 (2.3%)	8 (18.6%)		6 (14%)	3 (7%)	5 (11.6%)	10 (23.3%)
Spring 2003	Beg. (n=51)	10 (20.4%)		1 (2%)	1 (2%)	1 (2%)	7 (14.3%)	5 (10.2%)	30 (60.1%)	7 (14.35%)	14 (28.6%)	
	End (n=28)	4 (14.3%)	1 (3.6%)		1 (3.6%)	2 (7.1%)	3 (10.7%)	1 (3.6%)	1 (3.6%)	1 (3.6%)	2 (7.1%)	12 (42.9%)

In general, the Research Coordinator received high marks from students. The majority of respondents reported that the Coordinator either “always” or “frequently” “listens to and values my ideas and opinions,” “is available when I need to talk to her,” “provides guidance for solving problems related to my responsibilities,” and “makes me aware of research opportunities.” Responses to open-ended responses indicate that students liked the idea of having a centralized effort with a Coordinator at the helm. Many students saw the Coordinator as a second mentor and sought her advice frequently.

Students were also asked to select one or more responses indicating what they expected from their participation in an undergraduate research experience. The four most frequently selected answers concerned the students’ development as a researcher. Other frequently selected topics included professional skill development and mentoring. Four frequently selected topics are listed below.

- Better understanding of the research process
- More in-depth knowledge about the research topic
- Oral presentation skills/techniques
- Mentoring by a professor

Students were asked to describe why the undergraduate research experience was important to them and how the experience changed their life. Two common themes emerged in the responses;

students indicated a desire to participate in research and an expectation to gain experience for graduate school. The following is an example of this theme.

“MIE is important because I wanted to know about the research environment. This would allow me to see if I wanted to go to graduate school or medical school. I feel that after participating in REU, I would like to go to medical school but continue to do research. It’s been a wonderful experience. The time spent in lab has taught me more about my field of interest. I have learned new concepts, how to manage time, and how to prepare for a career.”

Many students indicated that the program gave them the opportunity to work on campus rather than off-campus. However, responses indicate that students got more out of the program than a paycheck. Typical responses are below.

“The experience has changed my life because I had always worked off-campus until I joined REU. I was able to spend more time at school and have a more flexible schedule and I was actually working on something that is beneficial to my career goals. I have learned how to write reports about my work, I have learned to speak in front of others and I have learned that hard work is deserving of reward and REU has been that reward.”

“I submitted an application because I saw this as a great opportunity to get paid for doing something I would anyway...I have realized that this is definitely what I want to spend my life doing. I will definitely pursue a Ph.D. and make every effort to assure I spend my life conducting research.”

“I submitted an application because although I already was volunteering in the lab, I couldn’t afford that anymore. I needed money so I was going to have to quit working in the lab, and I was going to start working in any place (like a restaurant) to obtain money. Dr. Das told me about the program, and I applied. So thanks to MIE, I was able to continue what I love. It has made me different. I have a lot more confidence. I believe more in myself. I have more experience and I have learned so much... If I hadn’t participated in this program, probably I wouldn’t be graduating this semester and probably I would have felt frustrated in graduate school. Why? Because you need to learn that sometimes, independently of your work or effort, things don’t work. I know that. And I know that if things don’t work, doesn’t mean that I am not good for science or that science is not my passion.”

Conclusion

To date, information has been collected on approximately three-fourths of the REU student cohort. The persistence and graduation rates for this cohort are high. Only 6 percent of the students that have participated in the program have stopped out before earning a baccalaureate degree. Almost half of the students that have graduated are either pursuing or have earned a post-baccalaureate degree. Based on REU students’ own responses on the questionnaires, most were interested in attending graduate school before participating in the program. Indeed, many students applied to the program in order to gain the skills and experience for graduate school. As one student explains, “My participation in this research project will undoubtedly increase my

chances of becoming a successful graduate student as far as giving me the confidence to believe in my own abilities and myself.”

Many students indicated that the program provided an “opportunity” for them: an opportunity to pursue an area of interest and gain experience while being paid to do so. Participation in the program allowed them to work on campus and develop research and professional skills. Some students indicated that they would be unable to pursue research without the funding provided by the program.

While students may have expected to gain skills and experience, they also gained a “passion” for their research topic and for research in general. Many reported being more passionate about both their research topic and research in general at the end of the semester. The experience seemed to validate both their initial interest in pursuing research and their desire to pursue research in graduate school and as a career.

It should be noted that the International students that have participated in the program seem to be particularly grateful for the program. Opportunities for UTEP’s Mexican National student population are scarce as national programs are usually limited to U.S. citizens. One student states, “I would also like to say that I really appreciated that MIE supported me these two semesters. I am an international student. And I think that’s a wonderful thing that MIE supports international students. Being an international student is difficult because you don’t have as many opportunities. So it is something to be proud of, that the MIE program doesn’t discriminate based on nationality. That is takes the best candidates.”

Gathering information on students that graduated and left UTEP continues to be a time-consuming effort. Phone numbers and electronic mail addresses on file are frequently no longer valid. By working with the Center for Institutional Evaluation, Research, and Planning, the STEM REU mentors, and the Colleges of Science and Engineering, the MIE assessment team will ensure that students applying for graduation will provide forwarding addresses and phone numbers on their graduation survey. Students that have received REU stipends will be notified that they will be contacted after graduation and will also be asked to keep us updated with their future educational pursuits. Efforts will continue to contact the remaining REU graduates without current status information.

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All surveys were developed by Connie Kubo Della-Piana.

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BENJAMIN C. FLORES is Professor and Chair of Electrical and Computer Engineering at the University of Texas at El Paso. His teaching interests include Electronics, High Resolution Radar, and Radar Signal Processing. His education research focuses on the development and assessment of academic models for STEM student success. Dr. Flores is a member of ASEE, AAAS, NSBE, and SPIE.

ANN DARNELL is the Assistant Director of Evaluation for the Model Institutions for Excellence Program and is currently responsible for leading a longitudinal study for the evaluation of the MIE program. She has also evaluated the Technology Integration Challenge Grant and has extensive experience in information technology.

JANA RENNER MARTINEZ is the Assistant Director of the Model Institutions for Excellence Program. She currently manages the day-to-day operations of the program and assists in assessment activities for the Research Experiences for Undergraduate Program.

AIDA RUBIO is a student research assistant for the Model Institutions for Excellence Program.