Engineering Learning Communities – USA National Survey 2012

Dr. Jess W. Everett, Rowan University

Jess Everett, Ph.D., P.E. is a professor of Civil and Environmental Engineering. He has over 26 years experience as an environmental engineer and professor and has published over 63 refereed journal articles, chapters, and books. He has worked on more than 60 funded projects (totaling over $6M) and has worked with more than 100 undergraduate teams (over 220 different undergraduate students). He has been the director of the Rowan University Engineering Learning Community since 2009.

Ms. Maggie A Flynn M.A., Elizabethtown College

Maggie Flynn is an Area Coordinator in Residence Life at Elizabethtown College. She has an M.A. in Higher Education, Administration from Rowan University, and a B.A. in Communications from Temple University.

Engineering Learning Community – USA National Survey 2012

Abstract

The purpose of this study was to identify and describe Engineering Learning Communities (ELC) at US four-year institutions in 2012. ELCs were identified at 149 out of 356 US institutions with engineering majors. Information was obtained from 76 ELC coordinators, a response rate of 51 %. Most ELCs were targeted at the general engineering population; however, significant numbers were targeted at women, minority students, students in specific engineering majors, or some combination. Almost all ELCs accept freshman year students. Smaller percentages accept sophomores, juniors, and/or seniors. Most ELCs have students live on campus in a single residence hall and have students take one or more common class. According to the coordinators, tutoring/mentoring was the activity ELC students participated in the most hours per semester or quarter, followed by academic coaching and social events. Only 37 coordinators provided budget information. Amounts varied widely, but most were low.

The most commonly used evaluation methods used were retention rate, surveys, and GPA. Retention rate estimates--after one year in an ELC--ranged from 33 to 100 %, with a mean of 82.6 % and median of 85. The majority of coordinators reported high retention. Those programs are likely to increase their institution's 6-year graduation rate; however, the presence of 6 low retention programs indicates that ELCs are not a miracle cure. Scenarios exist where ELCs do not lead to high retention.

Introduction

The purpose of this study was to identify and describe Engineering Learning Communities (ELC) at US four-year institutions in 2012. Information was solicited from the coordinators of ELCs at 149 US institutions.

Background

The modern day living and learning community (LLC) concept serves a population of motivated students who learn by collaborating with faculty and other students. Engineering Learning Communities (ELC) are, to the most part, LLCs. Most LLCs are communities in which students pursue their academic curriculum with a blended co-curriculum involving a theme, concept, or common subject matter while living together in a reserved part of a residence hall.[1] Students are often connected through enrollment in specific sections of courses that act as supportive scaffolding to the community.[2] LLCs range in size but typically do not exceed 75 participants.[3] The small size of LLCs assists in developing supportive peer relationships.[4]

Living and learning communities are designed to increase student satisfaction and learning in order to create and sustain student success.[5,6] They use a constructivist approach to learning: knowledge is not discovered; rather, it is socially constructed.[7] Living and learning communities can assist in developing supportive peer relationships.[4,8,9,10] Many studies on LLCs confirm that students who participate in living and learning communities have an enhanced academic experience through intentionally shared experiences.[11,12] LLCs can be characterized by close working relationships among students and faculty; specialized course assignments; study groups; close relationships among student members; and specialized events, activities, and

workshops.[3,8,9] According to Schroeder et al., learning communities can substantially enhance academic achievement, retention, and educational attainment, especially for freshmen.[13]

Retention and student housing may appear to be separate issues, however the implementation of LLCs at some institutions has resulted in a significant increase in retention.[14] Some LLCs are created exclusively for the purpose of curbing low retention rates. According to LaVine and Mitchell, LLCs increase retention by generating an encouraging and success-oriented learning environment.[15] The retention rates for LLC students are higher than non-LLC students, perhaps because of innovative approaches to learning, strong academic support services, increased interaction with instructors, and peer support systems.[12,15]

Method

A survey was developed to obtain a snapshot of ELCs at US Institutions. Questions were designed to obtain information on important characteristics of ELCs, as identified in the literature and from personal experience operating an ELC for 3 years at Rowan University.

ELC Coordinators were identified by asking all US Engineering Deans at four year colleges and universities to indicate the presence/absence of ELCs at their institution and provide email addresses for coordinators. Up to three emails were sent to Deans requesting this information. The websites of unresponsive institutions were searched for references to ELCs and appropriate contacts identified. ELCs were identified at 149 of 356 (41.8 %.) US institutions with Colleges of Engineering

In April 2012 emails were sent to ELC coordinators asking them to complete a survey administered using SurveyMonkey. Up to two follow up emails were sent to coordinators over the next two months. Responses were obtained from 76 (51.0 %) coordinators.

Survey Results

Seventy-five coordinators provided the title of their ELC. The most popular words were: Engineering (60), Learning (41), Community (41), Living (26), Science (13), and Women (12). No other significant words were used by more than four respondents.

Most ELCs were targeted at the general engineering population (Table 1); however, significant numbers were targeted at women, minority students, students in specific engineering majors, or some combination. Responses in the other category included combined Engineering /Science ELCs and ELCs targeting men (1), entrepreneurs (1) and students in need of academic support (1). Almost all ELCs accept freshman year students (Table 2). Smaller percentages accept sophomores, juniors, and/or seniors. The one program not targeting freshman was for juniors and seniors. Some programs target more than one population, hence the responses add up to more than 76 in Table 1 and 2.

Table 1: ELC target population

Targeted Population	Response Percent	Response Count
Any engineering student	66.2%	48
Women	27.0%	20
Minority students	16.2%	12
Engineering students in a specific major	13.5%	10
Honors students	8.1%	6
Financial need students	4.1%	3
Other	24.3%	18

Table 2: ELC membership eligibility by year

Student Year	Response Percent	Response Count
Freshmen	98.7%	75
Sophomores	40.8%	31
Juniors	23.7%	18
Seniors	22.4%	17

The goals of ELCs are mostly related to improving performance or relationships (Table 3). Performance goals include retention, academic success, and easing the transition to college. Relationship goals include peer and student-faculty relationships as well as connectedness to the campus. Among the six goals provided in the relevant survey question, building peer relationships was a goal of nearly every respondent. Four goals were selected by at least 80 % of respondents. The only goal selected by less than 75 % was building student-faculty relationships. Other goals mentioned in open-ended responses included awareness of diversity issues, appreciation of the real-world applicability of engineering, improved technical writing skills, having fun, etc.

Responding institutions were 18.7 % private and 81.6 % public. ELC size ranged from 8 to 1000, with a mean of 146 and median of 60. Twenty five percent were smaller than 40 students, while twenty five percent had 225 students or larger. Regarding the size limit mentioned in the literature, 43 % of the ELCs were larger than 75 students. The significant number of larger programs could lead to reduced effectiveness of ELCs. Program coping strategies may include dividing large ELCs into sub-groups. Students need to be able to create stable peer relationships. This is expected to be easier to accomplish in small groups that persist over a semester or two.

Table 3: ELC goals

Goal Type	Response Percent	Response Count
Build peer relationships	96.0%	73
Improve academic success	90.7%	69
Increase retention	89.3%	68
Increase students' connectedness to campus	85.3%	65
Help with transition from high school to college	81.3%	62
Build student-faculty relationships	74.7%	57
Other	12.0%	9

Over 70 % of ELCs involved students living on campus in a single residence hall (Figure 1). The ~30% of ELCs without a common living space are probably not LLCs and may find it more difficult to create strong student-student relationships.

Approximately 73 % of ELCs involved students taking one or more common class (Figure 2). Fewer than 27 % had no common class. Those ELCs without common classes may find it more difficult to create strong student-student bonds. They may also be less able to increase student academic success, e.g., because the ELC members will have no opportunity to use their strong peer relationships to advantage in a shared class.

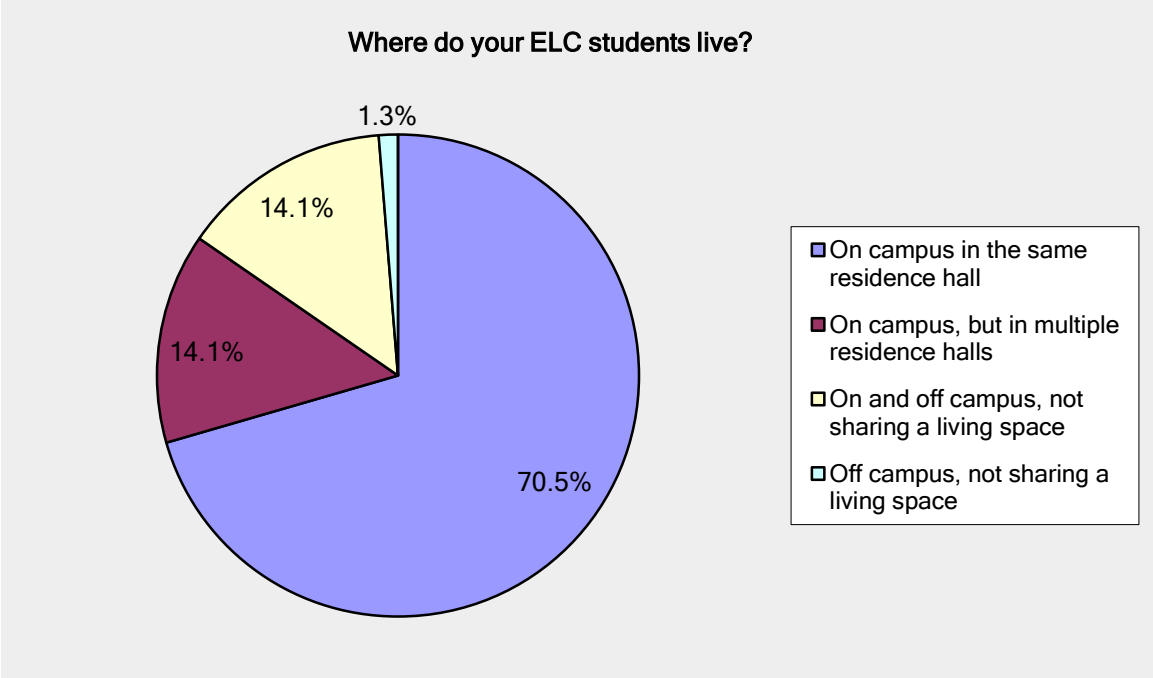

Figure 1: ELC Dorm

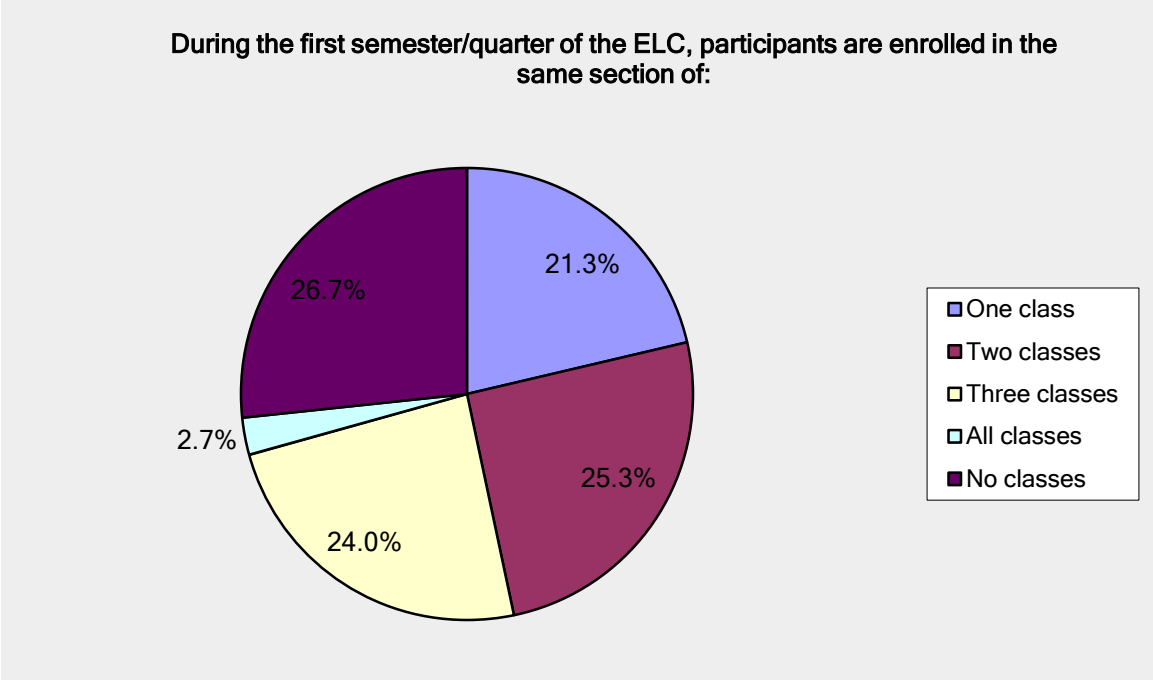

Figure 2: ELC Common Classes

Most of the ELC coordinators (66) responding to the survey were willing to estimate the number of hours students in their ELC spent on ELC extracurricular activities (Table 4). These included Social events, Academic coaching, Campus orientation, Tutoring/mentoring, and Community service. The highest average number of hours was for Tutoring/mentoring, at 30 hours a semester. Academic coaching and Social events were tied at 15 hrs /semester. Maximum hours reported were 180 (Tutoring/mentoring), 100 (Academic coaching), 110 (Social events), 50 (Campus orientation), and 30 (Community service). Minimum amounts were zero for all categories.

Table 4: Student extracurricular activities

Activity Type	Response Average (hr/semester or quarter)	Response Count
Tutoring/mentoring	30	59
Academic coaching	15	51
Social events	15	61
Campus orientation	8	57
Community service	6	47

ELCs are evaluated using a number of methods, including retention (78.9 %), surveys (77.6 %), GPA (64.5 %), focus groups (30.3 %), and other methods (3.9 %). The other methods included interviews, attendance at tutoring sessions, and a group meeting. A small percentage of ELCs are not evaluated (7.9 %). Retention and GPA are easy to use and provide a valuable measure of program success. Surveys can be targeted at more specific topics and can be used to obtain feedback useful for targeted program improvement.

Fifty-one coordinators provided an estimate of the percentage of students retained in engineering after one year in an ELC. More respondents indicated that they measure retention; thus, it is quite possible that the retention estimates are accurate. Retention ranged from 33 to 100 %, with a mean of 82.6 % and median of 85. Only twenty five percent had retention lower than 78.5 % students, while twenty five percent had retention of 90 % or higher. Given that most of the ELCs in the survey are for freshman these are good retention rates overall. There is no way, given the nature of the survey, to identify the causes of the low retention rates (e.g., at the six ELCs with retention lower than 70 %) without further contact with ELC coordinators. Approximately 63 % of students enrolling in 4-year science or engineering degree programs in 2003-2004 graduated within 6 years.[16] The ELCs with high retention rates are probably increasing their institution's 6-year graduation rate. The survey results provide some support to the literature findings regarding the retention benefits of ELCs; however, the presence of 6 low retention programs indicates that ELCs are not a miracle cure. Scenarios exist where ELCs are not able to produce high retention.

Most coordinators answered questions regarding their assessment of the effect of their ELC on student participants. Seventy answered the questions given in Figure 3, while seventy-two answered the questions in Figure 4 (with the exception of the second-to-last question which was answered by 71). At least 90 % of the respondents agreed or strongly agreed that ELC participants, upon completing of the program: had strong peer relationships, interacted with each other outside of class, were satisfied with their college experience, felt like a member of a community, were able to easily transition from high school to college, and studied together (Figure 3). Between 50 and 70 % agreed or strongly agreed that ELC members had strong relationships with faculty, interacted with faculty outside of class, and increased their GPA. These same three questions received a small number of disagree and strongly disagree answers, 10 % or less of respondents.

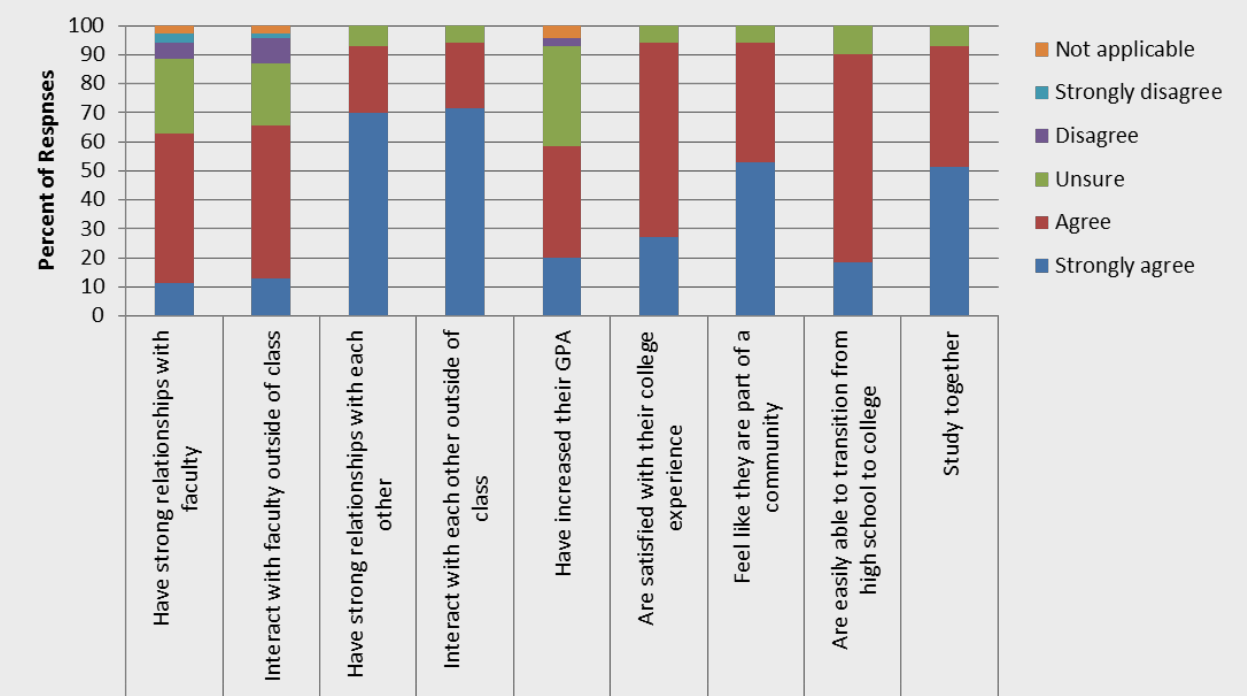

Figure 3: Responses to question "ELC participants, upon completing of the program…"

Similarly, at least 90 % of respondents agreed or strongly agreed that their ELC provided the tools needed to enhance student: study skills, adjustment to college, and knowledge of campus activities and resources (Figure 4). At least 80 % of respondents agreed or strongly agreed that their ELC provided the tools needed to enhance their: ability to network, ability to collaborate with others, and knowledge of engineering career paths. Between 50 and 70 % of respondents agreed or strongly agreed that their ELC provided the tools needed to: cope in a competitive atmosphere, handle stress, and manage time. Only two disagree responses were recorded.

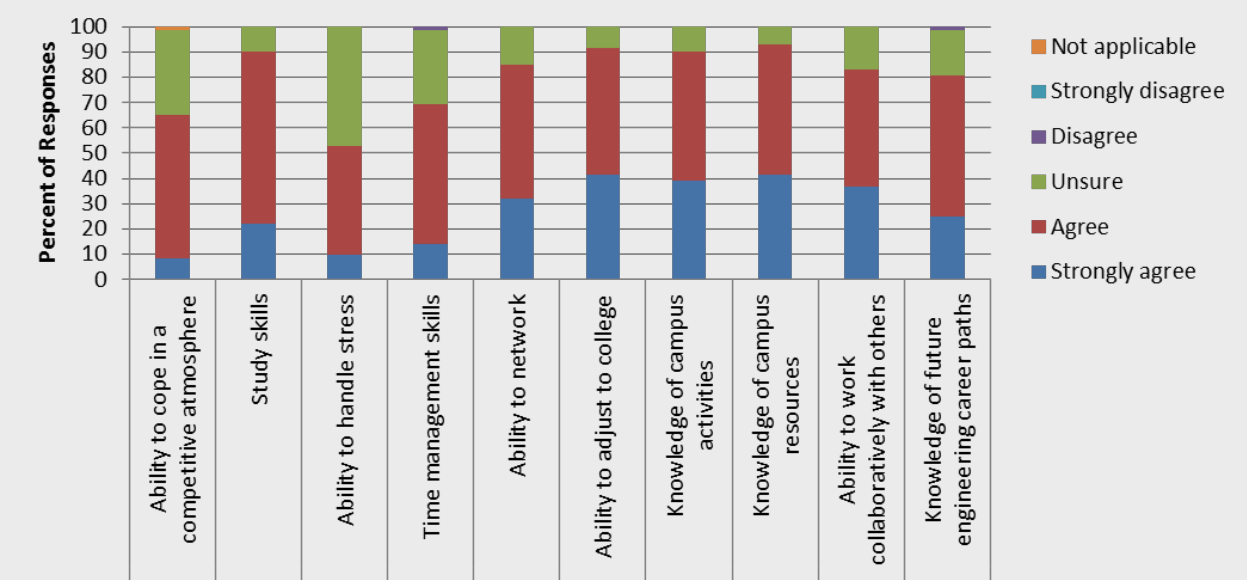

Figure 4: Responses to question "The ELC provided the tools needed to enhance student…"

The survey ended with five open ended questions, which were answered by 60 to 65 respondents.

- What feedback do you get from ELC participants?
- What value do you think your ELC brings to students?
- What value do you think your ELC brings to your institution?
- What are some incentives for students to join your ELC (e.g., scholarship, better housing, tutoring, social events, etc.)?
- What is the budget for your ELC and how is the money distributed?

The most commonly mentioned relevant words used in response to the question "What feedback do you get from ELC participants?" were community (31), enjoy (or similar) (22), living (13), learning (11), faculty (9), academic (8), sense (7), experience (7), together (or similar) (9), studying (4), support (4), mentors (4), activities (3), peers (3), tutoring (3), bathrooms (3). The two most common terms were community and words related to enjoy (which included 6 uses of the word "love"). Academic-related terms were less commonly employed. It appears that ELC coordinators believe that students enjoy the ELC experience and recognize that the ELC is a community, but are less likely to recognize or talk about academic benefits.

The most commonly mentioned relevant words used in response to the question "What value do you think your ELC brings to students?" were community (or similar) (41), academic (14),

support (or similar) (13), faculty (11), relationships (or similar) (9), service (or similar) (9), campus (9), study (9), career (8), experiences (7), tutoring (7), connected (7), peers (6), success (6), retention (5), transition (4), classes (4), writing (3) lab (3), advising (3), and mentors (3). Community was again the most common term. Academic, support, and faculty were also mentioned by at least 11 respondents. The word "faculty" was used in the sense of student-faculty interaction.

The most commonly mentioned relevant words used in response to the question "What value do you think your ELC brings to your institution?" were retention (or similar) (37), recruitment (or similar) (16), community (12), helps (7), women (9), support (4), satisfaction (3), well (3), culture (2), success (2), gender (1), and diversity (1). Retention was by far the most commonly used term. Recruitment and community were also mentioned at least 12 times. It appears that the value of ELCs is different for institutions and students.

The most commonly mentioned relevant words used in response to the question "What are some incentives for students to join your ELC (e.g., scholarship, better housing, tutoring, social events, etc.)?" were housing (or similar) (45), events (or similar) (32), tutoring (22), academic (13), networking (or similar) (12), faculty (12), classes (11), course(s) (10), community (10), program (or similar) (10), mentoring (7), support (7), scholarships (5), opportunities (5), trips (5), peers (4), advising (4), computer (3), early (2), and registration (2). Housing and events were the most common terms used, but tutoring was also popular, pointing to the perceived importance of housing to ELC students, probably in a common dorm, as well as providing them with events and tutoring.

Only 37 coordinators provided budget information. Thirty-three gave a total amount, while 5 gave a per student amount. Total amounts ranged from zero to $148,000, with mean $20,000 and median $9,000. Of course, the wide range in program size makes it difficult to interpret this information. The low median indicates that many programs have modest funding. The per student amounts varied from $10 to 150 per student, with mean of $47 and median of $5 per student, further evidence of diversity and the prevalence of modest funding.

Statistical analyses were used to explore relationships between retention and common dorm, common classes, target population, and total hours devoted to academic coaching and tutoring. Only ELCs limited to Freshman were included, 44 of the programs in the response set. Of those, 27 provided retention data (21 measured retention as part of their normal evaluation protocol, the remaining 6 appear to have estimated it "on the fly" for the survey). T-tests were conducted on the retention data, with ELCs divided into groups based on the presence or absence of a common dorm, the presence or absence of at least one common class, high or low total hours devoted to academic coaching and mentoring (the dividing line was 19 hours), and the target population (general engineering students and students in a specific major versus women or minorities. The only comparison with a p value even close to significant was the first. ELCs with a common dorm averaged 85 % retention, while those without averaged 80 % ($p = 0.118$). ELCs without a common course had slightly higher retention than those with at least one common course ($p=0.499$). ELCs with less than 19 hours devoted to academic coaching or mentoring had slightly higher retention that those devoting more than 19 hours ($p = 0.729$). Finally, ELCs targeting women or minorities had slightly higher retention than those targeting the general engineering

population or specific majors ($p = 0.711$). No single factor—among those measured for this study—had a significant effect on retention.

A linear regression of retention on the four variables (dorm and target population as dummy variables, number of common classes varying from 0 to 4, and hours of academic coaching and mentoring) did not result in a significant overall relationship ($p = 0.762$) nor any significant slope coefficients (the lowest p value was 0.331, for common dorm). It is likely that many unmeasured factors contribute to retention. The base retention level is probably a very important factor, given that retention varies between institutions. The difference between ELC retention and institution base retention would have been a better dependent variable for this study.

Conclusions

The purpose of this study was to identify and describe Engineering Learning Communities (ELC) at US four-year institutions in 2012. ELCs were identified at 149 out of 356 US institutions with engineering majors. Information was obtained from 76 ELC coordinators, a response rate of 51 %.

Most ELCs were targeted at the general engineering population; however, significant numbers were targeted at women, minority students, students in specific engineering majors, or some combination. Almost all ELCs accept freshman year students. Smaller percentages accept sophomores, juniors, and/or seniors. ELC size ranged from 8 to 1000, with a mean of 146 and median of 60. Large programs should divide students into subgroups to foster community and peer relationships. Most ELCs have students live on campus in a single residence hall, further fostering community. Most ELCs also have students take one or more common class. This both increases the sense of community and allows students the opportunity to use their peer relationships to improve academic performance. Tutoring/mentoring was the activity ELC student participated in the most hours per semester or quarter, followed by academic coaching and social events.

Among example goals provided in the survey, building peer relationships was selected by nearly every respondent. Improving academic success, increasing retention, increasing connection to campus, and helping with the transition to college were all selected by more than 80 % of the respondents.

The most commonly used evaluation methods used were retention, surveys, and GPA. Surveys are the only commonly employed technique that can provide feedback concerning program components and are better suited for directing program improvement efforts. Retention estimates--after one year in an ELC--ranged from 33 to 100 %, with a mean of 82.6 % and median of 85. Most ELCs had high retention rates and, thus, are likely increasing their institution’s 6-year graduation rate; however, the presence of 6 low retention programs indicates that ELCs are not a miracle cure. Scenarios exist where ELCs are not able to produce high retention.

At least 90 % of the respondents agreed or strongly agreed that ELC participants, upon completing of the program: had strong peer relationships, interacted with each other outside of class, were satisfied with their college experience, felt like a member of a community, were able

to easily transition from high school to college, and studied together. Similarly, at least 90 % of respondents agreed or strongly agreed that their ELC provided the tools needed to enhance student: study skills, adjustment to college, and knowledge of campus activities and resources.

Analysis of the most common words used in responses to open ended questions indicated that community is a commonly perceived student benefit of ELCs. The benefit to the institutions hosting ELC is commonly perceived to be retention, recruitment, and community. The most commonly employed incentives to join ELCs are better housing, events, and tutoring. Only 37 coordinators provided budget information. Amounts varied widely, but many were rather low.

Statistical comparisons were unable to identify any significant factors explaining retention variation among programs limited to freshmen. The common dorm was the only factor that was anywhere close to being significant ($p = 0.118$).

Future research can focus on identifying effective program components, e.g., types of social events, ways to incorporate tutoring, advising and mentoring, housing situations. Relationships between budget, size, and effectiveness could also be explored. Finally, for those programs with budgets, expenditure categories could be identified. Future studies should collect information on institution base retention, in order to better assess the effectiveness of ELCs.

References

1. Denzine, G., & Kennedy, A. (1997). Creating *learning communities* across the lifespan. *Journal of College Student Development, 38*, 668-9.

2. Levin, J., & Tompkins, D. (1996). Making learning communities work: Seven lessons from Temple University. *American Association of Higher Education Bulletin, 6*(2), 3-6.

3. Inkelas, K. K., & Weisman, J. L. (2003). Different by design: An examination of student outcomes among participants in three types of living-learning programs. *Journal of College Student Development, 44*(3), 335-368.

4. Gabelnick, F., MacGregor, J., Matthews, R., & Smith, B. L. (1990) Learning Communities: Building connections among disciplines, students, and faculty. *New directions for teaching and learning.* San Francisco, Ca: Jossey-Bass.

5. Browne, M. N., & Minnick, K. J. (2005). The unnecessary tension between learning communities and intellectual growth. *College Student Journal, 39*(4), 775-783.

6. Pike, G. (1999). The effects of residential learning communities and traditional residential living arrangements on educational gains during the first year of college. *Journal of College Student Development, 40*(3), 269-84.

7. Zhao, C. M., & Kuh, G. D. (2004). Adding value: Learning communities and student engagement. *Research in Higher Education, 45*(2), 115-138.

8. Inkelas, K. K., Vogt, K. E., & Longerbeam, S. D. (2006). Measuring outcomes of living-learning programs: Examining college environments and student learning and development. *The Journal of General Education, 55*(1), 40-76.

9. Knight, W. (2003). Learning communities and first-year programs: Lessons for planners. *Planning for Higher Education, 31*(4), 5-12.

10. Meath-Lang, B. (1997). Dramatic interactions: Theater work and the formation of learning communities**.** *American Annals of the Deaf, 142,* 99-101.

11. Johnson, J. (2001) Learning communities and special efforts in retention of university students: What works, what doesn't, and is the return worth the investment? *Journal of College Student Retention: Research, Theory, and Practice, 2*(3), 219-238.

12. Johnson, W. G. (2006) Strategies for enhancing student learning in the residence halls. *New Directions for Student Service, 75,* 69-82.

13. Schroeder, C. C., Minor, F. D., & Tarkow, T. A. (1999). Freshman interest groups: Partnership for promoting student success. *New Directions for Student Services, 87,* 37-49.

14. Cabrera, A. A., & Castaneda, M. (1993). College persistence: Structural equations modeling test of an integrated model of student retention. *Journal of Higher Education, 64*(2), 123-136.

15. Habley, W., & McClanahan, R. (2008, July). *What works in student retention?* Presented at the ACT Information for Life's Transitions Seventeenth Annual Enrollment Planner's Conference, Chicago, IL.

16. NSF (2012) *Science and Engineering Indicators*, www.nsf.gov/statistics/seind12.