AC 2011-467: ASSESSMENT OF FIRST YEAR EXPERIENCES AT SJSU

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First Year Experiences at SJSU

Abstract
San José State University (SJSU), located in San José, California, is the oldest campus in the California State University (CSU) system. SJSU produces an exceptionally rewarding learning environment for students, especially for those learning to become engineers. With nearly 5,000 students, the Charles W. Davidson College of Engineering (CoE) is the largest provider of engineers to Silicon Valley companies and is ranked 12th among engineering programs for master's-level institutions in 2009 *U.S. News & World Report*'s listing of "America's Best Colleges." The campus is classified as a Carnegie "Community Engagement campus."

To increase student retention in engineering programs, CoE offers several first-year experience (FYE) programs including residential and non-residential student learning communities, advising and support centers, and introductory engineering courses. These programs strive to increase student retention rates through three strategies: immersion, community, and hands-on learning. This paper will discuss the College's efforts to increase retention and graduation rates of its incoming freshmen students.

Introduction

SJSU is a fully-accredited, public, comprehensive university offering bachelor's and master's degrees in 134 areas of study to more than 30,000 undergraduate and graduate students in seven colleges. SJSU is accredited by the Western Association of Schools and Colleges (WASC) and many different programs are accredited by program specific accrediting agencies. As one of the 23 campuses in the CSU system, SJSU is a leader in high-quality, accessible, student-focused higher education. With 23 campuses, almost 433,000 students, and 44,000 faculty and staff, the CSU is one of the largest, most diverse, and affordable university systems in the country.

SJSU faculty and staff are dedicated to achieving the university's mission: to enrich the lives of its students, to transmit knowledge to its students along with the necessary skills for applying it in the service of our society, and to expand the base of knowledge through research and scholarship. For both undergraduate and graduate students, the university emphasizes the following goals: in-depth knowledge of a major field of study; broad understanding of the sciences, social sciences, humanities, and the arts; skills in communication and in critical inquiry; multi-cultural and global perspectives gained through intellectual and social exchange with people of diverse economic and ethnic backgrounds; active participation in professional, artistic, and ethnic communities; and responsible citizenship and an understanding of ethical choices inherent in human development.

The Charles W. Davidson College of Engineering is ranked 12th among engineering programs for master's-level institutions in the 2009 edition of "America's Best Colleges" by U.S. News & World Report. Close ties with Silicon Valley industry provide access to scholarships, internships, research projects, and employment for engineering students.

SJSU ranks comparatively low against similar universities in terms of six-year graduation rates. The first-year retention rate is 81% and the six-year graduation rate is 46.4% which is lower than comparable CSU campuses (see Figures 1 and 2). While six-year graduation rates at the University are disappointing, the rates for African American (38.7%) and Latino (39.9%) males are truly dismaying and unacceptable. The retention and six-year graduation rate in the College of Engineering is even lower than the university overall, particularly for African American and Latino students.

As a result of an examination and reflection on the causes of the low retention and graduation rates, the College established the 15x12 Initiative, with the goal of increasing our graduation rate 15% by the year 2012. We decided to focus on improving the effectiveness of our first-year experience (FYE) programs, as well to complete a major overhaul of our advising systems and methods. This paper focuses on the FYE programs. The effect of advising improvements will be discussed in a later paper.

Our FYE components are based on effective research practices developed at SJSU and other institutions. Our overarching theoretical model for student retention is based on Vincent Tinto's model.[1 2] We adapted this model, based on additional research,[3 4 5 6] to address the needs of URM students at SJSU. Tinto's model posits student retention as a complex, multifaceted environment; students' background characteristics, educational goals, commitment to their goals and to the institution, and the degree of student engagement all contribute to retention. According to this model, effective and positive interactions in college should increase the student's commitment and effort in college, and thereby, increase student retention.

Figure 1. 1-year retention rates for College of Engineering students

Engineering	Fall 2005	Fall 2006	Fall 2007	Fall 2008	Fall 2009
Number Entering	389	390	504	625	428
Overall Rate	81.5%	80.0%	79.6%	81.0%	85.7%
African-Amer	60.0%	82.4%	68.0%	86.5%	75.0%
Asian	85.1%	81.0%	84.0%	83.7%	87.5%
Hispanic	76.1%	75.9%	71.0%	76.1%	84.7%
White	80.0%	79.8%	80.0%	82.1%	87.0%

Figure 2. 6-year Graduation Rates for College of Engineering students

Engineering	Fall 2001	Fall 2002	Fall 2003	Fall 2004
Number Entering	598	569	381	413
Overall Rate	37.0%	38.1%	40.2%	44.1%
African-Amer	20.0%	11.5%	29.4%	37.5%
Asian	40.4%	42.3%	46.2%	49.2%
Hispanic	30.3%	25.0%	25.0%	30.3%
White	35.8%	34.8%	43.7%	49.5%

To understand what leads to the low retention and graduation rates, it is important to separate the issues of retention and time to graduation. Figure 3 shows the retention rates for the most recent cohort of students (entering Fall 2008) who are still enrolled at SJSU after their first two years.

Much of the low retention rate is due to poor mathematics preparation, such that it often takes students one or more years to reach their first level of calculus for their engineering degree. In addition many students work more than 20 hours per week, thus lowering their unit loads and taking longer time to graduate.

Figure 3. Overall Student Tracking by Cohort - College of Engineering. Fall 2008 First Time Freshmen

	Continuing semester				
	Fall 2008 - Entering	Spring 2009	Fall 2009	Spring 2010	Fall 2010
Continuation	**625**	588	506	486	467
Continuation Rate	100.0%	94.1%	81.0%	77.8%	74.7%
Degree Awarded	0	0	0	0	
Graduation Rate	0.0%	0.0%	0.0%	0.0%	
Retention Rate	100.0%	94.1%	81.0%	77.8%	74.7%
Average Term GPA	2.70	2.41	2.47	2.44	
% Good Standing	82.9%	80.6%	87.2%	88.7%	

Because of the low 1-year retention and 6-year graduation rates, the College of Engineering began to focus its efforts on retention and graduation. Extensive research in engineering and other disciplines has shown that FYE programs are linked with higher retention and graduation rates, better academic performance, more student involvement, and more frequent and meaningful interactions with faculty.

Although students' aptitude in engineering used to be linked with their persistence rates, engineering education has begun to change. Research suggests that students who leave engineering are often in good academic standing and performing well in the classroom.[7] Educators are seeking to understand student retention as it relates to advising, counseling, learning communities,[8] mentoring,[9] tutoring,[10] and programs designed for women and other minority students.[11] [12] These "high-impact" practices are often linked with higher student performances, learning, and development.[13, 14] A report by Kuh (2008) recommends that every student would benefit from participating in two high-impact practices, one in their first year and another in their major coursework.[15]

At SJSU, we have implemented three high-impact practices, specifically targeted for freshmen students: student learning communities, advising and mentoring, and FYE courses. Through these various practices, we have documented an overall increase in student retention and graduation over the past few years. This paper will describe our efforts to improve the first year experience in the Charles W. Davidson College of Engineering at SJSU.

Student Learning Communities

Student learning communities are created by enrolling a cohort of students in a collection of courses together. They often provide students with an identifiable peer group and make the campus feel more intimate.[16] Several studies reported that student learning communities significantly improve retention rates for underrepresented minorities and underserved populations.[17] [18] [19] CoE provides two student learning communities for engineering freshmen: Community for Engineering Learning and Living (CELL) and Engineering Learning Community for Academic Success (ELCAS).

The Community for Engineering Learning and Living (CELL) is a themed living community offered by the University Housing Services for first-year engineering students. CELL's objectives are to provide a cooperative learning environment, to encourage and build the engineering community and to foster a sense of belonging and responsibility to the community. Through facilitated study groups, CELL students will experience the academic support and cooperation of a community committed to academic success. CELL students will have regular access to faculty, advisors, and industry professionals through workshops and programs. CELL is about shared experiences and creating a vibrant and caring engineering community.

CELL students participate in the following activities:

- Academic advising workshops and tutoring/study groups on a regular basis
- Meeting with a peer advisor every three to four weeks for the entire academic school year
- Participating in Campus Village residential programs and CELL monthly community meetings
- Participating in facilitated study groups (e.g. (i.e. Algebra/Trig, Pre-Calculus, Calculus) by trained facilitators
- Participating in workshops facilitated by industry or faculty covering the various topics in engineering (e.g. latest technology, research, job opportunities) and networking with other students and professionals who are involved in engineering (e.g. HP, Lockheed Martin, IBM, engineering societies like SWE, BASE, and SOLES)
- Learning how to enhance their overall wellbeing to correspond with a lifestyle of being an engineer (e.g. team building activities, ice breakers, time management, study skills, etc.)

CELL started in Fall 2006 and there have since been five cohorts of CELL engineering freshmen: 42 students in AY 06-07, 41 students in AY 07-08, 45 students in AY 08-09, 43 students in AY 09-10, and 50 students in AY 10-11 with 41-50 students in each cohort. All entering Engineering freshmen are notified about the CELL program and they self-select to participate in it. SJSU has compared the demographics of CELL students with all CoE freshmen and has not found any significant differences between CELL students and all CoE freshmen. However, given that CELL students must complete an online application, it is possible that they are more highly motivated than their peers to excel academically.

Participation in CELL has been shown to increase student retention rates and GPAs, compared with all students in the college (see Figure 4). For all COE freshmen entering Fall 2008, the 1-year retention rate was 81%. The 1-year retention rate for Fall 2008 CELL students was 84.4%.

The 2-year retention rate of Fall 2008 CELL freshmen was 86.7%. In comparison, the 2-year retention rate for all Fall 2008 CoE freshmen was 74.7%.

A more impressive statistic is the major prep GPA of CELL students versus all other engineering students. Our college has been tracking the major preparation GPA of all undergraduates in order to track students who might be getting into academic problems in their majors. The Major Prep GPA is defined as all lower division math, science, engineering courses plus the first two English courses (Engl 1A and 1B). The data from the last academic year (Spring 2010 GPA) shows that 16% of our population as a whole has a GPA of less than 2.1 in their major preparation. In comparison, fewer CELL students have low major prep GPAs. For the CELL cohort entering Fall 2007, 11.8% had major prep GPAs less than 2.1. For the CELL cohort entering Fall 2008, only 9.5% had major prep GPAs less than 2.1. This evidence suggests that not only are CELL students retained better in the College and the university, they perform better in engineering-related coursework.

Figure 4. Retention rates and GPA for CELL freshmen and CoE freshmen (Fall 2006-Fall 2010)

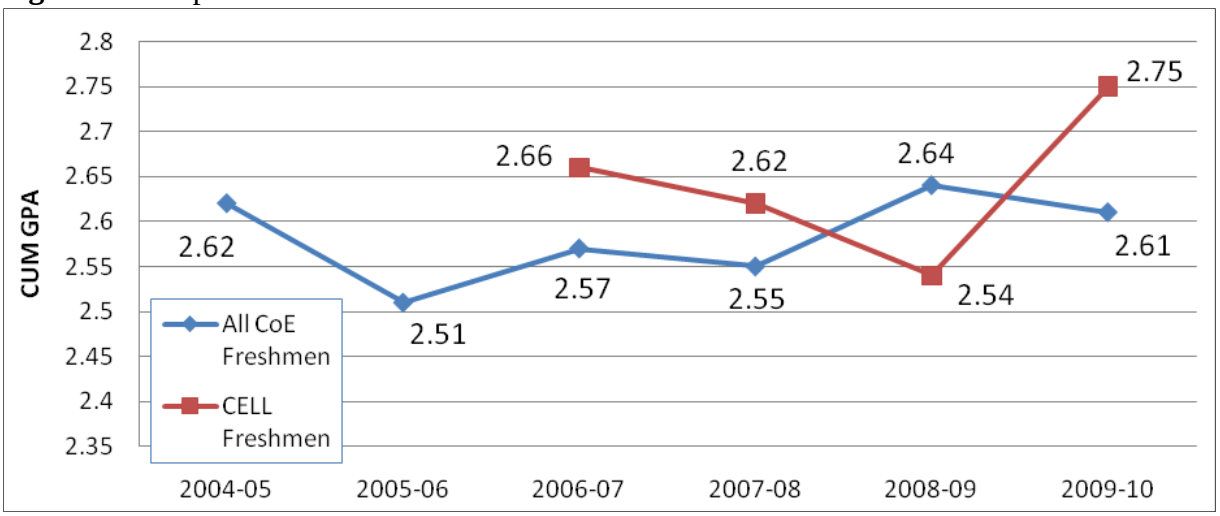
	FA 2006	**FA 2007**	**FA 2008**	**FA 2009**	**FA 2010**
Total CELL freshmen	42	41	45	43	50
1 year university retention rate for CELL freshmen	87.8%	87.8%	84.4%	88.4%	--
2 year university retention rate for CELL freshmen	87.8%	75.6%	86.7%	--	--
1 year avg. GPA	2.66	2.62	2.54	2.75	--
	FA 2006	**FA 2007**	**FA 2008**	**FA 2009**	**FA 2010**
Total CoE freshmen	389	501	625	428	395
1 year university retention rate for all CoE freshmen	80%	79.6%	81.0%	85.7%	--
2 year university retention rate for all CoE freshmen	67.4%	72.8%	74.7%	--	--
1 year avg. GPA	2.57	2.55	2.64	2.61	--

The 1-year cumulative GPAs for CELL freshmen are generally higher than for all CoE freshmen (with the exception of the Fall 2007 CELL cohort). As seen in the figure below, the cumulative GPA for Fall 2009 CELL freshmen is significantly higher than for all CoE freshmen.

The Engineering Learning Community for Academic Success (ELCAS) program provides a supportive environment for non-residential engineering freshmen through a cohort system. Ten to twenty students are grouped and enrolled in the same class sections for selected courses, helping them form peer networks. Throughout the semester, there are facilitated study groups, tutoring, academic support services and social events; most of these are held together with CELL cohorts. ELCAS started in Fall 2007 and there have since been four cohorts of engineering freshmen (see Figure 4). Similar to the CELL program, the 1-year retention rate for Fall 2007 and Fall 2008 ELCAS freshmen was higher than all CoE freshmen (92% in Fall 2007 and 83.3% in Fall 2008).

The two year retention rate for Fall 2007 and Fall 2008 ELCAS students was also higher than all COE freshmen (83.8% in Fall 2007 and 83.3% in Fall 2008).

Figure 5. Comparison of Cum GPA for CELL students and all CoE freshmen



In comparing the major prep GPA of ELCAS students versus all other engineering students, the data suggests that ELCAS students do not perform as well as all engineering students in their engineering coursework. The major prep GPAs for our two of our three ELCAS cohorts were significantly higher: 25% of the Fall 2008 ELCAS cohort and 40% of the Fall 2009 ELCAS cohort had major prep GPAs <2.1.

Figure 6. Comparison of retention rates for ELCAS freshmen and CoE freshmen (Fall 2006-Fall 2010)

	FA 2007	**FA 2008**	**FA 2009**	**FA 2010**
Total ELCAS freshmen	38	36	17	33
1 year university retention rate for ELCAS freshmen	92%	83.3%	81.2%	--
2 year university retention rate for ELCAS freshmen	83.8%	83.3%	--	--
	FA 2007	**FA 2008**	**FA 2009**	**FA 2010**
Total CoE freshmen	501	625	428	395
1 year university retention rate for all CoE freshmen	79.6%	81.0%	85.7%	--
2 year university retention rate for all CoE freshmen	72.8%	74.7%	--	--
1 year avg. GPA	2.57	2.55	2.64	2.61

Advising and Support Programs

CoE offers two advising and support programs to provide advising and mentoring to all engineering students: Engineering Student Success Center and MESA (Mathematics, Engineering, and Science Achievement) Engineering Program.

The Charles W. Davidson College of Engineering Student Success Center (ESSC) includes an infrastructure that provides academic, career, co-curricular, and advising programs for engineering students. It is an inclusive environment that fosters collaboration and responsibility among students, staff, and faculty. The mission of the ESSC is to empower engineering students from application to graduation, to support their academic and personal growth, and to engage them as lifetime members of the college learning community.

The ESSC's main goal is to support engineering students and the college learning environment by collaborating with on-campus and off-campus partners. The ESSC is the linchpin to the development and enrichment of a vibrant learning community in Silicon Valley. The ESSC will strive to increase student retention in the College by 15% by 2012.

The MESA (Mathematics, Engineering, and Science Achievement) Engineering Program (MEP), supports educationally disadvantaged and first-generation college students seeking degrees in engineering or computer science. MEP provides personal advising and specialized workshops, organizes industry tours, promotes professional organizations built around student affiliate groups, and raises awareness about scholarship opportunities. While MEP welcomes all student participation, it strongly encourages participation of students stemming from groups with historically low participation rates in college admissions. In Fall 2010, 80% of MEP students identified as Latino and 26% were female.

As discussed above, the data from Spring 2010 GPA show that 16% of our population as a whole have major prep GPAs < 2.1. In comparison, for the MEP students, only 9% have major prep GPAs < 2.1. This is strong indication that the MEP program is successful in helping students perform better than the college as a whole.

First Year Experience Courses

The purpose of a FYE course is to acclimate students to living and learning in a college environment. Research shows that participation in a FYE courses significantly improves student persistence from freshmen to sophomore year.[20 21 22] CoE offers two FYE courses to teach basic study skills and introduce students to various disciplines within the college: Engineering 8 (Engineering Success) and Engineering 10 (Introduction to Engineering).

The first course, ENGR 8, facilitates changes in students' behaviors and attitudes to improve student success and retention. This course was adapted from a textbook by R. B. Landis[23] and was first offered in Fall 2009. The course is designed around the following course learning objectives: (1) Discuss the value of higher education to individuals and society; (2) Locate academic and co-curricular experiences and resources at ABCU that will help them achieve their educational goals; (3) Identify the skills and attitudes that contribute to academic success as a university-level scholar and assess their own strengths and limitations in those areas; and (4) Demonstrate an ability to participate actively and respectfully in class discussions and dialogues, recognizing how their own and others' identities influence their interactions and how to bridge differences.

Students in Engr 8 attend two, one-hour lectures each week in which they discussed academic skills and strategies for university success. They must attend two campus events during the semester, consult with an academic advisor, and maintain a weekly course journal. This course provides students with the structure and information to form effective study habits during their first year at college.

Engr 8 was designed with embedded assessment, one of which was the Pittsburgh Freshmen Engineering Attitudes Survey. This survey measures several facets of students' attitudes, such as their opinions about aspects of the engineering profession and the reasons that they chose to study engineering. In total, the pre-survey contains 50 items and the post-survey contains 70 that are rated on either five-point Likert scales or ordinal-based self-assessed confidence scales.

After analyzing the pre- and post-survey data from Fall 2009, our data indicates the following results:

- 95% of the students believe that engineers have contributed greatly to fixing problems in the world (11% increase)
- 89% of the students feel confident in their ability to succeed in engineering (1% increase)
- 81% of the students feel confident about using their knowledge of mathematics to solve relevant engineering problems (no comparative data)
- 76% of the students felt knowledgeable about what an engineer does (28% increase)
- 67% of the students said they had no desire to change to another major. (4% increase)
- 86% of the students identified with a racially underrepresented minority group. (no change)

The pre- and post-tests were made available online through SurveyGizmo.[24] The response rate for the pre-and post-survey was 83% (85 out of 102 students) across three Engr 8 courses.

The second course, ENGR 10 (Introduction to Engineering), is designed to allow students to explore engineering through hands-on design projects, case studies, and problem-solving using computers. Students learn about various aspects of the engineering profession and acquire both technical skills and non-technical skills, in areas such as communication, team work, and engineering ethics. The class was restructured to focus on the following goals: (1) Provide an engaging and fun experience for students to explore engineering topics; (2) Increase retention for freshmen in the College of Engineering; (3) Give an early taste of engineering; (4) Expose students to the design process; (5) Present the global picture of engineering; (6) Provide engineering skill development; (7) Provide students with team work activities.

Figure 7. Number of Students Enrolled in Engr 10 (Fall 2006-Fall 2010)

	FA 2006	**FA 2007**	**FA 2008**	**FA 2009**	**FA 2010**
Freshmen	124	228	306	236	220
Sophomore	36	35	47	30	20
Junior	29	20	20	29	47
Senior	41	14	30	17	7
Post-Bac	1	3	4	3	0
TOTAL	**231**	**300**	**407**	**315**	**294**

Students in Engr 10 attend two, one-hour lectures each week in which guest speakers discuss various aspects of the engineering profession, global and environmental issues, engineering tools, and non-technical skills such as communication skills, team skills, and engineering ethics. All students also attend a three-hour laboratory each week. In the lab, students are engaged in at least four different projects using a team-based approach. This project links directly to the College's mission: be a learning community that empowers its students to **better the world through innovative applications of engineering knowledge and skills.** In addition to funding curriculum development by the faculty team, the College invested over $300K in updating the Engr 10 laboratories.

When comparing the grades of students enrolled in Engr 10 in Fall 2006 to Fall 2007 and Fall 2008, the data indicates that students had higher achievement rates in Engr 10 in Fall 2007 and Fall 2008 (see Figure 8).

Figure 8. Comparison of Student Grades in Engr 10. Fall 2006-Fall 2010

	FA 2006	FA 2007	FA 2008	FA 2009	FA 2010
A+, A, A-	95	146	257	134	170
B+, B, B-	85	136	128	149	104
C+, C, C-	24	4	12	21	13
D+, D, D-	9	3	5	5	3
F/WU	18	11	5	6	4
Average GPA in the class	**2.95**	**3.31**	**3.51**	**3.24**	**3.46**
Average overall grade in class	**B**	**B+**	**A-**	**B+**	**A-**

In Spring 2008, we conducted an in-depth assessment of student learning gains in Engr 10. The preliminary analysis of the data indicates that the following positive results from Engr 10.

- The students seem to "get" teamwork. They place a lot of value in their peers.
- The students seem to want to stay in engineering (though we don't know how much influence is from this class)
- They really like the hands on projects (especially the robot)

There were several areas that were identified as issues in the current course:

- The ethics portion of the course isn't working at all.
- The students really like the robotics but have mixed feeling about the other projects.
- The Excel project should be revised.
- The Solar cell project should be revised to be more challenging.
- The lectures need to have a bit more interaction.
- The Blackboard website isn't working well for them.

We conducted additional assessment of the class in Fall 2008. The two least effective assignments were the Excel assignment and the presentations about ethics (see Figure 9). Based on this assessment, we are in the process of revising the entire Ethics portion of this class and evaluating it in this current academic year.

Figure 9. Student feedback about assignments in Engr 10 (Spring 2008 and Fall 2008)

Assignments, graded activities, and tests	**SP 2008**			**FA 2008**		
How much did each of the following aspects of the class help your learning?	**N**	**Mean**	**Std dev**	**N**	**Mean**	**Std dev**
Wind turbine project	85	4.1	0.91	145	3.9	1.00
Solar cell project	83	4.0	1.03	125	3.4	1.15
Robotics project	84	4.3	0.95	145	4.1	1.05
Excel project	85	3.5	1.28	146	3.3	1.14
Presentations about ethics	85	3.1	1.34	151	3.2	1.12
Increases in your skills	**SP 2008**			**FA 2008**		
As a result of your work in this class, what gains did you make in the following skills?	**N**	**Mean**	**Std dev**	**N**	**Mean**	**Std dev**
Making ethical decisions as an engineering	84	3.6	1.26	151	3.6	1.17
Designing solutions to engineering problems	85	4.0	1.06	150	3.8	1.00
Writing lab reports	84	3.7	1.12	145	3.5	1.22
Using excel to solve problems in engineering	85	3.6	1.18	147	3.5	1.04
Using Inventor 2008	85	3.8	1.13	147	3.8	1.09
Using C programming	83	3.5	1.31	142	3.3	1.28
Using soldering skills	74	3.7	1.36	130	3.6	1.30
Working effectively with others	85	4.1	1.07	146	4.0	1.13
Preparing and giving oral presentations	85	3.5	1.06	145	3.5	1.19

Conclusion

Because of the low 1-year retention and 6-year graduation rates, the College of Engineering has begun to focus its efforts on retention and graduation. Extensive research in engineering and other disciplines has shown that FYE programs are linked with higher retention and graduation rates, better academic performance, more student involvement, and more frequent and meaningful interactions with faculty.

Our approach to increasing student retention has many facets and includes curricular and co-curricular components. Our approach is data-driven and we are continually evaluating and monitoring our FYE components to assess their effectiveness. Our main goal is to develop strategies for improving student success by coordinating and communicating the college's efforts that promote student success. This will assist us in understanding the "dynamics among the individual, institutional, and environmental variables to develop concerted institutional intervention strategies that will have an effect on the persistence process" at our university.[25]

Research has documented that a better managed university experience brings many dividends to the institution including increased student retention.[26] Through our college's many FYE initiatives, student support services will be integrated with advising to address the complex and holistic needs of our students.

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