
AC 2012-3867: COMPARISON OF A FIRST-YEAR EXPERIENCE COURSE WITH AND WITHOUT A LIVING

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Comparison of a First-Year-Experience Course with and without a Living-Learning-Community Arrangement

Abstract

Central Connecticut State University has offered a First-Year Experience (FYE) program in the Department of Engineering since 2003. The program is offered through an Introduction-to-Engineering course. In the fall of 2010, a Living Learning Community (LLC) for incoming engineering students was also established. The LLC arrangement places students who volunteer for the program in the same wing of a campus dormitory and requires them to take the same Introduction-to-Engineering and math courses. The goal of this arrangement is to foster academic success, the sharing of ideas and concepts, teamwork, and study partnerships. To evaluate the benefits of an LLC to students, a comparison of attendance, final grades, one-year university retention, one-year retention in the major, and GPA for two FYE Introduction-to-Engineering sections, one with an LLC and one without, is presented. Additionally, results from a survey of both sections, which focused on the students' learning styles, study habits, time management, and campus engagement, are presented.

The results indicate that the FYE section had a larger percentage of students attending 90% or more of the classes, at 74%, than the LLC, at 63%. The LLC, however, had a larger percentage of students with a C or better final grade, at 88%, than the FYE section, at 74%. The LLC also had a higher one-year university retention rate, at 94%, compared to 87% in the FYE section, and a higher one-year retention in the major, at 63%, compared to 56% in the FYE section. The LLC also had 88% of the students with a GPA of 2.0 or higher compared to 82% for the FYE section. The LLC students were also more involved in nine of twelve on-campus activities based on the percentage of students participating one to three times in each activity. Additionally, 53% of FYE students had never visited a professor during office hours, compared to 27% of LLC students.

Introduction

First-Year Experience (FYE) is a national program designed to ease the transition of first-year students to a university with the goal of increasing student retention and success. The FYE program at our university provides an extended orientation program in each major as part of an introductory course required of all incoming first-year students [33, 34, 37]. A General Education Review prepared by a sister university [37] claims that our school "has been nationally recognized for its unique First Year Experience program ... integrating the syllabus of a first-year experience orientation course into a 'freshman only' section of a traditional introductory-level course."

Engineering departments typically offer few courses to first-term students. Our Introduction-to-Engineering course, which develops problem-solving skills and applies those techniques to engineering subject matter, has proven ideal for the inclusion of FYE activities. Within this first engineering course, classroom lectures and activities are based on a text by Eide et al. [11], which includes chapters focusing on the engineering profession, the design process, engineering solutions and problem-solving format, dimensional unit conversions, basic and inferential statistics, mass balance, statics and mechanics of materials, energy concepts, and electrical theory. The desired student-learning outcomes include:

- Familiarity with the engineering discipline
- Engineering professionalism and behavior consistent with the code of ethics
- Problem-solving and solution presentation using the engineering method and format
- Recording data, displaying it graphically, and representing it statistically
- Using customary and international (SI) units of measure interchangeably
- Applying basic engineering formulae to machine and process design
- Working effectively on teams

Originally explained in a previous work [1], FYE activities added to the introductory course fall into three categories: informative, instructional, and support services. “Informative elements included a general engineering (and engineering) technology curriculum review, a welcome and membership invitation by student leaders of the technical student organizations on campus, and a session with the Career Services organization. Instructional workshops were given on required academic integrity, proper time management, and the role of the Myers-Briggs Type Indicator (MBTI) in design team building and team dynamics. Several student support services of the university were introduced specifically those of The Learning Center and those offered by Prevention and Counseling Services.”

A number of institutions claim through the literature similar goals for their engineering and engineering-technology programs. Some provide orientation advising and brief introduction to the engineering disciplines through the use of first-year seminars [10, 15, 16, 19, 20, 21, 23, 25, 26, 38, 42]. Similar to our university’s approach, many engineering and engineering-technology curricula start with an introductory course [6, 12, 14, 21, 25, 39, 40, 41, 43]. Improvements to the introductory course have been proposed by including design topics early in the program to retain students’ interest [15, 16, 21, 24, 28, 43], offering laboratory instruction [3, 10, 14, 20], or emphasizing the development of problem-solving skills [1, 10, 15, 16, 24, 25, 39, 40, 41]. Baylor University developed a further refinement of a problem-solving course through a self-paced subject-matter-mastery program [41].

Our university also includes within its introductory course a culminating team design project to reinforce learned problem-solving principles and skill sets as an experiential-learning opportunity [2]. In many respects, this team-project effort is similar to the BESTEAMS approach (Building Engineering Student Team Effectiveness and Management System) [29, 30], which uses personal knowledge, interpersonal effectiveness, and project management. Schmidt et al. [30] report that BESTEAMS uses a team-skill training manual with “discussions of team formation, member roles, responsibility sharing, and peer evaluation” in conjunction with learning styles and their positive impact on membership diversity within project teams. Besides learning styles, Schmidt, Fines, and Pertmer [29] list other common attribute filters, including the Myers-Briggs Type Indicator (MBTI) that we chose to adopt because of its widespread use for teamwork activities in industry. This approach differentiates our effort from the BESTEAMS model.

According to Smith et al. [31], “Learning communities are a variety of curricular approaches that intentionally link or cluster two or more courses, often around an interdisciplinary theme or problem, and enroll a common cohort of students. This represents an intentional restructuring of students’ time, credit, and learning experiences to build community, enhance learning, and foster

connections among students, faculty, and disciplines.” Key goals for Learning Communities at our institution [35] include:

- Improved retention from first to second year
- Improved graduation rates
- Eased transition of students from high school to college
- Increased academic success (reflected in higher GPA, fewer academic probations, improved student satisfaction)
- Recruitment and retention of stronger students
- Enhanced interactions between students

Our university website explains [36] that “our Living-Learning Communities (LLC’s) are on-campus communities designed for students with common majors and academic interests.” Engineering is one of three majors selected to participate in the university’s pilot LLC program. Students live together in a designated dormitory area and together take one similar course in addition to the FYE course.

This Living Learning Community effort in engineering complements similar work ongoing at many other institutions. Some have created Engineering Learning Communities [18, 22, 27] while others with resident-student populations have established Engineering Living Learning Communities [4, 5, 8, 13, 27, 32], several of which include an introductory first-year-experience course [5, 18, 27]. A review of the literature [4, 13] demonstrates that the purpose of many of the initial efforts was to improve the success of underrepresented engineering student groups, and the application has been expanded to the general engineering-student population. Overall, the research indicates that these programs tend to increase student satisfaction and persistence. This paper documents our findings to date when comparing the outcomes of a FYE course with and without a LLC arrangement.

The Introduction-to-Engineering Course

The Introduction-to-Engineering course is a three-credit-hour course required of all freshmen-engineering students. The course has no prerequisites, but it serves as a prerequisite for Statics, Manufacturing Engineering Processes, and Spreadsheet and Engineering Problem-Solving Tools. This course is offered by the engineering department as a FYE class. During the fall 2010 semester, a LLC opportunity was offered for the first time as part of the FYE program for incoming engineering majors. Students who choose the LLC format live together in the same dormitory. This paper compares one section of the standard FYE course with one section of the LLC FYE course.

The Introduction-to-Engineering course introduces students to the engineering design process and to engineering problem-solving techniques, including the engineering method. The required text, *Engineering Fundamentals and Problem Solving*, is by Eide et.al. [11]. Topics covered in the course are selected from the text, and they vary according to each instructor’s preference. For this comparison, both the FYE and LLC sections were taught by the same instructor and covered identical course content. The topics included engineering ethics; trigonometry applications in solving engineering problems; graphing, including use of Excel; engineering measurements; significant digits; units and unit conversions; statistics; flowcharts; material balance; mechanics; and energy. Some topics, such as mechanics and energy, were not covered

in great detail, but were presented in an introductory fashion appropriate to the engineering profession and to future engineering courses. (Such topics were not covered on exams.) Other topics--such as graphing, significant digits, units and unit conversions, and material balance--were emphasized heavily in the lectures and in sample problems, and therefore were covered on the exams. The teaching of these topics also included homework problems that were assigned from the text and collected and graded. During the last few weeks of the semester, students were also assigned a team project that required the application of many aspects of the topics covered throughout the semester. Five FYE-specific assignments (involving participation in university-orientation experiences) were also required of the students. These FYE assignments were graded on a binary basis, with the student either completing the assignment and earning credit or not completing the assignment and earning no credit.

The following sections compare the Introduction to Engineering FYE and LLC sections in terms of student demographics, SAT math scores, attendance, FYE-specific assignment completion, final grades, one-year university retention, retention in the major, and GPA. This comparative analysis is followed by results from a student survey completed by both sections and focusing on the students' learning styles, study habits, time management, and campus engagement.

Student Demographics

The FYE section comprised 23 students: 21 males and 2 females. The FYE students were a mix of 12 commuters and 11 residents who lived in non-LLC dormitory accommodations. The LLC section started with 17 students: 15 males and 2 females. Approximately three weeks into the semester, one male student from the LLC was expelled from the University for behavioral misconduct unrelated to academic performance. Because the expulsion occurred early in the semester, all data for the LLC section is based on 16 students (14 males and 2 females). The LLC students were housed on the same floor in one dormitory, with male students in one wing and female students in another.

Scholastic Aptitude Test (SAT) Math Scores

During the Introduction-to-Engineering course, math concepts such as the solution of simultaneous equations, logarithms, trigonometry, and basic statistics are reviewed prior to their use in solving engineering problems. A comparison of math SAT scores for both the LLC and FYE sections is presented in Table 1 as an assessment of math skills of students entering the course.

Table 1. Math SAT Comparison

Math SAT Score	FYE	LLC
Average	539	594
High	630	660
Low	400	500
Median	540	600

These results clearly indicate that the LLC students have much higher SAT math scores than the FYE students.

Attendance

Studies have shown that attendance is a key metric for student success. For instance, Crede, Roch, and Kieszczyńska [9] determined that class attendance was a better predictor of college grades than other known predictors of academic performance, such as study habits and study skills.

The Introduction-to-Engineering classes met for 75 minutes twice a week. The semester ran for 15 weeks, and attendance was taken at 29 class meetings. The attendance comparison for the FYE and LLC sections is shown in Table 2. The table shows the percentage of students in each Introduction-to-Engineering class who attended the specified percentage of classes.

Table 2. Attendance Comparison

Classes Attended	FYE	LLC
100%	26%	25%
90-99%	48%	38%
80-89%	9%	25%
70-79%	9%	6%
60-69%	4%	6%
50-59%	4%	0%
< 50%	0%	0%

Both the FYE and LLC classes had essentially the same percentage of students with perfect attendance. Attendance at 90% or more of the classes, which involved missing no more than three classes, totaled 74% for the FYE section and 63% for the LLC section. If attending 90% or more of classes is considered minimally acceptable, the FYE section had a better attendance rate than the LLC section. This result is surprising because the FYE section included commuters, while all the LLC students lived on campus. However, if the minimally acceptable attendance level is dropped to attendance at 80% or more of the classes, which involved missing up to seven classes, attendance in the LLC section, at 88%, exceeded that of FYE students, at 83%. This 80% attendance rate is, however, unacceptable in this academically rigorous course.

FYE-Specific Assignments

Five FYE-specific assignments were required during the semester. The purpose of the assignments was for the students to learn more about themselves and about the university. As noted above, these FYE assignments were graded on a binary basis, with the student either completing the assignment and receiving credit or not completing the assignment and not receiving credit. The five assignments involved attending a university activity and writing a paragraph about the experience, completing the Collegiate Learning Assessment (CLA), completing a time-management diary for one week, touring the university library, and completing the MBTI assessment in preparation for the team project.

A comparison of the percentage of students in the FYE section and in the LLC section who completed the specified number of FYE assignments is provided in Table 3.

Table 3. FYE Exercises-Completed Comparison

FYE Assignments Completed	FYE % Completed	LLC % Completed
5	22	31
4	26	25
3	17	31
2	22	0
1	9	6
0	4	6

The LLC section had a considerably higher percentage of students completing all five FYE assignments, at 31%, than that in the FYE class, at 22%. The LLC section also had a larger percentage of students who completed three or more assignments, at 87%, than the FYE section, at 65%. Both sections had approximately the same percentage of students who completed one or none of the assignments, at 12%. The LLC students completed more of the FYE assignments, but whether this can be attributed to their being in the LLC remains unknown.

Final Grades

Both the FYE and LLC sections had the same grading structure. The final grade was determined by the student's completion of the following requirements: an ethics quiz, worth 15%; two exams, each worth 25%; a team project, worth 25%; five FYE-specific assignments, each worth 1%; and two homework assignments, each worth 2.5%. The final grade-distribution comparison is shown in Table 4.

Table 4. Final-Grade Comparison

Final Grade	FYE	LLC
A	13%	13%
B	17%	44%
C	43%	31%
D	9%	6%
F	17%	6%

Both the FYE section and the LLC section had the same percentage of A grades, at 13%, but the LLC section had a much larger percentage of B grades, at 44% than the FYE section, at 17%. In the FYE section, 74% of the students passed; that is, they earned grades in the A-C range. In the LLC section, however, 88% of the students passed. University policy requires that students earning final grades in the D and F ranges must retake the course before registering for any further engineering course. With final grades in the Introduction-to-Engineering course taken into consideration, then, students in the LLC section outperformed their counterparts in the FYE section.

One-Year University Retention

One of the goals of the FYE program is to improve retention rates at the university. A comparison of the FYE students and the LLC students based on one-year retention at the university is shown in Table 5.

Table 5. Comparison of One-Year University Retention

One-Year University Retention	FYE %	LLC %
Enrolled	87	94
No Longer Enrolled	13	6

The LLC program shows a clear advantage in retaining students, with 94% remaining enrolled in the university one year later, compared to only 87% of the FYE students.

One-Year Retention in the Major

A comparison of student majors one year after the Introduction-to-Engineering course is shown in Table 6.

Table 6. Comparison of Major After One Year

Major After One Year	FYE %	LLC %
Engineering	56	63
Non-Engineering	31	31
No Longer Enrolled	13	6

The results show that 7% more students remained with engineering as a major in the LLC than in the FYE section. The LLC does, therefore, show a benefit for retaining students in the engineering major.

GPA

A comparison of the student GPAs at the end of the freshman year is presented in Table 7.

Table 7. GPA Comparison

End of Freshman Year GPA	FYE %	LLC %
3.5-4.0	13	0
3.0-3.49	17	19
2.5-2.99	30	38
2.0-2.49	22	31
< 2.0	18	12

The FYE section has more top performing students (those having achieved a GPA of 3.5 or higher), at 13%, than the LLC, with none. The LLC section, however, has more students with an acceptable GPA of 2.0 or greater at the end of the freshman year, at 88%, than the FYE section, at 82%.

Results of Student Survey

A student survey was completed by both the FYE and the LLC sections at the end of the semester. In the first part of the survey, students were asked to indicate to what extent they agreed with a specific statement about themselves in regard to their learning styles and study habits with the choices “strongly agree,” “agree,” “neutral,” “disagree,” and “strongly disagree.” The survey statements and the percentage of students selecting “strongly agree” and “agree” for the FYE and LLC sections are shown in Table 8. The statements are listed in the order of the most students agreeing.

Table 8. Results of Student Learning Style and Study Habit Survey

Statement	Strongly Agree + Agree FYE	Strongly Agree + Agree LLC
I have not committed any act of academic dishonesty (copying another's work, cheating, etc.) since I have been at CCSU.	100%	100%
I have a good understanding of my personal strengths and weaknesses.	89%	100%
I can describe where to get help on this campus when I need it.	95%	100%
I have developed strong relationships with other students at CCSU	79%	100%
I regularly collaborate with others on group projects.	74%	93%
I seek out help when I have difficulty with academic work.	68%	80%
I feel a strong sense of belonging to the CCSU Community.	58%	80%
I meet all assignment deadlines.	79%	73%
I regularly discuss ideas and concepts from coursework outside of class.	53%	73%
I can explain the purpose and role of my general education courses requirements.	68%	73%
I regularly teach or tutor other students at CCSU about ideas and concepts.	10.5%	60%
I learn well on my own.	68%	53%
I have developed strong relationships with faculty members at CCSU	16%	53%
I study effectively.	58%	40%

These survey results indicate that students in the LLC had a better understanding of their personal strengths and weaknesses, had developed stronger relationships with other students and faculty members, had more frequently collaborated with others and discussed ideas and concepts

from course work outside the classroom, had more often tutored other students, and had gained a stronger sense of belonging to the university community than their counterparts in the FYE. Students in the LLC were, however, much less likely to learn well on their own. These results demonstrate that the LLC is meeting its goal of fostering student interaction, the sharing of ideas and concepts, teamwork, and study partnerships.

Learning time-management strategies is an important part of the FYE experience. In one of the FYE-specific assignments, students were asked to complete a diary of how they spent their time for one week. The results were then analyzed to gauge to what degree students were making optimal use of their time. The survey results of how students spent their time are shown in Table 9.

Table 9. Results of Time-Management Survey

How many hours do you spend in a typical 7-day week doing each of the following?	Section	0 to 5	6 to 10	11 to 20	21 to 30	31+
Preparing for class (e.g., studying, reading, writing, doing homework or lab work, analyzing data,	FYE	26%	32%	21%	16%	5%
	LLC	13%	47%	27%	13%	0%
Working for pay on campus	FYE	100%	0%	0%	0%	0%
	LLC	93%	0%	0%	7%	0%
Working for pay off campus	FYE	74%	10.5%	5%	0%	10.5%
	LLC	67%	13%	13%	7%	0%
Participating in co-curricular activities (entertainment event, clubs, student government,	FYE	42%	32%	21%	0%	5%
	LLC	47%	27%	20%	7%	0%
Relaxing and socializing (watching TV, partying, etc.)	FYE	5%	26%	32%	32%	5%
	LLC	27%	13%	27%	17%	7%
Providing care for dependents living with you (parents, children, spouse, etc.)	FYE	89%	0%	11%	0%	0%
	LLC	93%	7%	0%	0%	0%
Commuting to class (driving, walking, etc.)	FYE	74%	21%	5%	0%	0%
	LLC	67%	33%	0%	0%	0%

These results indicate that the LLC students spent more time preparing for class and significantly less time relaxing and socializing than their FYE counterparts. Both groups spent about the same amount of time participating in cocurricular activities. One LLC student had an on-campus job requiring 21-30 hours per week, while no FYE students worked on campus. A comparison of off-campus employment shows that 33% of the LLC students and 26% of the LLC students had off-campus jobs requiring more than five hours of work per week, and 10.5% of the FYE students worked more than 31 hours per week.

The student survey also measured campus engagement. Students who are engaged in campus life perform better academically and are more likely to graduate than those who do not involve themselves in the life of the university beyond the classroom. Carini, Kuh, and Klein [7] linked student engagement positively with thinking critically and earning respectable grades. The survey results indicating the degree to which students participated in various campus activities are shown in Table 10.

Table 10. Results of Student Engagement in Campus Activities Survey

In which of the following on-campus activities did you participate?	Section	Never Attended	Attended 1-3 Times	Attended 4 or More Times
Attended a talk/lecture (outside of class)	FYE	74%	26%	0%
	LLC	47%	47%	6%
Attended entertainment events on campus (e.g., movies, concerts, comedians)	FYE	32%	58%	10%
	LLC	27%	53%	20%
Hung out in the Student Center	FYE	21%	42%	37%
	LLC	20%	40%	40%
Went to Breakers game room	FYE	58%	16%	26%
	LLC	53%	27%	20%
Attended CCSU athletic events	FYE	42%	26%	32%
	LLC	20%	47%	33%
Attended and/or participated in recreational or intramural activities?	FYE	53%	16%	31%
	LLC	13%	27%	60%
Attended a residence hall sponsored event	FYE	53%	37%	10%
	LLC	13%	27%	60%
Attended a theatrical, musical or artistic performance (on campus or on a campus-related trip)	FYE	89%	11%	0%
	LLC	73%	13%	14%
Attended Thursday night events in the Devil's Den	FYE	74%	21%	5%
	LLC	60%	33%	7%
Attended other on-campus events (career fair, health fair, major fair)	FYE	53%	47%	0%
	LLC	20%	73%	7%
Did volunteer work in the community	FYE	68%	21%	11%
	LLC	47%	33%	20%
Visited a professor during his/her office hours?	FYE	53%	21%	26%
	LLC	27%	53%	20%

These survey results demonstrate that the LLC students are more involved in campus activities, although these results may be influenced by the large percentage of commuters in the FYE section, with 12 of the 23 students commuting. For nine of the twelve activities, the percentage of LLC students participating one to three times exceeds that of the FYE students. Additionally, the percentage of FYE students who have never participated in a specific campus activity exceeds that of LLC students for every activity except for that of using the Breakers game room. This may be attributed to the fact that FYE commuter students spend time in the game room between classes instead of returning home. More importantly, 53% of FYE students have never visited a professor during office hours, compared to 27% of LLC students.

Conclusions

A comparison of FYE and LLC sections of an Introduction-to-Engineering course was completed. The summary academic comparison is shown in Table 11, in which the percentage of students achieving the specified metric is shown for each section.

Table 11. Summary Comparison of FYE and LLC

Metric	FYE	LLC
Attendance at 90% or More of Classes	74%	63%
Completion of All 5 FYE Assignments	22%	31%
C or Better Final Grade	74%	88%
One-Year Retention	87%	94%
One-Year Retention in Major	56%	63%
GPA 2.0 or Higher	82%	88%

The academic benefits of an LLC, as the results demonstrate, are that a larger percentage of students complete all five FYE assignments, earn a C or better final grade, achieve an overall GPA of 2.0 or higher, have a higher one-year university retention rate, and have a higher one-year retention rate in the engineering major.

It is surprising that attendance at 90% or more of classes for the FYE students exceeds that of the LLC students, especially since 12 of the 23 FYE students were commuters. It is reasoned that perhaps the LLC students were more likely to skip class and get classroom notes from their LLC classmates. This conclusion appears to be confirmed in the survey of student learning styles and study habits (Table 8), which shows that the LLC students had developed stronger relationships with other students and faculty, had more frequently collaborated with others, and had discussed ideas and concepts from coursework outside the classroom than their FYE counterparts. These results indicate the LLC is meeting its goal of fostering student interaction, the sharing of ideas and concepts, teamwork, and study partnerships. Additional time-management-survey results (Table 9) show that the LLC students spend more time preparing for class and significantly less time relaxing and socializing than their FYE counterparts. Finally, although the student-engagement survey (Table 10) reveals that the LLC students are more engaged in campus activities, this may be a result of the large percentage of commuters in the FYE section (12 of 23 students).

The present study will be supplemented with additional data obtained from a comparison of LLC and FYE sections of Introduction to Engineering during the fall 2011 semester.

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