Creating a Community for Women Engineers at RIT

Margaret Bailey and Elizabeth DeBartolo

Mechanical Engineering Department, Rochester Institute of Technology

Abstract

At the Rochester Institute of Technology (RIT), the number of women engineering students graduating each year from the Kate Gleason College of Engineering is approximately 11%, significantly below the 2003 national average of 20.4%. However, unlike the national trends in engineering student attrition, the overall retention rate for this relatively small group of RIT women is actually higher than the retention rates associated with their Caucasian male peers at RIT. In response to the relatively low number of women enrolled in the Kate Gleason College of Engineering, and the desire to improve their retention, an Internal Advisory Board formed in early 2004 as part of RIT's Women Engineering (WE@RIT) Center. Active members of this board consist of engineering faculty, administrators, and students from three different colleges within RIT. In its first year of existence, the WE@RIT Internal Advisory Board created and approved a mission, supporting objectives, and an in-depth strategic plan. The group has developed a comprehensive plan aimed at improving retention of current women engineering students. In this paper, the authors provide an overview of the WE@RIT program, with a focus on community building activities and programs aimed at students during the pre-freshmen, first and second years.

Women in Engineering at RIT

At RIT, the number of women engineering students graduating each year from the Kate Gleason College of Engineering is approximately 11%, significantly below the 2003 national average of 20.4% [1]. However, unlike the national trends in engineering student attrition, the overall retention rate for this relatively small group of RIT engineering women is actually higher than the retention rates associated with their majority male peers, although both groups fall below RIT's long-term student retention goals.

Perhaps more RIT women engineers (on average) graduate with engineering degrees as compared with other engineering colleges due to a positive community for women where personal resiliency can be developed and improved. Three of the most prevalent supporting characteristics that support women students within engineering at RIT include the relatively large number of women engineering role models; the success of women focused student organizations within engineering; and the name of the college. RIT's engineering college has several women role models on the faculty and administration including:

- 40 % of the college's engineering department heads,
- 10 % of engineering faculty, and
- 17% of the mechanical engineering department's faculty.

In addition, all of the engineering women faculty actively support WE@RIT through direct involvement in the design and administration of college-level outreach, retention, and recruitment efforts.

RIT's Women Engineering program (also known as WE@RIT) has been in existence since 1996. The program is designed to help students achieve career goals by offering activities aimed at fostering a positive community for women within the college. As a result, in both 2003 and 2004, RIT's Society of Women Engineers (SWE) student section won the SWE National Outstanding Student Section award for small and medium student sections, respectively. This national recognition is a great honor. WE@RIT strongly supports its highly successful SWE Student Section and identifies that the organization provides a strong community for its members.

RIT's Kate Gleason College of Engineering is the only engineering college within the United States named after a woman. In recognition of her significant personal and professional accomplishments, the college is named after Kate Gleason who was an exceptional entrepreneur, engineer and businessperson. Ms. Gleason was born on November 25, 1865 in Rochester, New York. Both of her parents favored women's rights and her mother was a staunch suffragist and friend of Susan B. Anthony. Ms. Gleason studied mechanical arts at Cornell University and at Mechanics Institute, now known as the Rochester Institute of Technology. Shortly thereafter, she joined her father at his factory - Gleason Works. Kate Gleason promoted his business, which became one of the leading sellers of machine tools in the United States and Europe largely due to her efforts.

"Kate Gleason's place in American history is ironic. The accomplishment she is most often credited with, the invention of the gear planer, was her father's. Henry Ford mistakenly attributed the invention to her, the press picked it up and it stuck. That overshadows her real legacy: using her remarkable instincts and business skills, and her father's inventive genius to build an international industrial giant" [2].

WE@RIT Program Overview

WE@RIT's goals are to increase the recruitment and retention of women in engineering degree programs. In order to achieve these goals, an emphasis exists to establish an active outreach/recruitment program for middle and high school women as well as improve retention efforts for women engineering students. In response to the relatively low number of women enrolled within the Kate Gleason College of Engineering, a new Women Engineering Internal Advisory Board addresses the issue. The authors of this paper are both active members of the board as well as other engineering faculty, staff, administrators, and students. The committee's goals for the 2003/04 academic year included:

- Improving the understanding of gender diversity issues within engineering at RIT,
- benchmarking other successful (gender diverse) engineering programs, and
- creating a three-year prioritized **strategic plan** to improve gender diversity within engineering as shown in Figure 1.

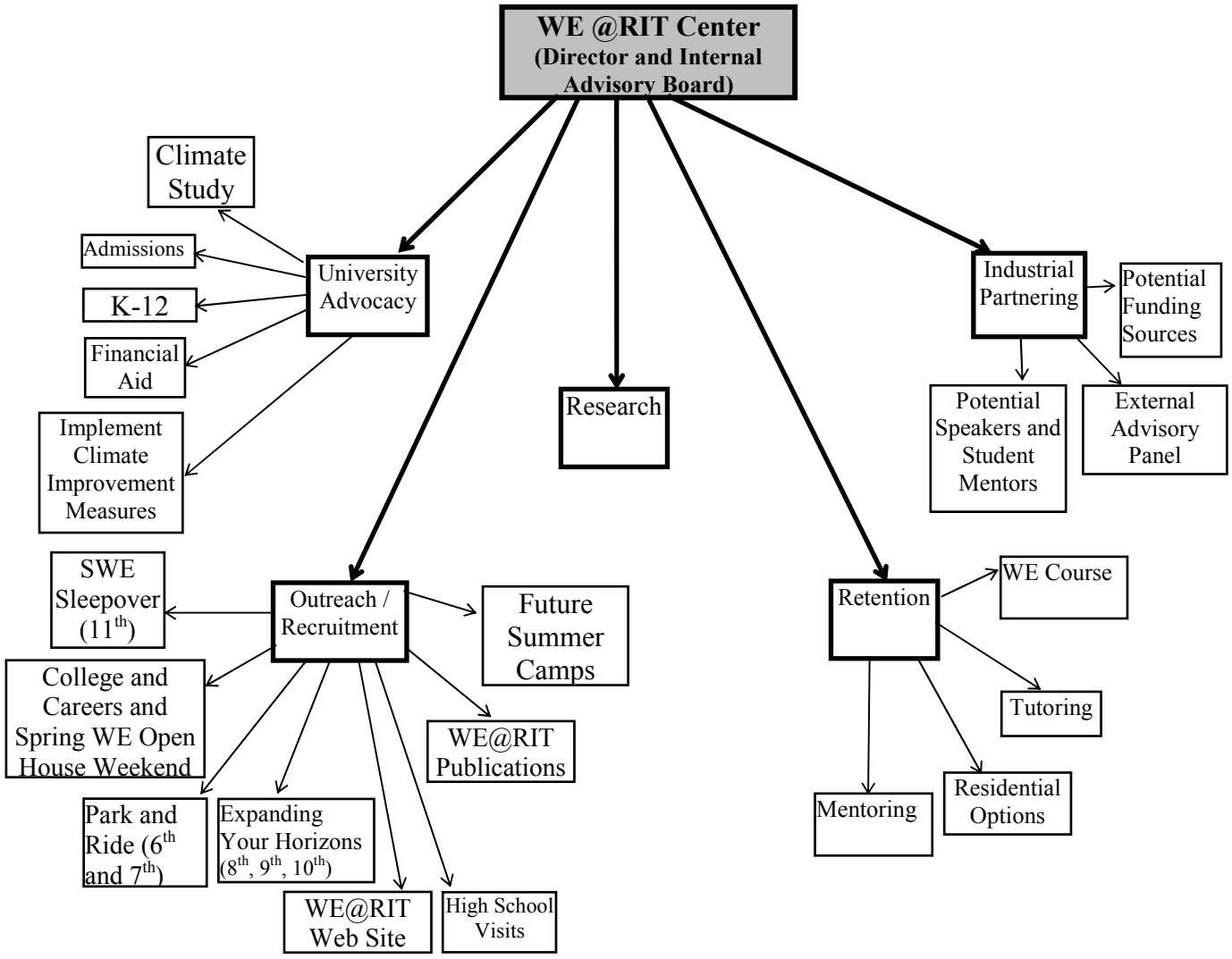

Figure 1: WE@RIT Strategic Plan Flow Chart

WE@RIT Community Building for 1st and 2nd Year Women Engineering Students

Creating the strategic plan was the result of extensive data analysis – both qualitative and quantitative, examples of which follow. Table 1 includes excerpts from data collected in May 2004 from surveys and focus groups targeted at current upper class RIT women engineering students. Questions regarded housing preferences, value of free tutoring services, and desire for mentoring. Based the data (which included the data shown in Table 1 along with several written responses) regarding housing, it was clear that a residential option already in existence at RIT was perceived as high quality by women engineering students. The choice is a relatively small co-ed engineering interest dormitory with a strong, positive community. The house's long-term goal is to achieve a gender-neutral (50/50) membership. It currently includes approximately 20% women. WE@RIT is promoting the housing option to incoming first year women engineering students in order to increase the percentage of women within the house.

Table 1: RIT Women Engineering Student Data (May 2004)

Residential Living	YES	NO	Maybe
Have you considered or do you live in all female housing?	10	14	
When you entered as a freshman, if RIT had offered an all female engineering floor, would you have wanted to live there?	1	18	5
When you entered as a freshman, if RIT had offered a gender neutral engineering floor (50/50 men-women), would you have wanted to live there?	2	9	5
Do you think offering an all female engineering floor would attract more women to RIT?	9	14	1
Would mentoring and/or tutoring services within the house be beneficial?	19	2	1
Do you know of other universities that offer an all female engineering floor?	0	22	0

Tutoring	YES	NO
During your 1st and 2nd years at RIT did you use the free study help provided by the college in the Engineering Learning Center?	6	17
If you are entering your second year and you find you need additional help with a class, would you ask for a tutor if the program is provided this coming	10	5

Mentoring	YES	NO
Do you have or have you had an engineering mentor?	5	19
If yes, was it a successful relationship?	3	2
For 1st and 2nd year RIT female engineering students, do you see a benefit in having an older female engineering student as a mentor when beginning at RIT?	16	3

Based on survey results (included in Table 1 as well as written responses), 84% (16 out of 19) respondents wished they had had a mentor during their first two years at RIT. Currently, only 20% (5 out of 24) of the respondents have mentors and of those, 40% (2 out of 5) feel that the relationship is unsuccessful due to a lack of consistent communication. Women engineering students gave the following responses when asked for suggestions in helping the college design a strong mentoring program. The majority of the comments are in favor of a new mentoring program; however, the last two comments listed are not.

- *Approach students personally and provide a kind of mandatory "meet with a mentor day". It does not have to be a long-term relationship.*
- *Talk to females in years ahead and ask what classes to take, professor advice, etc. Have some social events where people can meet first and pair mentors/protégés based on how they click at these events rather than how they look on paper.*
- *Write letters to incoming female engineering students; get professors to talk about the mentoring program more in the freshmen classes.*
- *Start over the summer, incoming students are meeting enough new people when they arrive.*
- *Involve the female faculty, have mixers with female students and faculty, build a community!*
- *Do not introduce it right away; when freshmen first arrive, they are bombarded with many other opportunities. They may be more willing once they are settled into college for a month or two.*
- *Strong emphasis on communication even non-engineering related keep the lines open.*
- *Offer study time and social activities - at least once per month.*
- *I do not think the program should just be for women. I think all incoming freshmen, regardless of gender, should have a mentor.*

- *Special treatment is silly. If somebody wants a mentor, they can find one. Do not want the college to develop a mentor program.*

In response to the respondents' collective input and the results of several focus group discussions with women engineering students, WE @ RIT created a new mentoring program called *Connections*, designed to introduce women engineering students to the benefits of developing formal and informal mentoring relationships. The yearlong comprehensive program includes various educational, social and service-related events designed to create a strong, well-defined community for engineering women within RIT. The program goal is to provide first and second year women engineering students with an effective mentoring experience through the participation of supportive, affirmative, and educated upper class engineering students. A complete schedule of program activities spread throughout the academic year provide opportunities for student interaction on a nearly monthly basis (refer to Table 2). Some of these events build on the already-successful RIT student participation in new and existing outreach activities. While there is no formal student-to-student "mentoring" during the outreach events, they provide an opportunity for women engineering students to get to know one another in a relaxed environment.

Assessment of the Connections program will occur annually based on year-end data collected from both mentors and protégés. An example of the evaluation instruments developed for these purposes are available from the authors.

Table 2: WE@RIT Mentoring Program for2004/05 Academic Year

Date	Event Name
Fall Quarter	What is Mentoring About? – Reception, dinner, and keynote speaker
Fall Quarter	Expanding Your Horizons Social
Fall Quarter	Jan Gleason Reception – Brick City Festival
Fall Quarter	Financial Aid Presentation
Winter Quarter	Park & Ride Social
Winter Quarter	Leadership Retreat
Winter Quarter	Outreach Programs
Spring Quarter	SWE Overnight Mentoring Luncheon
Spring Quarter	WIE@RIT Open House Luncheon
Spring Quarter	Regional SWE Conference
Spring Quarter	Spring Celebration

WE@RIT Community Building for Pre-College Women

The outreach/recruitment plan shown in Figure 1 took shape through the analysis of data collected from both participants and parents during years of outreach events at RIT. For example, parent survey data collected at the conclusion of RIT's first Park and Ride Program is listed in Table 3. This two and a half day event with a theme of amusement park design highlights engineering opportunities in the entertainment industry for middle school girls. The program includes hands-on design of amusement park rides using Lego Mind Storms, an industry panel for parents, and relevant speakers from RIT and industry. The data shown in Table 3 indicates strong program support and evidence that the parents perceived the event as high quality. The data collected on future program preferences has helped support current efforts to establish a summer camp program at RIT for young women interested in engineering.

Table 3: Parent Post-Event Survey Data (2004 Park and Ride Event)

General Program Questions:	**Totals (scale 1-5)**
Were the program dates convenient?	4.86
Were clear directions provided?	4.71
Were the program start/stop times convenient?	4.71
How effective was the engineering panel discussion in better understanding the academic and industrial aspects of engineering?	4.50
Were the SWE volunteers effective in serving as positive role models for your daughters?	4.93
Did you think that the closing award event a positive expereince for your daughters?	4.67
Did the pizza social at the event's conclusion give you an opportunity to meet with other parents and professors and learn more about engineering as a potential field for your daughter?	4.86
Would you send your daughter to this program again?	Yes 100%
Do you feel your daughter has benefited from this program?	Yes 100%

Future Program Preferences:
Rank your preferences for the following engineering outreach event options. Results shown highest to lowest: Day Camp (1 week), Day Camp (3 days), Overnight (2 days), Overnight (1 week)
Rank your preferences for event timing. Results shown highest to lowest: Summer, fall, winter, spring
Rank your preferences for event target audience. Results shown highest to lowest: 9th, 8th, 10th, 11th, 12th, 6th, 7th

Currently, five outreach programs are in place at RIT, with a target audience ranging from girls in the 6th grade to 12th graders preparing to matriculate in engineering at RIT [3]. Women faculty from across the college of engineering are directly involved with developing the outreach programs to help encourage young women to pursue an engineering education, and in particular, to do so at RIT. In addition to the faculty, each quarter several undergraduate students serve as program assistants for WE@RIT in support of the ongoing outreach efforts. These students learn valuable leadership skills while gaining experience in teamwork, program design, research, program evaluation, and the planning, organization, and facilitation of meetings and activities. The programs are staggered throughout the year, to reduce the load on the students and faculty who participate.

An important aspect of the outreach efforts is the involvement of current RIT women engineering and engineering technology students. For example, during the *I Built My Computer @ RIT* summer workshop, student assistants are typically RIT first-year women who had participated in the program during the prior summer. This novel summer workshop successfully addresses the transition issue for women entering RIT engineering degree programs. Program participants are women who are entering RIT in the fall as freshmen and who have designated engineering as their major. The summer workshop is a three-day event using the construction of a personal computer (PC) as the central theme. The students (in teams of two) are given computer components for two PC's. During the program, RIT engineering faculty and staff instruct teams on how to build a computer. At the conclusion of the workshop, the participants have a fully functional PC that they take home and later in the summer bring back with them as incoming first year engineering students. Augmenting the technical sessions, participants stay in the residence halls on campus and participate in extracurricular activities. The experience provides incoming women with an early chance to feel like they are part of a community at RIT thus assisting in transition from high school to college.

Since its inception in 2001, past participants have raved about the program and feedback is positive as shown in Table 4. Participants were asked (pre and post workshop) to rate their abilities on a scale from 1 to 5 in specific technical areas that are encountered during the workshop. The ratings correspond to 1 = not comfortable, 3 = moderately comfortable, and 5 = very comfortable. Technical areas include working with basic hand tools, working in teams to solve technical problems, loading/installing software, and assembling computer hardware. Because of their participation in this program, participant's confidence levels in these technical areas increased by 42%. In addition, written feedback from several participants indicated that attending the summer program removed the anxiety associated with going to college. Data listed in Table 4 shows an average confidence level regarding starting college at 4.35 where 4 is comfortable and 5 is very comfortable. The workshop participants had already made new friends, knew their way around campus, met key faculty and staff, and knew what to expect when they returned in the fall.

Table 4: I Built My Computer @ RIT Participant Feedback Data

Program Year	**Number of Participants**	**Average Confidence in Relevant Technical Areas Pre-Workshop**	**Average Confidence in Relevant Technical Areas Post-Workshop**	**Average Confidence to Start College Post-Workshop**
2001	19	2.96	4.39	3.95
2002	21	3.27	4.38	4.33
2003	13	2.65	3.73	4.23
2004	17	2.72	3.99	4.35
	Average:	*2.9*	*4.12*	***4.22***

By giving RIT women engineering students so much control over the direction and tone of the outreach programs, WE@RIT accomplishes two important elements. First, the visiting middle and high school students are given a true taste of what the college and its students are like.

Secondly, RIT women students gain leadership experience and can take ownership of these activities, which helps create a community among the volunteers.

Lessons Learned and Plans

Important lessons learned in the development of the WE@RIT Program are listed below:

- Not all women engineering students welcome the idea of special programs aimed at just women. Therefore, stress the possibility that mentoring programs can help this audience meet their full potential rather than emphasizing their supportive attributes.
- Timing of mentoring activities is important in regards to the quarter academic schedule.
- Most women engineering students do not know how a mentoring relationship begins, ends, becomes successful, etc. Therefore, develop a mentoring handbook and distribute early in the academic year. Handbook includes discussion on mentoring benefits, suggested discussion points, and basic program guidelines.
- Design at least one mentoring event per month to provide communication opportunities.
- Carefully plan the annual kick-off event each year in order to maximize the number of first year students who attend. This target group is inundated with emails, invitations, etc. during the first month or so of college, therefore capturing their attention for this event is challenging.
- Many entering engineering women students do not see the need for a mentoring program until at least mid-way through their first year. Therefore, trying to capture their attention in the summer before their arrival is difficult as well as too early in the academic year.
- Self-selected mentoring pairs appears to be more successful than assigning the pairs.

Plans for the WE@RIT future include over the next three years include expanding efforts in university advocacy, industrial collaborating, and research. Short-term plans to be implemented over the next year include developing a new course on the history of women in engineering, with particular emphasis on Kate Gleason and other Rochester-area women, as well as developing a new program for accepted women engineering students. In addition, with a continuous series of mentoring programs, WE@RIT can begin to track participants from year to year and determine whether the program has a positive effect on their RIT experience. In addition, their feedback will be used to further improve and refine the new Connections mentoring program in order to enhance its effectiveness and increase student participation.

References

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Biographical Information

MARGARET BAILEY, registered professional engineer, is the Kate Gleason Chair and Associate Professor in Mechanical Engineering at RIT. She earned her BSE at Pennsylvania State University in 1988 and her Ph.D. at University of Colorado at Boulder in 1998. She conducts research with students on exergetic analysis and neural network modeling of energy consumption in complex mechanical systems. Dr. Bailey is very active in the creation and guidance of RIT's Women in Engineering program.

ELIZABETH A. DEBARTOLO is an Assistant Professor in the Mechanical Engineering Department at the Rochester Institute of Technology. She earned her BSE at Duke University in 1994 and her MSME and Ph.D. at Purdue University in 1996 and 2000, respectively. She works with several students on predicting and enhancing fatigue life in aircraft materials and structures and is active in the college's outreach programs.