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AC 2009-1113: SUCCESSES OF AN ENGINEERING RESIDENTIAL-COLLEGE PROGRAM WITHIN AN EMERGING RESIDENTIAL CULTURE

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Successes of an Engineering Residential College Program within an Emerging Residential Culture

Abstract

Boise State University is in the process of transforming from a historically "commuter" campus into a metropolitan research university which includes a growing residential culture (currently 8% of students live in residence halls). First time, full time freshmen age 18 or younger have increased from 61% of the incoming class in 2000 to 72% of the incoming class in 2008. To support our growing residential culture, University Housing, in cooperation with six academic colleges, began the Residential College (RC) program in 2004. Key among the five current RC communities is the College of Engineering. The Engineering Residential College (ERC) admits first and second year students with declared majors in one of our six undergraduate programs (civil engineering, computer science, construction management, electrical engineering, materials science and engineering, and mechanical engineering) and undeclared engineering. The 2007-2008 academic year was the first during which an engineering faculty member lived in residence, the Faculty-in-Residence (FiR), with the 26 members of the ERC. The physical structure of the ERC supported collaborative work and study with student community members. Daily interaction of student ERC community members with the FiR and structured activities outside the classroom facilitated learning that enhanced engineering academics. In this paper, we discuss the qualitative life skills and quantitative academic successes of this living-learning community facilitated by a live-in engineering faculty member during the past three semesters and make recommendations for improving the overall ERC experience.

Introduction and Background

Living-learning communities are enhancing student success and enriching campus culture as Boise State University transforms from a historically "commuter" campus into a metropolitan research university.[1,2] Freshmen, age 18 or younger, have increased from 61% of the incoming class in 2000 to 72% of the incoming class in 2008. More of our students are following a traditional approach to their education, which includes residing in on-campus housing during their first and second years.

Living-learning communities support overall student academic success and retention.[3,4] To support the growing residential culture at Boise State University (currently 8% of students live in residence halls), University Housing, in cooperation with six academic colleges, began the Residential College (RC) program in 2004. Five communities were formed around similar majors or academic interests where students live and learn together. These five communities include: Arts and Humanities, Business and Economics, Civic Leadership, Engineering, and Health Professions. The Engineering Residential College (ERC) is a living-learning option for first and second year students with declared majors in one of our six undergraduate programs (civil engineering, computer science, construction management, electrical engineering, materials science and engineering, and mechanical engineering) and undecided engineering.
It is generally understood that student cohorts experience greater academic success and retention.[5,6] Research shows that students who make meaningful connections with faculty are academically more successful.[7,8] The RC program at Boise State University is further enhanced

by an individual faculty member, known as Faculty-in-Residence (FiR), who lives and learns in each of the five communities with students. The RC program enriches student learning through direct connection with live-in faculty who bridge academic and personal life, fostering interdisciplinary inquiry.[9,10] Each of the five communities is bound together by the common values of academic success, civic engagement, intellectual curiosity, and the pursuit of lifelong learning.

Students from all cultural and socioeconomic backgrounds interested in a RC community must complete an additional step in their application to University Housing. Application to participate in a RC community does not guarantee admission. Students must submit (1) a resume outlining past work experience, volunteer and extra-curricular activities, and (2) an essay explaining their interest and commitment to the RC program. Academic record is not a consideration in the resident selections process, so there is no bias toward students with the highest academic potential. The ERC admission process also does not specifically focus on at-risk students. Any student who academically qualifies for acceptance to Boise State University can choose to major in engineering or computer science (i.e., there are no additional academic requirements) and may apply for admission to the ERC. All student applications are reviewed by the FiR and selections are made based on students' overall commitment to learning and community. The resume provides the FiR an indication of students' life experiences and commitments in high school to aid in building a diverse community.

A grant from the National Science Foundation (NSF) was utilized to award scholarships to students who are academically capable (i.e., high school GPA greater than 3.0 out of 4.0) with financial need. Students who qualified for this scholarship were provided with additional funding for University Housing costs to encourage participation in the ERC because community building is one of the scholarship's tenets. Academic eligibility for this scholarship is relatively moderate, giving financially needy students with diverse backgrounds the opportunity to attend college. In this way, students participating in the ERC and NSF scholarship recipients are representative of our engineering student population. Participation in the ERC by NSF scholarship recipients included: 10 of 28 in the fall 2007 semester, 9 of 26 in the spring 2008 semester, and 6 of 22 in the fall 2008 semester).

Each RC community is supported by a program assistant (PA) who works in close relationship with the FiR in planning and executing living-learning activities. The PA is generally a second year student who has been a member of a previous RC community. As compensation, the PA receives a stipend, which includes a modest salary, and a room and meal plan. Applicants for PA must submit a resume and essay similar to students seeking only community membership. Candidates are interviewed to determine their level of maturity, commitment to the RC program, leadership ability, and optimal fit with their intended community. The PA plays a major role in providing a bridge between the FiR and student RC community members.

Selection of the faculty member for the FiR position is based on interest in exploring innovative teaching opportunities. Candidates for the FiR position must demonstrate a commitment to teaching and must be willing to serve in the position of a minimum of two years. Marital and tenure status are not part of the FiR selection process. Faculty members selected for the FiR position have a range of family situations, both married and single, and some have children.

Living arrangements, in the form of a fully functioning separate apartment, are provided for each FiR's family to reside comfortably during their appointment. Further, four of the five current FiR are pre-tenured and in their second or third year as tenure-track faculty at Boise State University. Applicants for FiR submit a letter of interest and letters of support from their college's dean and department chair to the Assistant Director of Residential Education. Candidates are interviewed to determine optimal fit with their intended community's curricular component and within a residence hall system where relationship building is a critical element of the position. Serving as FiR is considered part of the faculty's teaching workload and faculty receive course release for one semester during each year of service in this capacity.

Membership in a RC community incurs no additional cost to the students beyond that of their University Housing contract. The University, as a whole, has made a commitment to the success of our living-learning communities by pledging financial and in-kind support. University Housing, which is organizationally part of the Division of Student Affairs, has committed approximately 95% of the financial support to the RC program in the form of providing FiR apartments, meal plans, parking permit fees, PA stipends, and half of each RC community's activities budget (approximately $100 per student). The Provost's Office and involved Colleges, which is organizationally part of the Division of Academic Affairs, has provided matching funds to the RC community's activities budget and in-kind support in the form of course release time for participating FiR.

The 2007-2008 academic year was the first during which an engineering faculty member lived in residence with the 26 members of the ERC. The physical structure of the ERC was such that students lived in suites with a shared common meeting space, which facilitated collaborative work and study. Through structured activities outside of the classroom, the FiR facilitated learning that enhanced engineering academics (e.g., advising, study groups, tutors), community building (e.g., informal drop-in coffee nights, rock climbing), and supported the RC program common values. Success of these programmatic activities was assessed qualitatively (i.e., student's perceptions articulated through reflective writing) and quantitatively (i.e., academic performance in key freshman engineering courses).

Qualitative Life Skills Successes

To fully assess the successes of the ERC, we chose to first qualitatively examine the experiences of residents over the past three semesters. One of the major changes implemented in the ERC in the fall 2008 semester was a once a week required 50-minute seminar during which ERC students were exposed to aspects of engineering not typically taught in traditional engineering courses. The seminar syllabus was structured such that ERC students received academic credit for participating in in-class, community building, and community service activities.

An important element in assessing the impact of the living-learning experience on participants is in individual reflection. How did this activity affect me as an individual? Reflective writing assignments were graded according to a rubric that was used to evaluate emerging, meeting, or exceeding critical thinking and writing skills.

Seminar sessions included guest speakers to discuss the academic and career aspects of specific engineering disciplines, administration and interpretation of personality profile surveys to better

understand group dynamics, and watching and discussing documentaries dealing with topics such as sustainable building practices and alternative fuel transportation.

Activities aimed at community building included a raft trip down the Boise River with the Health Professions RC immediately prior to beginning the fall 2008 semester, a bike ride along the Boise River Green Belt to explore the multi-disciplinary engineering aspects of hydro power, and informal fireside chat drop-in coffee nights.

The Health Professions RC is located in the same residence hall as the ERC. The river raft trip was an optional activity that students from both RCs were encouraged to attend the day prior to the beginning of fall 2008 semester classes. Students and the FiRs enjoyed a cool river float on one of the last summer-like days of the year and the opportunity to make connections within and between communities. These connections translated into students from both RCs developing bonds of friendship and peer-to-peer mentoring. When asked informally what they liked best about being part of the RC program, student responses included:

- I feel like I really know the other people who are living in this hall.
- This feels like home.
- I can walk into the common area or into some of the suites and get help with my homework.
- There is a faculty [member] who lives here and I can talk to; I've never done that with any of my other teachers.

One critical element included in the ERC seminar syllabus was attending and participating in a daylong challenge ropes course. This event was an important element in building the ERC community and guiding residents toward a better understanding of their individual role in community. On Saturday, September 20, 2008, we engaged in activities to enhance individual personal development and team building. An interesting twist on the challenge ropes course experience was the weather; it rained steadily the entire morning. After the challenge ropes course, students reflected on their experiences of the day. Listed below are some of their insights:

1. Even rain can't affect how I want to make myself a better person.
2. I did know myself well enough to know if I didn't commit to [the "leap of faith"] I wouldn't do it at all.
3. This one event managed to take all that diversity and give us a common ground on which to step.
4. I was able to determine what role I was willing to take as a student in the Residential College.
5. Communication was a huge part in the ropes course, but it wasn't necessarily verbal.
6. After September 20, I feel that I can move forward and do what I need to do without fear of messing things up, and if I happen to fail, it is a learning opportunity.
7. Throughout the day, I learned that even though in my past I had been a dominant leader in pretty much everything of which I have been a part, it is OK to not be in charge.
8. By opting to go after the other five teams in my group, I had the opportunity to study the problems and challenges [those other teams] faced on the activities, so that I might learn

from them even if they weren't readily apparent. I didn't feel TOO much more ready by the time my turn came around (watching can only prepare you so much), but I still had a better idea.

9. Everyday, we must choose whether we will engage in an activity or not. Sometimes, choosing in is the optimal choice: it would be better to choose to participate in the political process and vote than to choose out. Other times, it is better to choose out: few would argue that choosing to join in [committing] a crime is preferred over choosing out.
10. The [ropes course] trip showed me that I shouldn't assume that things are impossible so quickly.
11. The [ropes] course just helped some people to open up, not necessarily to become a big leader.

The opportunity to serve as the FiR informs teaching. Each of the current FiRs have identify the experience as "one of the most rewarding at Boise State University". Each community is cohesive and creative, working together to learn more about themselves and their fields of study. The FiRs enjoy working with students to create innovative learning experiences that combine community building with academics. Some students have shared that being part of a community decreased their stress about coming to college and increased their social support network. The FiRs get to create an environment where students feel comfortable and have enjoyable learning experiences. This unique teaching opportunity translates into teaching effectiveness in the other courses taught by the FiRs. Each FiR is more aware of the reasons behind some of the unexplained classroom behavior and occasional decline in academic performance. That is, the FiRs have a greater understanding of the complexities experienced in lives of today's college students. The FiRs are able to adjust classroom activities to better suit the learning styles of today's students.

Quantitative Academic Successes

Academic success of ERC students was measured by (a) first-time, full-time freshman (FTFTF) retention from the fall 2007 semester to the fall 2008 semester, (b) current semester grade point average (GPA), (c) performance in one of three first and second-year mathematics courses (MATH.: Precalculus, Calculus I, and Calculus II), (d) performance in one of four first and second-year science courses (SCI. CRSE.: Chemistry I, Chemistry II, Physics I, and Physics II), and (e) performance in one of the four first and second-year concurrent science laboratories (SCI. LAB.). All course grade data were averaged over the three semesters included in this study (i.e., fall 2007, spring 2008, and fall 2008) to ensure adequate sample sizes. Course grades are reported out of 4.0 and were considered passing when greater than 1.7. Similar results for all other undergraduate (1) engineering or computer science students residing in on-campus housing (Eng-on), (2) non-engineering students residing in on-campus housing (Non-Eng-on), (3) engineering or computer science student who resided in off-campus housing (Eng-off), and (4) non-engineering students who resided in off-campus housing (Non-Eng-off) during the 2007-2008 academic year and fall 2008 semester were compared. These groups were selected because they represent students pursuing similar academic goals as those students participating in the ERC. Groups included students residing in both on-campus and off-campus housing to examine the effect of living in community with other students. Sample sizes for each quantitative academic success measure for each of the five groups included in this study are listed in Table 1.

Table 1: Sample sizes of each quantitative academic success measure for each of the five groups included in this study.

Quantitative Academic Success Measure	ERC	Eng-on	Non-Eng-on	Eng-off	Non-Eng-off
FTFTF retention	17[a]	51	66	99	102
Term GPA					
Fall 2007	26	82	210	504	1111
Spring 2008	26	78	202	534	1049
Fall 2008	22	70	171	640	1248
MATH.	47	126	224	866	1191
SCI. CRSE.	45	107	143	684	685
SCI. LAB.	44	108	141	651	930

[a] Both freshman and sophomore engineering students participated in the ERC, hence the sample size is smaller than the actual number of student residents.

FTFTF retention is one of the most common student success metrics used by university and college administrators nationwide.[5] In September 2004, the Provost and Vice President for Student Affairs at Boise State University charged a task force with "making recommendations for creating a campus environment that will result in a successful transition to university life for first year students." Two critical recommendations to enhance FTFTF retention were made by the task force in April 2005. First, the task force recommended increasing the admission index standard by 30%. The admission index is a formula that includes the student's high school GPA, and ACT or SAT scores. This was intended to raise the overall academic potential of students qualifying for admission to Boise State University. Second, the task force recommended providing students with opportunities to make positive and meaningful connections with faculty. The RC program was implemented, in part, to support these recommendations. Since 2004, Boise State University has experienced an overall increase in FTFTF retention. Specifically, a 2005 study showed that freshman retention at Boise State University was related (statistical significance) to living on campus and other also intangibles that added to the students' experience.[11] Stress, physical illness, and a sensed lack of support contribute to a student's choice in not returning to Boise State University after their first year.[12]

In general, students living in on-campus housing, regardless of declared major (1) exhibited higher percentage of retention from the fall 2007 to fall 2008 semester and (2) achieved greater overall academic success as indicated by Term GPA compared to similar groups not living in on-campus housing. Of the three groups living in on-campus housing, the ERC exhibited the highest percentage FTFTF retention and Term GPA. The percentage FTFTF retention from the fall 2007 semester to the fall 2008 semester is shown in Figure 1(a). Current term grade point average (Term GPA) for the fall 2007, spring 2008, and fall 2008 semesters is shown in Figure 1(b).

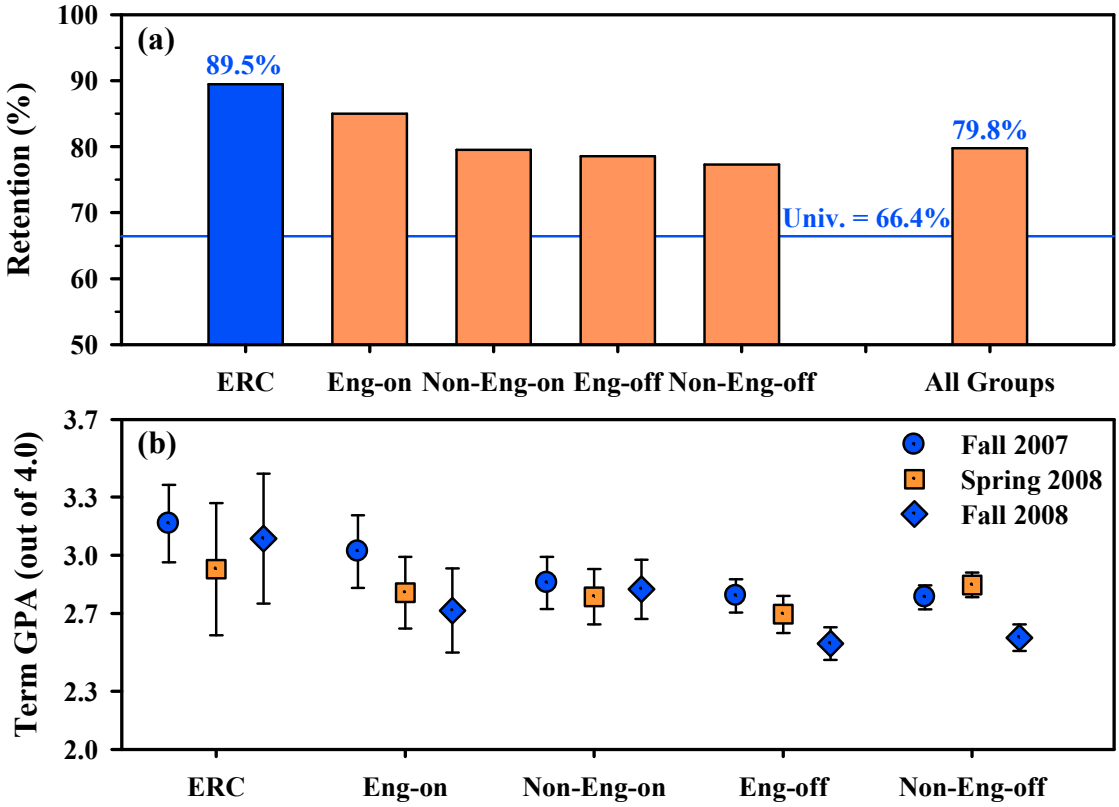

Figure 1: (a) Comparison of first-time, full time freshman retention from the fall 2007 semester to the fall 2008 semester. The solid blue line indicates overall University retention of 66.4%. (b) Comparison of current term grade point average (Term GPA, out of 4.0) for the fall 2007, spring 2008, and fall 2008 semesters.

The FTFTF retention for the five groups included in this study was 79.8% compared to 66.4% for the University as a whole. Students in these five groups are unique in that they are all enrolled in some of the most academically challenging courses undertaken by first and second-year students. Increased admission index standards play a role in assuring that all incoming FTFTF are more likely to be prepared for the challenges of college. The FTFTF retention for the ERC was highest among the five groups, 89.5%. For example, all FTFTF engineering and computer science students are required to take an introductory course where teamwork is an essential element. Students are assigned activities though which they must solve engineering or computer science problems in teams. The interaction of engineering students not living in on-campus housing is limited by their time together engaged in classroom activities. The success students in participating in the ERC may be due, in part, to its physical structure that facilitated collaborative work and access to a dedicated, live-in faculty member.

The ERC Term GPA for the fall 2007 (3.16 ± 0.20, $n = 26$), spring 2008 (2.93 ± 0.34, $n = 26$), and fall 2008 (3.09 ± 0.34, $n = 22$) semesters was higher than for any of the other four groups in this study. In general, the Term GPA declined between the fall 2007 and spring 2008 semesters. This may be due to the overall increase in complexity of courses in which students enrolled during the spring versus fall semester.

In general, students living in on-campus housing, regardless of declared major, achieved greater overall academic success as indicated by first and second year mathematics, science course, and science laboratory grades averaged over the three semesters of this study compared to similar groups not living in on-campus housing. Of the three groups living in on-campus housing, the ERC and Eng-on groups exhibited similar and the highest grades in first and second year courses (Figure 2).

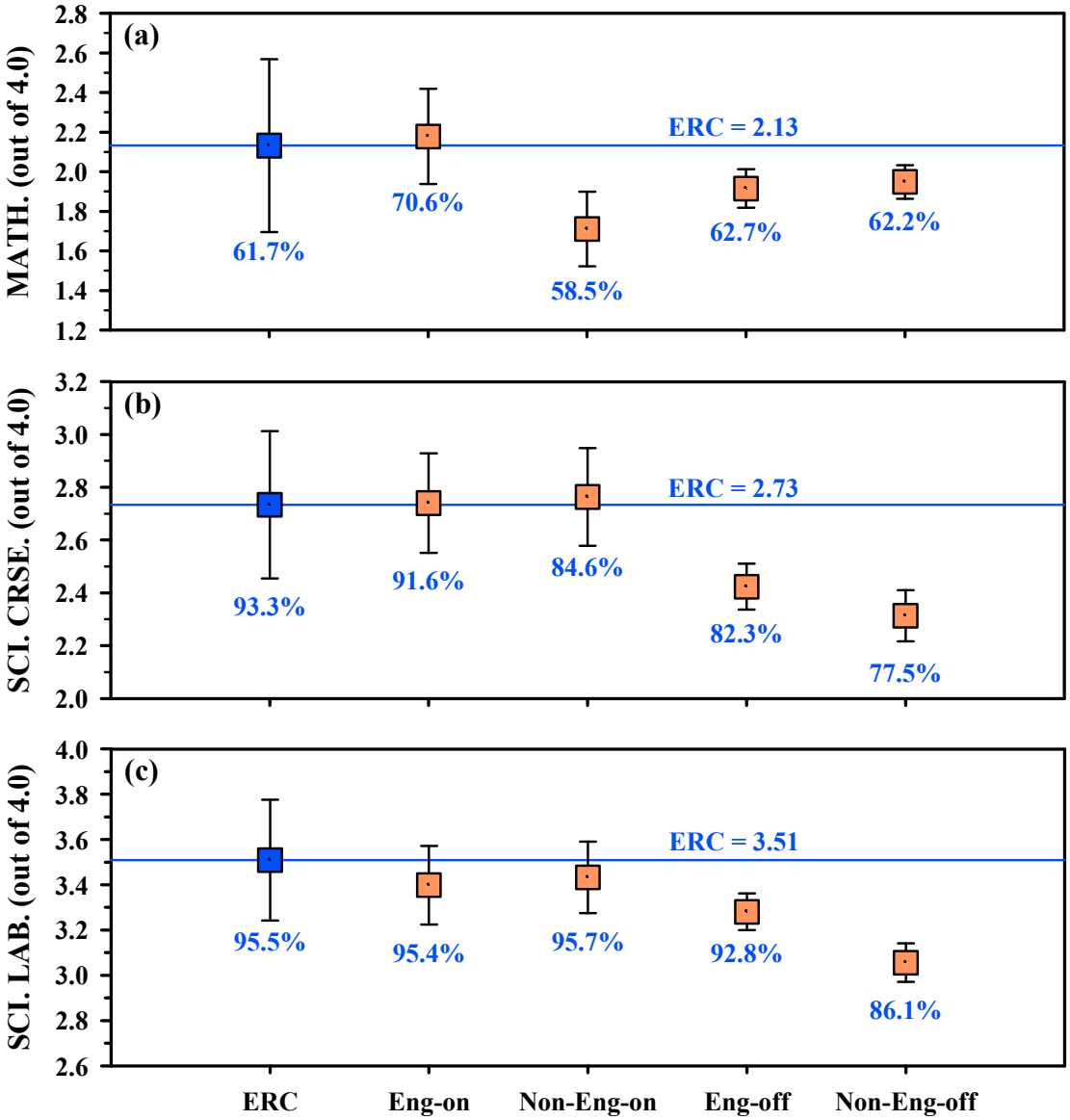

Figure 2: Comparison of academic performance in (a) one of three first and second-year mathematics courses (Precalculus, Calculus I, and Calculus II), (b) one of four first and second-year science courses (Chemistry I, Chemistry II, Physics I, and Physics II), and (c) one of the four first and second-year concurrent science laboratories. Symbols indicate course grades averaged over the fall 2007, spring 2008, and fall 2008 semesters. The solid blue line on each graph indicated the mean grade (out of 4.0) for the ERC. The values shown on each graph indicate the percentage of students passing (greater than 1.7 out of 4.0).

Average grades in one of three first and second year mathematics courses (Precalculus, Calculus I, and Calculus II) are shown in Figure 2(a). Mathematics course passing rates for the ERC (61.7%) were greater than or similar to three of the other four groups. Students enrolled in the ERC generally reported mathematics grades (2.13 ± 0.44, $n = 47$) greater than or similar to those of the other four groups. Differences in mathematics passing rates may be attributed to the smaller sample size of the ERC. These differences may indicate a need for additional academic support for mathematics in the form of scheduled tutoring within the ERC. We implemented structured mathematics tutoring sessions at the beginning of the fall 2008 semester and observed improvements in student grades and pass rates.

While any student may benefit from additional tutoring in mathematics and science, there was added value in providing tutoring and enrichment services in the ERC community, rather than at a tutoring center. The College of Engineering at Boise State University places high priority on community building. Every student's needs and interests are different, so the College provides different opportunities for students to participate in engineering communities that foster team building and student-faculty interaction. The ERC is one primary program. Others opportunities include learning communities, undergraduate research, vibrant and active student academic clubs, tutoring in the College of Engineering and the University, NASA Microgravity University, Service Learning, active cultural associations, honor society, student government, and MentorNet.

Average grades in one of four first and second year science courses (Chemistry I, Chemistry II, Physics I, and Physics II) and concurrent laboratories are shown in Figure 2(b) and (c). Science course (93.3%) and science laboratory (95.5%) passing rates for the ERC were greater than or similar to the other four groups. Science course (2.73 ± 0.28, $n = 45$) and science laboratory (3.51 ± 0.27, $n = 44$) grades for the ERC were greater than or similar to the other four communities. In general, students enrolled in the ERC have achieved similar or better quantitative academic success in first and second year science courses and laboratories. Nevertheless, these students may benefit from additional structured science and writing tutoring as part of their ERC experience.

Conclusions and Recommendations

Students who choose to reside in the ERC have an overall sense of community and satisfaction in their college experience and increased academic success. Although academic success in science courses and laboratories was comparable to other engineering and science students residing in on-campus housing, the retention rate of the ERC students was 5 to 10 percentage points higher than any of the other four groups included in this study. Students in the ERC over the last three semesters have experienced quantitative academic success greater than or similar to other groups enrolled in first and second year mathematics and science courses. We implemented structured mathematics tutoring sessions at the beginning of the fall 2008 semester and observed improvements in student grades and pass rates. Incorporating structured academic support outside the classroom and within the living experience is a critical element in improving success.

Daily interaction of student ERC community members with the FiR and structured activities outside the classroom facilitated learning that enhanced engineering academics. Structured community activities help to enhance the overall RC experience and build a stronger sense of

community for its residents. Activities structured to explore individual personal development and team building serve to enhance qualitative life skills that employers are looking for in potential employees with the same level of importance as technical engineering skills and competency.

Although academic performance among students in the ERC was, in some cases, slightly higher or similar to that of the other four groups included in this study, FTFTF retention of ERC students was much higher. Other factors of the ERC student experience, such as feeling a sense of community and overall satisfaction with their first college, are explanations for their higher FTFTF retention.

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