AC 2011-680: PEER MENTORING, A TRANSITIONAL PROGRAM TO IMPROVE RETENTION IN THE COLLEGE OF ENGINEERING

Summer Dann Johnson, Louisiana State University

Ms Dann is the Project Manager for the College of Engineering's STEP program. She has her Master's of Science in Mechanical Engineering and worked for industry for 9 years prior to returning to academia.

Paige Davis, Louisiana State University

Paige Davis has 20 years experience as an Instructor in the College of Engineering at Louisiana State University. In addition to teaching she assists with the STEP program. She received her baccalaureate degree in Engineering Technology and her master's degree in Industrial Engineering from Louisiana State University.

Ashley Elisabeth Thibodeaux, Louisiana State University

Ms. Ashley Thibodeaux graduated in May 2010 in biomedical engineering from Louisiana Tech University. She is currently employed with the STEP program and serves as one of the assistant STEP coordinators. Her future aspirations include attending graduate school for prosthetics and orthotics.

Laura H. Ikuma, Louisiana State University

Laura Ikuma is an assistant professor in the Department of Construction Management and Industrial Engineering. Her research interests are in human factors and safety, in particular the links between lean production, psychosocial factors, and injury outcomes.

Kelly A. Rusch, Ph.D., P.E., Louisiana State University

Associate Dean College of Engineering

Warren N. Waggenspack, Jr., Louisiana State University

Warren N. Waggenspack, Jr. is currently the Associate Dean for Academic Programs in the College of Engineering and holder of the Ned Adler Professorship in Mechanical Engineering at Louisiana State University. He obtained both his baccalaureate and master's degrees from LSU ME and his doctorate from Purdue University's School of Mechanical Engineering. He has been actively engaged in teaching, research and curricula development since joining the LSU faculty in 1988. As Associate Dean, he has acquired funding from NSF to support the development of several initiatives aimed at improving student retention and graduation rates as well as supporting faculty with development with effective learning and teaching pedagogies.

Peer Mentoring, A Transition Program to Improve Retention in the College of Engineering

Introduction

The Louisiana State University (LSU) College of Engineering's Peer Mentoring Program is an interdisciplinary program that utilizes upperclassmen to introduce and assist freshmen with their transition into the university environment. The mentoring program was initiated with five engineering "team leaders" working with 45 freshmen in the inaugural LSU 2007 Encounter Engineering (E^2) bridge camp. Over the last four years, the E^2 camp increased to 125 freshmen participants and the need for more peer mentors and a more formalized structure grew accordingly. In 2009, the E^2 peer mentoring model was expanded to support LSU's two credit hour course, ENGR 1050 Introduction to Engineering. A formalized leadership structure was developed and implemented in 2010. To date, seventy three students from eleven different engineering and math disciplines have participated in the peer mentoring program.

Background

The trend of low student retention, particularly in science and math curriculums, is a key problem for a university's graduation rates. Nationally, while 80% of students who declare a major in engineering finish a traditional college curriculum within eight years, only 40% of those students actually receive their bachelor's degree in engineering (1, 2). The average six year graduation rate for LSU College of Engineering (COE) students prior to the implementation of the LSU STEP grant was 36%, consistent with national statistics (3). A survey of engineering freshmen at Arizona State University found that the lack of, or only minimal engineering contact during the first semester or first year may be insufficient to reinforce the students' original reasons for entering engineering (4). French et al reported that student persistence requires a strong academic background, achievement of good grades and academic motivation (5). Their findings suggest that retention programs should focus on academic achievement. Johnson (1997) found that the most distinguishing characteristics between retained and dropout students were faculty and staff-student interaction and connection (6).

When structuring a program to increase retention, consideration needs to be given not only to support services for academic achievement, but also to optimizing community building and interactions amongst the students and faculty/staff (6). Aid and support is easily found when living in a learning community among peers with the same course load. Peer study groups have the ability to shape disciplined work habits. A mentoring program can offer advice and boost self-confidence when facing adversity (7). For at risk students, peer-mentoring programs have shown to be effective. One nursing school noticed a high attrition of students after one or more of the eight complex core courses and initiated their own peer-mentor program. It targeted students entering these complex core courses with less than desirable GPAs. Each week, students would meet with peers, who had scored highly in these courses, for tutoring and support. Faculty were often present to encourage positive relations with students. The results showed that success of students participating in the mentor program were higher than students who were not mentored (8).

Four years ago, the LSU College of Engineering implemented a STEP program for incoming freshmen. The mission of the STEP grant is to create a model within the College that promotes a sense of community, active learning and engagement of all constituents (9). The retention rates of the freshmen that have participated in one of the STEP programs are consistently higher than students who have not participated (3).

Peer Mentoring Program

A. Participants

The beginning of the peer mentoring program started rather informally as upper classmen were recruited to be team leaders for the LSU E^2 bridge camp. Over the course of four years, the program grew to include all of the engineering disciplines and math (Figure 1). The numbers of peer mentors, basic demographics and their classifications are presented in Tables 1 & 2. Approximately 40% of the peer mentors (PM) are past participants of the E^2 bridge camp or ENGR 1050 class and 25% (18/73) of them have mentored for multiple years.

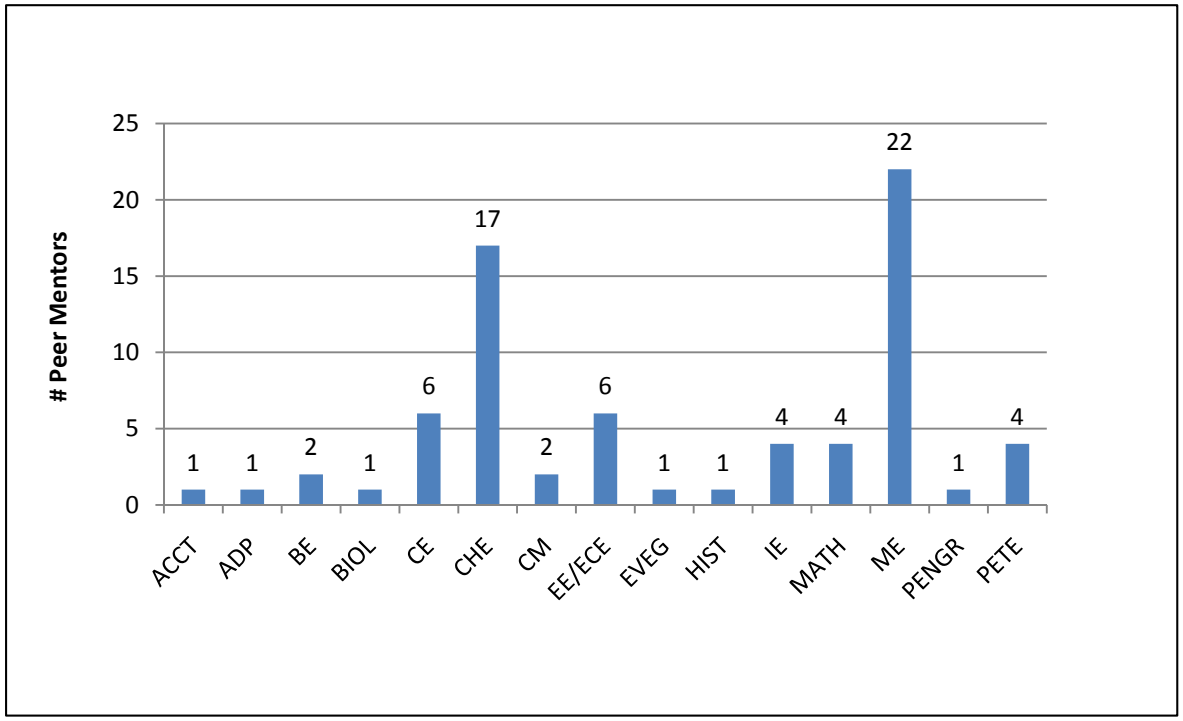

Figure 1. Disciplines of the Peer Mentors, as of Fall 2010

All of the peer mentors are still pursuing degrees or have graduated. Of the 73 students, 65 students are currently in an engineering discipline. Three students left engineering after their sophomore year to pursue liberal arts degrees, and two students are pursuing other STEM degrees. Two students left the university due to financial or personal reasons; however, both are continuing their studies at smaller schools. Nine students have graduated in engineering; three of them are continuing their education with advanced degrees.

Table 1 . Classification of Peer Mentors*

Classification	*# of Peer Mentors*
Freshmen**	2
Sophomore	45
Junior	20
Senior	6
Total	73

*First year they participated in program

** In 2007, students who had been on campus in the summer were eligible.

Table 2. Numbers and Demographics of Peer Mentors per Program

Program	*Program Year*	*# of Students*	*Demographics*
E^2 Mentoring	Year 1	5 Peer Mentors	60/40% male: female
			21% minority*
	Year 2	15 Peer Mentors	60/40% male: female
			21% minority
	Year 3	31 Peer Mentors 4 Ambassadors	71/29% male: female
			15% minority
	Year 4	30 Peer Mentors 11 PM Leaders**	71/29% male: female
			7% minority
1050 Mentoring	Year 3	14 Peer Mentors	60/40% male: female
			20% minority
	Year 4	9 Peer Mentors 1 PM Leader	56/44% male: female
			11% minority

* Includes anyone non Caucasian.

** Developed from ambassadors, includes group leaders, see Program Details

B. Program Details

The peer mentor duties have evolved from basic interaction to developing and leading activities. Initially peer mentors held the role of team leader in the design portions of the E^2 camp and participated in the Ropes Adventures sessions of the camp. Each upperclassman was assigned a group of freshmen; the ratio of upperclassmen to freshmen evolved from 1:8 in 2007, to 1:5 in 2009. In 2007 and 2008, all evening activities were programmed by the camp coordinator. In 2009, students who were not team leaders but wanted to help with the camp were recruited as "ambassadors." They assisted faculty and staff in implementing other sessions such as 7 Habits, Study Skills and Physics reviews.

In 2010 in order to effectively coordinate their increased numbers, a peer mentor hierarchy was established for effective monitoring, communication and management. Eight peer mentors who had participated in either the camp or the class at least twice were recruited as Peer Mentor Leaders to guide the new peer mentors' interaction with participants and to assist with the logistics of the camp. Six peer mentor leaders instructed or assisted in the instruction of the academic and professional development sessions of the camp. These sessions included time management, a design competition and the math lab. Mentors still assisted in physics and 7 Habits. Additionally, peer mentors organized and hosted optional evening activities for which approximately 75% of the campers attended. Evening activities included "Tigerball," soccer, tackle football, ultimate frisbee, video game contests, board game night and bowling.

The role of the peer mentors for ENGR 1050 class differs slightly from that of the E^2 peer mentors. The main duty of the class mentors is to be the team leader for the design project. In addition, they have been encouraged to make announcements concerning student organization meetings or upcoming university events and host sessions and panels to promote their experiences with internships, participating in academic programs abroad and research experiences for undergraduates. Anecdotally, several protégés asked their mentors about instructors or faculty, advice on general education classes, how to dress for interviews and inquired on other activities around campus.

At the conclusion of the E^2 bridge camp or ENGR 1050 class, peer mentors are all encouraged to continue including protégés in semester activities such as student organization meetings, design competitions, professional/personal development seminars and other university activities such as Career Day and Fall Fest.

C. Recruitment and Training

Recruitment and training of peer mentors begins in the spring. In 2008 and 2009, recruitment consisted of contacting past participants of the E^2 bridge camp and the ENGR 1050 class or getting names from faculty, staff and other peer mentors. In 2010, due to the increase in the camp participants, a broadcast email was sent to all students in the College of Engineering. Students were required to submit an application and a letter of recommendation. Students were interviewed by the College staff in the Dean's office and, if selected, students were hired as 'student workers'. This process typically produced the number of students needed for the camp and the class. For 2011, due to increased advertisement and interest, the hiring process will be

modified. Past peer mentors and leaders will host an interview panel and provide recommendations to the staff for the 2011 cohort.

As the peer mentoring program has developed and grown over the last four years, changes in the training process have been made to ensure each peer mentor had the adequate skill sets to be effective mentors. In 2007 and 2008, the STEP program offered one training session (6 hours) just before the beginning of the E^2 bridge camp. For 2009 and 2010, the team incorporated a spring session (4 hours) for mentors to meet one another and to describe in more detail what mentoring is in general. The training sessions prior to the camp and class were tailored to include more logistic and management techniques. Training included topics of proper personal/social boundaries with protégés, first aid, university rules and guidelines and availability of student services on campus. A round table panel of past peer mentors answered questions on how to keep protégés involved and how to appropriately manage unexpected events that may occur based on their experience from prior camps.

Integration of several textbooks or leadership books has been attempted throughout the years with varying degrees of success. Due to the heavy emphasis of team projects and personal management in the camp, the 2008 peer mentors who had not been through either the E^2 bridge camp or ENGR 1050 class were required to read *7 Habits of Highly Effective Teens* (Covey, 2004). All students were required to read the *17 Essential Qualities of a Team Player* (Maxwell, 2006). In 2010, returning peer mentors and those chosen for leadership were required to read *Leadership 101* (Maxwell, 2002). All mentors were given a quiz during the 6 hour training session on their books and results were discussed in an open forum. Also in 2010, due to the large number of peer mentors and the fact that the majority of them were new to mentoring, informal "wrap up" sessions were held in the evenings during the camp or right after the end of the class.

Assessment of the Peer Mentoring Program

Assessment of the peer mentoring program consists of qualitative analysis using surveys and focus groups with the peer mentors and quantitative analysis of retention data using independent samples t-tests to compare the peer mentor group with a control group of similar backgrounds and experience (10). Surveys and focus groups with the peer mentors have allowed for adaptation of the peer mentoring and the freshmen programs.

A. Survey Results

Surveys at the conclusion of each E^2 bridge camp and ENGR 1050 class are conducted to provide information for continual program development and improvement. On surveys given to the camp or class participants, freshmen protégés consistently report that interactions with the peer mentors are the most valuable and most enjoyable aspect of each camp and class. Approximately 60-65% of freshmen will state that they would like to be a peer mentor in the future. Peer mentor feedback has led to changes such as incorporating the peer mentors as leaders, providing resource training materials, and having a peer mentor management system. In 2010, developing and implementing two formal activities between peer mentors and protégés was suggested in the surveys and focus groups.

In order to assess the effectiveness of the peer mentoring program, a survey of the current and past peer mentors was performed in the fall of 2010. The response rate was 59% (N=43). Peer mentors were asked a variety of questions such as their current major or degree, the number of and mode of contacts with protégés, study habits, and current professional and academic activities. If mentors participated in one of the STEP programs as freshmen, they were asked to evaluate their preparedness for the academic program and whether they utilized the other campus resources (N=28).

In general, almost all of the peer mentors reported that they have stayed in contact with at least one of their protégés and more than half stay in contact with three or more of their protégés, (Table 3). For reference, peer mentor protégés numbers could range from three to nine. Incidentally, peer mentors reported that they talk with the students even if they are no longer in the College of Engineering. Peer mentors have encouraged their protégés to take advantage of campus resources or use camp/class programs.

Finally mentors were asked to indicate if they were involved with programs on campus such as memberships in student organizations, participation in REU's, or living in the ERC. The responses are presented in Table 4. In general, the peer mentors are active in student professional and academic programs that are encouraged and supported through the STEP freshmen programs; especially significant is the percentage of students active in their student chapter of their professional society and the fact that they had formed study groups with other engineering students.

Approximately half of the peer mentors are past participants of either the E^2 bridge camp or the ENGR 1050 class. The survey asked the previous campers to reflect on their freshmen year and comment on their preparedness for classes and whether they participate in university or college activities and programs, (Table 5). Overall, the peer mentors felt that the E^2 camp had prepared them for the rigor of the university classes and more than half felt encouraged to interview for an internship or research experience for undergraduates.

Table 3. Interactions with Protégés

Respondents, n=43

Protégé Contact Information	Percentage Total
still stay in contact	92%
stay in contact w/ 3 or more protégés	56%
How Often do you stay in contact:	
Daily	4%
Weekly	25%
Monthly	36%
By Semester	25%
Not at all	11%
Encouraged protégés to visit/use:	
Center for Academic Success	44%
Guaranteed 4.0 System / Learning Strategies	35%
Engineering Communications Studio	47%
To meet w/ engr. faculty and advisors	63%
To be a peer mentor	70%
To pursue an internship/REU/Programs Abroad	72%
7 Habits	28%

Table 4. Professional/ Personal Activities

Respondents, n=43

Student Org.	Percentage Total
Active Member	88%
Held Leadership Position	42%
I am actively pursuing:	
An internship	65%
REU	21%
Programs Abroad	7%
Other	7%
I have participated in:	
An internship	30%
REU	12%
Programs Abroad	5%
Other	5%
I am in:	
Study group w/ engineering students.	81%
Met study group through E²/ENGR 1050	37%
Lived in ERC	60%
Told Others about the STEP program	100%
Participated in the recruiting events for STEP	56%

Table 5. Past E² or Class Participants

Respondents, n=28

Experience with camp/class encouraged you:	Percentage Total
To join an organization?	60%
To visit Center for Academic Success?	42%
To use the Communication Studio?	56%
To pursue an internship/REU/Programs Abroad?	63%
E² Participants were prepared for	
Math Class	81%
Physics Class	88%

B. Retention Analysis

The peer mentoring program developed from the team leaders employed by the freshmen programs initiative (STEP programs). The main goal of the STEP program is to increase the graduation rate in the college of engineering. This goal is measured by tracking the retention of students in the College of Engineering over time by documenting student majors and enrollment. All students enrolled must meet the minimum admission requirements for the university, ACT >22, high school GPA 3.0. For 2007 through 2009, data was collected and sorted for all freshmen by the student's entry year, N_{total}=2,542 (Table 6). Using these years, eliminated twenty-four peer mentors; these students were freshmen from 2003-2006 and control data for those years is not part of the STEP longitudinal data. One peer mentor was removed from the data pool due to illness preventing him from being in the program the full year.

Table 6. Sample and Population Numbers per Year

Year	Number of Peer Mentors	Number in Control Group	Total Per Year
2007	14	852	866
2008	18	857	875
2009	17	784	801
Total	49	2493	2542

Engineering retention data is collected annually on the 14th day of Fall. Data reported in this document was obtained on the 14th day of Fall 2010. Thus, retention numbers are for one year for the freshmen class of 2009, two years for 2008 and three years for 2007. Figure 2 shows the percent retention of the peer mentors compared to the freshmen program participants and also students who have neither participated in STEP or peer mentoring.

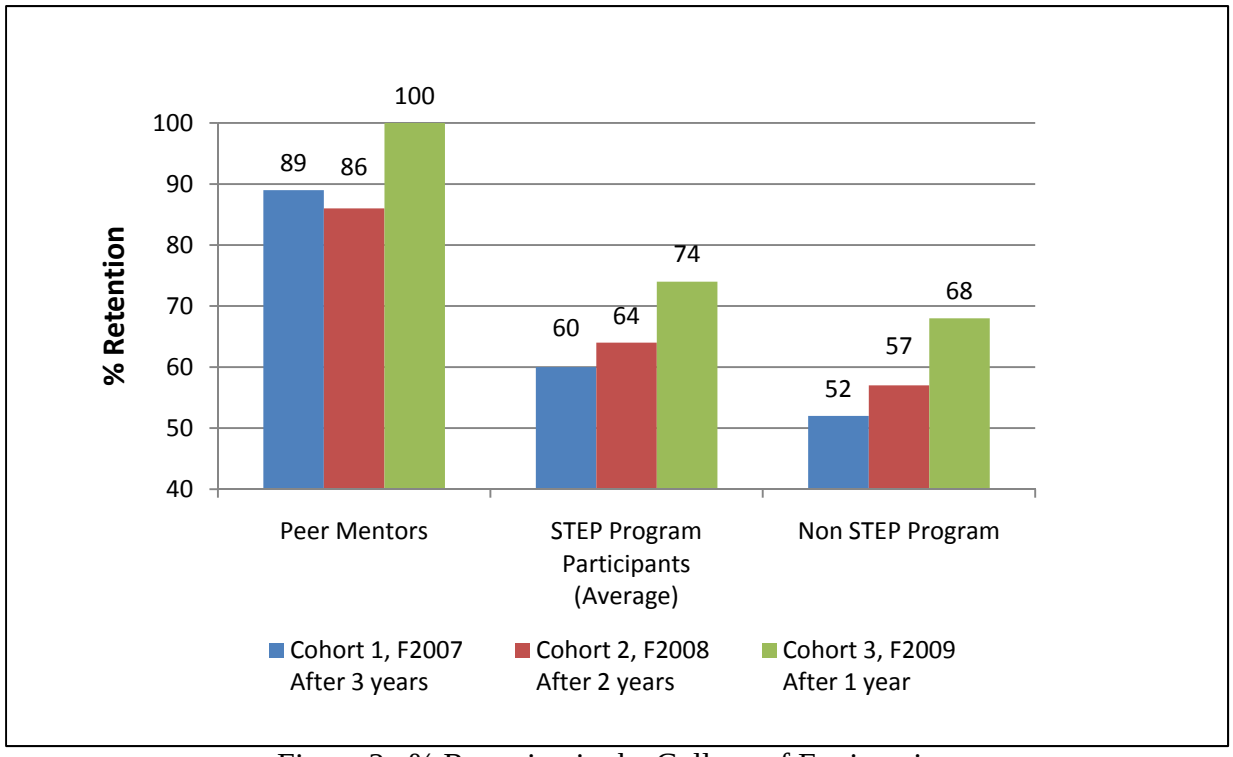

Figure 2. % Retention in the College of Engineering

Independent samples t-tests were used to determine if the difference in the mean retentions of the peer mentors as compared to the overall engineering population were significant. T-tests ($\alpha = 0.05$) were used to determine differences in retention within the Collage of Engineering, within STEM disciplines, and within LSU. The hypothesis is that the program, through the training and connection to the staff and upper class students, is a significant factor in the retention of these students in the college. The results showed that peer mentors were more likely to remain in engineering, in STEM disciplines, and at LSU than their cohorts within the College of Engineering (all $p < 0.0001$). There were no significant differences in retention levels between cohorts of peer mentors ($p > 0.331$). Thus, we can conclude that peer mentors have a higher retention rate in engineering, in STEM, and at LSU than the remaining engineering student population as a whole.

Discussion and Conclusion

One confounding factor in determining effectiveness in retention is GPA. Peer mentors have significantly higher GPAs than the remaining College of Engineering students, peer mentor mean GPA 3.25 (SD 0.56) vs. other COE student GPA 2.68 (SD 1.31), $p = 0.002$. In the beginning, the program did not have a minimal GPA requirement; after the third year, the peer mentoring program started implementing a minimum GPA of 2.0. Additionally, peer mentors may also have higher GPAs due to their participation in the program. Participation may have fostered an increased commitment to studies through added access to professors and other engineering professionals, pressure to perform well through increased visibility to students and professors, structured programs to foster development, etc.

Although the peer mentoring program was initially implemented as a support and community building program for incoming freshmen, the results of the quantitative and qualitative assessment indicate that the program has a positive effect on GPA and retention in the college for the peer mentors. In conclusion, the peer mentoring program provides a support structure and guidance for students as they transition from freshmen to sophomore year and beyond.

1) Vogt, Christina (2008) "Faculty as a Critical Juncture in Student Retention and Performance in Engineering Programs", Center for Advancement of Scholarship on Engineering Education, National Academy of Engineering, Journal of Engineering Education, January 2008, 27-36.
2) Astin, A.W. and Astin, H.S. (1992). "Final Report: Undergraduate Science Education: The Impact of Different College Environments on the Educational Pipeline in the Sciences," Higher Education Research Institute, Graduate School of Education, UCLA.
3) Engineering Engagement for Student Success, ENG2, National Science Foundation, STEP Project #0622524, College of Engineering, Louisiana State University.
4) Anderson-Rowland, Mary R. (1997). "Understanding Freshman Engineering Student Retention through a Survey," Proceedings, American Society for Engineering Education Annual Conference and Exposition.
5) French, Brian F., Immekus, Jason C. and Oakes, William C. (2005). Journal of Engineering Education, American Society for Engineering Education, October.
6) Johnson, K. K., et al. (1997). "Focus groups: A method of evaluation to increase retention of female engineering students," ERIC Documentation Service No. ED399875 Online, ERIC, February.
7) Besterfield-Scarce, M., Atman, C.J., Shuman, L.J. (1998). Engineering Student Attitudes Assessment, Journal of Engineering Education, Vol 87, No. 2. 133-141.
8) Benjamin, Mimi, (2007) "Role Construction of Residential Learning Community Peer Mentors," Journal of College and University Student Housing, Vol 34, No. 2. 31-42.
9) Robinson, E and Niemer, L. (2010) "A Peer Mentor Tutor Program for Academic Success in Nursing " Nursing Education Perspectives, Vol 31, No. 5. 286-289.
10) Felder, R, Forrest, K., Baker-Ward, L., Dietz, J, and Mohr, P (1993) "A Longitudinal Study of Engineering Student Performance and Retention. I. Success and Failure in the Introductory Course," Journal of Engineering Education, Vol 82. No 1. 15-21.