

Growing an engineering living and learning community

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ABSTRACT: Over the past eight years, Rowan University's Henry M. Rowan College of Engineering has created an inclusive and collaborative living and learning environment for first-year engineering students. The engineering living and learning community uses a traditional residential learning community model that includes living in the same residential housing, cohort cooperative learning, and both educational and social programming and activities to ease students' transition from high school to college. Recently, the programme expanded threefold with student workers used for the first time to facilitate important elements. Data gathered to evaluate the programme after these major changes indicate the engineering living and learning community has an overall positive impact on its participants. Recommendations are provided for institutions interested in creating or expanding similar programmes.

Keywords: Engineering, living and learning community

INTRODUCTION

Rowan University's Henry M. Rowan College of Engineering (RCE) has operated a first-year living and learning community (LLC) since 2009, the *engineering learning community* (ELC). In fall 2016, it was expanded from two groups to six. ELC groups are comprised of approximately 20 students and complete ELC activities together, including ELC seminars. The ELC seminar is a zero-credit enrichment seminar meeting approximately every other week. Also in fall 2016, ELC seminars were facilitated for the first time by paid student workers, previous ELC participants in their sophomore or junior year. ELC student workers were paid five hours a week to plan, develop and facilitate ELC seminars under a faculty member's supervision. They also served as peer mentors. Finally, student workers provided grading assistance to ELC faculty, which freed faculty to participate more fully in ELC seminars.

The purpose of this article is to explore the impact of the fall 2016 ELC on student transition from high school to college, peer-to-peer and peer-to-faculty relationships, sense of belonging to the university and first-year retention. The authors describe the results of the study and offer insights to institutions considering similar programmes.

BACKGROUND

In 1927, Alexander Meiklejohn's experimental college at the University of Wisconsin developed living-learning communities [1]. LLCs are now a critical part of many first-year college experiences, providing unique opportunities for students [2][3]. LLCs use many different components to facilitate students' transition to college, such as summer bridge programmes (SBPs), mandated assessment, required placement in developmental courses, mandatory developmental advising and freshman seminars, but all include students living and learning together. In addition, many LLCs carefully and intentionally monitor academic progress and provide regular feedback within the first six weeks of the semester to help with student transition [4].

Institutions of higher learning can improve retention by providing information/advice, support and participation or improving learning opportunities. One key to retention is active engagement in various aspects of the college experience, a major component of LLCs [3]. Students who participate in LLCs report a high level of satisfaction with their collegiate experience, enjoy a more seamless academic transition from high school to college, are more involved and engaged in diversified topics, and have a higher chance of completing college in four years [5].

A student's sense of belonging to a university is linked to interactions, the learning environment and degree of involvement [6-9]. Positive faculty and peer interaction influence students' connection to campus by providing a supportive social and academic environment; thus, increasing the retention rate. Successful LLCs may accommodate student diversity, both in needs and backgrounds [8].

A number of studies have been conducted on LLCs for STEM majors (science, technology, engineering and mathematics). STEM LLCs had positive influences on student overall satisfaction, connectedness to the institution and the department, positive student-faculty relationships and peer interactions, improved academic performance, increased involvement, and helped ease the transition from high school to college [10-14]. What makes LLCs effective and successful is not solely what they do but the way they operate [4]. Living-learning communities benefit the institution at large, because students involved in LLCs tend to perform higher academically, thus increasing retention rates [5][15].

The fall 2016 incoming class at RCE consisted of 383 students (Table 1). Twenty-one percent of the students belonged to groups underrepresented in STEM. Forty percent had more than \$5,000 in remaining financial need after scholarships.

Table 1: RCE incoming class, fall 2016.

| Group | Size | Underrepresented groups in STEM | | | Remaining need > \$5k (before any ELC scholarship) | SAT |
|-----------------------|------|---------------------------------|---------|-------|---|-------|
| | | Total | Females | Other | | |
| ELC (scholarship) | 15 | 10 | 8 | 6 | 15 | 1,293 |
| ELC (non-scholarship) | 109 | 27 | 30 | 4 | 54 | 1,258 |
| Non-ELC | 259 | 43 | 37 | 18 | 83 | 1,263 |
| Total/Average | 383 | 80 | 75 | 28 | 152 | 1,263 |

All students wishing to participate in the ELC were able to do so. Each of the six ELC groups lived in the same dormitory with roommates from any ELC group and/or the Honours programme, took three ELC courses together each semester of the first year (in their ELC groups), and had access to ELC tutors. By living together and taking three courses together each semester, it was anticipated that students would form support networks and create stronger bonds with each other and faculty; thus, easing the social and academic transition from high school to college. The ELC seminar (one of the three ELC courses) included both fun social events, to form bonds, and academic events, lectures, tutoring opportunities, and workshops, to help student perform better academically. Due to scheduling issues and previous collegiate experience (e.g. AP courses), a small percent of students did not enrol in all of the ELC course sections for their group.

The students in the ELC (scholarship) group were awarded National Science Foundation (NSF) S-STEM scholarships of \$5,000 per year for up to four years. Ten of the students awarded an NSF S-STEM scholarship in fall 2016 were from underrepresented groups in STEM (67%). All had more than \$5,000 in remaining financial need. Each was mentored by an NSF S-STEM Grant Co-PI (assigned by Major) and met with their mentor at least once a semester individually and at least once in a group lunch during their first year. They also participated in an all-day pre-semester experience that included academic success sessions and physical ice-breaking activities.

EVALUATION

An online questionnaire was administered to all first-year engineering students near the end of the spring 2016 semester. Two hundred and nineteen students completed the survey (58%). The questionnaire results are used to support the programme evaluation presented here. The survey had 50 questions with varying formats. Five-point Likert scale response questions are used here. The chi-squared goodness of fit test is used for all comparisons, as the responses are non-numeric. For questions with response options strongly agree, agree, neither, disagree or strongly disagree the levels are collapsed to strongly agree/agree, neither, disagree/strongly disagree to ensure at least five expected counts in all cells for statistical testing. Honours students were excluded from the non-ELC category, because they also participated in an LLC.

Focus group data was collected through an identical/similar semi-structured group interview process. Each focus group was moderated by Professor Egbert, who had minimal interaction with students outside of the focus groups. Professor Egbert asked a series of structured questions, while actively managing group dynamics. She provided clarity for questions when asked. Standard questions were used in all focus groups, however, one focus group consisted of non-ELC students. For these non-ELC first-year engineering students there were fewer questions asked because specific questions regarding the ELC were omitted. While these focus groups followed a structured protocol, Professor Egbert also permitted discussion to emerge, when students began having conversations about the various questions/topics.

All focus groups were voice recorded and transcribed. All of the participants were given a random number and asked to identify themselves and refer to others with that number. For example, when answering a question a student might say, student 4, prior to answering the question. Furthermore, students might piggy back off others answers; for example,

I agree with what student 7 said, I feel... The purpose of this method was to keep the student anonymity and to ease transcription from the recording. It is important to note that all participants signed consent forms and IRB approval was given for these focus groups.

First-year retention was obtained from direct observation, the *Course Analysis Dashboard* database maintained by the Rowan Office of Institutional Effectiveness, Research and Planning, and direct analysis of course enrolments. For the purposes of this study, first-year retention is defined as continuing to be enrolled in a RCE major one year after enrolling in the College as a first-year student.

RESULTS

The survey results provide some support that the ELC helped students academically transition from high school to college. Thirteen of the 15 (87 %) fall 2016 ELC scholarship students strongly agreed or agreed with the statement *...participating in the ELC helped me maximize my academic success*. Sixty of 91 (66 %) non-scholarship/non-honours ELC students also strongly agreed or agreed with the statement. Seventy-six percent of ELC respondents agreed or strongly agreed that their academic transition went well, versus 67% of non-ELC/non-Honours (Table 2), but the difference was not statistically significant (chi-squared probability = 26%). Historically, high retention levels indicate that RCE students transition well to college.

Table 2: Academic transition from high school to college went well.

| Response | ELC | Non-ELC (non-Honours) |
|-------------------|-----|-----------------------|
| Strongly agree | 31 | 19 |
| Agree | 50 | 45 |
| Neither | 16 | 15 |
| Disagree | 6 | 14 |
| Strongly disagree | 4 | 2 |
| Sum | 107 | 95 |

The ELC helped students form supportive groups. Fifty-seven percent of ELC respondents believed they belonged to a supportive peer group within two weeks of the start of the semester, versus only 27% of non-ELC/non-Honours students (Table 3). The chi-squared probability is 0.002%, indicating that the difference between the two groups is statistically significant. ELC students were more likely to strongly agree or agree with the statement *...I participated in a good number of RCE activities (clubs and events) in my first semester at Rowan* (59 versus 34%). The difference was statistically significant (chi-squared probability = 0.2%).

Table 3: Time to get in a group of supportive engineering peers, percent of respondents.

| Results | ELC | Non-ELC (non-Honours) |
|-------------------------|-----|-----------------------|
| Zero to two weeks | 57% | 27% |
| Two weeks to two months | 29% | 31% |
| Never | 14% | 42% |

The ELC does not appear to have made it more likely for students to report strong relationships with faculty. The chi-squared probability is 19%, indicating that the difference between the two groups is not statistically significant. All ELC students interacted with faculty outside standard first-year classes in the ELC seminar; however, for some ELC groups this was the same faculty member they had in their introduction to engineering course, so perhaps the results are not too surprising.

For many freshman college students the transition from high school to college is anything but smooth. In the focus groups, the ELC participants were more positive about their social experience with the transition from high school to college. *I made friends so fast because of the ELC and having classes together made my transition so much smoother*, said one student. *Although I was very overwhelmed at first, having people in the ELC with similar interests and workloads I was able to do things with them together and I already formed connections with them before the semester started. It was nice to have those relationships beforehand to keep track of everything together*, added another. *I like being part of a community of people that are all engineers. We were all in this together so that really helped my transition*, this feeling was shared among all the ELC focus groups.

The academic transition was made easier for many of the ELC scholarship students, because of additional information and presentations provided early in the semester. *I like that the ELC introduced me to all the resources available on*

campus. *I was so overwhelmed during orientation that it was nice to hear about the resources again through the ELC,* said an ELC student.

Aside from exposure to academic resources, students also participated in social activities with other members of the ELC and with engineering faculty. *All the extracurricular ELC events made me take time away from my studies and get to hang out with others. I enjoyed that,* responded one student. *I am quite shy, so being in the ELC helped me branch out and meet new people right away. It felt comfortable because I was interacting with others right away,* added another.

A different picture was revealed in the focus groups with non-ELC first-year engineering students. More non-ELC students admitted the transition was difficult compared to ELC students, a departure from the survey results mentioned earlier. Non-ELC students in the focus groups reported a more difficult academic transition from high school to college compared to ELC students. Most admitted that making friends was challenging in the beginning. *Academically, it wasn't a difficult transition but I literally knew no one when I came [to Rowan]. My roommate is really social so she pulled me out of the room to help create an environment where I got to know people.*

The workload hit me in the face. I needed to learn balance because I wanted to be in clubs and do well in school, said one non-ELC student. High workload for many of the students had social implications. *The workload made me close off from clubs and organizations,* replied one non-ELC first-year engineering student.

The ELC students felt connected to RCE, but not necessarily to the Rowan campus. *I feel like an Honours or engineering student not a Rowan student,* said one. Another responded *...I agree I feel like a College of Engineering student. I don't go to Rowan events I go to engineering events. I just hang out with my group.* Non-ELC engineering students in focus groups felt more connected to campus than the ELC students. Perhaps this is because they lived with a greater variety of majors, attended classes with a mix of students and were *forced* (as one student referred to it) to mingle with students outside the engineering major.

Despite ELC students having a lower sense of belonging to the campus, the focus groups uncovered that the ELC students overwhelmingly agreed that their participation in the ELC made their first-year experience at Rowan better, easier and more fun. *Living together, having classes together, the tutoring, I enjoyed all of it but getting to know my friends was by far the best benefit.* The interpersonal relationships the scholarship ELC students made with each other seemed to make the biggest impact of all. *I would not have met as many great friends without the ELC.*

The ELC students were very positive about their ability to meet and build friendships with their peers. During the focus groups most talked about the benefits of living with other people they knew and had class with. *We work pretty well together,* one student said. *Most of my friends are from the ELC group,* chimed another. *I know the people in this group best,* added a scholarship ELC student.

The ELC students were very enthusiastic about their peer-to-peer relationships. *We know each other very well and have deep conversations with each other.* Another student stated *...having classes together helped so much. Great collaboration. We all worked together just to get through our chem [istry] course.*

A common theme among the ELC students was that living among all engineers helped with course work. *All my roommates helped with homework, studying, and helped me to get involved with other organizations on campus.* Another added, *We have a strong support system from living together and taking classes together.* The students enjoyed living in close proximity to the people in their major, other likeminded students, so they felt more connected to each other. A mutual response from the non-scholarship and scholarship ELC students was that living together made it easier to create homework and study groups with people from the ELC. *For classes we had together and the more difficult projects/homework assignments there were smaller groups within the ELC. I had a group of 3 I worked with all the time.* Another nodded in agreement adding, *We worked together in the lounges in the residence hall which was super convenient.* Although most non-ELC first-year engineering students said they eventually make friends, many admitted that the process to build peer relationships took time.

Studies show that relationships with faculty members are a crucial component to success in the classroom and a critical benchmark on a student's overall satisfaction with their collegiate experience. The ELC students seemed to make deep, lasting connections with faculty, more so than non-ELC first-year engineering students. *As a whole our entire class was able to connect with our teachers more because we were close as a group so we had a better relationships,* said one ELC student during a focus group. The others in the group all nodded in agreement.

I am in a class now where no one knows each other and it's awkward and silent. Knowing each other has really helped connect with the teachers, added an ELC student. *We bonded right from the beginning so the teachers took to that. We all had fun with each other. It was comfortable,* said another ELC student. It was uncovered during the focus groups that the engineering faculty knew the ELC participants by name. The students attributed this to smaller class size in the ELC sections, even though there was little actual difference between ELC and non-ELC class size.

A majority of the non-ELC first-year engineering students did not seem to build strong peer-to-faculty relationships based on the focus group discussions. The non-ELC first-year engineering students seemed to overwhelmingly agree that they didn't interact much with faculty outside of class, but did concede that most professors were nice and willing to help, but the students needed to make the effort to interact outside of class. The students claimed that opportunities for first-year engineering students to cultivate relationships outside of class or office hours were not available.

I feel like I have better relationships with professors who I attend office hours as opposed to my other professors. If I am doing well I don't know them. If I am struggling I get to know them. Another added, *If I am doing well in the class I will talk with the professor - if I'm not I stay away.* To which another student replied, *I don't make an effort to get to know my professors and they don't try to get to know me either.*

The one-year retention rate of all 383 students entering RCE in fall 2016 was 84%. The 272 non-ELC students had a one-year retention rate of 83%. The one-year retention rate of the 124 students who took the ELC seminar (including the ELC scholarship students) was 86%. The 15 ELC scholarship students had a 100% one-year retention rate.

CONCLUSIONS AND RECOMMENDATIONS

The 2016-2017 ELC cohort in RCE included 124 students. A majority of ELC students believed the programme helped them achieve academic success. According to survey results, ELC students formed supportive groups faster and participated in more college activities compared to non-ELC students. The ELC students rated their transition to college similarly to non-ELC students; however, focus group results pointed to differences between ELC and non-ELC students, with ELC students reporting an easier transition to college. The survey questions may not capture the subtlety of the college transition experience. The timing of the survey, at the end of the first year, may also effect the results. Conducting the survey earlier may help students better assess the transition period, which is expected to largely occur during the first semester.

The first-year retention rate of ELC students (86%) was slightly higher than that of non-ELC students (83%). The historically high RCE baseline retention makes it difficult to create a large increase. It is likely that students joining the ELC are more concerned about their transition to college. The fact that they ended up with a slightly higher one-year retention rate points to the success of the programme. The ELC scholarship group had a first-year retention rate of 100%. Given the large presence of students from underrepresented populations, as well as higher levels of financial need, this is a very positive sign.

Fall 2016 was the first year each ELC group had a student worker paid five hours a week to facilitate its ELC seminar. The programme worked well and continued in fall 2017. With student worker involvement, we are able to offer more ELC seminar sessions to each ELC group. Several faculty now ask to teach ELC sections, because the ELC groups are enjoyable to work with and because the student workers help with grading to free the faculty to help with the ELC. The student workers are an additional mentor available to ELC students.

Some changes were made for fall 2017. The authors are now only selecting workers who are juniors and seniors, to provide greater separation between ELC participants and workers. This is especially important given that the student workers grade some assignments. ELC seminars are now front-loaded in the fall semester with weekly sessions for the first month, then bi-weekly for the rest of the semester. The early seminars focus on social activities to help students quickly make friends and form support groups. Academic topics are covered after the first month. Based on student feedback fewer seminars are planned for the spring semester and students will be allowed more input in selecting topics or activities. By this time, the transition to college is largely complete.

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BIOGRAPHIES



Dr Trisha Egbert serves as the USciences Coordinator of the Writing Center and is an Assistant Professor for the writing programmes. Dr Egbert earned her doctoral degree from Rowan University in 2011. Dr Egbert's dissertation study focused on first-year female, minority and low-income STEM students involved in a residential learning community. Dr Egbert has taught several sections of rhetoric, expository writing, scientific and technical writing, business writing and engineering writing. These classes include traditional face-to-face writing classes, as well as hybrid courses (mix of on-line and face-to-face format).



Jess W. Everett is a Professor of Civil and Environmental Engineering and Experiential Education at Rowan University with 27 years' experience. He has conducted research in solid waste management, site remediation, sustainable engineering and pedagogy using operations research and statistical methodologies, as well as laboratory and field-based experimentation. He has worked on 70 funded projects, published 57 refereed journal articles and created five electronic Web-book for pathfinder.rowan.edu. He has been the Director of the Rowan University Engineering Learning Community (ELC) since 2009.



Felicia Crockett is a first-year PhD student studying education with a specialisation in higher and postsecondary education in the Center for Access, Success, and Equity (CASE) at Rowan University. She received her MA in higher education from Rowan University and BS in biology from Ramapo College of New Jersey. Felicia is a PhD research fellow for CASE and her research interest include access and equity issues in higher education, particularly focused on underrepresented student populations.



Dr Stephanie Farrell is Professor and Founding Chair of the Department of Experiential Engineering Education at Rowan University, Glassboro, NJ, United States of America and the 2017-18 President-Elect of the American Society of Engineering Education (ASEE). Dr Farrell has been recognised nationally and internationally for contributions to engineering education through her work in experiential learning and faculty development. Her research interests also include inductive teaching in engineering pedagogy and development of spatial visualisation skills.



Mary M. Staehle is an Associate Professor and Undergraduate Programme Chair of Biomedical Engineering at Rowan University. Before joining the faculty at Rowan in 2010, Dr Staehle worked at the Daniel Baugh Institute for Functional Genomics and Computational Biology at Thomas Jefferson University and received her PhD in chemical engineering from the University of Delaware. She also holds a BS in Biomedical Engineering from Johns Hopkins University. Dr Staehle serves as the Biomedical Engineering S-STEM Scholarship faculty advisor, and has led or participated in the ELC seminar for both scholarship and non-scholarship ELC students.