

Assessing the Effect on Retention of an Engineering Living/Learning Community

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Abstract – Beginning in the fall of 2007, the Bagley College of Engineering at Mississippi State University began offering engineering students the option of a living/learning community in one of its older residence halls. Engineering freshmen live on the same floor with upper-division mentors and are co-registered in a freshman chemistry class in addition to the other first-year courses as appropriate for their majors. Admission to the program is by application and requires only that the students be admitted to the Bagley College of Engineering and have a math ACT that will allow them to take the chemistry class (22). The students in this program participate in monthly social activities such as bowling, tailgating, pizza nights in the dorm and visits to the local Boy Scout camp to participate in team-building activities. Mentors in the community provide on-demand career counseling as well as scheduled tutoring hours each week in the chemistry class as well as math and other courses students are enrolled in their first year. In the fall of 2009, a one-hour seminar course was also added as a requirement for students participating in this program. This class provides a scheduled one-hour meeting time per week and covers basic college survival skills (time management, study skills) and an introduction to various enhancements provided by the college (co-op, study abroad, graduate school, etc.) This program was started in response to a survey of students who had left engineering majors. These students listed as one of the primary reasons for their leaving engineering that they did not feel a sense of community within their major. Students participating in this program are retained within engineering at a higher rate than the general engineering student population.

Keywords: Retention, Learning Community, Freshman Year Program

CONTEXT AND RATIONALE FOR CREATING ENGINEERING LIVING/LEARNING COMMUNITY

The Bagley College of Engineering (BCoE) at Mississippi State University (MSU), like all public engineering colleges, is concerned about the recruitment and retention of majors into its ten engineering disciplines. In the last five years the college personnel have been working to determine the causes of students leaving engineering and to develop programs to address these causes. In the BCoE, the six-year institutional graduation rate for students who enter in engineering is approximately 67%. However, the six-year graduation rate within engineering is only 41% overall and worse than this for underrepresented minorities. The six-year graduation rate for female students tends to be roughly equivalent to that of male students for the college as a whole but varies widely across the different disciplines within the college. Although we expect that some students will discover other majors once they get to college or will discover that engineering does not fit their long-term career goals, we feel that some students are leaving engineering for reasons that are not related to their interests or abilities.

As a result of participation in the program for conducting rigorous research in engineering education hosted at Colorado School of Mines in the summer of 2005 [1], we developed a research study to examine the reasons that students, particularly from underrepresented groups, were leaving engineering. This experiment surveyed students who had entered in an engineering major in the 2002-2005 time frame, were still enrolled at MSU, but were no longer majoring in engineering. This population was chosen for two reasons. First, the population was easily accessible for survey distribution. Secondly, it represented a population that was successful in remaining enrolled at the institution so they displayed at least some of the skills necessary to be successful in college. The survey was adapted from the AWE Leaving Engineering survey. [2] The primary finding which motivated the work described in this paper was the assessment of the factors that contributed to students leaving engineering. Students were asked to

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rate a number of factors on a scale of 0 to 4 (where 0 indicated the factor was not at all relevant to their decision to leave engineering and 4 indicated that the factor was a significant factor in their decision to leave). An average was then calculated for each factor and comparisons made across different race and gender groups. Table 1 shows some of the top factors and their rankings by different groups. Although the differences across groups were not statistically significant, there are some interesting differences between the groups and factors for all groups that we found interesting.

Table 1. Means of Ratings by Ethnicity and Gender

	AA Fem n = 8	White Fem n = 36	AA Male n = 4	White Male n = 75
Did not feel as if I belonged in engineering	3.63 (1)	2.72 (3)	3.00 (1)	2.69(3)
Engineering was not a satisfying major for me	3.13 (2)	2.89 (2)	2.75 (3)	2.77 (2)
A non-engineering career more fulfilling to me	2.25 (5)	3.22 (1)	2.25 (6)	3.04 (1)
I was unhappy with my grades in Eng	3.13 (2)	1.97 (6)	2.25 (6)	1.79 (7)
Excessive work load in Eng curriculum	2.13 (7)	1.22 (11)	3.00 (1)	1.39 (12)

The numbers in parentheses after each mean indicates that factor's rank ordering within the group. Of particular interest to the college was the fact that the minority students (in this case African-Americans) indicated that not feeling as if they belonged was the most dominate factor in their leaving engineering. Although not the top reason, this reason was third as well for the majority students. Based on these results and our own anecdotal conversations with students, it was decided to pursue the establishment of an engineering living/learning community to help address the students' perceptions of not belonging in engineering.

Coincidentally at the same time that this study was being conducted, MSU's office of housing and student life was dealing with an issue of uneven quality of dormitory housing due to bringing online several new dormitories that were in significantly higher demand than its older buildings. This created the opportunity for the college to partner with the housing office to develop a retention program with a residential component with support from the housing office. As a result of this partnership, in the fall 2007 semester we began offering incoming engineering freshmen the opportunity to participate in a living/learning community during their freshmen year. This program was aimed at addressing the issue of building a sense of community among engineering freshmen. Although the program concentrates on underrepresented groups in engineering, it is not restricted to these groups.

PREVIOUS WORK ON LEARNING COMMUNITIES

A review of the literature about learning communities indicates a number of formats that have been used for these programs over a long period of time. Stassen [3] reports a variety of models that have been used for learning communities. These can vary dramatically in formality. Some include only linked courses, where students are enrolled in the same courses but the courses are independent. Other more formal arrangements lead to communities that have the students involved in integrated, theme-based, interdisciplinary courses. Each of these different models can either have a residential component or not. Stassen [3] reports increased retention of students across three very different models studied. This supports Tinto's theory of student departure [4] that suggests that students are more likely to persist at an institution when they have become connected to that institution both socially and academically. Pascarella and Terenzini [5] also found gains in student outcomes for students involved in learning community programs. Their study indicates that these gains result from the interpersonal relationships that student develop through participation in these programs. Other research suggests that combining academic and non-academic factors to support student success has the greatest impact [6].

In the engineering disciplines, learning communities have also been popular. Arizona State University began a residential learning community for its freshmen engineering students as early as 2001 [7]. Virginia Tech began providing a residential learning community for its freshmen women in 2001 and has since extended this to include sophomores as well as freshmen [8]. These communities operated in different formats with some including service-

learning components in addition to the typical residential and academic components. All are reported to have a positive impact on the retention of participants who participated in the program.

LEARNING COMMUNITY PROGRAM COMPONENTS

Given the strong support in the literature for the impact of learning communities on student retention and the findings of our own study of students leaving engineering, it seemed natural to develop a learning community for students at MSU to determine if this helped to address issues with retaining students in engineering majors. The components of the program have varied some during the four years of the program's existence. However, from the beginning the idea was to provide both academic and social programs for the students. Male and female mentors are provided who live on the floor with the students. Since housing was looking for "value added" for the older dormitory that houses this program, they provide free private rooms to the mentors in the program. Mentors are also paid approximately \$500/semester. Mentors are responsible for two hours of tutoring per week each and are expected to have an "open door" policy on the hall to be available for students with concerns or questions related to either academics, careers in engineering or other issues common to college freshmen. In addition to the student mentors, the author has served as the faculty advisor for this program for the four years of its existence.

Recruitment and Acceptance Into Program

The criteria for admission into the engineering living/learning community (LLC) program are simply that students have been admitted to the Bagley College of Engineering and that they have the math ACT requirement that allows them to take the freshman chemistry class (22). Students are also required to write a brief (one-page) essay indicating why they believe the LLC will be beneficial to them. Admittance has typically been on a first-come, first-served basis for male students. We have always had enough openings in the program to accommodate all female students who have applied.

The recruitment efforts for this program have varied over the four years of its existence although they have been consistent for the past two years. Housing applications at MSU become available the August of high school students' senior year – a whole year before they come to campus. Since we did not get approval for this program until January of 2007 for the fall semester of that year, most students had already made their housing selections and were not notified of the option for the engineering LLC. For the first year of the program we send emails to the prospective students' email addresses as well as letters to the parent's of all freshmen who had been accepted into engineering and notified them of this program and invited them to apply for admission. We were successful in recruiting 28 men and 10 women into the program the first year. For the second year of the program we added the engineering LLC as a choice on the housing selection form. We did not actively recruit students (except for female students at our summer orientation sessions) and did not require an application. We simply accepted any student who indicated they wished to be in the community on their housing selection. This led to a problem with low levels of involvement by the second year participants so we went back to requiring an application during the third and fourth years of the program.

Recruitment of female participants in the program has been a struggle from the beginning. Students were told that they could only select their roommates in this program if their roommate also applied and was accepted into the LLC program. Although this does not cause many issues with male students it is a problem with the female students who often have a friend from their home town who they wish to room with who is not an engineering major. After the first year of the program we relaxed this requirement for the female participants. Since we have not filled up the floor in any year, this has not been an issue. Women have consistently made up approximately 25% of the community participants. During this same period the BCoE had approximately 17% women in its undergraduate population.

Dormitory Components

We have placed three male mentors on the floor with the male LLC students. Two to three female mentors have also been used on the floor with the female students. In general, housing also uses an engineering resident assistant on these floors as well. Each mentor provides two hours of tutoring per week in the dorm with the hours spread out so that there is at least one mentor each day with tutoring hours. In addition, mentors are encouraged to have an open door policy that encourages students to feel free to drop in and discuss coursework, co-op, and other issues as they come up.

MSU has a freshman move-in day each fall for incoming freshmen. New students and their parents are encouraged to arrive on campus on this day and the university provides staff and student volunteers to help unload belongings from cars and carry them to the students' dorm rooms. LLC student mentors and the faculty advisor participate in this move-in day experience at the hall that houses the community. Each student has a list of students and their assigned rooms so that they can greet the students by name, welcome them to campus and invite them to the first social event of the year. The first three years this first event was a cookout on the day after move-in day sponsored by our AIChE chapter. This year move-in day was on a weekday and we sponsored a bowling night in the evening after the move in.

Social and Team Building Components

Because building a sense of community is one of the primary motivations for the establishment of the LLC, social events are planned to regularly encourage students to get together outside the academic setting. Approximately once per month a social event is planned for the community. A mix of programs both inside and out of the dorm are used to provide opportunities that are attractive to a variety of students. One of the most popular activities for the students is the trips to the bowling alley. Another activity that draws good participation from the students is pizza nights in the dorm where we simply buy pizza and gather the students in the kitchen on their residential floor. Other activities that have been popular with the students are trips to the ropes course at the local boy scout camp. On one occasion the mentors even spent the night with the students in tents at the camp. The faculty mentor declined to stay overnight but did participate with the students in the evening team-building activities as well as the high-ropes challenge the following morning.

In addition to the events organized by the faculty advisor, some years the participants have organized their own events. Mentors have aided in the organization of frisbee golf and flag football intramural teams for example. The participants from the third year of the program were avid football fans and organized tail gating and belly-painting activities for each of the home football games during that year. Interestingly, this group, now in their second year, can still be easily spotted each home football game in the end zone and often get televised for their creative slogans for each game.

Class Components

From the inception of the community students each year were co-enrolled in the same section of the freshman chemistry class required for all engineering majors. Students may be in additional classes with other community members but because of the mix in math ACT grades we have not attempted to co-enroll students in the same math classes. During the second semester of their experience, there is even more diversity in the courses in which students are enrolled. However, we find that many of the students who are required to take the second semester of freshman chemistry do try and enroll in the same section where possible.

In the first two years of the community seminars on extracurricular activities (student organizations, cooperative education, study abroad opportunities, time management, etc.) were mixed in with the social activities on approximately a monthly basis. This became problematic for several reasons. First, there was no time slot that was available for all the students in the community. This made it difficult to require attendance for community participants. Secondly, the scheduling of a room on campus for these events became difficult as MSU's enrollment grew and classroom space became less available. In the second year we tried moving these seminars into the dorm itself. However, this space was not big enough to accommodate all participants and dormitory rules which required that any event hosted in the dorm must be inclusive of all residents made this arrangement non sustainable.

In the third year of the program we added a one-hour freshman seminar class for the community participants. This class, along with the LLC section of freshman chemistry was added to each participant's schedule prior to their coming for our summer orientation programs. This guaranteed a time slot when all students would be available and a room that was reserved for this as a regular academic class. The intent of this seminar class is to expose students to opportunities (e.g., cooperative education) that we feel they should be encouraged to take advantage of as well as to teach them some skills necessary for success in their engineering major (e.g., time management).

The seminar class does carry one hour of academic credit and is graded so that students take the assignments seriously. Table 2 shows the graded components of the class. The writing components were added to allow the instructor to gauge the student's academic maturity. The ability to follow simple formatting directions as well as the ability to logically structure a written assignment can provide valuable insight into the student's college

preparedness. This also emphasizes to students the importance of clear writing in the engineering curriculum. In some semesters this assignment has students look for the National Academy of Engineering Grand Challenge problems that they might be interested in addressing [8]. In other semesters this paper has tied MSU's freshman reading book to the engineering profession. Other assignments force students to attend events to broaden their horizons or plan out their academic career so that they have realistic expectations about the course load and requirements for majoring in engineering.

Table 2. Grade Components for LLC Seminar Class

Percentage of Grade	Description of Assignment
10%	Two-page paper tying the students major to either the engineering grand challenge problems or MSU's freshman reading program book – varies by semester
10%	Attendance at the college's New Student Convocation which introduces new students to the dean's office staff and the different student organizations
10%	Attendance at a seminar related to engineering or freshman reading program
10%	Completion of the Felder-Silverman learning styles assessment
10%	Time management assignment
10%	Plan of coursework required to complete the degree requirements for the students' chosen major
15%	Three-page paper. Topic varies but generally related to engineering grand challenge problems
25%	Attendance (one absence allowed without penalty; after this each absence costs 5 points and students with 5 or more absences fail the course)

The lecture component of the class meets once/week for the semester. The first week the students do some ice breaker activities so that they can begin to know who in the class is in the same engineering major that they are. The faculty advisor for the community presents the lectures on study skills and time management but the other lectures are presented by other personnel in the college and in other units on campus. Table 3 shows a week-by week schedule of the class.

Having the class has improved the learning community interactions in several ways. First, it has allowed the faculty advisor to interact with the students on a more regular basis. Simply coming to the class often encourages students to interact with the faculty advisor and ask questions that they would not have taken the time to ask had they had to seek out the advisor during her office hours. In addition, this has improved the interaction among the students as well. The class meets on Monday afternoons at 3:00 and many of the students are in their dormitory rooms immediately preceding class. This leads to the students walking in groups to class where they interact as well as interactions within the class itself. The students have often expressed the desire to continue with a similar one-hour class in the spring semester because they miss these interactions in the spring.

Table 3. Weekly Schedule for LLC Seminar Class

Date	Topic
Week 1	Course Introduction, Syllabus review, Preliminary questionnaire
Week 2	Cooperative Education Panel
Week 3	Holiday

Date	Topic
Week 4	Study Skills
Week 5	Time Management
Week 6	Learning Styles
Week 7	Study Abroad Opportunities
Week 8	Holiday
Week 9	Licensure & Professional Registration
Week 10	Pre-registration advising
Week 11	Post graduate education (grad/professional school)
Week 12	Certificate Programs & Minors
Week 13	Effective Communication
Week 14	Tea with the Dean
Week 15	Wrap-up; Evaluations

RETENTION DATA

The initial goal of this program was to improve the retention of students within the engineering disciplines. In order to determine the impact on retention, the retention to the second, third and fourth years (in an engineering major) for the program participants was calculated and compared against that for the freshman engineering class as a whole in the same cohort year. Table 4 shows this retention data. We have not yet analyzed this retention data statistically to determine if the differences seen are statistically significant. However, there seems to be a large difference in the retention rates between the two groups, particularly for differences in the retention to the second year. These differences do seem to diminish as the students get further away from the program.

Table 4. Retention of Engineering Students and LLC Participants

Cohort Year	Eng. ACT	LLC ACT	Eng. 2nd year ret	LLC 2nd year ret	Eng. 3rd year ret	LLC 3rd year ret	Eng. 4th year ret	LLC 4th year ret
2007	26.9	26.0	68.4%	84.2%	53.4%	60.5%	47.8%	47.4%
2008	27.5	26.6	70.3%	84.4%	56.3%	65.6%	-	-
2009	27.0	26.5	73.6%	92.5%	-	-	-	-

There are several issues with directly comparing these two samples. First, the incoming average ACT of the LLC participants tends to be one half to a full point lower than the overall engineering average. Students who are eligible for entry into the Shackouls Honors College at MSU tend to choose to live in the dormitory associated with that college rather than the engineering LLC. We believe this leads to the LLC appealing to more students who are not eligible, or chose not to, participate in the Honors College. Although we do have honors students in the program,

these tend to be the exception. In addition, the students in the LLC self-select to participate in this program. This also makes comparison to the general engineering student body problematic. However, the improvement in retention for a weaker group of students is certainly a positive sign.

CONCLUSIONS AND FUTURE WORK

Although the trends to date have been positive, it is too early yet to determine if the LLC has had a positive impact on the six-year graduation rates within engineering. In addition, no matched studies have been done to compare the LLC students with a similar group of students entering at the same time to minimize the issues of ACT differences between the two groups.

Since the current data indicates that the effects of the programs seem to “wear off” as the students get further away from the program it would be interesting to consider a follow-on program in the second year that continues to engage this group of students. Many of these students actually continue to live in the LLC dormitory so they could be easily involved in some of the activities with the first year students or have activities of their own planned into the second, and even third, years.

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