

# **2006-1196: RETENTION IN ENGINEERING TECHNOLOGY PROGRAMS AT ROCHESTER INSTITUTE OF TECHNOLOGY**

**Carol Richardson, Rochester Institute of Technology**

Carol Richardson is the Miller Professor and the Vice Dean of the College of Applied Science and Technology

# **Retention of Engineering Technology Students at Rochester Institute of Technology**

## **Abstract**

This paper describes several programs at Rochester Institute of Technology (RIT) that have been implemented in the past four years to improve the success and graduation rates of RIT students. RIT programs such as the Early Alert System, Freshman First Year Experience, Learning Communities, and the North Star Center are being used to improve the success of Engineering Technology (ET) students. New ET programs such as the mentoring of women ET students, a transfer student scholarship program, and the addition of professional staff advisors to the ET departments have also been added. The success of these programs is measured by comparing the attrition of ET freshman and transfer students for the past five years to the RIT attrition of freshman and transfer students.

## **Introduction**

RIT is a private university with a modern 1,300 acre campus located in Rochester, New York, the third largest city in New York. There were 11, 821 undergraduate students and 2,041 graduate students enrolled in the fall of 2005. Over 50% of these students are enrolled in Science, Technology, Engineering, and Mathematics (STEM) programs RIT students can prepare for technical and professional careers in more than 200 different academic programs. Many of the academic offerings are unique or unusual: imaging science, microelectronic engineering, software engineering, and telecommunications engineering technology; the programs draw students from every state and more than 80 foreign countries. Many degree programs emphasize co-operative education where periods of formal instruction are combined with off-campus hands-on paid internships which enhance the university's "learn by doing" philosophy. RIT is respected internationally as a world leader in career-oriented and professional education and has one of the oldest and largest co-op programs in the world, with more than 1,300 employers and 2,600 students participating in the program each year. More than 450 companies visit RIT annually to conduct 5,000 employment interviews.

ASEE reports engineering technology (ET) statistics on their web site each year. The latest statistics (2003-04) show that RIT is ranked fifth and had 1,105 students enrolled in their seven undergraduate programs in ET. The ET programs are in the College of Applied Science and Technology (CAST) at RIT in three different departments. These programs are:

- Electrical, Computer, and Telecommunications Engineering Technology (ECTET) programs in the ECTET Department
- Manufacturing, Mechanical, and Electrical/Mechanical Engineering Technology Programs from the Manufacturing and Mechanical Engineering Technology/ Packaging Science Department
- Civil Engineering Technology (CET) Program from CET /Environment Management/Safety Technology Department

The ET programs attract transfer students to RIT although the number of transfer students to these programs have declined over the past ten years while the ET enrollments have steadily increased since 1997. All of the RIT ET baccalaureate programs are five-year programs that require 50 weeks of mandatory paid co-operative educational experience. This experience usually begins in the third year of each of these programs and can be accomplished in five single blocks (10 weeks) or a combination of single and double blocks (20 week) over a three year period. Each student finds co-op employment with help from an assigned co-op coordinator from Enrollment Management and Career Services Division.

### **Problem**

RIT wants to improve the success rate of all students and this success is important as many of these Science, Technology, Engineering, and Mathematics (STEM) graduates supplement the pipeline of engineering graduates from the United States which is often compared to the number of engineering graduates from India and China. A recent study at Duke University stated that if one adds up all the engineering and technology graduates (computer science, information technology and engineering) in the United States that we can see that the United States is graduating about the same number of students as India and India has more than three times the population of the United States.<sup>1</sup>

RIT has 57% of their students enrolled in STEM programs. The College of Applied Science and Technology (CAST) had 1,135 students enrolled in ET programs in the in the fall of 2005 and 200 additional students enrolled in packaging science, environment management, and safety technology programs which is about 10% of the RIT students. RIT had approximately 21% of the students enrolled in the Kate Gleason College of Engineering and 20% of the students in the B. Golisano College of Computing and Information Sciences which has computer science, information technology, and software engineering programs. Students graduating from all three of these colleges in STEM disciplines enter the engineering pipeline.

RIT has better student success with transfer students as compared to the student success with freshman students. RIT has implemented five different programs in the past five years to improve student success and these programs have improved attrition. Table #1 lists the number (N) of freshman students that have entered RIT during the past five years and the percentage of these students that have left RIT each year for the next five years. First Year Experience (FYE) was implemented in 2001 and the North Star (NS) Center started in 2002. The Early Alert (EA) system was implemented in 2003 for all RIT

students and the freshman learning communities were piloted in 2004. Tables #1 and #2 indicate that these four programs have improved freshman to sophomore retention rates for all RIT programs. Table #3 has the same information for the ET programs and shows that the ET programs have higher attrition rates as compared to all RIT programs.

Year	N	1st year	2nd Year	3rd Year	4th Year	5th Year	Program
2000	2125	13.22 %	22.58 %	27.67 %	31.48 %	36.37 %	
2001	2056	12.98 %	22.71 %	27.16 %	35.06 %		FYE
2002	2138	12.67 %	21.42 %	26.47 %			NS
2003	1935	10.95 %	21.03 %				EA
2004	2032	11.86 %					LC Pilot

Year	N	1st year	2nd Year	3rd Year	4th Year	5th Year	Program
2000	155	18.06 %	31.6 %	33.55 %	38.84 %	43.87 %	
2001	176	15.34 %	26.7 %	31.82 %	35.8 %		FYE
2002	172	14.53 %	21.51 %	28.49 %			NS
2003	142	13.61 %	30.61 %				EA
2004	169	15.38 %					LC Pilot

RIT has had more success in retaining and graduating upper-division transfer students. Table 3 below shows the retention data from 1998 to 2002 for all RIT transfer students as well as for the participating departments (Electrical Engineering, Mechanical Engineering, and Engineering Technology) in a NSF grant scholarship program for transfer students. Funding for the NSF program is from the Computer Science, Engineering, and Mathematics Scholarships program and is the Multi-Department Engineering and Engineering Technology (MEET) program. Information on the MEET program was presented at the ASEE 2005 Annual Conference. <sup>2</sup>

Entry: Fall Quarter of →	1998	1999	2000	2001	2002
All of RIT	91%	85%	91%	85%	87%
EE+ME+ET Only	91%	87%	91%	87%	84%

	Entry: Fall Quarter of →	1994	1995	1996
	Graduating in/before →	2001	2002	2003
Upper-division	All of RIT	87%	80%	75%
Transfers Only	EE+ME+ET Only	90%	88%	82%

Table 4 shows the graduation rate of upper-division transfer students within seven years of study at RIT in federal reporting guidelines for graduation rates. Most transfer students will graduate in three years with one year of cooperative educational experience.

## **RIT Student Success Programs**

RIT has implemented five programs in the past four years to improve the student success of all RIT students and three of these programs are for freshman students in STEM programs. The programs are the Early Alert System, Freshman First Year Experience, Honors, Learning Communities, and the North Star Center.

### **Early Alert System**

Effective academic advising is critical to student success, especially in the first year. RIT has established the Early Alert (EA) system to identify first-year students who may be struggling with a particular class or area of study. This system ensures that they receive the intervention, direction and additional tutoring they need to get back on track. Early Alert is a web-based system that allows faculty members to notify students and their advisors electronically about students' early progress in their courses and faculty utilization of this system is mandatory.

This system is modeled after a program established at RIT's National Technical Institute for the Deaf which is a college of RIT that operates with federal funding. The system starts with a software module on the faculty/staff advising Web site. Instructors are able to notify a student online as to how he or she is performing in class. Performance evaluations are generated using predetermined categories of achievement and evaluation, as well as space for the instructor's individual comments.

Evaluations are e-mailed directly to the student. Included with this evaluation is an "alert" notice that can be forwarded to the student and can be automatically copied to his or her First Year Enrichment coach, academic advisor or home department head. Through this alert notice, the student and these advisory parties are made aware of performance problems and have the opportunity to intercede to assist the student or provide direction.

Results from the Early Alert System have been very positive. Receiving the alert notice often provides enough motivation for students to begin actively seeking help and to begin focusing more time and energy on their course work. Many times, this extra study time is all that is needed to turn the student's grades around. In other cases, academic advisors put the student in contact with support services, such as RIT's Academic Support Center, where their specific needs are assessed. They then are able to receive training in study skills and time management and can work with tutors to strengthen weak academic foundations. In a few cases, students have been accurately diagnosed with learning disabilities for the first time as a direct result of the Early Alert System and these students are then able to receive appropriate help and support.

### **Honors Program**

The RIT Honors Program was founded in 2000 and 2001 honors class was a three-college “pilot” program. The institute-wide program began with the 2002 freshman class and had 75 freshman students in the program. CAST had two freshman students in the Honors program in 2002 and six in 2004 so this program has not had a significant effect on ET freshman retention. Larger numbers of freshman honors students enter other RIT STEM programs. The Honors Program provides students with an enhanced honors curriculum, a cohesive and diverse community of faculty, staff, and students, and special opportunities for research, conferences, travel, study abroad, and cooperative education. The intent of the RIT Honors Program is to enrich our academic endeavors, further our personal growth through leadership, foster a sense of unity, promote service in the community, and develop skills lasting beyond our time at RIT.

## **Learning Communities**

Learning Communities have been existence for many years and their role in retaining engineering technology students hasn’t been fully explored. Many learning community studies quantitatively measure grades and retention and the vast majority of these studies are directed at general freshman populations.

Fourteen RIT Learning Communities were piloted in 2004 and 2005 and three of these learning communities consisted of engineering technology students. A RIT learning community places small groups of first-year students (up to 25 students per community) into two or three of the same classes over the course of two or three consecutive academic terms. Students in RIT learning communities ideally have the same faculty members each term, and course content, assignments, and co-curricular activities are coordinated. Selected Learning Communities offer a living option for students living in the residence halls. Students selecting this option will be assigned to the same floor and programming in the residence halls will complement the living/learning community. Students in a learning community or a learning/living community will have a team of professionals such as faculty, advisors, residence life staff, and peers who are all focused on the student’s success.

Students in a RIT learning community begin their academic career as part of a small cooperative, collaborative community, not as a solitary student knowing few, if any, students and make friends with other students in their major. Learning Community faculty members are encouraged to use highly interactive teaching methods which have been proven to enhance significantly student learning and performance and develop close relationships with their students. The content and assignments in the Learning Community classes is coordinated and often integrated so that you will develop a deeper and more comprehensive understanding of the connections among the subjects you are studying.

## **First Year Enrichment**

First Year Enrichment is an interactive course designed to support students in their transition to RIT and as they begin to make meaning of their college experience. Through classroom activities and individual performance coaching, students and their instructors will explore academic and social success strategies that can help each student get the most of their RIT experience. This course is designed to enhance the student's knowledge of themselves, how they interact with others, and how they affect and are affected by the campus community/environment.

The mission of the First Year Enrichment (FYE) Program is to empower first-year students to realize their academic, professional, and personal potential. FYE will provide a curricular plan through coaching and instruction that guides students in becoming independent members of the college community in order to facilitate their academic and personal success at RIT. FYE instructors promote the development of personal responsibility and ethical decision making in both local and global contexts.

Colleges are allowed to customize the FYE curriculum and some of the ET programs worked with the FYE instructors in 2005-06 to do this customization. This work will continue in the spring and summer of 2006 in the ET programs.

### **North Star Center**

A central component of this center's missions is the recruitment, retention, and graduation of African-American, Latino American, and Native American (AALANA) students at RIT. The center's philosophy focuses on the importance of promoting a deeper understanding of what it takes to live in a rapidly changing and highly interdependent world where science and technology are transforming the globe. Students are supported and encouraged to excel academically and enhance their ethical/character development while simultaneously learning about their own and other cultures. Other goals of the center are community development and maintaining wellness. The center sponsors several different K-12 partnership programs in the Rochester community and encourages AALANA students to participate in these programs. Each AALANA student is assigned an advisor from the North Star Center. The percentage of RIT students who are AALANA students has increased from 6.8% in 2001 to 7.7% in 2005. There are 145 AALANA students enrolled in ET programs. The Center has assigned a liaison to the college and this person attends the college professional advisor monthly meeting and meets regularly with the ET department chairs.

### **ET Student Success Programs**

The ET programs have implemented three different specialized programs to improve success and graduation rates of ET students in addition to participating in the RIT Student Success Programs. The program to increase the retention of female freshman and sophomore students started in the winter quarter of 2003, a scholarship program for transfer students began in the winter quarter of 2004, and professional staff advisors were added to all the departments with ET programs in the fall of 2005. ET programs have had higher freshman attrition during the past two years than the RIT freshman attrition

given as shown in tables #1 and #2. The freshman to sophomore attrition in the fall of 2005 increased from the previous year in the three ET programs. The attrition was 12% for Civil Engineering Technology program for 25 freshman students, 21% for Computer Engineering Technology program for 38 freshman students and 22% for Mechanical Engineering Technology for 45 freshman students.

### **RIT Pilot Learning Communities**

The most recent RIT program, Learning Communities, was piloted in fall of 2004 and expanded in the fall of 2005. Three learning communities were piloted in three different ET programs in 2004 and expanded to five learning communities in 2005. The pilot ET learning communities did not improve the overall freshman ET attrition but the students in the ET learning communities has less attrition as compared to the ET freshman students who were not in learning communities.

There were 283 RIT students who participated in fourteen 2004 RIT learning communities during the 2004-2005 academic year. The 283 RIT students in the learning communities were compared to control groups in the same departments that had learning communities across the Institute. The 14 learning communities in 2005-2005 had a retention rate of 90% compared to the control group retention rate of 85%. It should be noted that departments with higher attrition rates like the engineering technology programs volunteered to participate in the learning communities. There was only one learning community from the RIT College of Imaging Arts and Science (CIAS) and none from the College of Science (COS). The first-year attrition in CIAS was 8.5% in 2003 and 9.5% in 2004 while the COS was 10.5% in 2003 and 7.5% in 2004. The College of Applied Science and Technology (CAST) first-year attrition was 13% in 2003 and 12.5% in 2004 while Kate Gleason College of Engineering was 10.5% in 2003 and 10% in 2004. There were significant spikes in first-year attrition in the College of Business (18%) and the College of Liberal Arts (23%) in 2005-05. The RIT seven-college freshman attrition rate steadily decreased from 15.5% in 1999 to 11% in 2003. The 2004 seven college attrition slightly increased in 2004 to 11.5%. RIT graduation rates dipped to 61.4% in 2004 from 62.9% in 2003 and increased to 64.4% in 2005.<sup>3</sup>

### **ET Learning Communities**

Three pilot learning communities in CAST were formed in the fall quarter of 2004 for 26 civil engineering technology (CET), 23 computer engineering technology (CpET), and 21 mechanical engineering technology (MET) freshman students. A student with a leave of absence can return to RIT within four additional quarters after the quarter that they leave RIT so these students are considered RIT students in the following statistics if they had a leave of absence in the fall 20051 quarter. The attrition rate of each ET learning community is compared to the attrition rate of the freshman students from the previous year and was less for the MET and CpET learning communities. The CET learning

community had a lower attrition rate than the MET and CpET learning communities but did not improve from the previous year.

### **CET Learning Community**

All of the freshman students (26) in the Civil Engineering Technology program were placed in a pilot learning community in the fall of 2004. The attrition of these students in the 2005 fall quarter was 12%. There were 14 freshman CET students in the 2003 fall quarter and their attrition after one year was 7.14%. One year attrition rates for CET freshman students were 16.66% for 24 students in 2002, 9.52% for 21 students in 2001, and 25% for 20 students in 2000.

### **MET Learning Community**

The MET 2004 pilot freshman learning community had 21 students and the attrition of this learning community in the fall of 2005 was 14%. Twelve of these learning community students returned to RIT in the fall of 2005 and 10 stayed in either MET and Manufacturing Engineering Technology (MFET) programs which are identical programs in the freshman year. There were a total of 45 MET freshman students in the fall of 2004 as they lost a total of 10 students for an attrition rate of 22.22%. One year attrition rates for MET freshman students were 17.02% for 47 students in 2003, 14.63% for 41 students in 2002, 14.7% for 34 students in 2001, and 3.22% for 31 students in 2000.

A study of this learning community found that two variables, grade point average and participation in the learning community are statistically valid predictors of success and a high final grade in one of the learning community courses, Manufacturing Processes. The students in this learning community performed better than their peers that did not participate in a learning community. (2006, Castro-Cedano)

### **CpET Learning Community**

The CpET 2004 freshman learning community had 23 students. The attrition of these CpET learning community students in the 2005 quarter was 17% as they lost 4 students. There were a total 38 CpET freshman students in the fall of 2004 and their attrition was 21.05% with a loss of 8 students. One year attrition rates for CpET freshman students were 10.52% for 38 students in 2003, 8.51% for 47 students in 2002, 15.94% for 69 students in 2001, and 23.41% for 23 students in 2000.

The success of the pilot RIT learning community for the Computer Engineering Technology (CpET) freshman students was also measured by comparing the academic performance and attrition rate of this community with a control group that consisted of the remaining CpET students. The average cumulative GPA of the CpET learning community students was 16.6% higher than that of the control group and the attrition rate

of these same students was 10.4 % less than the control group. The CpET results were consist with the aggregate results of the other fourteen RIT learning communities<sup>4</sup>

### **ET Retention Program for Freshman and Sophomore Women**

The ET programs have been receiving a small amount of funding for the past three years through the Perkins III (VTEA) initiative to provide support services for first and second female students enrolled in the engineering technology programs. The Perkins III act provides support for students in special populations enrolled in vocational or technical education programs, primarily through state grants. The special population of these female ET students in non-traditional students since the percentage of woman enrolled in ET programs is approximately 8% at RIT and approximately 30% in all RIT programs. The percentage of women graduates from all U.S. engineering technology programs has decreased from 13% in 1999 to 11.7% in 2003.<sup>5</sup> Funding was used to hire female adjunct faculty members teaching in the RIT ET programs to work two hours a week facilitating the formation of study groups. Funding is also available to hire peer tutors to work with these female students in the study groups, purchase laboratory kits for the students who participate in the study groups, and payment of their expenses to attend a regional conference of the Society of Women Engineers. The retention of women students has improved some in the past three years and we found that students who left ET or RIT did so in the first two years of the program.<sup>6</sup>

### **Future Directions**

The College of Applied Science and Technology (CAST) where the engineering technology programs are housed has participated in all of the RIT programs that have been implemented in the past four years to improve the success and graduation rates of RIT students. CAST will continue to participate in all of these ongoing programs.

CAST has implemented three additional programs were to improve the success of Engineering Technology (ET) students. New ET programs are mentoring of women ET students, a transfer student scholarship program, and the addition of professional staff advisors to the ET departments in the fall of 2005. This is the final year for the women's mentoring program and the theme for the Perkins funding has changed every three years in the past. The call for new Perkins proposals has not been received at this point in time. The transfer scholarship program for engineering and ET students is in the second of a four-year program and has been very successful for the ET students. There are 45 students in the scholarship program and 29 of the students are ET students. All of the ET students are in good standing and still enrolled in their original ET program. RIT will be requesting additional funding for this program in 2006 as the National Science Foundation recently announced a new scholarship program.

The effect of the professional advisors on the ET retention will be reviewed in the fall of 2006 when the new freshman to sophomore attrition data is available. The professional advisors have been well received in the ET departments and are working well with the

ET faculty advisors. A request for an additional professional advisor for the ET programs was made in the annual budget request. The new professional advisors have been doing exit interviews with ET students that leave RIT to obtain more insight on personal issues which hasn't been previously collected. Interviews were conducted with at-risk students in the spring of 2004. It was found that the at-risk students had a difficult time with abstract ideas and questions but could response to concrete questions. Freshman ET at-risk students reported that personal use of computers often takes precedence over academic responsibilities and that they had a difficult time understanding what types of jobs they will be qualified for once they complete their degrees.

The ET departments are planning on increasing the number of learning communities in the fall of 2006 so this option is available to more freshman students. The ET faculty members will be working with the FYE instructors this year to enhance the FYE courses and improve communications between the professors teaching in the learning community courses. One of the proposed enhancements is more career information. It was observed this year that students in the CpET 2005-06 learning community are having some difficulty adjusting to different personalities and course management when instructors change<sup>4</sup>

The programs to improve student success that have been implemented have improved the retention of ET students and we are not planning additional programs at this point in time. Two of RIT's goals are to have no more than 10% attrition for freshman students from the freshman to sophomore year and a graduation rate of 74% in 2011 for entering freshman students. The ET departments would like to see increases in our student success rates so we can be active participants in achieving these goals.

## **Bibliography**

1. Gereffi, G., Wadhwa, V, (2006) Framing the Engineering Outsourcing Debate: Placing the United States on a Level Playing Field with China and India Retrieved 2/2006 from <http://memp.duke.edu/outourcing>
2. Richardson, C., Gupta, S., Valentine, M., Merrill, R., Amuso, V., Multi-department Engineering and Engineering Technology Scholars Program 2005 Annual Conference Proceedings of American Society for Engineering Education
3. Mayberry, K. Retention Update Institute Council January 11, 2006
4. Hurny, J, Hurny, G., (2006) Applying Learning Community Pedagogy to First-Year Computer Engineering Technology Students: A Pilot Program in 2006 ASEE Annual Conference Proceedings of American Society for Engineering Education
5. Grebski, W. Engineering Technology Programs: Challenges and Opportunities Retrieved 2/2006 from <http://www.asee.org>

6. Romanowski, C., Richardson C., Valentine, M., Wolcott, T., Christman, J. (2006) Retention of Women Engineering Technology Students at Rochester Institute of Technology in Proceedings of the 2006 WEPAN/NAMEPA joint Conference