An Institutional Model for Student and Faculty Support

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Abstract

The University of Texas at El Paso (UTEP) has developed a comprehensive support system for undergraduate science and engineering education with support from the National Science Foundation. This model integrates four programs designed to increase the retention and success of science and engineering students attending an urban commuter campus. In order to ensure a successful transition into college, UTEP has implemented an entering student program for our science and engineering majors. To strengthen the community of student learners on campus, UTEP has created both a state-of-the-art academic center for student support and a center for effective teaching and learning for professors, teaching assistants, and undergraduate peer leaders. Finally, UTEP has developed an undergraduate research program for students who wish to participate in an academic research experience under the guidance of a faculty mentor. Since the implementation of these programs, first and second-year student retention in science and engineering has increased significantly over baseline data. The graduation rate is expected to double over an eleven-year period. This paper describes the structure, goals, impact, and evaluation of the program.

I. Introduction

The under-representation of ethnic and racial minorities in the fields of science and engineering has become a growing concern among educators and policymakers in recent years. In order to ensure that our nation remains at the forefront of science and technology, it is imperative that the science and engineering workforce be representative of the entire workforce.[1,2] In recent years, efforts have been made to increase the number and diversity of students who earn baccalaureate degrees in science and engineering and go on to pursue graduate degrees in these fields. With the support of the National Science Foundation (NSF), UTEP has developed a comprehensive model focused on achieving this goal.

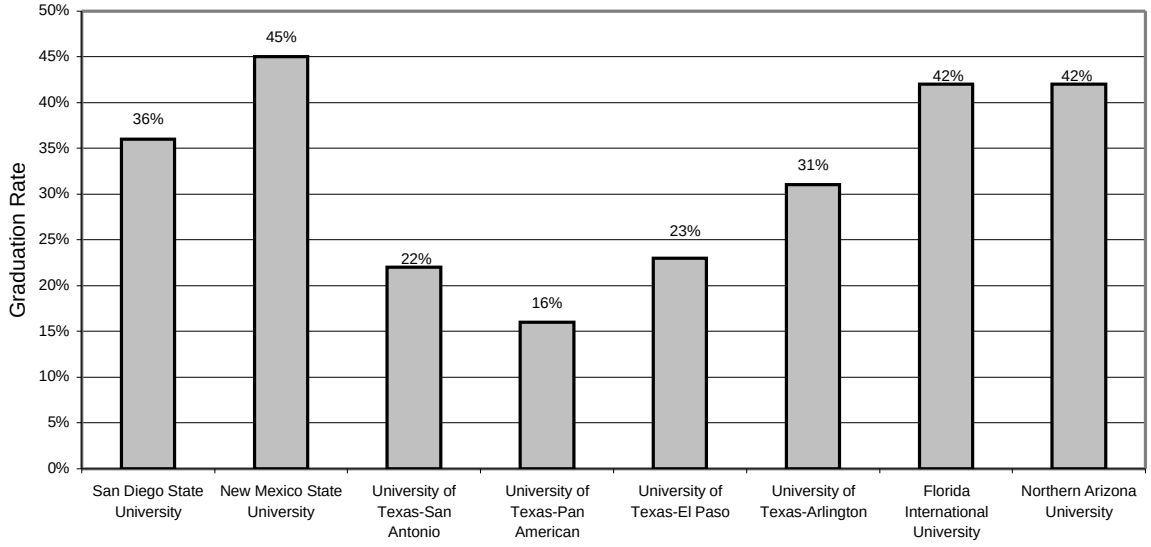
Research in the area of persistence and departure in higher education emphasizes the importance of student involvement both the academic and social aspects of college life. According to Tinto's (1993) model of departure and persistence, colleges are "interactive systems" in which both the social and academic aspects are linked, and some degree of integration in both systems influences the student's decision to stay or leave.[3] Because factors such as interactions with faculty and an engaging academic environment play a role in retention, UTEP's academic support model consists of four components designed to engage students academically, encourage student involvement on campus, and increase interactions with faculty.

II. Background

Located in the largest bi-national metropolitan region in the world, UTEP serves a non-traditional student population. Almost all of its 16,220 students commute to the university daily, and 81 percent work in order to finance their college education. Over 70 percent of UTEP's students are Hispanic and an additional 10 percent are Mexican nationals, making UTEP the largest Mexican American majority university in the nation and first in the nation in engineering bachelor's degrees awarded to Hispanic students. More than 50 percent of UTEP's students are the first in their families to attend college.[4] On average, it takes a successful UTEP student six or more years to graduate.

Figure 1 shows the six-year university-wide graduation rate, 23 percent, as compared to institutions with similar demographics.[5] Based on baseline data from the 1990's, the six-year graduation rate for the Colleges of Engineering and Science at UTEP has been slightly lower than the university-wide rate despite the fact that the first-year retention rate in these colleges (approximately 70%) has been higher than that of the general university (approximately 66%).[6] These factors have led to a major systematic effort to modify the institution's focus on science, engineering, and mathematics (SEM) undergraduate education. The Colleges of Engineering and Science have joined forces in an effort to better prepare their first year students for upper division courses, to increase the interaction between students and faculty, to make faculty more aware of innovative teaching and learning strategies, and to provide students with the resources and opportunities that will make them successful college students.

Figure 1: Six-Year Graduation for Selected Institutuions
June 2001



A catalyst for this systemic change is the NSF Model Institutions for Excellence (MIE) program. In 1995, UTEP was selected as one of only six institutions in the nation as an MIE institution. These six institutions represent the spectrum of minority-serving colleges and universities:

Bowie State University, Spelman College, the Oyate Consortium, Universidad Metropolitana of Puerto Rico, Xavier University of Louisiana, and UTEP. The goal of the MIE initiative is to increase the quantity and quality of under-represented minorities who earn degrees in SEM and go on to pursue graduate degrees in these fields. At UTEP, this goal translates into an effort to double the number of SEM degrees conferred by 2006.

The MIE program is now in its second phase and in its seventh year of funding. During the first phase, programs and activities that target student retention and success in science and engineering were developed. The MIE initiative at UTEP was required to provide the following:

- A mandatory Freshman summer transition program for all SEM students and course clustering for all entering students, including University Seminar, Mathematics, and English Composition.
- The services of the Academic Center for Engineers and Scientists (ACES), which is a home for student support, including peer tutoring, study groups and professional societies.
- Research, mentoring, and professional internships, including expansion of undergraduate research experiences.
- Enhancement of lower division SEM courses to take advantage of the collaborative learning and other study skills developed in the entering student program.
- A center for effective teaching and learning opportunities dedicated to serve faculty university wide.
- Enhancement of the institution's capacity for evaluation and assessment for improvement, accountability, and understanding of undergraduate education in SEM.

The focus of the second phase has been to expand and institutionalize the programs and activities that are successful. This paper describes the four cornerstone MIE initiatives at UTEP: an entering student program for first-time SEM students, an academic student support center, a faculty teaching and learning center, and an undergraduate research program.

III. Program Description

UTEP's model is an integral approach of four otherwise independent programs, which are described below.

A. CircLES

UTEP's model places its foundation in its nationally recognized[7,8] entering student program, Circles of Learning for Entering Students (CircLES). The CircLES program began as an effort to increase the first-year retention rate of pre-science and pre-engineering students by providing them with an academic "home," connecting them to the university and the colleges early in their college career, and providing them with the skills for college success. This effort is especially important at UTEP because many first-year students are not calculus-ready when they enter the university and, therefore, cannot declare a major in science or engineering during their first year in college. Prior to the implementation of CircLES, these students had virtually no interactions with the engineering and science colleges, faculty and staff during their first year.

The CircLES program started as a pilot program in 1997 with 60 students who were self-selected. In 1998, the Colleges of Engineering and Science adopted the program to include all entering pre-science and pre-engineering students. CircLES combines an intensive summer orientation, course clustering, and proactive advising. A new administrative position, the Associate Dean of the Colleges of Engineering and Science, was created to head the program. Three advising coordinators advise students, schedule course clusters, and coordinate the summer orientation sessions.

Entering students who express an interest in majoring in science and engineering participate in a one-week orientation during the summer before their freshman year. Approximately 500 entering students participated in one of six CircLES summer orientation sessions in the summer of 2000. During the week, students attend general university information sessions (cost of tuition, course catalogue, etc.) and personal development training, such as Math Anxiety and Time Management workshops. In addition to these general sessions that introduce students to college life, students participate in activities that connect them to the Colleges of Engineering and Science, and the faculty and staff. Students have lunch with SEM professors and participate in science and engineering laboratory modules. The engineering module, the "Egg Module," and two science modules, "Air Sample" and "Water Sample," are designed to build teamwork and communication skills. Students work in teams on different segments of the modules throughout the week and present their results on the last day.

Students also attend a math refresher course designed to improve their math placement scores. Students take the math placement exam prior to attending their orientation session and retake the exam after participating in the math review. Figures 2 and 3 show that the number of entering SEM students placing into Introduction to Algebra has decreased while the number of students placing into Calculus has increased after taking the CircLES math review.

Figure 2: Introduction to Algebra. Comparison of Initial Math Placement and Actual Course Enrollment After CircLes Math Review

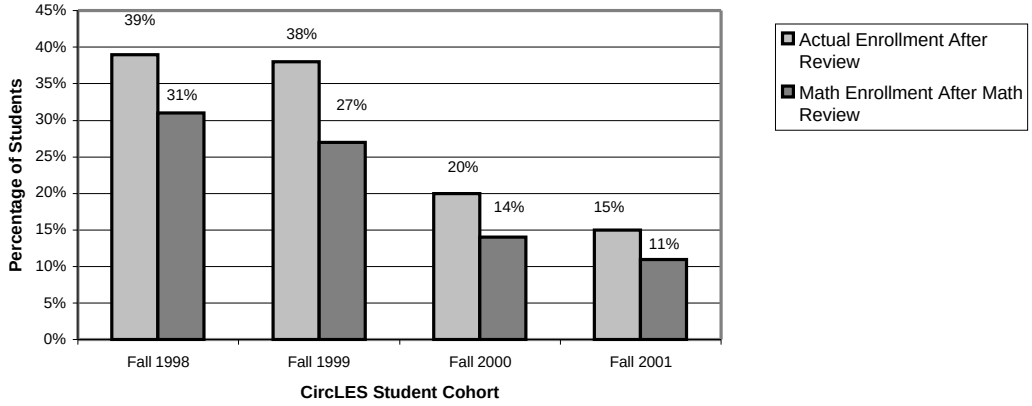
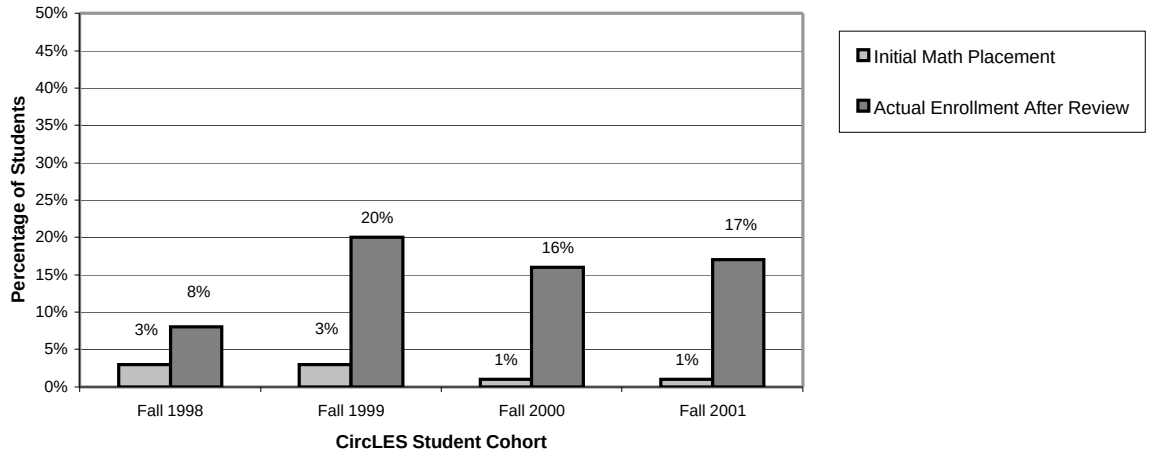


Figure 3: Calculus. Comparison of Initial Math Placement and Math Enrollment After CircLES Math Review



The impact of the math review is significant: students effectively reduce the amount of time spent on developmental course work by placing into a higher-level math course. In addition, these students are able to declare their major earlier. Eighty percent of these students are successful (earn a C or better) in the math course in which they placed.

On the last day of orientation, students are advised and register for their first semester. CircLES coordinators specialize in advising science and engineering students and offer academic, professional and personal guidance. Students continue to be advised by CircLES staff until they have declared their major. Each semester, CircLES staff advises approximately 1200 pre-science and pre-engineering students.

During advising, most students are placed into course clusters based on their Mathematics and English placement scores. The students are placed into course clusters of approximately 25 people who study English, Mathematics, and University Seminar together. University Seminar, a university core course taught by science and engineering faculty and staff, completes the process of providing students with skills for college success, such as communication and problem solving skills. Course clustering allows students to interact with science and engineering faculty, staff, upper division peer facilitators, and their peers while developing the skills necessary to be successful SEM students.

CircLES staff work closely with the registrar, the English Department, the Mathematics Department, and the Pre-Engineering Program in scheduling the course clusters. Table 1 gives possible course cluster combinations.

Table 1. Course Clusters

Pre-College Math I	Pre-College Math II	Pre-Calculus	Calculus
Seminar in Critical Inquiry	Seminar in Critical Inquiry	Seminar in Critical Inquiry	Seminar in Critical Inquiry
Pre-College or College English	Pre-College or College English	Pre-College or College English	Pre-College or College English
	Introductory Engineering/ Science Course	Engineering/Science Discipline Course	Engineering/Science Discipline Course

B. ACES

UTEP's science and engineering students also have access to an excellent student center. The Academic Center for Engineers and Scientists (ACES) was created to promote and support good study habits and to encourage commuter students to stay on campus to study and network. However, ACES has evolved into more than just a study center. Located in the engineering-science complex, it is a multi-functional state-of-the-art resource center that offers students a "one-stop shop" for resources (see Table 2) and is open extended hours.

Table 2. ACES Resources
Technology Aids
Laptop and Desk Top Computers
Multi-media Presentation Equipment
Copy Machines
Study Aids
Exam Banks
Reference Materials
Text Books
Physics and Chemistry Tutorial Software
Free Tutoring for Selected Courses

Students check out laptop computers, tutorial software, and multi-media presentation equipment for use in the center. Quiet study areas are available for those who chose to study alone, and cooperative study areas are available to those who wish to study in groups. Meeting rooms can also be reserved for group presentations and student organization meetings. Student employees also provide free tutoring in selected courses. ACES also hosts a number of student development workshops (see Table 3) and provides information on graduate school, research, and career opportunities.

Table 3. ACES Workshops
Academic Development Workshops
GRE and MCAT Reviews
Microsoft Word
PowerPoint
Microsoft Office
EXCEL
Calculus Review Sessions
Professional Development Workshops
Interviewing Skills
Resume Workshop
Career Fair Etiquette
Personal Development Workshops
Seven Habits of Highly Effective People
Time Management
Stress Management
Dining Etiquette

The effectiveness of ACES lies in its unique management approach. A student management team of approximately 25 science and engineering majors oversees the day-to-day operations of the facilities under the direction of a professional coordinator. The management team also plans and offers workshops and activities. Team members participate in a rigorous training program in order to assist students with available resources. The employees have made it their goal to provide excellent customer service to their peers. Because the employees of the centers are students themselves and are able to relate to their peers' experiences, they are able to deliver personalized service. This approach gives all students, both the management team and students utilizing center, a sense of ownership.

Institutionalization plans for ACES includes a student fee of $5.00 per semester hour with a $75.00 maximum fee per SEM student. The money generated from the fees would be used to pay student employee salaries, fund workshops, and maintain and purchase electronic equipment and software.

C. REU

As students progress in their studies and begin to make plans for the future, they are given the opportunity to participate in undergraduate research. Each semester, UTEP's Research Experiences for Undergraduates (REU) program offers stipends to qualified students so they can perform research under the guidance of a faculty mentor. These stipends provide UTEP students, many of whom must work in order to finance their education, the opportunity to work on campus while gaining hands-on experience in their field of study. Through this experience, students receive additional mentoring in their field and encouragement to persist to graduation and consider graduate school.

The REU program also encourages students to apply to external summer research programs at other universities and national research centers and laboratories. Historically, El Paso has been geographically isolated, and many of UTEP's students have had little opportunity to travel. These research experiences provide many UTEP students with their first work experience away from home. Additionally, students experience research at top research centers and universities, make external contacts for research opportunities, and work in an environment similar to graduate school.

The REU program has also played an integral role in faculty culture. Faculty members from every SEM department participate as mentors. Because UTEP is designated as a Doctoral/Research Intensive University in the Carnegie Classification of Institutions of Higher Education, faculty members are encouraged by the administration to seek external funding. Undergraduate research is an integral part of that effort.

D. CETaL

Students are not the only group who receive support under the MIE model. The Center for Effective Teaching and Learning (CETaL) was created to provide leadership in teaching excellence at UTEP and in the region, to mentor new faculty and encourage senior faculty to stay focused on teaching, and to support the scholarship of teaching and learning. CETaL fosters attitudes that value teaching and learning excellence through a number of services and activities. Additionally, CETaL offers support for instructional design, development, and evaluation through a number of services including individual consultations, assistance in course planning, and classroom observations. CETaL also hosts a number of workshops and seminars for UTEP faculty, staff, graduate students, and undergraduate peer facilitators. In fact, there is a CETaL event on campus almost weekly. Workshops address issues such as teaching excellence and syllabus design.

Two co-directors and a coordinator run the center. A group of approximately 20 full-time faculty members representing six colleges and the University Library are nominated to serve as CETaL fellows, who act as advisors to the center. The CETaL directors, CETaL fellows, and UTEP faculty and staff plan and present the workshops. A real effort is made to make sure every department on campus is aware of CETaL events. Flyers advertising the events are distributed to each department approximately a week in advance. The average attendance per CETaL event is 25. Attendance is voluntary; however, it is now a requirement that all tenure-track professors include a teaching portfolio in their promotion packets. By attending these workshops, professors are given the opportunity to improve or enhance teaching and learning, share ideas in teaching and learning, or learn about new teaching philosophies or strategies that they can implement in their own classrooms.

IV. Impact and Evaluation of Program

A. CircLES

Since the implementation of CircLES, the retention rate for engineering and science students has increased significantly over baseline data. The retention rate is defined as the percent of first-time, full-time students in each cohort that re-enrolled at UTEP the following year.[4] Figure 4 is

provided in order to give a historical perspective on first-year retention of SEM students at UTEP. Notice that from 1992 to 1997, the first-year retention rate was approximately 70 percent.[5]

Figure 4: SEM First-Year Retention Rate

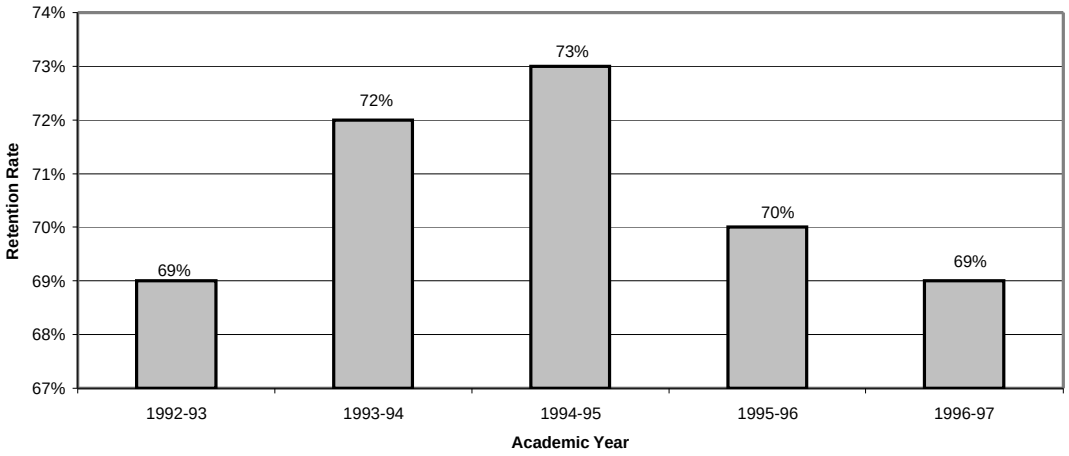
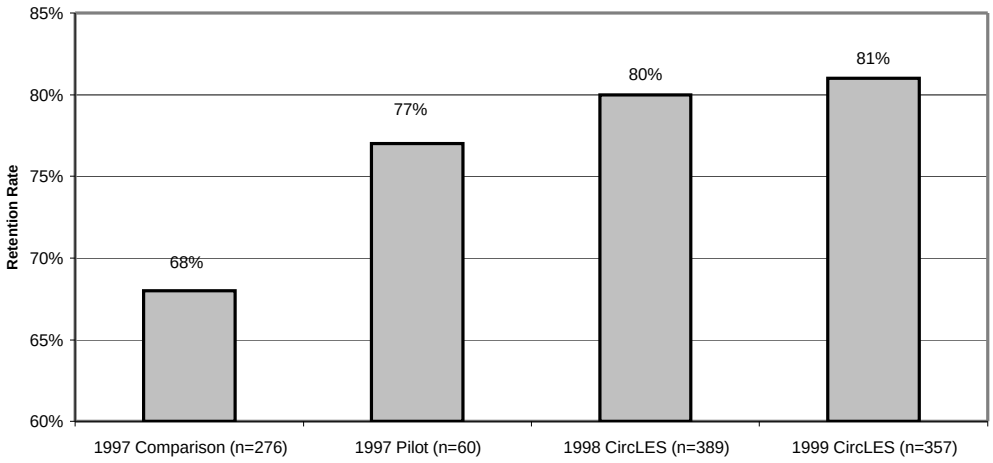


Figure 5 compares the first-year retention rates of the 1997 Pilot Group, and 1998 and 1999 CircLES cohorts to the 1997 Comparison Group. Sixty students who were self-selected to participate in the pilot project comprise the 1997 Pilot Group. A larger comparison group who chose not to participate in the pilot project makes up the 1997 comparison group. The latter is also used as the baseline group. The 1998 and 1999 CircLES cohorts include first-time, full-time (i.e. enrolled for at least 12 hours) pre-engineering and pre-science students enrolled at UTEP in the fall semester and who participated in the summer orientation. As the figure demonstrates, the first-year retention rates of CircLES cohorts are higher than the baseline group. The retention rates for the 1997 comparison, or baseline, group was 68 percent. The first-year retention rate for the 1997 pilot group, 1998 CircLES cohort, and 1999 CircLES cohort was 77 percent, 80 percent, and 81 percent, respectively. Achieving a first-year retention rate of 80 percent should have a positive impact on the total number of degrees conferred five years later.

Figure 5: One-Year Retention Rates by Student Cohort



The second-year retention rate of the 1998 CircLES cadre continues to be higher than the baseline group. Figure 6 demonstrates that the second-year retention rate for the 1998 CircLES cohort is 69 percent while the second-year retention rate for the 1997 baseline group is 54 percent. (Because of its small size, the 1997 pilot group is not included in this data). Retention rates for CircLES cohorts will continue to be evaluated for subsequent years.

Figure 6: One and Two-Year Retention Rates by Cohort

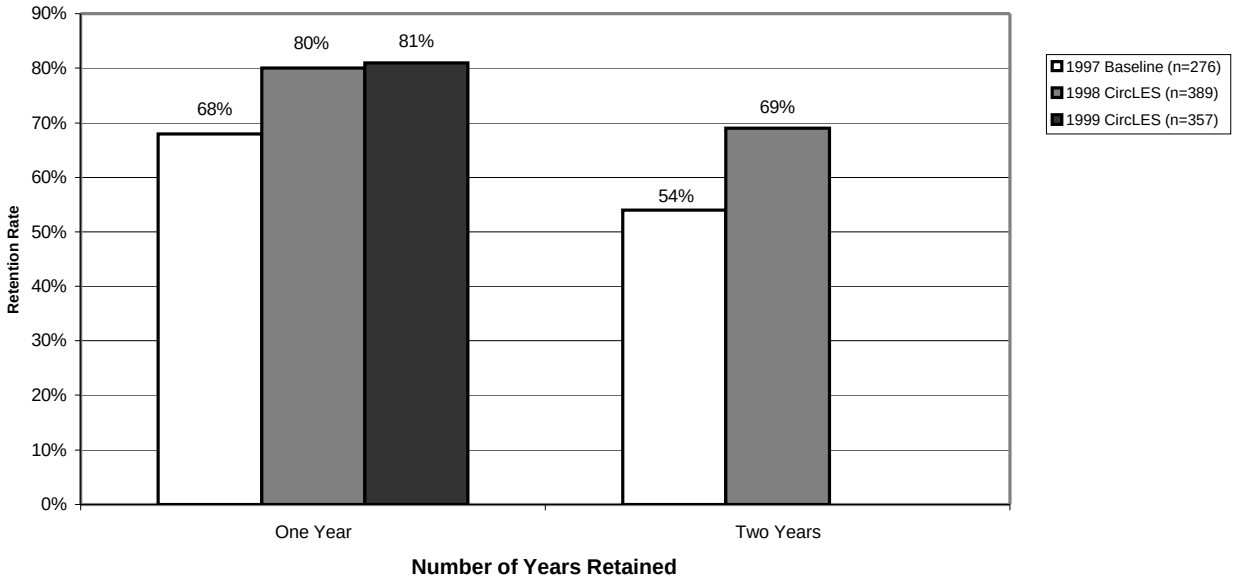
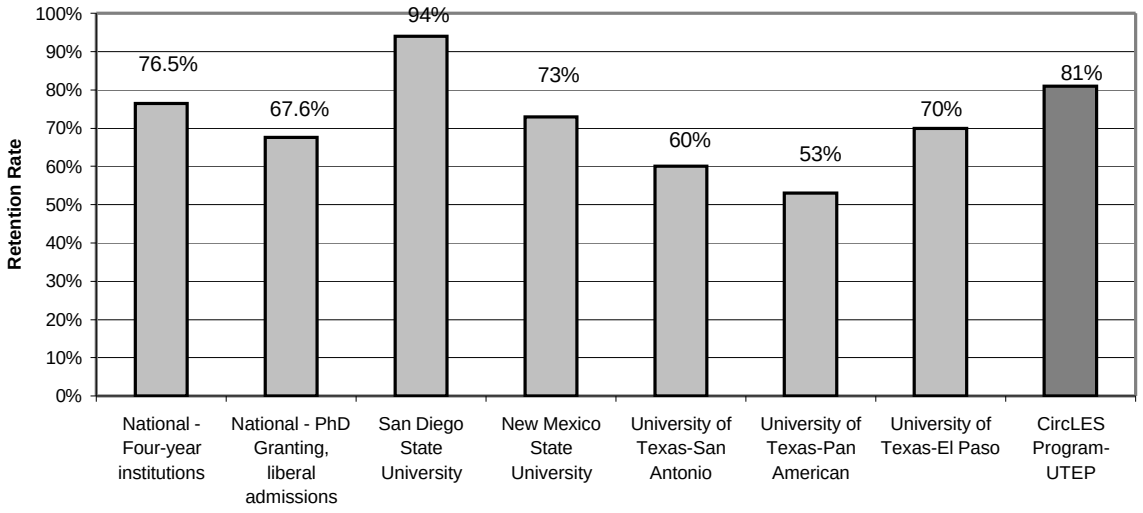


Figure 7 compares the CircLES first-year retention rate with UTEP's and other universities' retention rates. The primary success of the CircLES program is to raise the retention rate above the national average.

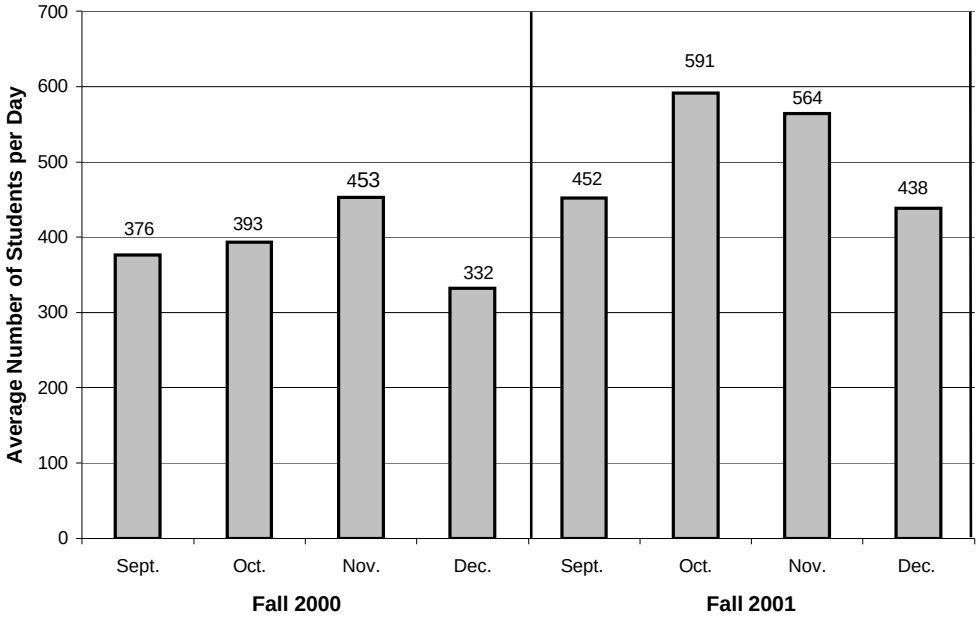
Figure 7: One-Year Retention for Selected Institutions
Fall 1999 Entering Student Cohort



B. ACES

The goal of creating a center such as ACES is to offer commuter SEM students a welcoming, comfortable environment to study and congregate. While the success of ACES can be demonstrated in a number of ways, one measure of success is the number of students who frequent the center. Students do have other places to go and study, such as the University Library and the Tutoring and Learning Center, and many chose ACES. In fact, over 70% of SEM students are active ACES users demonstrating that it has filled a niche in the science and engineering student population. Figure 8 shows the daily average student usage for the fall of 2000 and fall of 2001. The increase in usage over a one-year period points to the popularity of the center.

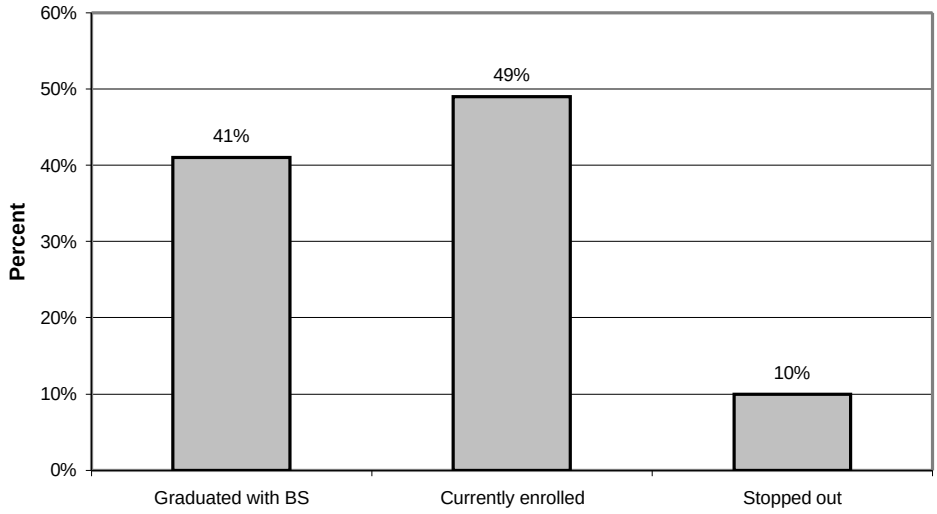
Figure 8: ACES Average Student Usage: Fall 2000/ Fall 2001



While the direct impact of ACES on students' academic performance is compounded by many factors, a majority of the students utilizing the center report that they are more academically prepared, more aware of employment and research opportunities, and more eager to participate in campus life. ACES is considered a place that facilitates success rather than directly influencing it. In other words, ACES is a place where students take responsibility for their own learning and success.[9]

Interestingly, employment at ACES also seems to have an impact on retention of the student staff. As seen in Figure 9, 41 percent of ACES staff (1997 to present) has graduated, 49 percent are still currently enrolled, and only 10 percent have stopped out. Working on campus in an environment that promotes studying is an extremely valuable student success strategy.

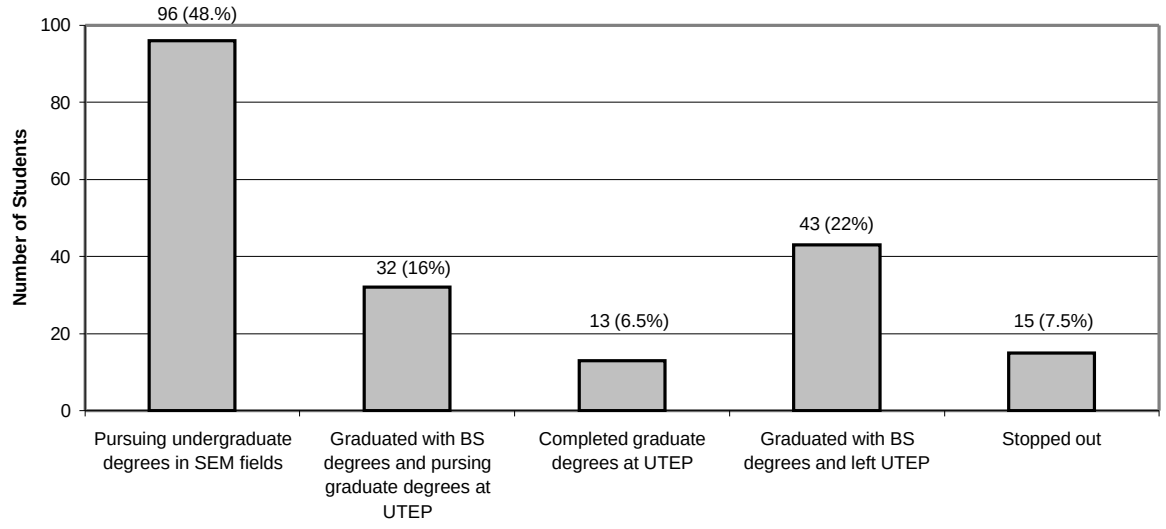
Figure 9: ACES Staff Retention and Graduation Status (n=83)



C. REU

Undergraduate research combined with faculty mentorship is a proven strategy for increasing both retention in SEM disciplines and the number of students who pursue graduate degrees in Science, Engineering, and Mathematics.[10] Interactions with faculty, in addition to support from graduate students and other undergraduate students with similar goals, can instill students with the desire and motivation to persist to graduation and continue their studies in graduate school. Since 1996-97, 199 students have participated in undergraduate research through the REU program. Of these, a majority are either still at UTEP pursuing SEM degrees or have graduated with a BS. In addition, 16 percent are pursuing graduate degrees at UTEP. Only 7.5 percent have stopped out. (See Figure 10). Further efforts are being made to determine the future plans and whereabouts of all REU graduates.

Figure 10: REU Students 1996-2000 (n=199)

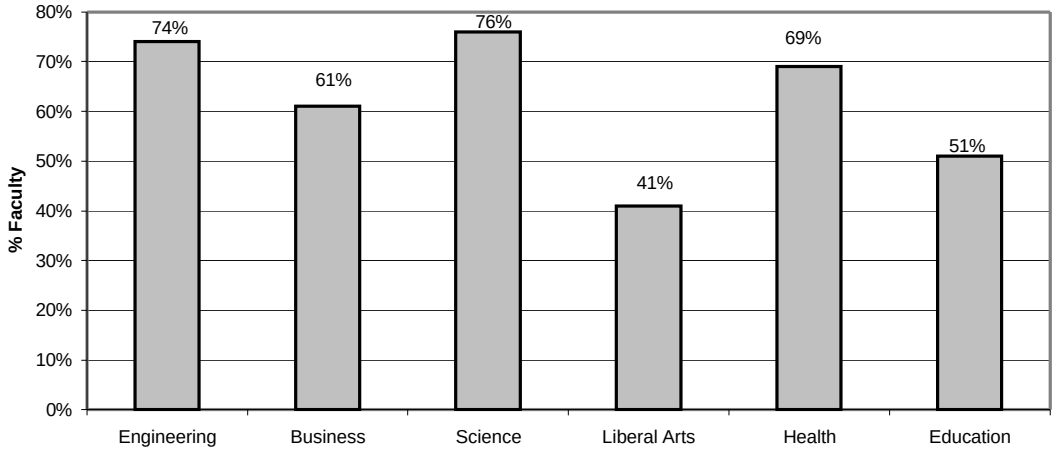


D. CETaL

The number of CETaL activities and workshops offered increase each year. During the 2000-2001 academic year, CETaL hosted 47 workshops or seminars. Over 400 individuals attended these workshops. Figure 11 shows that 74 percent of the faculty from the College of Engineering and 76 percent of the faculty from the College of Science attended at least one CETaL event from 1998-2001.

While the direct effect of CETaL on student retention cannot be measured, this type of faculty support ensures that more faculty, especially those who teach first and second year students, are aware of the current and accepted teaching and learning strategies that support MIE's long-term goal of creating a more student-centered environment and better prepares students for upper division coursework. In recognition of CETaL's value to faculty support, the Office of the Provost has committed to support the center.

Figure 11: Faculty CETaL Workshop Attendance, 1998-2001



V. Final Remarks

UTEP's SEM education model is a catalyst for long-term systemic change. This type of change challenges traditional undergraduate education and involves institutional and cultural changes. Due to the nature of the model, the longitudinal study of effects on retention and graduation rates is a long-term effort. In many cases, the direct and indirect effects will not be seen for six to ten years. Consequently, one of the main challenges is to get and keep the interest and involvement of key players.

Buy-in from administrators, faculty, and professional staff is essential for the success of the model. Of course, the support from the president and the provost is an important factor, but support is also needed from the two colleges and the ten departments involved. The deans, department chairs, and key faculty have the authority to make decisions and can influence and encourage the participation of others. Finally, all people involved must be willing to talk to one another, share ideas, and their own experiences.

Results from the first two years of the entering student program indicate that upon refinement of this program the first-year retention rate will effectively increase by 10 percent. The current plan is to assess until 2006 to confirm these rates. Given the additional improvements in student support, the added emphasis on scholarly teaching, active learning, undergraduate research, and a new plan to reduce the number of credit hours to 128, it is hoped that the per year retention rate for each year will increase by 10 percent. In this optimal scenario, the graduation rate could increase to 47 percent. This would effectively double the number of graduates. Even if the retention rate per year increases by a conservative 5 percent at all levels, the graduation rate would increase to 33 percent, thus justifying institutionalization of this model for student success.

VI. Acknowledgements

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