Civil Disobedience and the Wise Consumer

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A favorite topic among college professors is the fact that students aren't what they used to be "back in the day", presumably back in the day they were students. One of the laments is that today's students view a college degree as a consumer item, like a car or computer.   Students with a consumer mentality think a business (university) should please the customer (the students). Faculty think that if the university gives in to this it will ultimately lead to grade inflation and the devaluation of a degree. This argument has gotten a lot of attention, and authors have attributed this change in attitude among students to factors which range from the effects of overexposure to television advertising to post-modernism [1]. This consumer mentality is equated in the minds of faculty with the decline of higher education and students' lack of preparation and willingness to work. From the viewpoint of the professor who spends hours each week talking to a sea of blank faces, these arguments are persuasive.

For years, I have repeated these same arguments to countless parents who visit our campus in the hope that they will find a university in which their daughter or son will learn enough to, at the least, become financially independent. As a huckster in this university shell game my favorite selling point is comparing the college experience to a poker game. There is no guarantee you will win, you have to pay (ante up) to even join the game, but a skilled player can win over the long term if they stay in the game and work hard. Parents love this soft-sell since a similar analogy can be made about any type of success. You can succeed at (fill in the blank) with a willingness to work hard, but we can't guarantee your success. There is a lot of truth to this point of view. To succeed at anything you have to have individual initiative. Research has shown that those students who want to learn engineering are much more likely to graduate than those who study engineering because they were told they have an aptitude for math and science or because they want to make a good salary [2]. Any professional knows that achieving goals is always much harder than dreaming about what will happen when you reach them. Thomas Edison said it best a century ago: "Opportunity is missed by most people because it is dressed in overalls and looks like work."

If we dropped the discussion here, every university in the country could rest peacefully on its laurels, secure in the knowledge that they are selling opportunity. But as engineering schools are slowly beginning to realize, opportunity alone is not that hot a commodity. As the costs of college educations continue to rise, students and parents are taking a very hard look at the payoff of their investment in time and money, and

engineering doesn't look so good. While starting salaries are high, relatively few students graduate in four years [2]. Although it is too early to see what effect overseas outsourcing will have on employment prospects, job security is not what it was twenty years ago. To a freshman or sophomore, engineering can seem both hard and dull. Engineering students have less leisure time and take longer to graduate than their peers. Students lose sight, if they ever saw in the first place, of how introductory college courses can lead to an interesting, fulfilling career. Hearing that your introductory physics class "establishes a scientific and mathematical foundation" or "it gets more interesting later" sound pretty hollow at three in the morning. Students do not, and should not, blindly trust such promises. While some authors have said students' lack of trust in faculty reflects the failing trust in society [1] the simple fact may be that the students have it right.

While certainly an oversimplified comparison, there is some value in making analogies between an engineering degree and a consumer item. Looking from a purely economic point of view, statistics of engineering education paint a gloomy forecast. The number of undergraduate electrical engineering degrees awarded each year is tracked by the Division of Science Resources Statistics of the National Science Foundation [3]. As the figure below shows, the overall trend in degrees has been downwards since the late 1980's. Women are still under-represented, as are minority students. If degrees are the product of a university, from a business point of view productivity is down and production costs are rising. Education is expensive, and continues to outpace inflation as shown in the figure below [4]. This trend will likely continue as federal and state support for universities and students continues to decline.
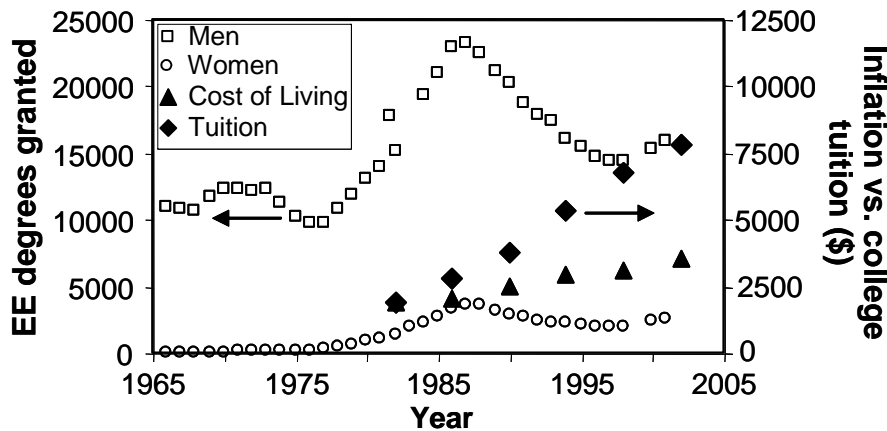
Any business would be horrified by an annual report that looked like this. The shareholders would demand blood, careers would be destroyed, and all levels of the enterprise would be subject to intense scrutiny to bring costs down and make the business more efficient. One important indicator of the process of creating new engineers is retention rate; the fraction of students who enter into college engineering programs compared to those who earn their degrees. If we assume retention indicates the efficiency of the process of creating engineers, universities are quite wasteful. Although retention rate varies between universities, nationally the retention rate is about 50% [2]. Admittedly college retention is a different problem from turning iron ore into building

girders. Most students who leave *choose* to do so, and granting degrees to all students who enter college is neither a wise nor practical goal. But how many students who could become good engineers leave, and for what reasons? Asking students why they left engineering and comparing their answers to why professors think students leave flags one area that needs urgent attention: communication between students and faculty. When students are asked why they leave engineering the most common reasons are a loss of interest, poor teaching, or being overwhelmed or overloaded by the curriculum [2]. In studies which ask faculty why students leave, the most common responses are difficulty mastering math, poor study habits, and social distractions [5].

Why is there such a difference in how faculty and students view the roots of the retention problem? Part of the answer, the easy part, is that faculty are so familiar with the material that they forget the difficulties students face in learning engineering. A more subtle point is faculty generally teach the way they were taught. Since few "C" students go on to become professors, faculty are a self-selected group that succeeded under, support, and promote the predominant model of teaching. Currently this model is that students learn through lecture, homework, and examinations. What is not clear is that this predominant model lets students find excitement in engineering as a career or helps them to see how engineering is relevant to problems they care about. This criticism of the current status-quo of engineering education is supported by the reasons given by students who leave engineering. Faculty should not so easily dismiss the opinions of those students who transfer out of engineering because they lose interest or can not succeed under the predominant model. Faculty who focus on transmitting information without first finding out what students do know or demonstrating why the information is relevant risk having minimal information transmitted with a high error rate.

If poor communication and boring classes are reasons that educating the next generation of engineers is an inefficient process, what can be done to improve this process? If past history is any indication, not much. Numerous calls for better teaching have, to a large extent, fallen on deaf ears. The unwillingness to change arises from multiple reasons. First, since faculty are a self-selected group, they generally believe the current system is effective and are unwilling to devote time to a problem that they can't see. Second, with some notable exceptions, there is little incentive for faculty to become better teachers. At large research universities—where most engineering degrees are granted— personal and professional rewards come from research. Most research contracts are for tens or hundreds of thousands of dollars a year that faculty can use for salaries, equipment, and supplies. Since all universities take a sizable fraction (on the order of 40%) of these funds, there is clear financial benefit to both individual faculty and the university as a whole to emphasize research above teaching. Although new accreditation procedures and federal support of engineering education are causing slow changes, the pace is glacial. As in inefficient companies, there is simply not sufficient need, will, or resources to stimulate the needed changes within academia.

The one voice within academia that can potentially catalyze the needed changes has been conspicuously silent: the students. While students and parents often do a good initial job of comparison shopping between schools, once at a university students either accept the

product offered with no complaints or vote with their feet. To effect changes in engineering education students need to hold universities accountable for the quality of their education. Although knowledge is a difficult thing to measure, especially when you don't have it, students need to become active and discerning consumers.

To develop such a consumer mentality it helps to think of what you could buy with the money you spend on a single class. At my university a class has the approximate value of a new computer or stereo system. How can you judge whether that money is more wisely invested in a college class or in a respectable mutual fund? One way to judge is to reflect on what skills, knowledge, and expertise you gained from a given class. Does the time spent in class add value over simply reading the textbook? Do assignments and examinations build new skills and help you grow as a person, or are they merely busy work? A second characteristic of a good investment is that its value increases over time. We have all made impulse buys that we never get much use from. Other times seemingly frivolous items have lasting value. This is particularly true with education since it is difficult to judge the value of knowledge until we have applied it. In which of last year's classes do you feel you understood and retained the material? What classes have relevance to your life or what you are learning now? Finally, to avoid making future bad investments it is necessary to understand what to avoid, what helps you learn, and to have clear goals for your future. Everyone has different learning styles and what may be a bad class for some students may be an outstanding one for others.

As consumers with a strong financial stake in their own education, how can students help bring about the changes that are necessary to improve the quality and efficiency of engineering education? First of all, act in concert. While individual complaints go unheard, if many students have the same complaint there is likely a legitimate issue. Second, make concerns known in writing. Write a letter outlining the issues and address it to the department head and the coordinator of the department's ABET committee. Try to open a dialog rather than send an ultimatum. You are more likely to be listened to if you understand the constraints faculty work under, offer specific suggestions for improvement, and actively participate in your department. Include parents, another major stakeholder in education, in this dialog. If necessary, talk to the dean, provost, or the university president, but always start at the department level. Third, question the status-quo. Why is this course a necessary part of the curriculum? Is this the most effective way the course could be taught? How does this material relate to previous courses I have taken, what are the connections? Fourth, participate as an alumnus immediately following graduation. Don't wait. The voices of alumni carry more weight than that of students because they have more experience behind their opinions.

It is clear that engineering education needs to change, and this change will occur sooner if students hold the feet of faculty and university administrators to the fire. Ultimately change will require concerted actions by all stakeholders. Currently universities are financially rewarded for research. In the future, universities need to be financially rewarded for good teaching, and students rewarded for individual initiative and mastering new concepts. How to do this in a way that is acceptable to students and faculty will require innovative thinking. For example, some science fiction writers have discussed

scenarios where an individual could finance college by selling shares of their "personal stock" (i.e. future earnings) which would increase or decrease in value with their performance in college or on the job. A more chilling, but likely, scenario is that universities will begin to sell individual assessments of a student's strengths, weaknesses, and performance to potential employers. However, since education is financed by the public, this would raise serious legal and ethical considerations.

Although many faculty decry the fact that students and parents treat a college education as a commodity item, a more fundamental problem is that students are poor consumers. Legitimate complaints are lost or muffled by the compartmentalized structure of the university. Academia complains about changing student values while remaining unwilling to try new paradigms in fear of diluting academic rigor. The will for change does not exist within the academy. It will take the voices of students to finally tell us that the emperor has no clothes.

[1] Peter Sacks, *Generation X Goes to College*, Open Court, Chicago, 1996.
[2] Elaine Seymour and Nancy Hewitt, *Talking about leaving: why undergraduates leave the sciences*, Westview Press, Boulder, CO, 1997.
[3] Data from the Division of Science Resources Statistics of the National Science Foundation can be accessed online at: http://www.nsf.gov/sbe/srs/stats.htm. Accessed Novermber, 2004
[4] Joh. A. Boehner, and Howard P. Mckeon, "The College Cost Crisis: A Congressional Analysis of Colleege Costs and Implications for America's Higher Education System", available on-line at:
http://edworkforce.house.gov/issues/108th/education/highereducation/CollegeCostCrisis Report.pdf. Accessed November, 2004.
[5] MathSoft Engineering & Education, Inc., "Analysis of Higher Education Survey and Higher Education Survey", available on-line at:
http://www.educationnews.org/mathsoft_engineering.htm. Accessed November, 2004.