



Bridging the Gap in Transition of Students from Community Colleges to Universities

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Abstract

Transition of students from Community Colleges (CC) to universities is a major issue for many universities including our university in Mississippi. This problem is severe in engineering and technology programs compared to non-STEM (Science, Technology, Engineering and Mathematics) programs. Universities and local community colleges need to work collaboratively to improve that situation. Few years ago, our Industrial Engineering Technology (IET) program had less than 33% students who were coming from local community colleges. A significant portion of these IET students were part-time and/or non-traditional, and took longer than the traditional four years to graduate. Approximately, 20% of these IET students failed to graduate because of financial, motivational, and family or job related problems. To improve that condition we had taken a huge initiative to bolster the transition and retention of our students. It is worthy to mention that no other states in the US have the same level of desperate need as Mississippi to increase its STEM degrees. A September 2011 report published in Industrial Engineer Magazine reveals that Mississippi ranked the lowest in preparing STEM students.

As part of the initiative, we implemented several programs such as *Let 'em Know*, *Inter-Institutional Visits*, *Portfolio Tracking*, *2+2 consortium*, and *Peer Led Team Learning (PLTL)*. Our *Let 'em Know* program, (which is similar to the Catch the Dream program implemented at Lake Michigan College) focuses on increasing transfer rates from CC to our university. *Let 'em Know* program provides first year STEM students with four year degree guidance regardless of institutional enrollment. The *Inter-institutional visits* guided ET students during their second year at the CC. Each semester our IET faculty visited all our local seven CC campuses. Providing university faculty as guest speakers has proven an effective tool for student motivation. The *Portfolio Tracking* tracks the progress of CC students across coursework, targeting STEM specific 4 year accreditation objectives, beginning in their freshman year. These portfolios were reviewed across campuses, providing individual feedback for every student. The portfolios were targeted to increase retention of underrepresented minorities and female students by providing direct support and encouragement to them. The *2+2 Consortium* laid the foundation of effective transition. The *Peer Led Team Learning* sessions were an effective way to engage large numbers of students with in-depth course material within a group work environment. While all of these programs had positive impacts on transition and retention, Portfolio Tracking and 2+2 consortium had the most impact among others. This paper will discuss those program designs, implementation plans, and effectiveness of those programs with program data and analysis.

Introduction

As the nation prepares to meet President Obama's goal of eight million new college graduates by 2020, the transfer process - the pathway between community colleges and universities - will take on an increasingly vital role¹. For many four-year colleges and universities, however, this pathway is uncharted territory¹. To help clear a path, this paper highlights the perspective of university leaders who have had success in recruiting, enrolling and serving transfer students. We have created a Science, Technology and Engineering Program (STEP) initiative to support an efficient recruitment, transfer and support system for students from regional high schools (HS) and community colleges (CC) into the university's Engineering Technology (ET) programs. This paper explains how we improved the existing pathways and implemented new pathways, expanding opportunities for STEM students, focusing on women and minorities, with the goal of recruiting, retaining and graduating ET professionals to meet our growing need in the Gulf South region. The current economic climate, coupled with Mississippi's non-traditional students, frequently make CCs the only viable education option. Mississippi's board of higher learning is currently looking to increase cooperation between and transfer rates from Associate and Bachelor granting institutions.

The STEP program augmented our separate programs with cross campus activities, joint committees, shared web services and coordinated student tracking beginning in the freshman year. Scheduled activities are cross-institutional. Proposed tasks were expansions of existing institutional programs to assure long term sustainability: Training 75 CC faculty members and 12 university professors, industrial site visits for students and faculty members, professional mentoring, summer ET Academy, and industrial internships. We estimated that the proposed project would reach more than 15,000 STEM students, impact at least 1640 potential ET majors and 87 STEM educators over five years. Our goal was to double ET enrollment at our university and triples our annual graduation rate. Concurrently, our target included increasing female students by 150% and minority students by 200%.

Initial enrollment and graduation rate

Our university had a fall 2009 undergraduate enrollment of 37 students in Construction Engineering Technology (CET), 45 students in Industrial Engineering Technology (IET), and 13 students in Logistics Technology (LT). CET, IET, and LT were our three ET focus areas. Of these, 34% students were transferred from local CCs. A significant portion of these ET students are part-time and/or nontraditional, and may take longer than the traditional four years to graduate. Approximately, 20% of these ET students fail to graduate as financial, motivational, and family or job related problems. The following table 1 shows our recent three year enrollment, retention, and graduation statistics by gender, ethnicity, type of enrollment (full- vs part-time), and college year.

Proposed vision

STEP's overarching objective is to increase our ET graduates to meet the growing regional industrial need. We have three student focus areas: (1) Recruitment, (2) Retention, and (3)

Graduation and Career Placement. Within each phase of student development, our research goals and objectives are summarized in Table 2.

Table 1	Enrollment			Retention Rate (%)			Graduation		
	2009	2010	2011	2008-09	2009-10	2010-11	2009	2010	2011
Total	70	79	91	71	73	72	12*	15*	18*
Men	60	68	78	73	71	82	12*	13*	15*
Women	10	11	13	80	80	75	0	2*	3*
Full time	45	50	60	76	82	82	N/A	N/A	N/A
Part time	25	29	31	63	59	56	N/A	N/A	N/A
White	59	65	68	67	78	73	11*	13*	15*
Afro- American	8	10	18	86	40	63	1*	2*	2*
Hispanic	2	2	1	N/A	50	0	0	0	0
Other	1	2	2	50	100	100	0	0	1
Freshman	5	5	9	100	80	N/A	N/A	N/A	N/A
Sophomore	9	9	11	33	56	73	N/A	N/A	N/A
Junior	15	16	16	54	75	72	N/A	N/A	N/A
Senior	41	49	55	76	77	71	N/A	N/A	N/A

*Using number of graduates instead of graduation rate; graduation rate for these programs are not available

This research model draws on the strengths of several successful nationwide programs. In particular, it includes components similar to: (a) Bridge Scholarship and Internship Programs at the University of Nebraska, (b) Minority Scholarship Programs at Louisiana State University, (c) Professional Mentorship programs at Colorado State University, (d) Peer Lead Team Learning (PLTL) at the University of Texas at Arlington, (e) Summer ET Academy (Early Undergraduate Enrichment)) program at Lane College, and (f) Video-Based Recruiting at Saint Mary University.

Table 2: Research Model Research Questions	Supports & Mechanisms	Measurements & Assessments
Phase # 1 - Increase Enrollment in STEM ET Programs		
a. Which incentives and recruitment methods are the most effective for engineering technology programs? b. Which methods reported by minorities and women are the most enticing for ET? c. Which mechanisms best facilitate student transfer from CCs to university specifically in engineering?	1. Improve program awareness in CCs (CC) through Let 'em Know and institutional visits 2. Recruit displaced workers and non-traditional students through regional job fairs. Increase presence in regional HS's. 3. Increase transfers from CC through CRM database & ET Bridge incentive programs 4. Increase participation by women and minority students through tuition supplement, Portfolio support, joint-campus mentoring, etc... 5. Provide Summer ET Academy for CC students entering university 6. Identify prospective students through outreach programs such as industry visits, Focus Day and job fairs.	<ul style="list-style-type: none"> • Student Database <ul style="list-style-type: none"> - ACT and SAT scores - Previous GPA - Track student enrollment - Enrollment departments contact students • Survey university, CC and HS students and displaced workers <ul style="list-style-type: none"> - Summer ET Academy Desire for BS degree - Role of financial support • Survey CC Faculty <ul style="list-style-type: none"> - University support, materials - Recruitment materials - Suggestion for recruitment - Evaluation of 3-Day ET training and immersion

	7. Provide CC faculty members 3-day training, tablet and stipend	
Phase # 2 – Retain and Increase the Number of Graduates in ET		
a. In what way does professional mentoring and enhanced advising benefit ET students? b. How and in what ways are students using the university centers and other provided resources? c. In what way does internship experience direct the student to a career path and does this differ for women and minorities? d. How do our support mechanisms help disadvantaged students stay on track academically? e. How are students motivated to complete the ET degree requirements in a timely fashion?	1. Support financially distressed students - Tuition supplements - Books, equipment, tablet 2. Mentoring by professionals in the field - Students matched to mentor through web based program 3. Motivate students through close academic advising 4. Monthly guest speaker series 5. Peer Led Team Tutoring 6. Eagle Alert System 7. Alternate course delivery 8. Midterm grade posting.	<ul style="list-style-type: none"> • Survey students <ul style="list-style-type: none"> - Relationship with mentors - Peer tutoring - Financial incentives • Internship <ul style="list-style-type: none"> - Performance evaluation from supervisor. - Required student report • Log of Eagle Alert System detecting students in academic trouble. • Interview students individually to discuss program specifics • Assemble course evaluations, student comments, and feedback about delivery method.
Phase #3 - Develop graduates who meet our industrial partners' expectations		
a. In what ways should communication be facilitated between industry and academia to best support curricular improvements? b. What weaknesses/gaps do industrial partners identify in the training of graduates and how can these be effectively communicated to all institutions? c. How can we improve these strategies to prepare competent ET graduates?	1. Mentorship Program 2. Internship Program - Student reports 3. Industry Advisory Council 4. University – Industry partnership program.	<ul style="list-style-type: none"> • Personal communication with industrial partners • Surveys of the industrial partners and mentors • Council notes and surveys • Exit surveys for ET Students <ul style="list-style-type: none"> - Survey - ET Open Ended Questions • Exit Interview with ET Advisor • Compilation of student GPAs

Proposed program designs

Our personnel team was diverse and included both faculty members and university staffs from recruitment, retention, and public relations. The program was monitored and guided by internal and external evaluation team as well as an external advisory board. The External Advisory Board met annually to interview ET students, reviewed collected data, and interviewed internship employers with the intent of refocusing/rebalancing our efforts should we fall short of our intermediate goals. Three phases of activities were initiated in the first year and continued for all five years. A brief description of those activities is as follows;

Phase 1: Recruitment

There were two support populations for recruitment, (1) direct recruiting by institutions and staff, and (2) direct support by alumni and local business people.

Potential STEM Students

Our *Let 'em Know* program, (which is similar to the Catch the Dream program implemented at Lake Michigan College) focuses on increasing transfer rates from local CCs to our university. *Let 'em Know* program provided first year STEM students with four year degree guidance regardless of institutional enrollment. The focus of these tasks was to improve communication between MS gulf coast HSs, CC's and our university. Information, in various formats, was sent to STEM students at all participating institutions. ET program information included program offerings, course information, career prospects, articulation catalogs, scholarship information, resource loan details, early undergraduate enrichment opportunities, recruitment schedule, retention activities, facilities and location information, dates of key events, and any other relevant information. Inter-institutional visits guide ET students during their second year at the CC. Our participating faculty members each fall, visit all seven participating CC campuses. Providing university faculty as guest speakers has proven an effective tool for student motivation^{2,3}. Our faculty members talk about ET career prospects, research opportunities and degree programs. The goal of the *Let 'em Know* program is to provide one-on-one contact and communication about regional ET career opportunities to at least 200 students per year across the participating CC campuses.

In addition, a 2 yr./4 yr. Portfolio was prepared for each student. The portfolio tracked their progress across coursework, targeting STEM specific 4 year accreditation objectives, beginning in their freshman year. These portfolios were reviewed across campuses, providing individual feedback for every student. The portfolios were targeted to increase retention of underrepresented minorities and female students by providing direct support and encouragement them.

Tracking and collecting assessment competency and student outcome data on a single campus is an essential and yet time consuming task that typically includes an $O(n^2)$ communication component between both faculty and students and faculty themselves. As a result, many assessment tasks consume significant amounts of faculty time, and yet are not well done. To reduce the communication component between faculty and students to linear time, we proposed to prepare a Majors Portfolio for each student in our program which directly benefits the student by individually tracking and assessing their progress annually, and yet offloads the task of data collection to each student. To reduce the communication time between faculties, the task of entering the student data is being moved to the student advisor, again reducing the complexity to linear time. Overall, we significantly reduced the amount of work for the instructor, the faculty advisor and even the student while concurrently collecting the relevant data and providing the student with a new level of overall performance evaluation annually. Because portfolio management was introduced in our K-12 classrooms, students were both comfortable and adept at the task.

In addition to improving single campus assessment processes, Student Portfolio's also provides an opportunity to extend assessment analysis across different Institutions of Higher Learning. It is this feature of the Portfolio that forms the basis for this grant request. We have organized our Portfolio's so as to include information about both the Community College and the Senior College Institutions. Our portfolio presents the student with an overview of the senior college major degree program in detail, and tracks and guides potential students before they arrive on

campus. Students are thinking about and focusing on their four year degree from the time they begin Community College.

The Portfolio is designed so that each Institution still has autonomy, and they prepare their own sections for inclusion in their complements student portfolios. Further, the nature of the Portfolio, and its management, are easily ported to Web pages, providing the basis for automation. The Portfolio is organized into several major sections. The first four sections are provided by the Institutions, and include

- Campus/Degree/Website Overviews
- Schedule Rotations for all campuses
- Course Syllabi/Surveys/Competency Tests/Major Field Test Study Guides
- Rubrics
 - Accreditation Competency Rubrics
 - Student Outcome Rubrics
 - Course Related Rubrics
 - Programming Rubrics
 - Writing Rubrics
 - Speaking Rubrics

The last section is maintained by the students and includes

- For each semester and each course
 - Course Homeworks
 - Course Tests
 - Course Projects

Joint meetings between the Institutions are held annually to review the individual school's portfolio standards, and compare across campuses to keep synchronized. The Rubric format itself has been re-designed for this work. Most Rubrics evaluate skills from the perspective of a corresponding grade, so that columns equate roughly with F-A grades. We have replaced the standard 'column grade association' with an 'expected path of development through our program' association. Hence the lowest quality performance is associated with a freshman in our programs, while the goal skills we wish the students to have achieved by graduation can be found in the senior column. This is to insure that students do not become discouraged if they score low as freshmen. Although they hopefully wish to do better, they still feel that they are on track. If they do fall behind, they can use the annual assessment input to motivate them in successive classes, and also to focus their efforts more effectively on their points of weakness. This annual assessment also helps us with advisement; based on the Competency progress levels indicated, we can shunt students to different level classes depending upon relative skill levels.

As one can see, the Portfolio is designed to serve multiple purposes. It relieves some of the administrative burden from the faculty, freeing up time to work directly with students, and focusing both faculty and students on the areas where they need the most individual attention. It also dovetails with Computer Science Tutoring Labs, where students can come in for help from more advanced students, and the lab assistants know which types of programs to work with them on. It helps faculty actively track students whether they start at their institution or one of the cooperating colleges, increases communication between the Senior and Junior College faculty,

and thus increases retention potential. It utilizes technology to prepare for seamless accreditation preparation and report generation. Yet, because it focuses attention on students individually via an annual evaluation of their portfolio, it fosters a small college atmosphere where students feel individually guided and directed. Most importantly, it provides a vehicle for cooperation between the Junior and Senior Colleges, providing them with an opportunity to compare student progress across campuses, and adjust teaching content accordingly.

At the start of each fall semester, potential students from local HSs were invited to spend a focus day at our university. A presentation covers our ET programs, explains potential careers, and emphasizes the importance of immediate job placement and potential opportunities in coastal Mississippi, in the state and in the nation. Students were provided a hands-on activity that gives them a taste of university's ongoing research projects and a tour of the research centers. Enrollment specialists advertised this event at local HSs and CCs through flyers and emails. This activity was modeled around the College of William and Mary's Fall Focus Days. We expected participation of 20 students in the first year and anticipate growth to 50 students by the end of the fifth year.

Each summer we offer a week-long Summer ET Academy Program. This program targets primarily CC and senior HS students. Students engage in daily ET exercises and week-long projects with faculty and current university students, being immersed in real world ET projects. This week-long program allows students to meet and interact with university faculty, current ET students, and get familiarized with the university experience. The overall goal is to build students' interest and confidence in their ability to pursue STEM programs, to ensure success in entry level courses, and to create relationships that can lead to an early undergraduate research experience. We expected to recruit 15 students through our "Summer ET Academy" in the first year and grew to 30 by end of the fifth year.

CC Faculty ET Training & Immersion

There's a healthy relationship between our university and the local CCs, as they have an established curricular alignment and articulation agreement in place. However, the ET programs: Construction Engineering Technology (CET), Industrial Engineering Technology (IET), and Logistics Technology (LT), and the growing regional need for these majors, has not been well publicized. Our cross institutional work began with three days of training for CC STEM faculty members. We targeted to train 75 CC faculty members over the course of five years period. The goals of this training are to: (1) increase awareness and understanding of the ET programs at our university through tours of the facilities, study center, and curricular information, (2) inform them of future job potential through industrial speakers, representatives, and salary data, (3) develop their content knowledge about current ET projects at the various campuses by working through hands-on projects in groups, (4) provide classroom materials and activities the CC faculty members can use in their STEM content courses (e.g. mathematics, computer science, physics, chemistry), and (5) increase their awareness of the professional opportunities in the coastal region with a variety of site visits.

Phase 2 - Retain and Increase the Number of Graduates in ET

At the university level, our ET program has a current retention rate of 70%. This rate does not, however, include the CC students who do not transfer to a 4-year university. To improve the already high retention rate as well as to increase our target transfer student graduation rates, which have not previously been tracked, we planned to implement the following support services and mechanisms. We continue our close individual institutions advising activities with all students and provide enhanced academic advising, which is another effective retention tool ^{4,5}. For example, at our university, we train our ET faculty members through Quality Enhancement Plan (QEP) program during the summer months. These trained academic advisors will not only advise students for class selection, plan of study, and enrollment but will also support and direct them during any difficult academic times. We employ the Eagle Alert System that identifies, notifies, and seeks to assist students who are having academic difficulties based on midterm grades and faculty reports across the university. To cooperatively focus on 4 year graduation rates across campuses, we augmented our institutional work with the following cross institutional support programs.

Tracking and collecting outcome data on a single campus is an essential and yet time consuming task. We prepared a Majors Portfolio for each student on each campus which individually tracks and assesses student problems. The portfolios significantly reduced the amount of work while concurrently institutionalizing the practice of collecting the relevant data and providing students evaluations annually. Our portfolio presents the student with an overview of the senior college major degree program in detail, and tracks and guides potential students even before they arrive on the four year campus. Students think and focus on their four year degree from the time they begin CC. Each Institution prepares their own sections for inclusion in student portfolios.

The Peer Led Team Learning model ⁶ actively engages students in the learning process by having them solve carefully structured problems in small groups under the direction of a trained peer leader ⁷. Peer-led tutoring sessions are an effective way to engage large numbers of students with in-depth course material within a group work environment. Improved performance and retention, development of communication and team skills, higher motivation and course satisfaction, and increased interest in pursuing further study in science are among the benefits of the PLTL approach ⁸. The following core STEM courses, all of which are foundation courses for ET, will use PLTL, regardless of campus: Physics I, Physics II, Calculus I, Calculus II, Statistics and Engineering Economics. We will offer the PLTL program for up to three courses per semester and cover all six courses during each year. An additional benefit of peer tutoring is the exposure of all STEM majors to the experience of teaching. Peer tutors were attracted to the option of becoming science or mathematics teachers, an alternative Bachelor's degree path. We also offered a \$250 scholarship to outstanding student/peer tutor per semester to promote peer mentoring. A portion of the lab fees generated by these courses was used to maintain these programs.

Phase 3 - Develop and Produce Graduates Who Meet Industry Standards

We offer career preparation. Students have the opportunity to participate in field-based internship experiences at local industries (these are already part of our program). In addition, we

established a professional student mentoring program. Our Partner Industry Network (PIN) consists of local Gulf Coast industries. These companies offer co-op or internship opportunities and access to capstone research to our ET students. These programs benefit both the participating industries and our students. Huntington Ingalls Industries, Trinity Yachts, Chevron and Signal International are just a few of our partners. We partnered with several professionals who served as mentors, some of whom are our alumni. Mentoring has been shown to increase retention particularly in STEM fields^{9,10}. Florida State University, University of Iowa and Monash University have all implemented successful professional mentoring programs. We are measuring student and mentor attitudes and growth as a result of this partnership and developed a system of accountability for all participants. The mentorship program includes telephone conversations, email, face-to-face meetings, and portfolio reviews, to help guide students with term projects, capstone projects, career advising, and job searching. Each mentor was assigned up to 10 mentees. Each mentor was supposed to spend approximately 100 hours per year. Each mentor completes two surveys during the academic year and submits a summary report at the end of each year. Based on student response rates to portfolio activity, we expected most of our ET students to take advantage of this service. We recruited 10 professional mentors in the first year and increased the number to 20 by fifth year.

Measuring Program Effectiveness

Our project was expected to impact the following number of individuals (Table 3)

Table 3: Benchmarking impact throughout the project

CC Recruitment	15,000 STEM majors at area CCs (CC)
Regional Recruitment	1000 potential ET students at HSs, industries and businesses
Our Enrollment	228 new ET students
Training & ET Immersion	12 ET faculty members for academic advising at University 75 STEM educators from 8 participating CC campuses
Engagement	640 existing ET students in various retention programs
Industrial Network	10 corporations in the region
Professional Pool	20 professional mentors from local industry practitioners
Project Employment	One graduate and one undergraduate assistant
Effect	An additional 66 ET graduates per year from University

In Table 4, we list our measurements and assessments. In this section, we provided the details and logistics of the data rich online system we maintain and analyze. During Phase 1: Recruitment, we used incoming students' SAT/ACT, GPA and previous course enrollment and performance data. In addition to this quantitative data, we also collected survey data from potential and incoming HS and CC students, and non-traditional students. Our webpage has an online data monitoring system. We also collected pre and post data from the faculty members participating in the 3-day ET training and immersion. We measured content knowledge gains, understanding of the industry and workforce options for ET graduates, as well as how and in what ways they were using the materials provided during the training. We assessed and survey participants annually to document any practice changes and the quantity of students mentored. We were particularly interested in communicating the ways in which these faculty members were able to channel their students to STEM disciplines. The CC faculty members and their

teaching schedules allowed for multiple contact hours each week with potential STEM professionals. It was our hypothesis that given the right tools, working together, South Mississippi’s higher learning educators will become an excellent resource for guiding CC students to STEM career paths.

Students enrolled in the ET program, Phase 2: Retention was: (1) complete course evaluations, (2) provide internship evaluations and reports, (3) maintain a log of the time spent in the student center, (4) share feedback about the Peer Led Tutoring Team, (5) complete a financial incentives survey, and (6) provide mentorship feedback. This data were used during advisement and for monitoring and adjusting program mechanisms. In Phase 3: Graduation and Job Placement we were concerned with the quality of our graduates and how their new skill set met the expectations of our industrial partners. We documented personal communications, phone and email conversations with our industrial partners. We also asked various professionals in the field who have interacted with our students through our internship, mentorship, or as new employees to complete an online survey on our webpage annually. During our Advisory Council meetings, progress and feedback was monitored and used to improve existing programs. We included both direct and indirect measures of student performance. We collected graduating students’ data and final GPAs from Student Services as well as create and administer an ET program-specific survey tool. Lastly, each student met with their advisor for an exit interview to discuss the program, their job placement and potential role as a mentor for future ET students.

Table 4: Program Evaluation Questions	Instruments	Timeline
Phase 1 – Recruitment		
<ol style="list-style-type: none"> 1. To what extent do HS and CC students enrolled in STEM courses think about future STEM study? 2. How is their confidence and attitudes toward STEM study and career goals affected by STEP-UP support? 3. How does the ET field become more visible at HS and CC level? 4. What are the barriers to entry for students to ET? (and what can be done to remediate?) 5. To what extent are the recruitment efforts sustainable, adopted by local institutions? 6. How effective is the faculty training and tablet incentive as a model? 	e-surveys, workshop observation, recruitment, retention data from schools and colleges, sample interviews (structured protocol, telephone and in-person) with students and faculty	Fall, each project year.; summer (summer training sessions) Year 1: instrument design and development
Phase 2 – Retention		
<ol style="list-style-type: none"> 1. How effective are each of the retention support mechanisms toward shifting student attitudes about and confidence to participate in STEM careers, including: <ol style="list-style-type: none"> a. Professional mentoring b. Study Center c. impact on disadvantaged student sub-groups d. impact of internship e. completion rate of ET programs 	e-surveys, sample interviews (structured protocol) with students, mentors, intern supervisors, usage data, program completion data	Late fall-spring, each project year. Year 1: instrument design and development

Conclusion

The STEP program's overarching objective was to increase the number of Mississippi Engineering Technology graduates to meet the growing regional industrial need on the Mississippi Gulf Coast. We developed clear pathways that encourage STEM students, especially women and minority students, to complete their bachelor's degrees. We worked together to recruit, support and develop students in all phases of their education. The programmatic goal was to increase enrollment, improve retention and facilitate the graduation of students from a four-year university by removing transition barriers between CCs and our University. We also seek to broaden the participation of all students, particularly underrepresented groups, in STEM education.

Over the last few years, this program was targeted to reach more than 15,000 STEM students, at least 1640 potential incoming and existing ET majors and 87 STEM educators. The expectation was that the total yearly enrollment will double and annual graduation will triple. The percentage of women students was targeted to grow 150% while minority percentage is targeted to increase 200%. Current data shows that we are on target to reach our goal. The ongoing data collection planned for each phase of student development provides a rich data set for us to examine and disseminate results. Insight from a bottom-up approach of recruitment, customized retention and tech-savvy faculty training will help other institutions in building educational partnerships, increasing enrollment and improving retention & graduation of their STEM majors.

REFERENCES

- ¹The College Board (2011), *Improving Student Transfer from Community Colleges to Four-Year Institutions — The Perspective of Leaders from Baccalaureate-Granting Institutions*.
- ²Wen-Jung Hsin, 2007, "Student Motivation in Computer Networking Courses", *Student Motivation*, Vol. 2, pp 32-36
- ³Forsyth, D. R., and McMillan, J. H., 1991, "Practical Proposals for Motivating Students" In R. J. Menges and M. D. Svinicki (eds.), *College Teaching: From Theory to Practice*. New Directions in Teaching and Learning, no. 45. San Francisco: Jossey-Bass
- ⁴Wyckoff, S. C. (1999). The academic advising process in higher education: History, research, and improvement. *Recruitment & Retention in Higher Education*, 13(1), pp. 1-3
- ⁵Habley, W.R. and McClanahan, R., 2009, "What works in Student Retention", *American College Testing*
- ⁶PLTL Progressions Newsletter v3, 12, p10 and v4, 11, p7
- ⁷Quitadamo, I.J., Brahler, C.J., Crouch, G.J., 2009, "Peer-Led Team Learning: A Prospective Method for Increasing Critical Thinking in undergraduate Science Courses", *Science Educator*, 18, 1 (Spring), 29-39
- ⁸Schray, K., Russo, M. J., Egolf, R., Lademan, W., and Gelorm, 2009, "Research and Teaching: Are In-Class Peer Leaders Effective in the Peer-Led Team-Learning Approach?", *Journal of College Science Teaching*

⁹ Williams, R., 2008, "The need for professional mentors": <http://www.dotnetdevnet.com/Meetings/tabid/54/EntryID/25/Default.aspx>, November

¹⁰ Rob Williams, 2009, "Work in Progress - Professional Mentoring for CS Students", 39th ASEE/IEEE Frontiers in Education Conference, October 18 - 21, San Antonio, TX