Women in Engineering Technology at RIT: Strategies to Recruit, Retain and Advance Women Engineering Technology Faculty and Students

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Abstract

There are two projects underway at the Rochester Institute of Technology (RIT) funded by the National Science Foundation designed to address the underrepresentation of women faculty and students in the Engineering Technology programs. The AdvanceRIT project, an NSF ADVANCE Institutional Transformation project, aims to increase the representation and advancement of STEM women faculty across the university, which includes Engineering Technology. The Critical Mass of Engineering Technology Scholars (COMETS) project, an NSF S-STEM project, aims to increase the recruitment and retention of women students in Engineering Technology. This paper describes the projects’ goals, strategies to achieve these goals, program evaluation and steps being taken to sustain these programs beyond grant funding.

Introduction

The underrepresentation of females in engineering is a pressing national issue for several reasons: (1) the United States is losing its advantage as the world’s leader in research and development (2) the lack of potential contributions of women to the creativity and diversity of the engineering workforce and (3) the principle of social equity stipulating that careers should be open to all people, unconstrained by factors such as gender or race. Innovation in the science, technology, engineering, and math (STEM) fields is a key contributor to the United States global competitiveness, overall quality of life and security of its citizens. As noted in the National Academies publication “Rising above the gathering storm, revisited: Rapidly approaching Category 5” most of the future employment opportunities will be in the STEM field. Significantly increasing the female participation in the STEM areas will allow United States to fully tap the human potential of its citizen while enhancing and diversifying the STEM workforce.

As such, the need to increase female representation in engineering for the good of the profession, the good of the nation, and social equity, has been well established. As seen in Figure 1, the percentage of bachelor’s degrees awarded to females rose quickly from the 1950’s to the 1980’s but has remained fairly stagnant from the 1980’s to present. Overall, the total number of engineering bachelor’s degrees awarded has risen by seven percent from 77,572 in 1985 to 83,263 in 2012, but the percentage of women earning those degrees only rose from 14.5 to 19.2 during the same time period.
Compounding the problem of low numbers of women entering the engineering field is a college retention rate for female engineering students of 60%. While this is similar to the retention rate for male students, is it still a concern due to the low number of females in the major to begin with. A plethora of research into the root cause of attrition of female students in engineering has resulted in many theories, proving it to be a multi-faceted problem without a singular solution. Of particular concern is the lack of a critical mass as a main factor in why women leave engineering programs. Since engineering has always been a male dominated field, it caters to stereotypical male ways of knowing and standards of behavior. As a result females have a difficult time understanding and fitting in. Without a critical mass to change the male norms, the lack of women in the field perpetuates a lack of women in the field.

Research and our own experience tells us that mentoring is vital to the success of students and faculty alike, but even more so for those that are under-represented by race, gender, or ethnicity. As we strive to recruit and retain more women students to the engineering technology disciplines, we also strive to recruit and retain more women faculty into those disciplines. Without increasing the representation of women in our collegiate classrooms, we will continue to be short of mentors and role models for our students. Data shows that although the number of women earning doctoral degrees has increased over the past several decades, the same trend has not translated into additional representation in academic positions. This disconnect is most often associated with challenges around work-life balance, implicit and explicit bias and stereotype threat in the academic workplace. RIT mirrors national trends. The number of women faculty in STEM areas declined slightly over the 2009-14 period, although the percentage of women in STEM faculty positions increased slightly in three out of four colleges (23% to 24%).

Since 2001, the National Science Foundation (NSF) has funded over $130M in projects at institutions of higher education and STEM-related not-for-profit organizations in order to achieve their goal of increasing “the representation and advancement of women in academic science and engineering careers.” These projects address cultural and structural barriers that may adversely affect women faculty. RIT was a recipient of an NSF Advance Institutional Transformation grant in 2012 with the goal of increasing the representation and advancement of women STEM faculty, widely represented across ethnic, social, and cultural backgrounds. The
approach is to remove barriers to resources that support career success and create new interventions and resources. These approaches parallel those used to increase success for our women students, remove barriers to support resources and create community.

In order to address the need for a high quality STEM workforce in areas of national priorities, the National Science Foundation (NSF) Scholarships in Science, Technology, Engineering, and Mathematics program (S-STEM) supports projects that fund scholarships and activities that enhance and study effective curricular and co-curricular activities that support recruitment, retention, student success, and graduation in STEM. The program seeks to increase the success of low-income academically talented students who are pursuing associate, baccalaureate, or graduate degrees in STEM with demonstrated financial need. RIT was a recipient of an NSF S-STEM grant in 2011. This goal of this project is to increase the diversity of the Engineering Technology programs at RIT, with a primary focus on gender diversity. The approach is to build a strong community of women students in ET through financial, academic, professional development and social support. This strong community or “Critical Mass” will then aid in the recruitment and retention of women into the ET programs at RIT.

Background:

Women Faculty at RIT

The NSF ADVANCE Institutional Transformation Catalyst project Establishing the Foundation for Future Organizational Reform at RIT or EFFORT@RIT (#0811076, 2008-2012) had a research objective of identifying career advancement barriers for women faculty at RIT and establishing how well the university addresses issues in the recruitment, retention, and advancement of women faculty. Results of a faculty climate survey conducted as part of the project, in conjunction with objective data review and benchmarking, led to the identification of barriers in the areas of career navigation, climate, and flexibility in work/life management balance.

Key findings from the faculty climate survey that were statistically significant included: 1) on average, males reported higher satisfaction than females with their distribution of time, overall research/scholarship, long-range career map/plan, and position overall, 2) although promotion and tenure (P/T) success rates did not differ statistically by gender, women consider delaying P/T at higher levels than men with the highest levels reported by AALANA female respondents (56%) and 3) regarding work/life balance, more female faculty agreed that their career had been slowed by personal responsibilities (50% of women compared to 23% of men) and that they often gave up personal activities for professional responsibilities (66% of women compared to 47% of men).

The findings from the objective data review were compiled related to recruitment, retention and advancement of women faculty. The percentage of women applicants for STEM TT positions at RIT was 18.70%, significantly below the national pool of doctorates awarded to women in respective STEM fields as listed in Table 2. Tenure track acceleration or tenure credit upon hire was less prevalent among women STEM T/TT Assistant Professor hires. Based on review of faculty start-up letters from 2005-2008, of the 46 Assistant Professors hired, 16% (or 6/37) of
men received some credit toward tenure while 0% (0/9) of women received credit. In addition, from 2004-2009, only 10% (or 2/20) of female faculty hired were given the rank of Associate or Full at the time of hire as compared with 24.39% (or 20/82) of new hires that were men. The representation of women faculty was below national averages in many STEM disciplines as shown in Table 1.

Overall T/TT faculty data for 2002-2009 revealed higher levels of attrition for women faculty than men. As of October 2010, 28% of the 87 women faculty hired had left RIT compared with 14% of the 174 men faculty hired (rates varied considerably by college). A 2010 faculty salary study found unexplained salary differences along gender lines, and motivated equity adjustments for some faculty.

Table 1: Percentage of Women Faculty at RIT versus the Percentage Nationally in 2010

<table>
<thead>
<tr>
<th>Discipline</th>
<th>RIT % Women (2010)</th>
<th>National % Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering Technology</td>
<td>12%</td>
<td>15.3%*</td>
</tr>
<tr>
<td>Engineering (not Engr. Tech.)</td>
<td>12%</td>
<td>21.6%</td>
</tr>
<tr>
<td>Physical Sciences</td>
<td>17%</td>
<td>29.3%</td>
</tr>
<tr>
<td>Computer Sciences</td>
<td>29%</td>
<td>22.0%</td>
</tr>
<tr>
<td>Mathematics and Statistics</td>
<td>16%</td>
<td>31.1%</td>
</tr>
<tr>
<td>Biological Sciences</td>
<td>44%</td>
<td>50.6%</td>
</tr>
<tr>
<td>Psychology</td>
<td>40%</td>
<td>72.0%</td>
</tr>
<tr>
<td>Social Sciences</td>
<td>36%</td>
<td>48.6%</td>
</tr>
</tbody>
</table>

*National Engineering Technology data is for 2014

A literature review was also completed to compliment the climate survey and data review. Issues related to career navigation could be caused by women’s weaker self-agency and negotiation skills, coupled with a lack of “sponsorship” from more seasoned faculty and/or administrators, both could hinder the success of female faculty in obtaining advantageous start-up packages, assignments, compensation, and promotions. Climate issues are exacerbated by women’s view of the workplace in personal terms, as opposed to a more male process-oriented view, meaning that issues of connectedness, support, and interpersonal relations, are important to their success. Finally, managing work/life balance through flexible work arrangements, available and convenient child care, and tenure clock adjustments may lower stress and increase satisfaction, thus possibly contributing to better retention of retention of female (and male) faculty.

These findings from the faculty climate survey, objective data review and benchmarking laid the groundwork for the successful submission of a National Science Foundation Institutional Transformation (IT) grant. This project was implemented in 2012.

**Women Students in Engineering Technology RIT**

Prior to 2012, the percentage of female students in the Engineering Technology programs at RIT languished below 10 percent, despite successful efforts at RIT to attract more female students. The percentage of women in ET from increased from 7.7 in 2004 to 9.2 percent in 2012 (See
Figure 2). The number of women students increased from 73 to 166, an increase of 59%. Part of this growth is due to the size of the College of Applied Science & Technology at RIT growing by 29% over the same time period. The establishment of a Women in Technology support program in 2005 made the ET programs a more attractive option to female students. The COMETS program was implemented in the Fall of 2012.

![Engineering Technology Degrees by Gender](chart.png)

*Figure 2: Percentage of Women in the Engineering Technology Programs at RIT versus U.S.*

Diversity Initiatives at RIT Targeting Women Faculty and Students

**Women Faculty in STEM: Advance RIT**

The AdvanceRIT projects goals are threefold. First the project seeks to refine and strengthen institutional structures by installing practices that promote the representation and advancement of women faculty. Second, the project works to enhance the working environment by supporting the career advancement of women faculty through empowerment, inclusion and other additional symbolic aspects that reflect women faculty members’ professional quality of life. Third, the project looks to align institutional, administrative and informal systems of power and resources in order to support and sustain the progress that shapes the political frameworks impacting the representation and advancement of women faculty.

All of the aforementioned projects goals are expected to lead to three specific project outcomes. The first is to increase the representation of STEM/SBS women faculty within targeted STEM departments. This includes the sub-goal and outcome of increasing the retention of STEM/SBS T/TT women faculty at a rate equivalent to male faculty. Second, the project seeks the outcome of increased representation of women within STEM candidate pools at a rate of 30%. Third, the
project looks to increase the percentage of women in academic tenure-track leadership positions to 40%.

Strategies
To achieve these project goals and outcomes, the AdvanceRIT team has designed and put into position several key and strategic initiatives. They include: Connect Grants, Connectivity Series, Dual Career Hire Initiative, COACHE Climate Survey Data Analysis, Work-Life Integration Efforts, Faculty Gender Equity Salary Study, Policy Development and Unconscious Bias Education. Each of these initiatives will be described briefly in the section below.

Connect Grants
In early 2014, the AdvanceRIT project, Faculty Career Development Services, and the Office of the Provost collaboratively offered a new grant program, Connect Grants. The intent of the annual grants program is to support leadership and career development for all tenured and tenure-track faculty at RIT. Connect Grants are intended to broaden faculty opportunities and enhance plans of work associated with tenure and promotion preparation and overall career advancement, to support creative department level efforts to guide and manage faculty through career stages, and to support project oriented work to facilitate institutional transformation. Successful grant proposals are required to support one or more of the AdvanceRIT project goals. Funded Connect Grant Topics include peer-to-peer mentoring; gendered citation disparities in philosophy of science; application of the Appreciative Inquiry Process; post tenure mentoring and leadership initiatives; re-submission efforts for successful external funding; and effective mentoring and leadership skills for deaf and hard-of-hearing women faculty.

Connectivity Series
The Connectivity Series integrates practices that promote and advance women faculty by offering professional development for faculty that relates to the themes of retention, recruitment and advancement, and assisting with the development of networks. Workshops, panels and sessions are designed to increase participants’ social capital, widen networks, and develop competencies such as negotiation skills. For example, a Connectivity Series panel discussion “Daring Appreciation: Strategies for Increasing Recognition of Your Work” focused on strategies for promoting one’s achievements with the goal of career advancement and development. Women faculty shared their challenges and strategies in gaining recognition for their achievements from local and regional media sources and planning for tenure and promotion. The panel context was informed by a study conducted by the AdvanceRIT team, identifying gender disparities in the faculty awards on campus.

Dual Career Hire Initiative
Dual career employment issues are relevant for many faculty at RIT and although both genders report agreement with the need for more assistance with employment for spouse/partner, women report higher levels of agreement. AdvanceRIT is working to strengthen current resources to support dual career hire initiatives. This includes working with the Office of the Provost to review and revise current practices to allow for more employment opportunities for qualified academic partners. A comprehensive benchmarking exercise is being used to develop the program.
COACHE Climate Survey Data Analysis
The Collaborative on Academic Careers in Higher Education (COACHE) survey \(^40\) was administered at RIT in 2012. This faculty survey provides a measure of overall faculty satisfaction in regards to teaching, service, research and climate. The AdvanceRIT team, the COACHE Taskforce and the RIT administration have reviewed and presented the university and college-level results across campus. Interactive discussions with deans, chairs and directors, associate deans, and the Academic Senate have been conducted. Each presentation has included discussions on planned action and next steps based on survey findings. \(^36\) The university has committed to continuing to conduct the COACHE survey in spring, 2016.

Work-Life Integration Efforts
Independent college-level parental leave and work plan/transition policy development has been supported by AdvanceRIT benchmarking and review of best practices. An institute-wide Benefits Committee utilized this work to inform the development of a parental leave policy beyond the current standard six-week timeframe. This policy, informed and supported by AdvanceRIT efforts, applies to both faculty and staff. The new policy was announced in the fall of 2015 and includes extended maternity leave (8 weeks versus the previous 6) and new parent leave benefit where four weeks of paid family leave are available to the primary caregiver and two weeks paid leave for the secondary caregiver. This paid leave is for faculty and staff who become parents through birth or adoption of a baby under 12 months old.

Faculty Gender Equity Salary Study
AdvanceRIT took the lead in establishing a Resource Allocation Committee (RAC) to examine the need for an external faculty salary study. The cross-university committee was comprised of administrators, faculty and staff with expertise in statistical analysis, faculty hiring and review processes and institutional data. The committee collaborated to create a sustainable procedure in which stakeholders can have high confidence, planning, managing disparities with similar institutional salary survey practices and benchmarking data.

Policy Development
AdvanceRIT team members co-led a cross-divisional team that included Human Resources, the Office of Faculty Recruitment and Retention, and Academic Affairs in developing the exit interview process. The task involved creating the survey instrument and defining survey protocol. All faculty who voluntarily leave RIT are requested to participate. The faculty exit process kicked off in May 2013 and is currently housed within and managed by the RIT Human Resources and Academic Affairs units. \(^36\)

The AdvanceRIT team has also been instrumental in revisions to the RIT Tenure Policy. The policy underwent significant revisions during the 2012-13 academic year. The AdvanceRIT project principal investigator, Dr. Margaret Bailey, co-led the effort to make this policy more readable, understandable, clear, and useable. Revisions include a new provision to allow a tenure clock extension for one year for any faculty member who becomes a parent through the birth or adoption of a child. The tenure clock extension provision was the subject of productive conversation within the Academic Senate and the entire revised tenure policy was approved through governance in April 2014. \(^36\)
**Unconscious Bias Education**

The Unconscious Bias (UB) Education Ad-hoc Committee is another cross-divisional group that has developed two seminars focused on UB education. The first session, supported by the Provost as part of his ongoing academic directors and department chair quarterly retreats, discussed unconscious bias within the hiring process. AdvanceRIT generated and shared applicant pool and length-in-rank trend data during the session that was modeled after University of Nebraska data breakfasts. The next UB education offering was part of the Provost Town Hall series and open to the RIT community. Both sessions were intentionally designed to link education content with the university’s Strategic Plan. 2015 academic year plans include building upon these initial offerings with an UB education program designed for Academic Senate leadership and individual college-level programming.

**Program Evaluation**

The AdvanceRIT project routinely evaluates and measures its efforts and progress, engaging both internal and external evaluators in the planning, implementation and analysis of programmatic results. The overall project is guided by Bolman and Deal’s multi-framed organizational model from which program activities are organized into structural, human resources, political and symbolic frames. A project theory and corresponding frame logic models visually organize the work, measures and corresponding outcomes. External evaluation is conducted bi-annually by two experienced ADVANCE experts with an annual on-site visit every fall. External evaluators also serve as project advisors. Internal evaluation has been conducted by both internally and externally, qualified evaluators. Evaluation is conducted on an on-going basis using both formative evaluation to improve programmatic offerings (Connectivity Series and Connect Grants) and summative evaluation (NSF Indicators) to guide and benchmark annual progress.

Figure 3 shows the representation of STEM women faculty in the College of Applied Science and Technology (CAST) and the Kate Gleason College of Engineering at RIT from 2009-2014. The AdvanceRIT project was implemented in 2012. CAST is home to the School of Engineering Technology but this data also includes faculty in other STEM programs in CAST: Packaging Science, Environmental Management, Service Systems and Nutrition Management. Nutrition Management was moved to a different college in 2010, which accounts for the drop in the number and percentage of STEM women faculty in CAST between 2010 and 2011. There have been no new women faculty added to the Engineering Technology departments since 2010. The increase in the percentage of STEM women faculty in CAST is from STEM programs other than Engineering Technology. The Kate Gleason College of Engineering has shown steady increases in the representations of women faculty. This can be attributed to targeted recruiting efforts and, in recent years, external funding utilized to allow for competitive start-up packages.
Sustaining the ADVANCE project

We created the AdvanceRIT sustainability plan to sustain successful project initiatives beyond the length of the grant period. Development of a sustainability matrix aides in communicating plan details and considerations and a condensed version is included as Table 2. The plan is based on activity and program level assessments conducted in the 3rd, 4th, and 5th years of the grant by the grant’s evaluation personnel and through discussions with the grant’s Executive Advisory Committee (ExAC) and the External Advisory Board (EAB) in order to determine which grant related activities will be sustained beyond the length of the grant. The following is an in-progress representation of this exercise conducted within the first quarter of the 3rd year of the grant with limited initiative level assessment data available. In the near future, memorandums of understanding will be developed to more fully articulate aspects related to sustainability for each initiative.

Table 2: AdvanceRIT Project Sustainability Matrix

<table>
<thead>
<tr>
<th>Activity</th>
<th>Lead Organization</th>
<th>Decision Point</th>
<th>Sustainability Description and Background</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Additional Resources Needed – Grant Activities Incorporated within Existing Infrastructure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>COACHE</td>
<td>Provost Office/FCDS</td>
<td>Yr. 1</td>
<td>Conduct survey, dissemination, and data analysis on a triennial basis</td>
</tr>
<tr>
<td>NSF Indicator Data</td>
<td>Institutional Research (IR) and HR</td>
<td>Yr. 3</td>
<td>Annual compilation of table-ready faculty data (gender, rank, race/ethnicity, NSF designation) for analysis, representation, and dissemination by AdvanceRIT.</td>
</tr>
<tr>
<td>Additional Resources Needed – Grant Activities Incorporated within Existing Infrastructure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Connect</td>
<td>Provost Office</td>
<td>Yr. 5</td>
<td>Maintain grants program, on-line submission platform, selection</td>
</tr>
</tbody>
</table>

Figure 3: Representation of Women Faculty in STEM Programs RIT 2009-2014

Representation of Women Faculty in STEM Programs at RIT
<table>
<thead>
<tr>
<th>Activity</th>
<th>Lead Organization</th>
<th>Decision Point</th>
<th>Sustainability Description and Background</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grants</td>
<td>and FCDS</td>
<td>Yr. 5</td>
<td>committee, annual celebration.</td>
</tr>
<tr>
<td>Connectivity Series</td>
<td>Provost Office</td>
<td>Yr. 5</td>
<td>Continue program offerings in support of attainment and sustainability of efforts which support program goals.</td>
</tr>
<tr>
<td>Additional Resource Needed –</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infrastructure Creation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unconscious Bias Education</td>
<td>“”</td>
<td>Yr. 5</td>
<td>A refined educational approach that is built on an existing unconscious bias education approach led by the Office of Faculty Recruitment and facilitated at the college level.</td>
</tr>
<tr>
<td>Dual Career Hire Program</td>
<td>“”</td>
<td>Yr. 5</td>
<td>Administer dual career hiring program on campus which has been developed in collaboration with the Wallace Center, Academic Affairs, Office of Faculty Recruitment, and HR.</td>
</tr>
<tr>
<td>Salary Study</td>
<td>“”</td>
<td>Yr. 5</td>
<td>Conduct biennial faculty gender-equity salary studies and disseminate findings through the engagement of a cross-university committee of interested stakeholders.</td>
</tr>
<tr>
<td>COACHE</td>
<td>“”</td>
<td>Yr. 5</td>
<td>Conduct triennial, data analysis of COACHE sub-population data for dissemination in collaboration with the Wallace Center and the COACHE Taskforce.</td>
</tr>
<tr>
<td>Work-life Balance</td>
<td>“”</td>
<td>Yr. 5</td>
<td>Create and/or disseminate resources related to work-life balance, faculty evaluation, unconscious bias, etc.</td>
</tr>
</tbody>
</table>

Women Students in Engineering Technology: the Critical Mass of Engineering Technology Scholars (COMETS) project

**Project goals**

The objectives of the COMETS program are:

- Engage scholars in the Women in Technology community through participation in professional development workshops, socials, mentoring, and outreach events.
- Effectively prepare the scholars for the workforce or graduate school.
- Reinforce the students’ decision to major in Engineering Technology.
- Perform regular and thorough assessment of the COMETS program.
- Identify scholars struggling academically and provide proactive academic support.

**Project strategies**

The COMETS project strategies to achieve the objectives include academic, social support and professional skills development provided by the Women in Technology program in the college. Additionally, assistance is available to the scholars by the existing RIT support network: a well-established, substantial network of support services encompassing areas ranging from academic support centers to the Women’s Center to health and wellness programming.

Each scholar is assigned a faculty mentor. Faculty mentors establish and maintain effective rapport and consistent communication (on a regular basis) with their mentee. The results of this communication include:
• Having preferred modes of communication (email, phone, texting, informal meeting spaces, quick “check-ins”)
• Being open and available in ways that their mentee feels comfortable enough to share, without being intimidated by the boundaries of status and power
• Sharing personal professional experiences in ways that mentees can connect and relate to – these experiences can then be used to help mentees problem solve and come up with solutions to their own struggles
• Being aware of their mentees struggles so that they can proactively provide effective support and encouragement
• Asking questions and having conversations to promote mentee’s awareness of their own academic and professional progress.

The Faculty Mentors proactively supports their mentees academic and professional needs through:
• Shared experiences and discussions regarding professional behavior. This includes:
  o Addressing workforce issues, such as inequity and self-advocacy
  o Advice for handling conflict and complex situations
• Advice on job and co-op opportunities
• Suggestions for clubs and extracurricular activities
• Providing access to resources that the mentee may not be aware of, such as the writing center, free tutoring, or ways to get help for their classes
• Offering suggestions on effective studying techniques, time management or maintaining life balance

For academic support, targeted tutoring is available for the scholars and funded through the grant. Additionally, the scholars are encouraged to set-up study groups. Professional development workshops run through the Women in Technology programs include topics such as resume writing, networking skills, professional etiquette and composing your 30 second commercial or “elevator speech”. Scholars are strongly encouraged to attend a minimum of one professional development workshop each academic year. Tours of professional engineering facilities are coordinated. This allows scholars to have a better understanding of career opportunities for their major and to meet and interact with engineering professionals. Tours have included a Barilla pasta manufacturing facility, the hydro-electric power plant in Niagara Falls and a local nuclear power plant. Scholars are also encouraged to participate in outreach activities. The objectives for this involvement are to reinforce the scholar’s decision to major in Engineering Technology by promoting and explaining the discipline to others, aid in the development of community by having the scholars work with other ET students and faculty on these workshops, and to develop professional skills such as effective oral communication skills.18 Scholars can select from leading workshops for K-12 students, participating as a tour guide during an RIT Open House or visiting their high school to promote the ET programs at RIT. Regular social events are held to encourage community building for the women students in ET.

Program Evaluation

Project success and student progress is being determined utilizing formative and summative assessment techniques. Formative assessment is comprehensive and utilizes both quantitative
and qualitative techniques: participant retention, GPA, focus groups, individual interviews, etc. A system of tracking of retention statistics, GPAs and student satisfaction surveys is a well-developed function of the Women in Technology program. Results are compiled at the end of each semester. Data analysis and interviews utilize well established content analytical methods. Data is reviewed by the program team and a professional evaluation consultant is assessing program effectiveness and progress. The evaluator assisted with design and implementation of all assessment tools, assisting with data compilation, analyzing data and providing the project team an annual evaluation report.

Table 3: COMETS Assessment and Evaluation Plan

<table>
<thead>
<tr>
<th>Objective</th>
<th>Evaluation/Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engage scholars in the Women in Technology programming</td>
<td>Track scholar participation in WIT events</td>
</tr>
<tr>
<td></td>
<td>Analyze program satisfaction surveys</td>
</tr>
<tr>
<td>Effectively prepare the scholars for the workforce or graduate school.</td>
<td>Track career placement for graduates</td>
</tr>
<tr>
<td></td>
<td>Track graduate school intentions and applications</td>
</tr>
<tr>
<td>Reinforce the students’ decision to major in Engineering Technology</td>
<td>Evaluate interviews with scholars (given at the beginning of each academic year and exit interview)</td>
</tr>
<tr>
<td></td>
<td>Interpret focus group findings annually</td>
</tr>
<tr>
<td>Identify scholars struggling academically and provide proactive academic</td>
<td>Track GPA, academic performance in core technical courses</td>
</tr>
<tr>
<td>support.</td>
<td>Measure utilization of academic support services</td>
</tr>
<tr>
<td>Strengthen relationships with regional community colleges and high schools as a means of recruiting scholars.</td>
<td>Record interactions with community colleges</td>
</tr>
<tr>
<td></td>
<td>Compare number of scholarship applications from community college partners versus other schools</td>
</tr>
</tbody>
</table>

Summative program assessment information is compiled annually and reported to the NSF following NSF reporting guidelines. The summative evaluation includes the impact the COMETS program has made on the scholars; systematic impact on the recruitment and retention of female students; and impact on the participating departments, the Women in Technology program and other participating student support services.

The external evaluators focused on the following questions during focus groups with the scholars:

1. Did COMETS support scholars both academically and socially? How well did it support the needs of the scholars in the program?
2. What worked best for faculty, mentors, and scholars? What aspects of the program were most valuable to each of the stakeholders involved?
3. How can the evaluation design be improved to further develop and support the program and its goals?
The focus groups were recorded, transcribed and coded for overarching patterns using grounded theory techniques described from Charmaz. Findings from each focus group were compared to previous findings to see if there were any changes and variations to programmatic implementation and/or impact and outcomes. The overarching themes of connectedness (satisfaction of social needs), competence, and communication were prevalent in the data corpus and continue to be important in maintaining and creating supportive relationships within and among scholars and their network communities. From both interview and focus group data, scholars continue to have strong social needs to connect with others at RIT. These needs were satisfied through meetings with their mentors, interactions with classmates, hall mates, roommates, lab assistants and professors, professional organizations outside of Engineering Technology, and finally, attendance to COMETS and Women In Technology (WIT) events. However, the nature of where scholars went to satisfy these needs varied between scholars. In earlier years, most scholars received support primarily through their faculty mentors, but as the COMETS program grew, many turned to their peers, and other resources for help first.

Previous research on the recruitment and retention of undergraduate women in engineering seemed to indicate that student success was linked to feelings of connectedness/belonging as well as academic confidence. Feelings of isolation and lack of self-confidence can be exacerbated by the following factors.

- A lack of prior knowledge related to their engineering courses
- A lack of established female engineers and faculty as role models
- A non-supportive network of friends and family
- Demotivating and ineffective instructors
- Low grades leading to perceptions of self-doubt
- Poor time management because of both job and academic commitments.

Goodman et al. suggested that a supportive engineering community could support and counter these factors often encountered by female engineers – factors which our preliminary COMETS data from previous years indicate are existent at RIT. Furthermore, our previous studies have indicated that the reason community is able to support female undergraduate engineers may be explained using Self-Determination Theory (SDT).

SDT explains that three basic psychological needs—competence, relatedness, and autonomy, determine motivation within an individual. When these needs are not met, individuals may become demotivated. Hence, this demotivation may affect the success and retention rates of female undergraduate students. However, the knowledge-sharing COMETS community may nurture student opportunities to develop rich, supportive, personal networks that support and satisfy these needs; hence, students may be intrinsically motivated to support their own personal growth and well-being.

The first COMETS scholarships were awarded in 2012. As shown in Figure 4, from 2012-2014, the percentage of women in Engineering Technology has risen from 8.79 % to 11.75 %, a 34 % increase. At the same time, the number of students enrolled in Engineering Technology has also increased at RIT. The number of women has increased from 113 to 141, a 25 % increase. There has also been a notable increase in the number of AALANA (African American, Latin American
or Native American) women students in ET. In 2012, 2.84% of the ET students at RIT were AALANA women. In 2014, that percentage increased to 4.11%, a 45% increase.

![Percentage of Women Students in Engineering Technology at RIT 2010-2014](image)

**Figure 4: Percentage of Women Students in Engineering Technology at RIT 2010-2014**

**Sustaining the project**

The evaluation of the project has highlighted the important of reinforcing connectedness, competence and communication in the retention of women undergraduates in Engineering Technology at RIT. The Women in Technology (WIT) program will continue to provide programming that supports these needs. After the project ends, the financial support for the students will no longer be available. It is the hope of the team that the strong community of women that has grown during the COMETS project and continued support and targeted programming being provided by WIT will attract more women to the program and retain more of the women who enroll in Engineering Technology at RIT.

**Conclusion**

Although the Advance RIT and COMETS project are demonstrating success at implementing effective strategies to increase the recruitment and retention of women faculty and students in Engineering Technology, the current statistics indicate a need to continue and build on these efforts. Table 4 shows the current percentage of women students in Engineering Technology. These percentages are improving, but still are substantially below national averages for engineering programs, although in line with national Engineering Technology averages of ten percent. The percentage of women faculty at RIT in Engineering Technology is displayed by rank and department in Figure 5. Although, this data shows that the percentage of women faculty is higher than the percentage of women students, each bar of the graph represents one
woman, with the exception of the Manufacturing & Mechanical Engineering Department, where the 22% represents two women. Since 2008, only one new woman tenure track faculty has joined an ET department at RIT despite efforts to increase diversity in the faculty ranks.

Table 4: Percentage of Women Students in Engineering Technology Programs at RIT (2014)

<table>
<thead>
<tr>
<th>Program</th>
<th>Percentage Women Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Civil ET</td>
<td>17.1%</td>
</tr>
<tr>
<td>Computer ET</td>
<td>7.8%</td>
</tr>
<tr>
<td>Electrical ET</td>
<td>14.5%</td>
</tr>
<tr>
<td>Electrical-Mechanical ET</td>
<td>7.8%</td>
</tr>
<tr>
<td>Mechanical ET</td>
<td>10.2%</td>
</tr>
<tr>
<td>Manufacturing ET</td>
<td>7.4%</td>
</tr>
</tbody>
</table>

Figure 5: 2015 Percentage of Women Faculty in Engineering Technology at RIT by Rank and Department

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40. Cordova-Wenting RM, Camacho C. Women Engineers: Factors and Obstacles Related to the Pursuit of a Degree in Engineering. 2006; Chicago.


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