

2006-1910: HYPATIA: A LIVING AND LEARNING COMMUNITY FOR FRESHMAN AND SOPHOMORE WOMEN IN ENGINEERING

Amanda Martin, Virginia Tech

AMANDA M. MARTIN is a graduate teaching assistant in the Center for the Enhancement of Engineering Diversity at Virginia Polytechnic Institute and State University. Martin received her B.S. in Biological Systems Engineering from Virginia Polytechnic Institute and State University, and is currently pursuing an M.S. in Biological Systems Engineering. Martin is the director of the Second Year Hypatia Program.

Bevlee Watford, Virginia Tech

DR. BEVLEE A. WATFORD, P.E. is the founding Director of the Center for the Enhancement of Engineering Diversity, established in 1992. Watford received the ASEE 2003 Minorities in Engineering award due to her efforts to increase the recruitment, retention, and graduation rates of under-represented students in engineering. She is currently working for the National Science Foundation as a rotator in the Division of Undergraduate Education.

Whitney Edmister, Virginia Tech

WHITNEY A. EDMISTER is the Assistant Director of the Center for the Enhancement of Engineering Diversity at Virginia Polytechnic Institute and State University. She received her M.S. in Counselor Education, Student Affairs Administration from Radford University, and M.S. in Career and Technical Education and B.S. in Human Nutrition, Foods and Exercise both from Virginia Polytechnic Institute and State University.

Hypatia: A Living and Learning Community for Freshman and Sophomore Women in Engineering

Abstract

Virginia Tech has been providing support programs for undergraduate women in engineering since 1996. These programs offer an encouraging and supportive environment in order to promote academic success. In fall 2001, the Center for the Enhancement of Engineering Diversity at Virginia Tech implemented a residentially based program for women students enrolling as freshmen in the College of Engineering. Hypatia, named after an ancient Egyptian philosopher, was created in order to increase the recruitment and retention of female engineering students in the College of Engineering at Virginia Tech. Due to popular demand, in 2004, a second-year program was developed and implemented in the fall for Hypatia students who wished to remain in the community during their sophomore year of engineering study.

The first-year Hypatia program currently has 66 residents representing approximately 42% of the freshman engineering women. These students reside on two adjacent floors of a residence hall and are enrolled in the First Year Hypatia Seminar course (3 credits) in the fall. The goal of the seminar class is to help the students improve their academic and professional skills. The second-year Hypatia program currently has 21 residents representing approximately 12% of the sophomore engineering women. These students reside on one floor of the same residence hall and are enrolled in the one-credit Second-Year Hypatia Seminar in the fall. The focus of the second-year seminar is to help the students develop their leadership skills through activities available via the Hypatia program. Both programs help women in engineering to explore critical issues surrounding women's roles in predominately male fields. Both of the communities participate in programmatic activities in the spring semester.

Hypatia allows female freshman and sophomore engineering students to be a part of a living and learning community that promotes academic and professional success, increasing the rate of retention of women engineering students. The program also gives the students an opportunity to actively recruit women into the College of Engineering through outreach activities. This paper will discuss how the Hypatia programs contribute to the academic and professional development of participants, and will address the recruitment and retention of these Virginia Tech women engineering students. The paper will also present a longitudinal study of all Hypatia residents since its inception in 2001.

Hypatia

Hypatia is supported by the CEED office and is funded through donations through corporate sponsors. Hypatia is essential to advancing the mission of the CEED office, which is to increase the number of under-represented¹ students in the College of Engineering at Virginia Tech. The Hypatia program is not required for incoming women in engineering; it is a residential

¹ Within the College of Engineering at Virginia Tech, the term under-represented refers to women, African American, Latino/a, and American Indian students.

community that accepts applications from women engineering students at Virginia Tech. The application process consists of two essay questions that help the review committee determine whether the student will be an appropriate match for the community. The mission of Hypatia is to bring together first and second year women engineering students in a residential environment designed to provide encouragement and support in pursuing engineering degrees. This is accomplished by enhancing the academic and residential lives' of the participants with special programs and activities. Such activities may include teaching strategies and skills for academic success, professional, personal and leadership development. Currently in its fifth year, sixty-six (66) women participate in the first-year program and twenty-one (21) women in the second-year program. The students are housed on the third and fourth floors of Slusher Wing on the campus of Virginia Tech.

There are particular features of Hypatia that assist in creating a supportive and cohesive environment for the Hypatia women. The women are block scheduled for their first semester at Virginia Tech, meaning that they will be among at least ten other Hypatia students in all of their engineering, science and math related classes (chemistry and chemistry laboratory, calculus, engineering education, and linear algebra). Placing the students in classes together, creates a more comfortable environment by reducing the sense of isolation for the women and naturally facilitates the formation of study groups and collaboration on group projects and reports.

Another feature of the program that helps to create a supportive environment along with providing personal and professional development for the students is team building activity at the beginning of every academic year that helps to get the students interacting with one another. Other activities throughout the semester include attending career fairs, hiking, bowling, a speaker series, a book club, movie nights, and an industrial plant visit. These interactions allow the women to learn about themselves and other women in the field of engineering.

Hypatia Seminar

All of the Hypatia students are required to enroll in the Hypatia seminar during the fall semester. The seminar course for the first-year women is targeted to help the students improve their academic and professional skills. The focus of the second-year seminar is to help the students develop their leadership skills through activities available via the Hypatia program. Both programs help women in engineering to explore critical issues surrounding women's roles in predominately male fields.

For the first-year seminar course, the students are divided into two sections of thirty-three students. It has been found that there is more student interaction in smaller class sizes. One section meets on Monday, and the other section meets on Wednesday. On Thursdays, the entire group meets as one with the Galileo students. Galileo is the male counterpart to the first-year Hypatia program and is also offered through the CEED office. Each class is 75 minutes in length. Topics covered in the first-year seminar course can be found in Table 1.

As the course syllabus states, the course is designed to assist the students in their efforts to become successful engineering students at Virginia Tech, and to provide them with the information necessary to become successful both academically and professionally. From an

academic viewpoint, the course is built around the theme that learning is both an individual and a collaborative process. The students must determine what works best for them while learning how to utilize the skills and minds of others to assist them. It is explained to the students that the learning skills taught in the course will not be beneficial to them unless they decide to implement those skills in their daily routine. The professional development skills taught in the course are provided for a basic reason: all the engineering education and book knowledge in the world will not guarantee employment on a career path of choice. The women must learn to select what they want to do professionally, and then determine how to go after it.

The goals of the first-year seminar are:

- To foster achievement in first-year female engineering students.
- To enhance personal study skills and habits.
- To gain a sense of confidence in academic ability.
- To identify and employ strategies and skills for academic and professional success.

The second-year seminar is similar to that of the first in that it is designed to continue to assist the students in developing their leadership skills as well as their continued efforts to be a successful engineering student at Virginia Tech. During class time, the students are exposed to a number of different speakers and activities that focus on leadership from a number of different perspectives. Opportunities are available for the students to organize and lead events, giving them first hand experience with planning programs and taking charge of a team. As in the first year seminar class, this course is also built around the theme that learning is both an individual and a collaborative process. The course topics for the second-year seminar course are listed in Table 2.

The second-year course objectives are:

- To foster achievement in second-year engineering students;
- To enhance personal leadership skills;
- To demonstrate an understanding of the relationship between the leader and a follower;
- To identify and employ strategies and skills for academic and professional success;
- To appreciate diverse styles of leadership, including the ways personal preferences and stylistic differences of race, gender and class effect leadership practices.

Table 1.

Course topics for the first-year Hypatia seminar course

WEEK	AGENDA
1	Introductions and take pictures Academic integrity (Honors System Office) & icebreakers
2	Resumes Center for Academic Excellence and Enrichment (CAEE)
3	Study Skills/Time Management/Learning Styles Service Learning Center
4	Engineering Presentation with Olga Pierrakos Career Services, <i>How to Prepare for Expo</i>
5	Issues in the workplace (gender specific) Engineering Clubs & Student Activities
6	Diversity Library Information
7	Stress management/test taking skills Career Services, Co-ops/Extern & Internships
8	Fall Break-NO CLASS Presentation Skills with Professor Michael Alley
9	Alcohol and other drugs with Matt Stimpson Written Communication
10	Women's Health Aaron Barr's Presentation & Scholarships
11	Team Building & Project Management Emerging Engineers Series
12	Group Presentation Work Emerging Engineers Series
13	MBTI Emerging Engineers Series
14	Thanksgiving Break-NO CLASS Thanksgiving Break-NO CLASS
15	Group Presentations Service Learning/Assessment/Wrap-up
16	Group Presentations Reading Day-NO CLASS

Table 2. Course topics for the second-year Hypatia seminar course

WEEK	TOPIC
1	Class Overview
2	Service Learning Project with Girls Scouts of Virginia <i>(Sarah Baughman, Membership Services Manager)</i>
3	NO CLASS - Leadership Conference on Saturday Blue Ridge Summit "Leaders Under Construction"
4	Super Leadership: How to Empower and Motivate <i>(Amy Smith, Coordinator of Leadership Development)</i>
5	Class Discussion/Girl Scout Planning
6	Engineering Expo and Mock Interview Process Discussion
7	ePortfolio: Online, Personal Information Management <i>Brent Jesiek, Science and Technology Studies</i>
8	Learning to Lead by Learning Yourself <i>(Tim Filbert, Assistant Director of Leadership)</i>
9	TBA Girl Scouts Engineering Day
10	Situational Leadership <i>(Tim Filbert, Assistant Director of Leadership Development)</i> Girl Scouts Engineering Day
11	Open Class Discussion
12	Open Class Discussion
13	Powepoint Presentation Skills <i>(Michael Alley, Associate Professor, Engineering Education)</i>
14	NO CLASS - Thanksgiving Break
15	Committee Spring Planning
16	Course Evaluation and Wrap Up

One of the most important aspects of both Hypatia seminars is the addition of a service-learning component to the class. This component of the class is intended to have the students develop a sense of community on the larger VT campus (not just within Hypatia) and in the greater community, (Blacksburg, New River Valley, and Southwest Virginia). In addition, the purpose of this project was for the women to embrace the mission of the University: *Ut Prosim*, That I May Serve. In the first-year seminar, the students were required to complete a service learning project that was at least 4 hours long. Students were permitted to pick one of the projects provided by the instructor or they could find a service learning project themselves. All service learning projects not provided by the instructor required instructor approval prior to the start of the project. At the completion of the service learning project students were required to submit a 2-3 page reflection on the service learning experience.

At the end of the semester, a list of the different activities was compiled for future reference. The agencies that benefited from the service-learning project can be found in Table 3.

Table 3. Service-learning agencies for Hypatia program

Big Sisters- Southwest Virginia
Blacksburg Presbyterian Church (BPC)
Chi Alpha Christian Fellowship
Circle K International Organization
Cooper House Presbyterian Campus Ministry
FIRST LEGO league
Girl Scouts – NRV
Helping to Cross the Border
Hokies United
Humane Society
Humane Society- Fairfax
Immaculate Heart of Mary Church
Kroontje Health Care Center
Miriam's Kitchen
New Life Christian Fellowship
NSBE- PCI
Radford/Fairlawn Daily Bread
Red Cross
Residence Hall Federation
Salvation Army
Service Learning Center
Society of Women Engineers (SWE)
St. John the Evangelist Church
Student Engineers' Council
Student Government Association (VT SGA)
Virginia Aquarium and Marine Science Center
Women in Mathematics Career Day- Math Emporium
Women's Resource Center
World Changers Organization
YMCA

One of the Hypatia students was inspired by the tragedy of Hurricane Katrina when she was formulating her service learning project. Her idea was to sell Mardi Gras beads to the students at Virginia Tech in order to raise money for the victims of this natural disaster. She worked with a local church organization, New Life Christian Fellowship (NLCF), in order to organize this endeavor. Donations were given from a local party store in Blacksburg, VA and NLCF ordered extra beads from an online source for the fundraising event. Through careful planning and extensive involvement of the Hypatia student, over \$4,000 was raised and donated to the Salvation Army to help victims of Hurricane Katrina. Some of her comments were:

“I loved participating in the fundraising and seeing the generosity the students had on campus...It was amazing how selling something as small and inexpensive as Mardi Gras beads could raise that much money...I learned that...one person’s idea can mean the world and no one should hold back any suggestions...no matter how unimportant they may seem.”

Another student participated in a YMCA Alternative Break Trip during her Thanksgiving holiday. She joined a group of 54 Virginia Tech students who traveled to New Orleans to help the residents begin cleaning and rebuilding their community. They completed a total of 24 hours of work which included removing furniture, carpet and dry wall from the damaged homes. She was impacted greatly from the experience.

“My experience was amazing...[when we arrived] the bus was silent, completely in awe. We were on the main interstate, but it was *pitch black*...the scene is completely indescribable...nothing was more breath-taking than the homeowners I was able to work with...Their courage, strength, and faith really taught me something...[it] was so real and so genuine...they taught me you just need to put your head down and deal with whatever is thrown at you...Being down there over Thanksgiving really made me understand what Thanksgiving is all about...”

Another group of Hypatia students participated in a trip to the October Sky Festival in Coalwood, WV, home of Homer Hickam and the RocketBoys. The students had a Virginia Tech Engineering booth set up at the festival where they demonstrated robotics to children using Lego® Mindstorm™ kits. The students spent approximately 4-5 hours in Coalwood working with the children. A few comments were taken from the reports submitted by the students.

“It was obvious that many of the children had never played with Legos® before, and we had to help them learn how they could...be snapped together...”

“The kids are very able to do everything we do but just lack the resources to do it.”

“...I knew the story about the Rocket Boys, but actually seeing Coalwood made the story come to life for me...I got to introduce elementary aged kids to engineering and play with the kids and Legos®, both of which I love to do. I was glad I was able to participate...”

The second-year students were given the task of planning and implementing an event for Girl Scouts in the New River Valley area. They planned “Discover Engineering at Virginia Tech”, which was a full day event of team building and engineering related activities for Studio 2B Girl Scouts, ages 11-17. The event allowed the students to gain leadership and presentation skills, while allowing them to interact with young women interested in engineering, science and math. Participants in the “Discover Engineering at Virginia Tech” event expressed that they thought the program was “fun and educating” and they would “definitely like to come back next year”.

Opportunities

There are many opportunities available to the Hypatia students that set this program apart from other themed housing opportunities. Since the inception of the second-year program, the students have been able to take on multiple leadership and team building activities. Currently there are six different committees within the Hypatia community: Assessment, Announcements/Communication, Academic Support, Social/Community Service, Recruitment, and Seminar. Each committee is lead by a group of 4-5 second-year Hypatia students. When the students apply for the second-year program, they are asked to rank the committees in order of preference. They are then assigned as committee co-chairs by the instructor of the second-year program based on their success as a Hypatia student and the quality of their application. A description of each committee and its activities is listed below.

Assessment

- Organize and conduct interviews of former and current Hypatia residents
- Conduct demographic survey of current Hypatians and analyze data
- Create and deliver data presentation to various VT and other audiences
- Assist the other committees with assessment of program activities

Announcements/Communication

- Maintain a history book of Hypatia events
- Publish monthly Hypatia Newsletter or a Weekly Hypatia Short Bulletin
- Each newsletter or Bulletin should include
 - Profile of a resident
 - Calendars from other committees
 - Guest editorials
- Create and update the Hypatia website throughout the academic year
- Website must include:
 - Hypatia overview
 - Hypatia staff
 - Current and past Hypatia participants
 - Individual websites for current Hypatians
 - Calendar of events
 - Committees
 - Programs for elementary, middle, and high school girls

Academic Support

- Create student academic calendar; update throughout the semester
- Plan and implement 3 academic support activities each semester

- Hold office hours in the residence halls to assist Hypatia students with assignments (possibly hold office hours for Galileo students as well).
- Implement pre- and post-surveys of participants present at different activities (in conjunction with the Assessment Committee)
- Analyze survey data
- Provide suggestions for future changes

Social and Community Service

- Plan and implement 3 social activities each semester
- Organize and implement at least one community service event each semester. Event would preferably focus on pre-college students or underrepresented students in the local area.
- Implement pre and post surveys of participants present at different activities (in conjunction with the Assessment Committee)
- Analyze survey data
- Provide suggestions for future changes

Recruiting

- Assist CEED staff with planning and implementing Women's Preview Weekend
- Coordinate with CEED to recruit women for the college of engineering through other activities
 - Develop and conduct Hypatia presentations for Open House or College of Engineering Information Sessions
 - Communicate with potential first-year women in engineering
 - Conduct evaluations

Seminar

- Serve as a Teaching Assistant for the first-year Hypatia seminar
 - Help select speakers for the first-year Hypatia seminar
 - Hold office hours in the residence hall to communicate with first-year Hypatians about their experiences in Hypatia and Virginia Tech
 - Grade papers
- Analyze survey data for class evaluations
- Provide suggestions for future changes
- Help plan for the 2006 first-year Hypatia seminar

The first-year students can participate in any of the committees that they are interested in. Generally, student participation is better when they are allowed to choose which committees they would like to participate in. In certain situations, students have been urged to participate in particular committees based on skills that have been presented in seminar class. There are multiple benefits to the committee structure present in the Hypatia community. The students learn leadership and team-building. They are also able to have hands-on experience with recruiting for the College of Engineering (Women's Preview Weekend and Open House Events), planning social events, learning how to assess programs, as well as developing service-learning and community-service opportunities. There is currently no training involved for the second-year committee chairs, but they are required to meet with the instructor on a regular basis in order to report their progress during the semester. In the future, it has been proposed for the incoming committee chairs to shadow the current committee chairs in order to facilitate a smooth transition between the different academic years.

Longitudinal Data of Hypatia students

In order to gain a perspective on how successful the program is, the grades and enrollment status for the Hypatia students have been tracked and compared to a matching cohort group. Data has been collected for the Hypatia students and their matching cohort groups since the inception of the program in 2001. Tables 4 through 8 represent the summarized data from the 2001-2002, 2002-2003, 2003-2004, 2004-2005, and 2005-2006 academic years respectively. The tables include information on the number of students in the program, the current grade point average of participants in engineering, the first semester grade point average (fall semester), the percentage of students that have graduated from the College of Engineering, the percentage that are still enrolled in engineering at Virginia Tech, and the percentage of students that are no longer enrolled at Virginia Tech. The data is updated at the end of each academic year so that the progress and success of the students can be monitored. The cohort group is statistically identical to the Hypatia students on five variables of interest: gender, grade level, college, on-campus residence, and SAT total score. Each Hypatia student is matched to a non-Hypatia student within the College of Engineering.

Table 4. Hypatia and cohort data for the 2001-2002 academic year

2001-2002 Cohort						
	Number of Students	Current GPA Participants in Engineering	First Semester GPA	% Graduated VT COE	% still enrolled in Engineering	% not enrolled at VT
Hypatia Participants	40	3.11	3.13	47.5% (19)	40.0% (16)	7.5% (3)
Cohort Group	40	3.10	2.60	40.0% (16)	22.5% (9)	12.5% (5)

Table 5. Hypatia and cohort data for the 2002-2003 academic year

2002-2003 Cohort						
	Number of Students	Current GPA Participants in Engineering	First Semester GPA	% Graduated VT COE	% still enrolled in Engineering	% not enrolled at VT
Hypatia Participants	52	3.11	3.13	9.6% (5)	75% (39)	7.6% (4)
Cohort Group	52	2.75	2.92	11.5% (6)	36.5% (19)	23.1% (12)

Table 6. Hypatia and cohort data for the 2003-2004 academic year

2003-2004 Cohort						
	Number of Students	Current GPA Participants in Engineering	First Semester GPA	% Graduated VT COE	% still enrolled in Engineering	% not enrolled at VT
Hypatia Participants	52	3.00	3.09	0% (0)	88.5% (46)	3.8% (2)
Cohort Group	52	2.95	2.78	0% (0)	73.1% (38)	9.6% (5)

Table 7. Hypatia and cohort data for the 2004-2005 academic year

2004-2005 Cohort						
	Number of Students	Current GPA Participants in Engineering	First Semester GPA	% Graduated VT COE	% still enrolled in Engineering	% not enrolled at VT
Hypatia Participants	52	3.03	3.12	0% (0)	94.2% (49)	1.9% (1)
Cohort Group	52	3.10	3.03	0% (0)	78.9% (41)	9.6% (5)

Table 8. Hypatia and cohort data for the 2005-2006 academic year

2005-2006 Cohort						
	Number of Students	Current GPA Participants in Engineering	First Semester GPA	% Graduated VT COE	% still enrolled in Engineering	% not enrolled at VT
Hypatia Participants	66	3.31	3.31	0% (0)	95.5% (63)	4.5% (3)
Cohort Group	66	3.20	3.19	0% (0)	90.9% (60)	4.55% (3)

Overall, the number of students participating in the first-year program has increased from 40 to 66. Figure 1 shows a visual representation of this trend. The number of students who are permitted to participate in the program is a function of interest and the available space present in the residential hall. From 2002-2005, the goal was to maintain the number of women in the program. The decision was then made to allow more students to participate in the program once a successful trend was set. The projected number of participants in the first-year program is 100 students for the upcoming 2006-2007 academic year.

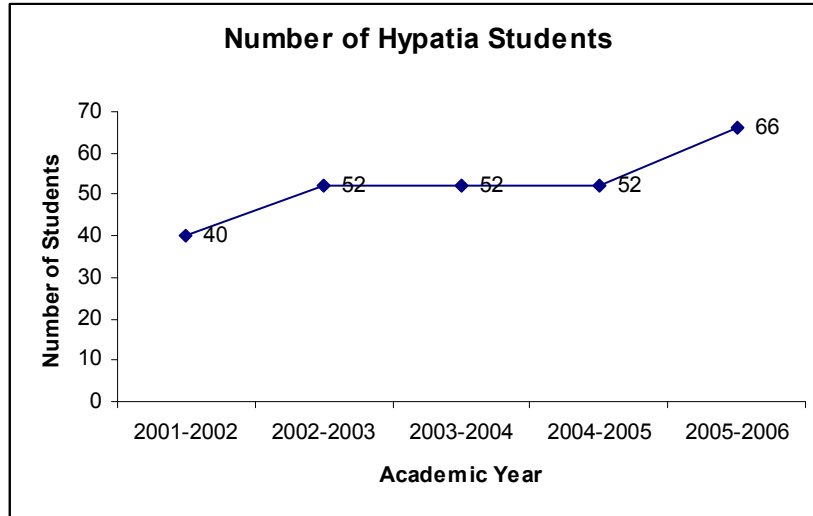


Figure 1. Number of students participating in the first-year Hypatia program.

The academic success of the Hypatia students has been one of the most important aspects of the program. The GPAs of the Hypatia students and the matching cohort groups have been monitored in order to determine participants' success as engineering students at Virginia Tech. Figure 2 below represents the first semester GPAs of the Hypatia students compared to their cohort. From this graph it can be seen that the overall GPA of the Hypatia students is higher than the cohort group during the first semester of engineering study. It can also be seen that the overall difference in GPA between the Hypatia students and the cohort groups has decreased since the inception of the Hypatia program in 2001. A most likely cause for this is that other programs sponsored by the CEED office including Women in Engineering Support Teams (WEST) mentoring program and the Student Transition to Engineering Program (STEP) have helped incoming women engineering students. Students in the cohort group may have also been indirectly influenced by the Hypatia program through interactions and close friendships with the Hypatia residents, and their overall first semester GPAs may have increased due to that influence.

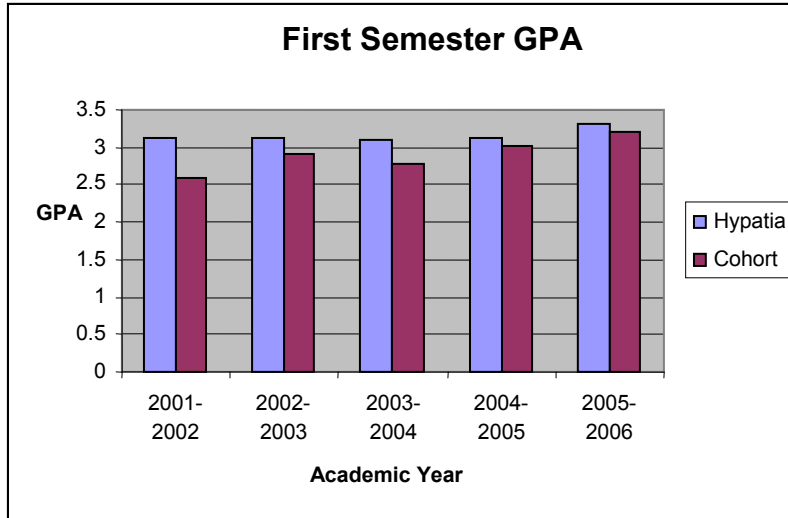


Figure 2. First semester GPAs for Hypatia and cohort group.

Another important aspect of the residential program is the retention of these women in the College of Engineering at Virginia Tech. It can be seen in Figure 3 that the retention of the Hypatia students is higher than that of the matching cohort of students.

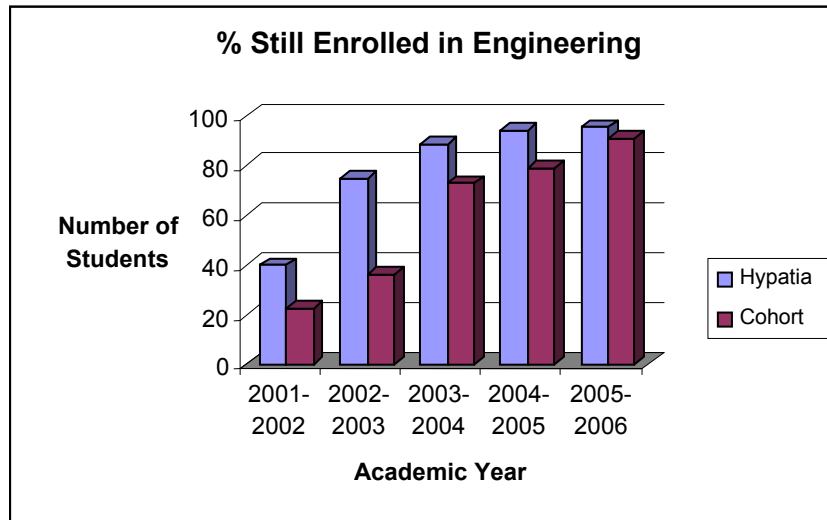


Figure 3. Students still enrolled in the College of Engineering.

Conclusion

Since its inception in 2001, the Hypatia program has been successful in promoting women in engineering at Virginia Tech and has been able to improve the academic success of these women. The Hypatia students are confident and diligent in their studies, and also participate in a wide range of campus activities. While not all women engineering students participate in the program, it is believed that the Hypatia students have an indirect and positive influence on other women in the college.

The addition of the second-year program has enhanced the experiences of the students that participate in the Hypatia program. Not only are the second-year students given leadership opportunities, but the freshman Hypatia students are given the opportunity to interact with sophomore level engineering students. The increased interaction between these women engineering students has proven to enhance their experience as engineering students at Virginia Tech.

The service-learning aspect of the seminar class has allowed students to get involved in both local and distant communities. The students have been able to participate in life changing experiences and will become more well-rounded individuals in the future. The students will be able to build from their experiences in Hypatia throughout their engineering careers.

From the data that has been presented, the conclusion is that the Hypatia students are more successful in their engineering studies at Virginia Tech. It is the goal of the CEED office to make sure these women are prepared for careers in the field of engineering and are aware of the importance of a diverse environment.

With the added opportunities available to the Hypatia students, it is believed that they will stand apart from other engineering students when they are ready to enter the workforce. The professional, leadership and outreach skills that they develop while they are members of the Hypatia program should make them excellent candidates for employment in a competitive market.