University Learning Skills: A First Year Experience Orientation Course for Engineers

Dr. Eric P. Soulsby
University of Connecticut
School of Engineering
Storrs, CT 06269

Abstract *- Knowing the 'smart' way to approach academic and personal challenges can make a big difference in the undergraduate experience at a university. University Learning Skills (ULS), an optional First Year Experience (FYE) one-credit orientation course, was established at the University of Connecticut three years ago in an effort to help students modify their high school study habits to those needed for success in college.*

Data on retention shows an alarming figure of 20-30% of engineering students departing after the first year. The high number of students who either have academic difficulty or decide to change careers prompted the creation of the ULS course.

The ULS course includes material on study skills such as time management, the Cornell note-taking method, and the SQ3R approach to textbook reading. It also introduces students to engineering facilities and university offices such as counseling services, career services, library, etc. Improved retention of these students who take the ULS course has occurred.

Student evaluation of the course has been positive with 3 out of 4 feeling that it met or strongly met the objective of promoting a positive adjustment and assimilation into the university.

Introduction

At the University of Connecticut, we have experienced a relatively dramatic decline in enrollment in the School of Engineering over the last two decades. From a high of 2060 students in 1982, the school showed a fall 1997 undergraduate enrollment of 947. In large part, the reason for the decline in enrollment has to do with demographics in the northeast part of the country which have exhibited a decline in the number of students in secondary schools and subsequent college attendees. There has also been a decline, both regionally and nationally, in the percentage of high school graduates seeking to pursue engineering. Fortunately, this "baby bust" appears to be beginning to show a turnaround, as noted in fall 1997 enrollment data compiled by the Engineering Workforce Commission [1].

The decline in enrollment, however, prompted a look at how well we were doing in retaining those students who seek the engineering degree and in how well students proceed through the four-year curriculum. The notion that we are perhaps not retaining those that start in engineering as well as we may have in the past, prompted a look at retention data for engineering students.

University of Connecticut Retention Data

A comparison of the 1993 graduating class in engineering with that from 1974 showed that 20% of the 1993 graduates had completed the degree in a four-year period, compared to 53% two decades earlier. Eighty-eight percent of the 1974 graduates, compared to 80% of the 1993 graduates, had completed the degree in five years or less. Of the 1974 graduates who finished in five years, 38% had taken summer classes to do so, while 53% of the 1993 graduates had taken some summer work. While some of this difference is due to students taking cooperative education work experience assignments (something not offered in the 1970's, with roughly 20% of the 1993 graduates participating), it appears that a trend toward a 'normal' five-year completion exists.

Given the desire of many of today's families to minimize the cost of obtaining the baccalaureate degree, it was surprising to see the higher number who were taking longer and needing summer work. There seemed to be a change in the ability of engineering students to finish the degree program in four years. This led to a concern about whether students were entering with appropriate study skills to enable timely completion of the degree and about attrition in engineering overall. The following table shows the four-year graduation rate for students who started the first-year in engineering, along with an indication of their status upon departure from the school:

ENGINEERING GRADUATION AFTER 4 YEARS	1991 Entry	1992 Entry	1993 Entry	1994 Entry
Graduated	9%	8%	10%	11%
Still Active	29%	28%	27%	28%
Changed Major	26%	28%	32%	28%
Canceled Registration	5%	6%	5%	7%
Withdrew	7%	2%	4%	2%
Inactive/No-show	3%	4%	3%	4%
Dismissed	21%	23%	19%	19%

As seen, after *four* years

- 10% complete the degree.
- Almost 30% remain active in pursuit of the degree.
- 30% switch to another major within the university.
- Almost 15% depart for non-academic reasons.
- 20% depart for failure to meet academic standards.

0-7803-5643-8/99/$10.00 © 1999 IEEE

ENGINEERING GRADUATION AFTER 5 YEARS	1991 Entry	1992 Entry	1993 Entry
Graduated	29%	27%	32%
Still Active	9%	10%	4%
Changed Major	26%	27%	32%
Canceled Registration	5%	6%	5%
Withdrew	8%	2%	4%
Inactive/No-show	4%	5%	3%
Dismissed	20%	22%	19%

After *five* years we have

- 30% complete the degree.
- Almost 10% remain active in pursuit of the degree.
- 30% switch to another major within the university.
- Almost 15% depart for non-academic reasons.
- 20% depart for failure to meet academic standards.

ENGINEERING GRADUATION AFTER 6 YEARS	1991 Entry	1992 Entry
Graduated	35%	32%
Still Active	2%	3%
Changed Major	26%	27%
Canceled Registration	5%	6%
Withdrew	8%	3%
Inactive/No-show	4%	6%
Dismissed	21%	23%

Finally, after *six* years

- Almost 35% complete the degree.
- A small number remain active.
- Almost 30% switch to another major.
- Almost 15% depart for non-academic reasons.
- 20% depart for failing to meet academic standards.

Clearly, the typical time to completion of the baccalaureate degree is now five years for most of our students. We see a fairly high percentage that switch to another major within the university, perhaps due to a desire to complete a baccalaureate earlier in a different major. We also see that a fair number of the students have academic difficulty. While difficulty for some is not unexpected, it is still of concern given that the engineering freshmen admits have average SAT scores that are 100 points higher than their liberal arts & sciences counterparts.

What is more disturbing in this data is the finding that roughly just *one-third of the University of Connecticut students who start higher education in pursuit of the engineering degree follow through to completion.* Also, roughly *one-third wind up pursuing another career path* within the university, and roughly *one-third depart from the institution for academic and non-academic reasons.* ("Look to the right, look to the left ...look in the mirror ... which of the three will be on the stage at commencement day?")

Today's College Students

Given the change from four to five years to complete the degree, it can be surmised that today's students may be different from those of earlier generations, or at least may have more demands placed on them which require a different approach to helping them succeed. Hansen [2], provides a marvelous look at demographics of today's college students vs. previous generations. Some highlights from his paper relative to this work are as follows:

- The percentage of high school graduates aged 16-24 in college rose from 47% in 1973 to 65% in 1996.
- Fields that lost in popularity since the mid 80's include engineering (-32%) and computer and information sciences (-50%).
- The proportion of students attending college part-time grew from 32% in 1970 to 43% in 1995.
- The percentage of 16-24 year-old, full-time college students who were employed rose from 36% in 1973 to 69% in 1995/96. Those working 20 hours or more increased from 17% to 37%.
- In the fall of 1995, 81% of public 4-year colleges and 100% of public 2-year colleges offered remedial programs. Of all first-time freshman twenty-nine percent took at least one remedial course (24% math, 17% writing, and 13% reading).
- In 1997, just 34% of freshmen reported having spent six or more hours per week studying during their senior year in high school, an all-time low (compared to 44% in 1987). In fact, the average student spent only 3.8 hours per week in 1997, down from 4.9 hours in 1987.
- Freshmen increasingly overestimate their own abilities, rating themselves as "above-average" in virtually all academic areas (e.g., 41% of students in 1997 rated themselves "above average' writers, compared with 27% in 1966).
- In a national poll of 15-17 year olds, only 25% said the "ability to formulate creative ideas and solutions" was extremely important and less than 40% said being "able to write well" was extremely important.

In an interesting look at Generation X college students, Sacks [3] presents the following results from a survey of his students:

Grades should be primarily based on	
How hard you try	16%
Your knowledge and performance in subject	52%
How much you improve compared to where you started	26%
Your attitude	2%

Surprisingly, the notion that students should be graded not on what they know but on their attitude and effort is held

dear to almost half of his survey respondents. In terms of their expected performance, the students indicated:

What do you think should be a reasonable average grade among students in a college-level course?	
2.0 [C]	10%
2.5 [B-]	35%
3.0 [B]	51%
3.5 [A-]	2%

Ninety percent thought the average grade should be a B- or higher in a college course.

These are sobering results to say the least. What they indicate is that today's college student *is* different! As a consequence, we need to rethink how we orient these students to higher education; i.e., we need to provide ways to introduce these students to the university in a way that can lead to success.

Of first-year students entering the University of Connecticut's School of Engineering in 1997, their self-evaluation of ability for success was as follows:

	NSC	NC	N	C	SC
Algebra	0%	0%	3%	30%	67%
Calculus	6%	11%	26%	46%	11%
Chemistry	3%	4%	25%	59%	9%
Computer	2%	3%	21%	45%	29%
Physics	1%	4%	17%	62%	16%
Speaking	2%	13%	30%	30%	24%
Trigonometry	0%	3%	13%	47%	36%
Writing	0%	15%	18%	50%	17%
NSC = Not Strongly Confident, NC = Not Confident, N = Neutral, C = Confident, SC = Strongly Confident					

Clearly, this shows that their expectations for success are high; i.e., they feel they are more than capable in subject areas important for success in Engineering.

Focus on Retention

In a look at the factors impacting a student's decision to leave college, Tinto [4] provides a longitudinal model of institutional departure that has the following components:

- *Pre-Entry Attributes*: those due to family and community background, intellectual and social skills, and prior schooling.
- *Goals/Commitments*: individual commitment toward goal attainment, to the institution to which they gain entry, and external commitments.
- *Institutional Experiences*: academic issues, involving performance and faculty/staff interaction, and social issues, involving extracurricular activities and peer group interactions.
- *Integration*: the extent that success is achieved in both academic and social integration into the learning community.
- *Revisit Goals/Commitments*: positive integration serves to raise goals and strengthen commitments; while the lower degree of social and intellectual integration into the community increases the likelihood of departure.
- *Outcome*: a departure decision results if success is not achieved in integration within the learning community.

As given in Tinto[4],

> "Effective retention programs are committed to the development of supportive social and educational communities in which all students are integrated as competent members."

Hence, a look at how students are oriented to higher education forms an effort aimed at improving retention.

The First Year Experience

It has been known for some time that a First Year Experience (FYE) orientation course has an impact on the ability of students to succeed in college. Upcraft & Gardner [5] provide a nice summary of the FYE movement. Landis [6], is an advocate of providing an orientation course for engineering students as a way to make them successful in pursuit of the engineering degree.

At the University of Connecticut, several efforts at 'learning communities' (see Gabelnick [7]) have been underway. One of these efforts involved the creation of a University Learning Skills optional FYE seminar course for first-year students.

University Learning Skills for Engineers

As part of the University Learning Skills course offerings for first year students at the University of Connecticut, a special optional course section for engineering majors has been offered during each of the last three fall terms. The course is offered for one-hour, once a week, with class sizes over the three years ranging from 45-75 students.

The course outline is given below. As indicated, there is an emphasis on providing study skill 'tools' up front, followed by an introduction to university facilities along with engineering departmental-specific facilities.

Week	Topic
1	Overview/Learning Styles
2	Lecture Notes
3	Time Management/Goal Setting
4	Textbook Reading
5	Exam Preparation
6	Career Services resources
7	Engineering Student Societies

8	Counseling Services resources
9	Library resources
10-14	Engineering departmental tours

There is no text for the course, since most of the 'college survival skills' texts on the market do not focus solely on skills or tools, but instead cover additional material often found in a three-credit FYE orientation course. Of the texts on the market, the work by Pauk [8] serves as nice reference. Engineers tend to be focused students in search of tools to put into practice and less concerned about 'wellness' material often found in other books.

Students in the course are expected to

- Attend class
- Prepare weekly one-page 'journal entries' in response to a question on that week's material
- Complete infrequent self-exploration exercises
- Use email
- Attend the Career Fair
- Attend a meeting of the student chapter of the professional society associated with their major

Students earn a letter grade in the course, unlike some orientation courses elsewhere which are graded on a pass-fail basis.

The emphasis of the course is one of providing tools or skills to the students that they can put into practice to help them bridge the gap between high school study habits and those needed to be successful in college.

The beginning of the term focuses on getting students introduced to tools to help them learn:

- *Learning Styles*: In addition to learning a bit about themselves via use of the Myers-Briggs Type Indicator, an overview of learning styles based on the work of Felder and Silverman [9] is presented. The key here is to make the students aware that each is different, each has preferred learning modes, that instructors may or may not teach to their preferred mode, and to be aware of this possible mismatch.
- *Cornell Note-taking Method*: Beecher [10] indicates that reviewing lecture notes is an effective learning strategy. This notion of review is a critical component of the Cornell Note-taking Method, which is summarized in an appendix.
- *SQ3R Textbook Reading Method*: A method that forces the student to actively engage the material being read and to review it after reading. It is also summarized in the appendix.

After these 'tools' are presented to the students, and after they have tried them for a while, the course shifts its emphasis to an orientation to facilities and support services. Often, this includes topics dealing with issues confronting the students at that point in the term; e.g., stress-reduction techniques around the first exam. The material covered includes:

- *Connection with University*: Presentations by Career Services, Counseling Services, and Library personnel help acquaint students with support services. Students are required to tour through the annual Career Fair and observe the upper-class students and employers to learn about which companies recruit what type of engineers. A follow-up lecture with a representative from the Career Services office then helps place what the students see in perspective. A representative from Counseling Services appears around the first set of exams and helps the students with test anxiety as well as stress reduction; often just learning that what they are experiencing is 'normal stress' makes a big difference to the students. A Library representative gives an overview of how to access information via the computer card catalog as well as how to do internet searching.
- *Connection with the School of Engineering*: Students are introduced to the leaders of the student societies and are encouraged to join the professional society in their major. Students are also toured through facilities associated with each major; in an effort to acquaint them with the school. The departmental tours provide a look at laboratories, senior projects, sophomore labs, etc. so that the students get an idea of what type of work they may be doing in subsequent semesters. There is also a limited overview of each major discipline. The key is a focus on *orientation to facilities*, rather than an 'Intro to XYZ Engineering', while at the same time providing some information about different disciplines since many of the first-year students are undecided regarding which engineering major is for them.

Throughout the entire term, a unique question and answer technique is used to provide useful advice to the students:

- *One-minute paper (see Angelo and Cross [11])*: At the end of each class period, students are asked to complete answers to the following two questions on a 3x5 card:
  - What is the main point that you learned today?
  - What remaining question do you have?

  Of these, the one that allows the students to ask a question leads to interesting results. Often the questions asked are on topics of interest pertaining to their residence hall, their other courses, their notion of what engineering is about, etc. These questions are compiled and answered in a handout for the next class. From week to week the students get answers to concerns that they often would not have anywhere else to turn to for a solution or advice.

The optional one-credit ULS course has been offered for three years with engineering student enrollment of 67 (37%) in Fall 1996, 44 (32%) in Fall 1997, and 53 (30%) in Fall 1998. (Total enrollment in the course was a bit higher, since there were a few more 'wannabee' engineers who were admitted to another school or college within the university in

each class. Data presented below, however, is just for those students who matriculated in the School of Engineering.) Results for each of these classes is given in the following with a comparison to preceding years:

ENGINEERING RETENTION AFTER 1st YEAR	1994 Entry	1995 Entry	ULS 1996 Entry	ULS 1997 Entry
Still Active	67%	79%	77%	83%
Changed Major	12%	5%	8%	6%
Canceled Registration	7%	4%	3%	1%
Withdrew	1%	3%	1%	2%
Inactive/No-show	1%	2%	1%	0%
Dismissed	11%	7%	11%	9%

ENGINEERING RETENTION AFTER 2nd YEAR	1993 Entry	1994 Entry	1995 Entry	ULS 1996 Entry
Still Active	48%	50%	56%	59%
Changed Major	25%	21%	15%	14%
Canceled Registration	5%	8%	5%	4%
Withdrew	3%	1%	4%	1%
Inactive/No-show	2%	4%	3%	2%
Dismissed	17%	17%	18%	19%

Overall, an improvement seems to be occurring. While an improved retention may be due to several factors, the question remains: Does the ULS course make a difference? If we compare retention of ULS and non-ULS students, we see the following:

ULS vs. Non-ULS TWO YEARS LATER 1996 Entry Class	ULS Students	Non-ULS Students
Still Active	58%	47%
Changed Major	10%	23%
Canceled Registration	8%	7%
Withdrew	0%	0%
Inactive/No-show	0%	3%
Dismissed	24%	20%

ULS vs. Non-ULS ONE YEAR LATER 1997 Entry Class	ULS Students	Non-ULS Students
Still Active	80%	70%
Changed Major	5%	14%
Canceled Registration	5%	4%
Withdrew	2%	2%
Inactive/No-show	0%	0%
Dismissed	9%	11%
ULS vs. Non-ULS AFTER 1st SEMESTER 1998 Entry Class	ULS Students	Non-ULS Students
Still Active	98%	90%
Changed Major	0%	6%
Canceled Registration	0%	0%
Withdrew	2%	1%
Inactive/No-show	0%	0%
Dismissed	0%	3%

It appears that the ULS course has an impact. A greater percentage of the students seem to obtain the 'connection' with their major that is important in achieving integration into the academic community.

Student Evaluation of the ULS Course

The following provides a summary of student survey responses at the conclusion of the fall 1997 and 1998 courses:

	SU	U	N	NU	SNU
Learning Styles	21%	53%	20%	5%	1%
Time Management	52%	38%	4%	4%	2%
Goal Setting	31%	50%	15%	3%	1%
Lecture Notes	22%	35%	33%	7%	3%
Cornell Method	15%	38%	34%	9%	4%
Textbook Reading	16%	51%	23%	10%	1%
SQ3R Method	16%	42%	29%	10%	3%
Group Study	14%	43%	30%	10%	3%
Exam Preparation	31%	42%	19%	3%	5%
Career Fair	29%	28%	29%	9%	4%
Student Societies	27%	40%	25%	6%	3%
Career Services	27%	43%	18%	10%	3%
Counseling Services	25%	38%	27%	10%	1%
Library	18%	39%	29%	12%	2%
Engineering Department Tours	34%	45%	12%	5%	4%

SU = Strongly Useful, U = Useful, N = Neutral, NU = Not Useful, SC = Strongly Not Useful

Clearly, the evaluation of the usefulness of the material in the course is quite high; i.e., the students perceive a true value added to their educational experience by taking the course. In addition to the ratings on topics covered, 72% said the course met or strongly met the goal of helping them learn and develop a set of adaptive study, coping, critical thinking, logical problem-solving, and survival skills.

Conclusions

A review of the graduation rates of students entering the School of Engineering at the University of Connecticut has shown that a discouraging number are successful in a four year period, with most of those that graduate needing a five year period to complete requirements. More troubling is that roughly only one-third of those who start in pursuit of the engineering degree are successful.

Given that today's students in college seem to be different from those of earlier generations, a concern about their ability to be successful in adapting their study behavior to the rigors of the college environment prompted the development of a First Year Experience University Learning Skills course. This optional one-credit ULS course has been offered for three years and has shown to lead to an improvement in the retention of students in engineering. Roughly 10% more of the ULS students are retained after the first year when compared to those not taking the FYE ULS course. Student satisfaction with the course is high, with roughly three-fourths feeling that the course was a positive factor in their adjustment to college.

The improvement in retention resulting from the FYE ULS course is anticipated to improve the percentage of students entering engineering who complete within a four or five year period.

References

[1] Engineering Workforce Commission, "Engineering Enrollments, Fall 1997", *Engineers*, Vol. 4, No. 2, April 1998.

[2] Hansen, E. "Essential Demographics of Today's College Students", *AAHE Bulletin*, Vol. 51, No. 3, November 1998, pp. 3-5..

[3] Sacks, P. *Generation X Goes to College: A Journey into Teaching in Postmodern America*, 1996, Carus Publishing Company.

[4] Tinto, V., *Leaving College: Rethinking the Causes and Cures of Student Attrition*, 1993, The University of Chicago Press.

[5] Upcraft, M.L. & Gardner, J.N., *The Freshman Year Experience: Helping Students Survive and Succeed in College*, 1989, Jossey-Bass, Inc.

[6] Landis, R. *Studying Engineering: A Road Map to a Rewarding Career*, 1995, Discovery Press.

[7] Gabelnick, F., MacGregor, J., Matthews, R. & Smith, B., *Learning Communities: Creating Connections Among Students, Faculty, and Disciplines*, New Directions for Teaching and Learning, no. 41, 1990, Jossey-Bass, Inc.

[8] Pauk, W., *How to Study in College*, 6th edition, 1997, Houghton Mifflin Company.

[9] Felder, R. & Silverman, L., "Learning and Teaching Styles in Engineering Education", *Engineering Education*, vol. 78, no. 7, pp. 674-681, April 1988.

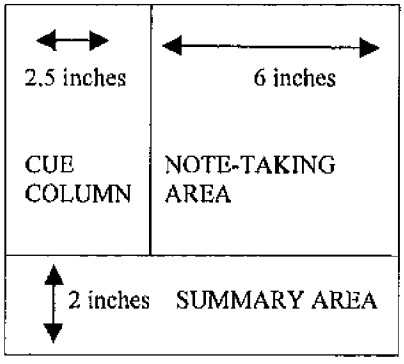
[10] Beecher, J. "Note-taking: What Do We Know about the Benefits?", Educational Resources Information Center (ERIC) Digest Number 12.

[11] Angelo, T.A. & Cross, K.P., *Classroom Assessment Techniques: a handbook for college teachers*, 1993, Jossey-Bass, Inc.

Appendix 1: The Cornell Note-taking Method

The Cornell method involves dividing a page of notes in the format shown and following the steps below:

1. Record the lecturer's ideas/facts in the *note-taking area*.
2. At your next free period, read over your notes to fill in gaps.
3. Determine the first main idea; then in the *cue column* write a question based on the main idea.
4. Block out the *note-taking area* with a sheet of paper, read the questions in the *cue column*, recite the fact needed to answer the question; repeat until the idea is mastered if not gotten the first time.
5. At the *summary area*, write a concise summary of the page of notes; this summary makes studying for exams efficient.
6. Review your notes immediately so that you can end up with a view of the whole rather than isolated facts and ideas.
7. Reflect on the facts and ideas contained in the notes.



In summary, the Cornell Method provides an opportunity for putting into practice the five R's of note-taking: Record, Reduce, Recite, Reflect and Review.

Appendix 2: The SQ3R Method for Textbook Reading

The SQ3R system was devised during WWII to help military personnel enrolled in special programs at a university to read faster and study better. It involves the following, for which it gets its name:

S = *Survey*: Leaf through an assigned chapter reading headings and subheadings, skimming topic sentences, and reading summary and concluding paragraphs.

Q = *Question*: Turn headings and subheadings into questions by preceding them with who, what, when, where or how.

R = *Read*: After a question is framed, read the ensuing paragraph or section to answer the specific question.

R = *Recite*: Immediately after reading, look away from the page and recite what you have just read in your own words.

R = *Review*: After finishing the chapter, go back to the beginning, glance at each heading and mentally note the contents.

As with the Cornell system for note-taking, the SQ3R method forces the student to actively engage the material being read and to review sufficiently so that the material becomes learned.