

September 19, 2013

To: UCITE Nord Grant Committee

We have been developing international engineering programs that intertwine the technical content with the culture of the host country. Pedagogically, these programs build on experiential learning theories put forth by Kolb and others. Our programs have brought over 90 US students to Africa over the past 3 years. The programs are financially self-sustaining, through fees paid by the students or grants from the National Science Foundation.

We are expanding our international offerings to courses in engineering entrepreneurship and communication. These topics are natural fits for international programs. The courses we are developing are:

- ENGR 484, International Engineering Entrepreneurship. ENGR 484 is for students in our Masters of Engineering Management program. This course is being piloted in the Fall 2013 semester, and we have 12 students enrolled in the course.

- ENGR 395, International Engineering Communication. ENGR 395 will fulfill a core requirement for undergraduate engineering students (in place of ENGR 398/ENGL 398). Thus the course will draw from the pool of all engineering students (over 400 per year). Based on our experience with other courses, we are confident that we will be able to attract at least 25 students per year in ENGR 395.

This grant request is in regard to our pilot offering of ENGR 484 this semester in Myanmar. This offering will also serve as a pilot to ENGR 395, since the course content, pedagogical methods, and course arrangements will be somewhat similar in the two courses.

I believe that this course offering can be of great value to CWRU in terms of publicity, as well as to the students. The staff member I'm working with at the US Embassy in Myanmar says the course "will be a tremendous opportunity. If I'm not mistaken, this might be the first time that a US course has been offered in Myanmar, so quite an historic step." In addition, the US Ambassador to Myanmar said "This sounds like an excellent initiative."

Description of our programs thus far developed

i. Undergraduate engineering core course taught at the University of Botswana. We developed a novel course (ENGR 225B), which we teach at the University of Botswana in a 3-week sessions in May/June. We taught this course the past 3 years, and have had 65 CWRU students take the course. The course is a special offering of a core course required of all CWRU engineering students, which covers thermodynamics, fluid flow and heat transfer. The course intertwines technical content with regional issues in sub-Saharan Africa – by holding the course in Botswana, students are able to experience the connections between technical content and regional issues. For example, energy balances for flowing fluids are addressed in the context of pumping water from wells in villages in the Kalahari Desert. We take a field trip to visit a village well, where we learn the well specifications (e.g., depth, flow rate, etc.). We then carry out calculations to determine how much energy is required to pump the water, what is the cost of the necessary fuel, and how does this fit in the village's economic budget? We have written an article about the experiential learning aspects of this course, which has been published in the journal *Chemical Engineering Education*.

ii. Capstone design project in Africa. I developed a new chemical engineering capstone design course, required of all chemical engineering seniors, in which students work in small teams on 'real-life' projects and interact with experts outside the university. Usually, these projects are carried out in conjunction with local companies. But for the past three years, teams investigated engineering solutions appropriate to African villages taking into account the economic, societal, ecological and institutional constraints. I traveled to Botswana with 3 students in 2011, Senegal with 5 students in 2012, and Malawi with 4 students in 2013. The projects addressed biogas reactors (2011), small-scale electrical generators (2012), and portable refrigeration units (2013).

iii. Undergraduate Research Training Program at the University of Botswana. We run a research training program for undergraduate students from the US and Botswana – note that the goal of the program is training students in research with a global perspective (rather than the research itself). The program takes place at the University of Botswana, and includes laboratory research and professional development activities (giving presentations, writing scientific reports, etc.). The theme of the program is sustainable energy relevant to

sub-Saharan Africa, such as solar energy, wind energy, and energy from biofuels. This program is funded at \$150,000 for 3 years by the National Science Foundation, beginning May 2011. Our program has thus far included 16 US students (from 14 different universities) and 16 Botswana students.

The purpose of this Nord Grant request

This semester we are piloting ENGR 484 "International Engineering Entrepreneurship". It is being taught in an intensive 2-week session in Myanmar in December, along with a few other class meetings during the semester at CWRU. The course activities in Myanmar will include Myanmar students, faculty and engineers -- a key aspect of the course will be peer learning between the US and Myanmar participants (e.g., group projects and presentations, where the groups have mixes of US and Myanmar students/faculty). The course will use active learning methods and follow the Kolb Learning Cycle, both for their direct pedagogical value and also to introduce our Myanmar colleagues to these modern teaching methods.

We have 12 CWRU students enrolled in the course, all from our Masters of Engineering Management (MEM) program. The students have paid non-refundable deposits and have registered for the course. We are very pleased with the level of student interest -- there are about 50 students in the MEM program, so almost 25% of the students in the program chose to take this course!

I was in Myanmar on a Fulbright grant this summer, working with their leading engineering school. It's a very exciting time in Myanmar. The country has been ruled by a repressive military government for 50 years. They had very strict censorship (e.g., no free access to the internet). The major universities had been closed by the government for over 10 years, due to student protests against the government. And in response, the US had imposed severe economic sanctions, and did not have an ambassador in Myanmar for over 20 years. But things are now changing for the better. Last year Myanmar had free and peaceful elections, where the opposition party won 43 of 45 open seats in the parliament, and there is now open access to the internet. In response, the US has removed most sanctions and appointed an ambassador, and Obama visited the country last November. The major universities have reopened last year, but this is a slow process (just first year students this year, first and second year students next year, etc.).

I believe this course offering will be of tremendous value to the students in the course, our Myanmar colleagues, and CWRU via positive publicity. Myanmar is in the midst of a very unusual 'opening-up' period, where it is making contact with the outside world (e.g., until last year it was only one of three countries in the world that did not sell Coca Cola!)

This course will also serve as the pilot for larger programs, as ENGR 484 and ENGR 395, once they are developed, can be offered in a variety of countries. And based on my experience with my previous programs, I am very confident that there will be great interest in these courses, and the programs will be financially self-sustainable.

Leveraging of funds

Other funds are also being used to support this course. First, my expenses are fully covered by a Fulbright grant. Second, the students are all paying their own travel expenses to get to Myanmar.

Sincerely,



Daniel J. Lacks
Professor
Dept. of Chemical Engineering



Uziel Landau
Professor and Chair
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Budget:

We request \$4000 to defray ground costs for the program in Myanmar. This will include ground transportation for course-related activities, possible fees for meeting space, and partial support of our students' lodging.