

Community-Engaged First Year Learning Community

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Introduction

First-year programs lay the foundation and serve as the front door for engineering programs. They play a significant role in recruiting and retention of a diverse student body as well as providing the foundational preparation for the upper levels of engineering programs. Programs often integrate advising and students development with curricular preparation. Many programs have common first years that a foundation for all or most engineering majors within the institution, presenting challenges to meet the needs of multiple majors across engineering [1].

Since the first year is critical for retention, many institutions have adopted initiatives that create cohorts of students in the form of learning communities. Students are placed into classes in groups with other engineering students and take one or more classes together. In some cases the students may also live together and participate in outside of class activities with other students and instructors. These approaches have shown benefits for retention and learning [2].

Pedagogical approaches can also help attract and retain diverse students. One such approach that involves students in meaningful experiences include community engaged learning, which has also been called service-learning, community-based learning and civically engaged learning. Community-engaged learning integrates work that meet the needs of an underserved segment of society and/or contributes to efforts for the common good of the local, regional, or global community with academic content [3]. The activity that meets the needs applies or connects to academic content within a course or program. The broad range of learning outcomes derived from community engagement experiences offers many ways to link to first-year programs.

The benefits of the pedagogy have been well documented and include learning gains that have been identified across a wide range of outcomes across many disciplines [4-6]. Within engineering, learning outcomes have been studied including technical and the broader professional skills needed for today's professionals [7-9]. Graduates of community engagement have reported easier transition into professional practice and benefits to their career advancement [10]. Increased retention has been reported within engineering engagement [11-13]. Improved diversity, especially in regard to gender, has also been documented within engagement [14-16].

This paper presents an approach that builds on the prior literature to create an alternate pathway through the first year in engineering that includes community-engaged learning community (LC) classes. Evidence from the experience is shared along with lessons learned.

Context: First-Year Curriculum

Purdue University has had a dedicated department or school responsible for the first-year of engineering for more than 60 years [17]. All engineering students at Purdue University are required to complete a common first year core of classes shown in Table 1. This set of requirements lays the foundation for all engineering majors. Students matriculate to their respective engineering major after completing the requirements and achieving minimum grade levels.

Table 1: First-Year Engineering Required Courses

Calculus I
Calculus II
General Chemistry I
Ideas to Innovation I
Ideas to Innovation II
English Composition
Fundamentals of Speech Communication
Physics I (mechanics)
Science Selective – (General Chemistry II, Computer Programming or Biology):

The two engineering courses, Ideas to Innovation I and II, are designed and taught by faculty in engineering education. The four main content areas are design, teamwork, major exploration and computing. While the content is integrated between semesters, the first course emphasizes design and major exploration with the second emphasizing computing skills and tools.

First-Year Learning Communities

Learning communities (LC) involve cohorts of students who take a cluster of courses and live in the same residence hall. The university has an extensive offering of learning communities and engineering has been a major participant in this initiative. LC instructors are expected to design and participate in co-curricular activities during their semester or year together with students providing experiences outside of the classroom. Students elect to participate in an LC after they are admitted to the university and make a housing registration because they are managed through the residence halls. Students apply for the learning communities and indicate their preferences for all they are interested in through a website. A central staff places students into the communities.

EPICS Program

EPICS is an engineering-centered, multidisciplinary, community-engaged design program where students earn academic credit partnering with nonprofit and community organizations to develop and deliver designs to meet needs [18]. In 2021-22, over 1300 students were engaged in 130 projects distributed across 44 sections. Each section has an average of about 16 students with 2-4 projects under development. The program is multidisciplinary with over 30 majors per year, and it includes students from their first-year to senior year. The curricular structure is designed to allow students to participate over multiple semesters and supports long-term, reciprocal community partnerships and long-term projects to be developed addressing complex and compelling needs.

Data has shown that students who are involved in EPICS early in their academic careers, report increase motivation to remain in engineering [13]. The LC was created to build a support network of peers and instructors in the LC classes to support the first-year students. Results from prior years have shown this has worked well [15] and in the most recent years as described below.

Alternative First-Year Sequence

Two semesters of EPICS were deemed appropriate to meet the design and teamwork learning outcomes. The computing outcomes, however, could not be satisfied across all project so a new course, “EPICS LC Course”, was created. It covers the outcomes related to computing skills and awareness of the engineering disciplines. Some topics, such as ethics and teaming, were also covered by the new course as well as EPICS. The sequence is shown in Table 2.

Table 2: First Year Sequence, Standard and Learning Community

	Fall Semester (credits)	Spring Semester (credits)
Standard Core	Introductory Engineering I (2)	Introductory Engineering II (2)
LC Sequence	EPICS LC Course (2) EPICS Course(1)	EPICS course (1)

Because the new course was unique to the LC, it could be customized to align with EPICS. An example is that the reflection assignments in the new course built on the EPICS experiences. For example, critical and reflective thinking is an area assessed in EPICS but first-year students often struggle. To help them, a weekly reflection was included in the common engineering course on their EPICS experience. Feedback was provided and this helped their work in the EPICS course.

The common course also provided a means to address issues that may arise in EPICS. For example, the EPICS assessments are modelled after professional performance appraisals and require students to identify their most significant accomplishments and document them for evaluation. This method is often foreign to students, but it was introduced and discussed in the common course.

All of the sections of the first-year engineering courses are taught in section sizes of 120 with one faculty member, a graduate teaching assistant and four undergraduate peer mentors. To keep the costs and resources consistent with the alternate pathway, the EPICS LC course is also taught at that size. One of the purposes of the learning communities is to provide a smaller and more personal experience. The EPICS design course has smaller sections averaging about 15 and offer a smaller experience. English and Communication courses are included as a third course and also provide smaller group experiences. The instructors collaborate between the course to create assignments that link across the courses and coordinate for the outside of class activities. Students are placed into a cohort with English, Communications or neither. The cohort without a third class is for students who brought in credit for English and Communications.

The EPICS LC has grown to 352 students in the 2021-22 cohort. The sections are not completely filled to allow room for schedule changes, conflicts and movement, especially those happening late in registration such as from AP credits. After schedules are stable close to the start of the fall semester, other students are invited in from the waiting list.

Results and Discussion

The success of the LC is evidenced in many ways. Since its inception, it has grown in popularity to where over 600 students apply to be part of it each year. This is one of most popular Learning

Communities in engineering and no additional marketing has been done by the university for this LC in particular. The largest reason stated by students for selecting the LC is the recommendation from prior students. One evaluation question asks students if they would recommend the LC to other incoming students. Figure 1 shows the results at the end of the first semester and the end of the year. The first semester in the LC is significantly more rigorous than the traditional track while the second semester is lighter. After students have a semester to reflect, those who did not want to repeat it were not changed but those who did have a good experience shifted to a better recommendation.

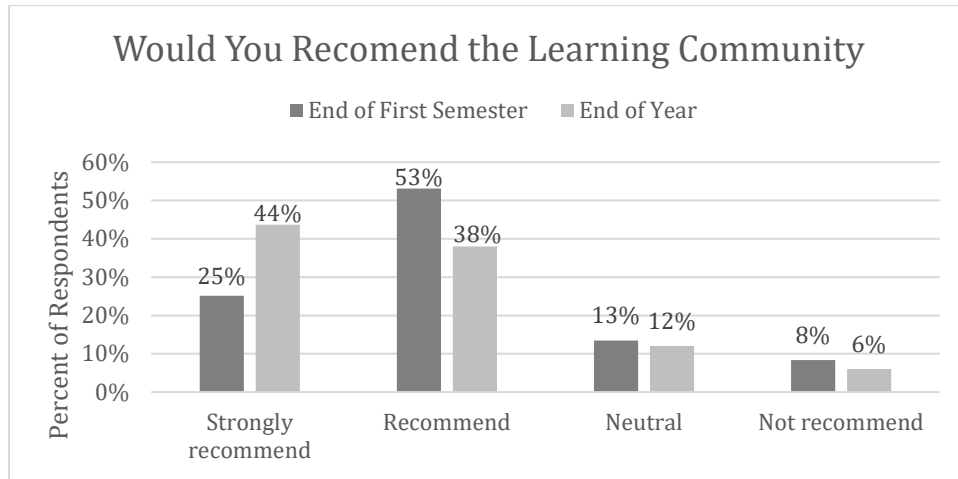


Figure 1. Learning Community Evaluation

The LC has attracted more diverse students. The Women in Engineering and the Minority Engineering Programs use it as part of their recruiting because of the success they have seen within the populations they serve. The LC has consistently drawn higher percentages of female students [15] remaining at or above 40%’s female. Figure 2 shows the last two years compared to the overall college demographics. The LC aligns with much of the research on diversity with its design in context of human, community and environment needs, strong mentoring, leadership opportunities and authentic design. Prior studies have shown that the women are seeking engineering experience and the ability to link the authentic experience with something that makes a difference in the lives of others aligns with their interests [15].

Retention is tracked for participants and Figure 3 shows the six-year graduation rate for the LC students compared to the overall college retention rates. The rates are at or above the college levels which include students from other LC’s. Future work includes exploring the impact on first-year retention as well as retention within engineering for the overall LC and demographic subpopulations.

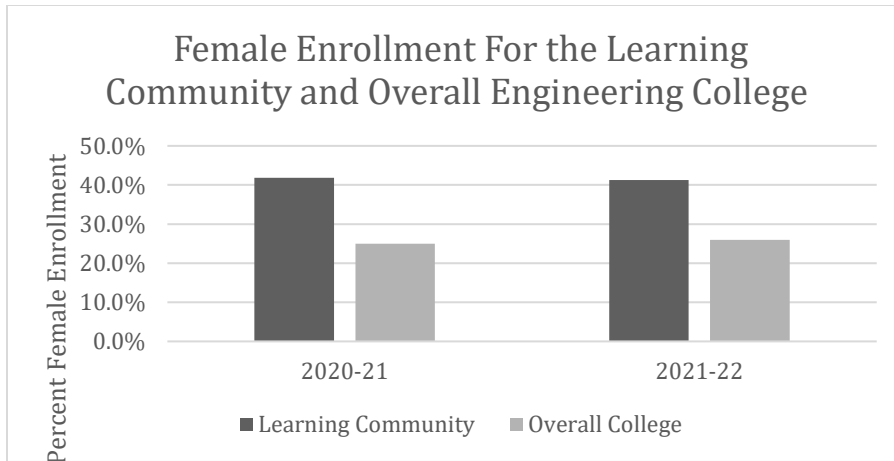


Figure 2. Percent Female Participants Compared to the Overall College

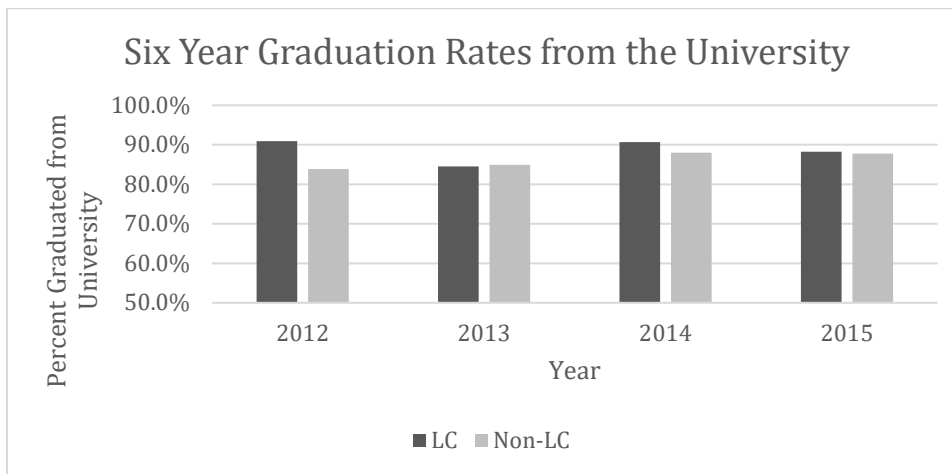


Figure 3. Six Year Graduation Rates for LC and non-LC students

The last two years have been a challenge in many ways and have complicated the LC models. Covid restrictions with masks and limits on outside of class activities has reduced the ability to create community outside of class. The overall evaluations are heartening that the work that included online sessions and the in-person classroom and co-curricular activities were sufficient for most students. The increased size to over 350 also added to the challenges of making personal connections with students. Students are in several communities from their residence hall floor, their EPICS section as well as smaller classes in English and Communication with other LC students. The multiple levels of community allow students to find ways to build community.

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