Impression of the status of engineering education at The University of Chile and The Catholic University

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As part of the MECE Higher Education Competitive Program, at the request of Professor Patricio Poblete of The University of Chile, I visited Santiago between January 9 and January 23 of 2007. I spent 6 days interviewing faculty members and a few students at The University of Chile and the Catholic University. I toured their facilities and gave a seminar at each institution.

While I congratulate the engineering faculty at both universities for initiating positive changes in their curricula, I think major cultural changes are essential before their engineering educations programs will provide students with a comparative advantage in the workplace and in life.

I cannot claim deep understanding of the Chilean university system. My impressions are influenced by years of experience at MIT where we faculty have cultural biases similar to those in Chile.

Both of the top Chilean universities have started hands-on, design-centered courses for first-year students. That is a very important first step. However, both faculty and students expressed the view that these courses are cultural anomalies. They do not have a respected place in the mainstream of the student and faculty priorities.

I have two basic recommendations:

1) <u>that the universities change admission policies so that students are admitted based on criteria more appropriate than scores on exams.</u> Intelligent, creative, and energetic young people are essential to Chile's future success. To pretend one can select the "best" of them by classical test scores is quite unrealistic. Especially in engineering, professional excellence is not primarily correlated with one's ability to perform well on written exams. A poor filter for

selecting the incoming students is a very serious and fundamental problem. Observing that "this is the way it is done in Chile" does not make it right. Based on 40 years of experience with very intelligent students at MIT, I would guess that at least 20% of the students in engineering in Chile should be replaced by others who are more appropriately talented and/or interested in being an leader in engineering. No nation can afford to squander talent.

2) <u>that the facuty-student relationships be shifted from adversarial to supportive.</u> In essentially every discussion about the first two years of Chile's engineering education, I heard an unambiguous message that the students are not respected as "customers" of the education system. A survivalist, boot-camp attitude seems pervasive. That is, in my opinion, badly flawed pedagogic practice. When the students regard the faculty as judges rather than helpers or mentors, communication is crippled. Students learn to fear innovation and independent thinking. In a time when creativity and innovation are essential for students' future, they are being provided with a rote, lecture-exam experience that encourages neither. Uninspired following is rewarded. The first years at a university sets the expectations and tone of the whole university experience. Current practice encourages an arms-length relationship when supportive mentoring would be more productive.

The first two years of engineering seem to be designed to "weed out" the students who are too weak to survive. Even if such a "survival of the fittest" philosophy were appropriate, it should at least be aligned with the behaviors and talents important to the profession being supported. Abstract math is not important to engineers. Engineers do not do mathematical proofs. Engineers are neither physicist nor scientist. Synthesis is far more important to engineering than analysis. In engineering, analysis has a supporting role for synthesis. In my opinion, the applied mathematics and physics important to engineers probably should be taught by engineers. Mathematicians and physicists generally are not often competent as engineers. They are unlikely to be qualified to select the best students to study engineering.

Obviously these two recommendations are sweeping and would require a substantial cultural shift. I understand that universities typically change slowly. So do the major automobile manufacturers in the United Stated. They are now paying the price of too-slow change. Ford just reported a $13 Billion loss for 2006 (Expressed another way, approximately $1000 for every citizen of Chile). Toyota is poised to oust General Motors as the largest automobile manufacturer in the world.

The forces for change are not under the control of the university faculty. These forces have a life of their own and will directly impact our students. I believe university faculties have an ethical obligation to focus on the students' future. "Old style" engineering is now a commodity. Computers do most of what "engineering science" curricula teach. India now graduates more engineers each year than the US and Europe combined. An engineer "trained" to use traditional methods of analysis is woefully outnumbered and outgunned. Each year new engineers with access to incredibly powerful computer analysis tools shift the game substantially. We must face the truth. Most of the content of traditional engineering-science programs convey no comparative advantage. Students and their families trust us and pay for an education that will help them achieve a meaningful life. We must change and change much more rapidly than ever before.