

## **AC 2007-2367: FRESHMAN ENGINEERING LIVING-LEARNING COMMUNITIES AT VIRGINIA TECH**

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# Freshman Engineering Living-Learning Communities at Virginia Tech

## Abstract

Living-learning communities have been a part of higher education for many years. Research indicates that students who participate in living-learning communities report a more favorable college experience and are more likely to persist to graduation, to report fewer social problems, and to perform better academically. At Virginia Tech, there are currently two living-learning communities for freshman engineering students. Hypatia, now in its sixth year, currently houses 75 freshman women, and Galileo, in only its second year, houses 180 men. Of our fall 2006 incoming class (186 women and 1040 men), these programs serve 40% of the women and about 17% of the men. This paper presents our experience with engineering students who choose this type of on-campus living arrangement, including our findings on residents' academic performance and persistence as compared to non-participating matching cohorts. We will also provide demographics of the residents, details on the required fall companion seminar course and the optional spring programming activities, and an overview of the challenges and successes of implementing a rather large living-learning community (Galileo) in the residence halls of a large university. Survey results on motivations to participate and on program satisfaction will be provided. Presented results will be offered in terms of the separate male and female communities, and in combined form when appropriate, so that distinctions between the communities can be noted and preserved.

## Introduction

Learning Communities have long been part of higher education's approaches to academic enrichment, and they have taken on many forms and versions as the years have passed.<sup>1-5</sup> Such programs that have a residential component are typically called Living-Learning Communities, or LLCs, and usually involve housing the participants in the same residence hall or portion of a residence hall. The Experimental College, established at the University of Wisconsin in 1927 by Alexander Meiklejohn and the first formally established learning community in higher education, was, in fact, a living-learning community that occupied a portion of Adams Hall for men.<sup>1</sup> Today, the structure of learning communities, and the influence of structure on expected outcomes, is of great interest.<sup>2,3</sup> And, the flexibility in that structure to adapt to different implementations is recognized as a great strength of learning communities,<sup>5</sup> allowing design for specific expected outcomes (e.g., diversity<sup>6</sup>). Perhaps one of the best testimonies to the formidable hold that learning communities, and living-learning communities in particular, have established in the reform of higher education is the Academic Village which is slated to open in fall 2007 at Colorado State University, Fort Collins, Colorado. The Village is a new facility that is to function as residential space for engineering students (~250) and faculty, and also is to contain College of Engineering faculty offices, classrooms, and laboratory space, and university dining facilities.<sup>7,8</sup> The current prevalence of "living learning communities" is easily made evident with a Google search on that combination of words, which pulls up a huge number of links to college campus initiatives across the United States and beyond. With such a web search,

one can also see the broad spectrum of community types and the various educational disciplines that now implement these communities (e.g., engineering, the sciences, nursing).

The usual expected participant outcomes from learning community implementation are improvements in academic success and persistence, an enhanced sense of community among the participants, and more engagement in the campus environment, including stronger connections to academic units. And, it has been reported that even living-learning communities that are somewhat loosely structured can produce notable gains in these areas.<sup>3</sup> The implementations of Hypatia and Galileo were done with these expected outcomes in mind, particularly persistence. It is recognized that first-to-second year attrition in engineering programs is most severe, and that intervention at the freshman level is paramount to increasing persistence to graduation in engineering degree programs.<sup>9-11</sup> Thus, freshman living-learning communities for engineering students seem to offer a very viable means to improve retention in engineering, especially at institutions that require, or strongly encourage, on-campus residence for freshman students.

Assessment of the Hypatia and Galileo living-learning communities includes longitudinal tracking of cumulative grade point average and retention. We also document community demographics and survey the residents on program satisfaction and on the impetus to participate. In order to maximize the utility of the assessment results and their discussion, we first present the structure and administration logistics for Hypatia and Galileo in some detail, and offer information on programming activities and on the required fall seminar course for each community.

### **The Hypatia and Galileo Programs**

Hypatia is a living-learning community for women in engineering that typically houses 50 to 75 freshmen. It was established in fall 2001 for female freshmen entering Virginia Tech in the College of Engineering. The community was implemented through the then Office of Minority Engineering Programs (now the Center for the Enhancement of Engineering Diversity, CEED), with additional associated costs provided largely through industrial sponsorship. The community is physically located in Slusher Hall, currently occupying the fourth floor of the “Wing.” The floor plan design in Slusher Hall creates pods, which are common outer areas that six to eight resident rooms open to. These pods function as small gathering spaces for the residents of the connecting rooms, and they are often utilized for socializing and as study zones. The Hypatia community for freshmen is in its sixth run during the 2006-07 academic year. Early participants who had developed a strong sense of community petitioned the CEED office to implement a second-year component to Hypatia for the first-year participants who wished to remain living in the Hypatia community during their sophomore year. So, in fall 2004, the community was expanded to house 20 to 30 sophomore women – women who had been first-year Hypatians. The second-year rooms are physically grouped together but remain in proximity to the first-year program rooms, and remain within the confines of Hypatia space in Slusher Wing. Anecdotally, Slusher Hall is considered by many students as “better than average” living accommodations on this campus, and Slusher Wing as especially nice quarters. Hypatia has two Resident Advisors (RAs) who serve both the first- and second-year components.

Galileo is the male counterpart to Hypatia. This men's community was established in fall 2005 as part of an expansion of freshman intervention programs to improve retention in the College of Engineering. The expansion effort was made possible through the award of a STEP (STEM Talent Expansion Program) grant from the National Science Foundation. Galileo is physically located on the 6<sup>th</sup> and 7<sup>th</sup> floor of Lee Hall and has five RAs. In its first run, Galileo served 162 participants, and the 2006-07 participation is 180 men. The floor plans in Lee Hall are fairly standard for a "hall-structured" dormitory, and the building offers what are considered average type accommodations to its residents. Being a fairly new initiative, Galileo does not yet have a second-year component. However, fall 2007 will see the first run of Galileo for second-year students who participated in the first-year component.

Outside of size, location, and sex of the participants, much of the community structure is the same for Hypatia and Galileo. The Residence Life Office hires and pays the RAs, but the STEP grant PI and CEED staff have graciously been given some discretion over RA assignment for both communities; we strongly recommend upper-class engineering students for these positions. The RAs in both communities often join forces to implement the programming activities that Residence Life requires of RAs, and these activities often have an engineering theme. Other community activities are implemented by CEED and STEP grant staff, with assistance from the RAs, and these are both engineering and social events. Both communities have a required academic component for the fall semester in the form of a seminar course. The course has two class meetings per week, and there are currently two sections of Hypatia's course and four sections of Galileo's (in fall 2005, course logistics were different). For the first class meeting of the week, the men and women meet separately, and even the community participants are split for more manageable class sizes. For the second meeting of the week, Galileo residents and first-year Hypatians are brought together for common activities/speakers, combining two Galileo sections with one Hypatia section for two runs of the second lesson each week. The objectives of the seminar course are academic, professional, and social development to facilitate first-year transition along those lines, and there is a service learning requirement as well.

During the fall semester, Hypatia and Galileo residents are also block scheduled in Math, Chemistry, and Engineering courses such that a community participant will find at least five to ten other community participants in those class meetings. This is done to help foster a strong sense of community among the program participants. When class sections are large (greater than 60), the number of community participants in those sections is increased. During spring semester, we slate activities geared toward professionalism and networking. Residents of Hypatia and Galileo are strongly encouraged to join in the spring activities (and we provide motivators – e.g., an iPod raffle), but they are not required to do so.

An aspect of community participation that must be emphasized is that students self-select to participate or not. Though we do go through an application procedure, essentially any engineering student who wishes to join the communities is accepted. This self-selection is not necessarily the same decision making process for freshman males as it is for freshman females and, therefore, does not necessarily wield the same impact on expected outcomes. The assessment results that follow are thus divided by community whenever possible.

## Assessment

### Matching Cohort Construction:

In order to provide a control group for comparison of GPA and persistence data, non-participating matching cohorts are constructed and tracked along with the participants as both Hypatia and Galileo groups progress through their degree programs. The non-participating cohorts are built by matching gender, SAT/ACT scores, high school GPAs, and ethnicity (self-reported) when possible. As the depth of matching increases, the ability to match all factors diminishes.

### Community and Control Demographics:

The demographics for the 2005-06 runs of Hypatia and Galileo are provided in Table I and those for the 2006-07 runs in Table II, along with the demographics for the corresponding non-participant control cohorts.

Table I. The demographic information for the 2005-06 runs of Hypatia and Galileo, along with the same information for the non-participant control cohorts.

Demographic Aspect	2005-06 Run		2005-06 Run	
	Hypatia (Women)	Control (Women)	Galileo (Men)	Control (Men)
Number of Participants	66	66	162	162
Asian/Pacific Islander	3	3	15	11
Black	3	3	2	5
Caucasian	48	48	122	113
Hispanic	1	1	3	3
Unknown	11	11	20	30
Out-of-State	22	19	63	61
Out-of-Country	0	1	5	3
SAT Math	659	662	667	666
SAT Verbal	624	619	610	609
SAT Total	1283	1281	1276	1275
High School GPA	3.95	3.94	3.81	3.77
First Generation Count	8	11		

Table II. The demographic information for the 2006-07 runs of Hypatia and Galileo, along with the same information for the non-participant control cohorts.

Demographic Aspect	2006-07 Run		2006-07 Run	
	Hypatia (Women)	Control (Women)	Galileo (Men)	Control (Men)
Number of Participants	75	75	180	180
American Indian/ Alaskan Native	1	0	0	0
Asian/Pacific Islander	6	7	12	12
Black	2	2	3	3
Caucasian	53	53	128	128
Hispanic	2	2	2	2
Unknown	11	11	35	35
Out-of-State	30	23	71	70
Out-of-Country	2	0	3	2
SAT Math	653	657	671	678
SAT Verbal	598	608	595	603
SAT Total	1251	1265	1281	1281
High School GPA	3.95	3.92	3.85	3.78
First Generation Count	10	7	25	31

Community and Control GPA and Persistence:

Data on the first semester and current cumulative GPA and retention for Galileo and Hypatia are provided in Tables III and IV.

Table III. Current Cumulative and First Semester GPA and retention data for Galileo.

2005-2006 Cohort									
updated 1-12	Number of Students	Current GPA All Participants	Current GPA Participants in Engineering	First Semester GPA	% Graduated VT COE	% Graduated VT Other	% still enrolled in Engineering	% still enrolled in Other	% not enrolled at VT
Galileo Participants	162	3.04	3.05	3.23	0% (0)	0% (0)	94.4%(153)	2.5%(4)	3.1%(5)
Cohort Group	162	2.93	2.96	2.91	0% (0)	0% (0)	92%(149)	6.2%(10)	1.8%(3)

2006-2007 Cohort									
updated 1-12	Number of Students	Current GPA All Participants	Current GPA Participants in Engineering	First Semester GPA	% Graduated VT COE	% Graduated VT Other	% still enrolled in Engineering	% still enrolled in Other	% not enrolled at VT
Galileo Participants	180	3.12	3.12	3.12	0% (0)	0% (0)	99.4%(179)	0.6%(1)	0% (0)
Cohort Group	180	2.91	2.91	2.91	0% (0)	0% (0)	98.3%(178)	1.7%(3)	0% (0)

Table IV. Current Cumulative and First Semester GPA and retention data for Hypatia.

2001-2002 Cohort									
	Number of Students	Current GPA All Participants	Current GPA Participants in Engineering	First Semester GPA	% Graduated VT COE	% Graduated VT Other	% still enrolled in Engineering	% still enrolled in Other	% not enrolled at VT
Hypatia Participants	40	3.15	3.11	3.13	47.5% (19)	5.0% (2)	40.0% (16)	0% (0)	7.5% (3)
Cohort Group	40	3.02	3.10	2.60	40.0% (16)	20.0% (8)	22.5% (9)	5.0% (2)	12.5% (5)

2002-2003 Cohort									
	Number of Students	Current GPA All Participants	Current GPA Participants in Engineering	First Semester GPA	% Graduated VT COE	% Graduated VT Other	% still enrolled in Engineering	% still enrolled in Other	% not enrolled at VT
Hypatia Participants	52	3.14	3.11	3.13	9.6% (5)	2% (1)	75% (39)	5.8% (3)	7.6% (4)
Cohort Group	52	2.91	2.75	2.92	11.5% (6)	5.8% (3)	36.5% (19)	23.1% (12)	23.1% (12)

2003-2004 Cohort									
	Number of Students	Current GPA All Participants	Current GPA Participants in Engineering	First Semester GPA	% Graduated VT COE	% Graduated VT Other	% still enrolled in Engineering	% still enrolled in Other	% not enrolled at VT
Hypatia Participants	52	3.03	3.00	3.09	0% (0)	0% (0)	88.5% (46)	7.7% (4)	3.8% (2)
Cohort Group	52	2.92	2.95	2.78	0% (0)	0% (0)	73.1% (38)	17.3% (9)	9.6% (5)

2004-2005 Cohort									
18-May	Number of Students	Current GPA All Participants	Current GPA Participants in Engineering	First Semester GPA	% Graduated VT COE	% Graduated VT Other	% still enrolled in Engineering	% still enrolled in Other	% not enrolled at VT
Hypatia Participants	52	2.98	3.01	3.12	0% (0)	0% (0)	90.4% (47)	7.7% (4)	1.9% (1)
Cohort Group	52	2.97	3.05	3.03	0% (0)	0% (0)	80.8% (42)	11.5% (6)	7.7% (4)

2005-2006 Cohort									
updated 1-12	Number of Students	Overall GPA All Participants	Overall GPA Participants in Engineering	Fall Semester GPA	% Graduated VT COE	% Graduated VT Other	% still enrolled in Engineering	% still enrolled in Other	% not enrolled at VT
Hypatia Participants	66	3.12	3.14	3.31	0% (0)	0% (0)	94% (62)	3.0% (2)	3.0% (2)
Cohort Group	66	3.14	3.17	3.19	0% (0)	0% (0)	74.2% (55)	21.2% (14)	4.55% (3)

2006-2007 Cohort									
updated 1-12	Number of Students	Overall GPA All Participants	Overall GPA Participants in Engineering	Fall Semester GPA	% Graduated VT COE	% Graduated VT Other	% still enrolled in Engineering	% still enrolled in Other	% not enrolled at VT
Hypatia Participants	75	3.34	3.34	3.34	0% (0)	0% (0)	100%(75)	0%(0)	0%(0)
Cohort Group	75	3.05	3.05	3.05	0% (0)	0% (0)	100%(75)	0% (0)	0% (0)

### Participation Reasons:

For the 2006-07 runs of Hypatia and Galileo, freshman participants were surveyed in the fall semester as to why they chose to participate in the living-learning community. The survey response options are listed in the first column of Table V. The students were instructed to indicate their top three reasons for participating, marking them 1, 2, and 3 in order of most to least influential. A summary of the survey results is provided in Table V. Ideally, the timing of administering this electronic survey should have been the same for both communities, but that was not the case. Galileo residents completed the survey in the second week of classes, while Hypatians did not see the survey until after Thanksgiving break, very near the semester's end. It is possible that this difference in the time within semester that the survey was given had an impact on the amount and type of reflection that each response received. However, the percentages for each response are fairly close.

Table V. Survey results for Hypatia/Galileo 2006-07 on reasons for participation in the living-learning community. Students were instructed to indicate their top three reasons from among the responses listed in the first column of the table.

Living-Learning Community Participation Reason Cited	Hypatia 2006-07 71 Respondents of 75 women (95% response rate)	Galileo 2006-07 146 Respondents of 180 men (81% response rate)
Parents	33 ( 47% of respondents)	82 ( 56% of respondents)
A desire to meet and live with other engineering students	68 (96%)	130 (89%)
A desire to live in Slusher Wing / Lee Hall	23 (32%)	55 (38%)
A desire to avoid other living arrangements	32 (45%)	66 (45%)
A desire to have help with academics	59 (83%)	119 (82%)
A desire to succeed in engineering	61 (86%)	142 (97%)
Other	3 (4%)	4 (3%)

### Program Likes/Dislikes:

For both runs of both communities, residents were surveyed at the end of the fall semester as to the aspects of the community that they liked best and least. This survey was administered by passing out 3x5 inch lined index cards and asking the students to write what they liked least on the lined side and what they liked best on the blank side of the card. These

Table VI. The frequently cited best and least liked aspects of the living-learning communities.

Community Aspect Cited	Hypatia Women				Galileo Men			
	2005-06 (59 of 66)		2006-07 (74 of 75)		2005-06 (140 of 162)		2006-07 (167 of 180)	
	Best	Least	Best	Least	Best	Least	Best	Least
Blank (no relevant response)	2	0	4	0	1	2	1	13
Seminar Course general aspects	5	12	12	12	40	60	49	46
Seminar Course Assignments	20	36	20	53	43	36	60	58
Seminar Course Speakers	21	15	0	11	17	41	11	78
Professional & Career Development	0	0	2	0	19	0	15	0
Living with other <u>engineering</u> students	14	0	9	0	27	0	38	0
Academic Help from peers	4	0	36	0	19	0	43	0
People of the Community	4	3	22	9	13	2	19	10
Common Classes	1	0	8	0	6	0	19	1
Socials & Community Activities	1	0	8	4	1	0	16	0
Living Arrangements (the themed community)	6	0	18	0	8	0	34	5
Team Building Day (2005-06 only)	1	10	N/A	N/A	0	4	N/A	N/A
Community Staff (from CoE, not RAs)	1	4	2	0	5	0	6	0
Residence Hall Building aspects	0	0	3	1	0	0	0	5

cards were then transcribed, and the responses categorized and counted to obtain the frequencies listed in Table VI. Though we expected only a single item on each side of an index card, students often listed several things on each side. Often, too, they responded with a full sentence, and we would then break down the sentence to capture all aspects mentioned. For example, one given response for the best-liked aspect was “I liked living with other engineers. We have most of the same classes and this helps with homework, understanding concepts, and projects.” This best response is counted once in “Living with other engineering students,” once in “Academic Help from peers,” and once in “Common Classes.” Table VI should be viewed as a summary of the common responses that we encountered; it does not include sporadic items that appeared very infrequently.

## **Discussion**

We have tried to account for differences in college preparedness by creating the matching cohorts. But there are problems with that approach. Namely, the matching cohort selection did not screen for participation in other LLCs on campus. And, there were no matches made for in-state versus out-of-state versus international student status. This is important to note because it may speak to college preparedness levels, but it is too difficult to build the cohort when matching goes to that depth. We feel that matching high school GPA and SAT/ACT scores covers the matching of student potential. Further, there are sufficient variations in preparedness for the same GPA (i.e., high school GPA) among the in-state high schools to warrant a skeptical view of any student preparedness equivalency assumed because of common status in that regard.

From the performance and persistence data provided in Tables III and IV, we see that the influence of participation in a living-learning community on GPA appears to have a notable effect in the first semester. However, that impact is not sustained as students in the program and in the non-participant cohort advance through the university. This diminishing distinction in cumulative GPA may be attributable to two things. First, the comfort level and sense of belonging for the non-participating cohort are catching up to the levels that were established early on in the LLCs. Secondly, more students in the non-participating cohort have moved to less rigorous (than engineering) curriculums. Looking at Hypatia data (Table IV), the influence on retention in engineering appears to be more pronounced as the students progress toward their degrees, and this supports our second reason for the diminishing distinction in cumulative GPA. The data for Galileo is not sufficient at this time to determine if the same is, or will be, true for men.

While much of what appears to be going on in Hypatia and Galileo seems very similar, there are size and gender factors and other influences that make the communities somewhat different. First, a higher degree of structure is possible in Hypatia than in Galileo. There are several reasons for this. Hypatia has an advantage of longevity that Galileo does not. There are current second-year participants in Hypatia who help to coordinate the first-year program and who live among the freshman residents. Hypatia is considerably smaller than Galileo, and that means the seminar course sections are smaller – which has a direct impact on the ability to build community among the residents. The difference in building floor plans for Slusher Wing (Hypatia) and Lee Hall (Galileo) also impacts the social dynamics of the communities. The pods in Hypatia usually lead to the development of sub-communities within the larger living-learning

community. This can be good at times, but it can also be bad. There have been instances of so-called “pod wars” within Hypatia. There have also been personality clashes within a given pod, and these can make life in the pod stressful. In comparison, Galileo seems fairly uniform in its level of community among the residents, though that seems in general to be not as strong as the “community” observed in Hypatia. While the standard hall floor plan of Lee Hall certainly promotes a unified community, there may well be gender issues at play as well. In the best/least survey results (Table VI), several of the nine *least* instances of “People of the Community” for Hypatia in 2006-07 cited the development of cliques among the women in the community. This does not seem to be an issue for the men in Galileo and, unfortunately, the Hypatia floor plan with pods may exacerbate any gender impact in this regard.

The best/least survey results in Table VI indicate that the students seem focused on the seminar courses in both what they like and what they do not like. This might be attributable to the timing of the survey falling at the end of the fall semester and, thus, at the end of the seminar course, but it is also likely due to the strong links between the courses and the respective communities. The courses are designed to provide developmental guidance for academic and professional success. Much of what the course offers will not seem relevant to the participants until they have the perspective of being upper-class students or working engineers. In the meantime, the courses do serve the immediate purpose of strengthening community among the residents.

Other things to note in the best/least survey results are community differences in the citations of the “Professional & Career Development” and the “Socials & Community Activities” responses. While both communities in both runs frequently cited a resume and a career fair (Engineering Expo) visit as favorite assignments, it is usually only men who discuss such things in terms of professional and career development. We also note that the interest in socials and community activities piqued in the 2006-07 run for both communities, but the response were very different. For Galileo residents, there was considerable appreciation for the tailgate social held before a Saturday afternoon Virginia Tech home football game. For the women of Hypatia, the formal etiquette dinner picked up the most votes (not mentioned by any Galileo resident). Also, for Hypatia, the four *least* citations in “Socials & Community Activities” listed events planned and implemented by second-year Hypatians.

The reasons listed by the freshmen for participating in the living-learning communities (Table V) seem fairly similar between the two communities. And, these results also seem to agree with the non-course responses to the best/least survey, namely that living with other engineering students and the available academic help from peers are very important aspects that the communities offer to freshmen. It is interesting to note that roughly half of the participants in both communities list “Parents” as one of their top three reasons for choosing Hypatia or Galileo for their residence.

## **Conclusions and future plans**

The ability of the living-learning communities to achieve the expected outcomes (better academic performance and better retention) seems evident for Hypatia. There is not yet sufficient data for Galileo to make the same call. We will keep you posted.

As for near term plans, there will be a second-year component of Galileo beginning in fall 2007. There are 38 current freshman residents that have applied (and been accepted) to stay in the community for their sophomore year. Also, the Theme Housing program at Virginia Tech has recently begun participation in the National Study of Living-Learning Programs (NSLLP) effort centered at the University of Maryland, and Hypatia and Galileo are included in that effort. The VT coordinator for the NSLLP participation is Mr. Jamie Penven of the Office of Residence Life.

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