

AC 2009-1693: MODERNIZING ENGINEERING EDUCATION AT HERAT UNIVERSITY A PARTNERSHIP BETWEEN UNIVERSITY OF HARTFORD AND HERAT UNIVERSITY

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Modernizing Engineering Education at Herat University A Partnership between University of Hartford and Herat University

Abstract

In 2007, the University of Hartford College of Engineering, Technology, and Architecture, in West Hartford, Connecticut began a partnership with the Faculty of Engineering at the University of Herat, in Herat City, Afghanistan. The goals of the project are to use a combination of curriculum revision and development, faculty development, distance learning and collaborative projects, and local/internal partnerships to establish the Herat University Faculty of Engineering at the preeminent Engineering program for Western Afghanistan.

Once a part of Kabul University, the Faculty of Engineering became a permanent part of Herat University in 2004. After functioning in Kabul for approximately 20 years, the Engineering program was closed following the Soviet occupation of Afghanistan in the 1980s. The program also temporarily relocated to Pakistan in the 1990s. Although the university was officially open in Herat City during the civil war years, programming and resources were extremely limited. Many of those constraints remain in place as the new Afghan government seeks to rebuild Afghanistan's Higher Education System.

The partnership between University of Hartford (UH) and Herat University (HU) was accepted for funding by the World Bank in 2007 with additional funding from USAID. Before the partnership began, all the engineering instructors at HU had bachelor's degrees only, with extremely limited opportunities for graduate study or professional development, including technology in the classroom, pedagogical innovations, and student-centered learning.

Since the partnership began a total of 12 instructors from Herat University have begun graduate studies in Civil Engineering. In addition to their coursework leading to a master's degree, they shadow UH instructors. Through this mentoring they are learning technological applications that are available (and that will be installed at HU via the World Bank funding), and are developing updated, student-centered course materials, assessment methodologies, and plans for continuing education and professional development strategies for when they return to HU. A number of the instructors also will be prepared to implement the Mechatronics and Architecture programs. These two curriculum areas have been developed collaboratively by HU and UH, and will begin running in late 2009 or early 2010.

This paper will address the key successes achieved as well as the challenges encountered in developing a robust partnership between countries with such different histories, cultures, educational philosophies, and resources.

INTRODUCTION

Education is one of the key infrastructure components needed to sustain peaceful development and maintain security so that the Islamic Republic of Afghanistan can meet the critical needs of its people as well as participate fully in the international community. Higher education, in particular engineering education, is at a crucial crossroads. A comprehensive and functional higher education system for engineering students will provide Afghanistan with the building capacity to develop in-country infrastructure as well as to expand its role in the international community.

Collaboration with international universities, under the framework of the Strengthening Higher Education Program (SHEP), has the support of the Ministry of Higher Education, Islamic Republic of Afghanistan, and is funded through a grant from the World Bank. At the outset, It was decided to provide technical assistance to six Afghan universities for the development of their strategic plans. Following the World Bank procedures, Request for Expression of Interest (REOIs) were published for academic partnerships in key areas identified for partnership by the Afghan universities: Engineering, English as a Second Language, Computer Science, Economics/Management and Natural Sciences.

A block grant of \$500,000 was disbursed to each university (based on block grant criteria) to kick off disbursements and maintain momentum. Initially, there was no response on REOIs and the project was unable to move because the implementation of block grants relied on partnerships. The first partnership was built on an unusual and existing relationship through the Rotary Club between Nangarar University and San Diego State University. After the first partnership was signed, the new spread through word of mouth and Afghan Academics in universities in the US and UK began to contact the Ministry of Higher Education directly.

A new leadership in the Ministry of Higher Education and the creation of a stronger implementation team in the summer of 2006 were the turning point toward building effective partnerships between Afghan and foreign institutions of higher learning. Table 1 reflects the University Partnership Program.

The partnership between the University of Hartford (UH) in West Hartford, Connecticut, USA, and Herat University (HU) in Herat City, Afghanistan was initiated in August 2007 to develop and implement a modern program to strengthen and modernize engineering education at HU. The program includes a number of activities such as curriculum review and revision, faculty development, and laboratory upgrading.

Under the partnership, junior HU faculty members, who currently have only a bachelor's degree, applied to enroll in the master's degree program at the UH and are working toward obtaining their master's degree. Earning this graduate degree will enable Herat faculty to be better teachers as well as better prepared to implement curriculum revisions. More qualified faculty also will attract better students and will provide the groundwork to expand curriculum to other engineering areas.

Table 1. University Partnership Program

Project University	Overseas University	Faculty & Contract value	Date of Contract	Contract Duration
Kabul University	Kansas State University	English \$2.4 million	April 2007	36 months
		Engineering \$3.2 million	April 2007	36 months
	University of Delhi	Sciences \$1.4 million	November 2007	33 months
Kabul Polytechnic University	University of Brighton	Electrical Engineering \$2 million	October 2007	36 months
Nangarhar University	San Diego State University	English \$2 million	December 2006	36 months
		Engineering \$2 million	January 2008	30 months
Balkh University	Kansas State University	English \$2 million	August 2007	36 months
	Asian Institute of Technology	Engineering \$1.5 million	January 2007	30 months
Herat University	University of Hartford	Engineering \$2 million	August 2007	36 months
	Technical U Berlin	Computer Science \$2.5 million	November 2007	33 months
MOHE (4 universities)	Ruhr U Bochum	Economics & Mgmt \$1.3 million	November 2007	30 months

BACKGROUND OF THE HERAT/HARTFORD COLLABORATION

Engineering education as a formal pursuit began in Afghanistan with the establishment of the Faculty of Engineering at Kabul University in 1956. That program flourished for over two decades in partnership with various overseas universities and government agencies. In 1984, five years after the Soviet invasion, the faculty was dispersed. Many left the country. A number of these faculty members established an engineering program in Peshawar, Pakistan, which in 1995 was transferred to Herat in Western Afghanistan. The program was officially incorporated as part of HU in 2002 (3).

Since the transfer of the engineering program to Herat in 1995, a total of 441 civil engineers have graduated. Table 2 shows enrollment data for the Faculty of Engineering in Herat since 1995.

Table 2: Enrollment Data, Faculty of Engineering, Herat University

Year	Number Enrolled	Number Graduated
1995	50	-
1996	35	-
1997	45	-
1998	59	22
1999	66	25
2000	73	23
2001	92	23
2002-2005	not available	260
2006	not available	48
2007	not available	40
Total	—	441

The goal of modernizing engineering education in Herat will be best achieved through a two-phase effort. Phase I, which concentrates on developing current junior and senior faculty and upgrading the existing program and curriculum. Phase II, which concentrates on establishing two new bachelor's degree programs: Architecture and Mechatronics Engineering. These activities, which are not mutually exclusive, are being pursued concurrently.

Phase I Project Activities

The project activities under Phase I concentrate on upgrading the current engineering program at HU.

The **outcomes** for this phase of the project include:

- Review and update the Civil Engineering undergraduate curriculum
- Provide opportunities for HU junior faculty to enroll in the UH master's degree program in civil engineering
- Promote updated pedagogical, classroom management and facilitation skills for HU junior faculty through mentoring and participation in engineering extracurricular opportunities such as clubs, engineering societies, etc.
- Facilitate HU senior faculty's ability to lead curriculum revision efforts and other key administrative skills through mentor/shadowing opportunities via short-term visits at UH and follow-up at HU
- Provide assistance to develop and implement a program assessment plan at HU
- Provide technical assistance in laboratory upgrading
- Serve as an educational model for other departments at HU and other universities in Afghanistan

Curriculum Revision

The engineering curriculum at HU was outdated and contained too many credit hours for a four-year degree in engineering. The credits were reduced from 165 credit hours to 145 credit hours by eliminating and combining courses (1, 2, 4, 5). The goal of the undergraduate curriculum revision is to modernize the curriculum and establish a measure of equivalency between UH system universities abroad using the UH system as an example. Under this plan, all engineering courses at HU are designed as transferable to the UH as equivalent courses. The Civil Engineering curriculum has been updated, approved by HU, and is being phased in.

Faculty Development

Currently there are 18 anticipated full-time engineering faculty members at HU. Seventeen of those faculty members have a Bachelor of Science degree in engineering; one faculty member is in charge of teaching Islamic Studies and an additional several part-time faculty members teach related courses such as mathematics, physics, chemistry, computer science, English and management. Two types of faculty development were undertaken under this partnership. A long term master's degree program for junior faculty, and a short term shadowing at UH for the senior faculty from HU.

Senior faculty from Herat shadow Hartford faculty

In this step, a senior faculty member from HU shadows a UH civil, mechanical, or electrical engineering faculty member. One senior faculty was at UH in November 2008. The second senior faculty member will be at UH in 2009. The duration of this shadowing activity is one month, and includes:

1. Observation of engineering classes at different levels.
2. Supervised assistance teaching a variety of engineering courses to develop a variety of pedagogical models and options; a UH professor will supervise the activities of the visiting HU professor.
3. Assist develop course(s) for HU, particularly in an electronic/computer-based classroom or for the distance-learning environment. One point of emphasis is the development of future shared projects between UH and HU students.
4. Observation, study, and practice of administrative and management skills, including ongoing faculty and curriculum development and revision.
5. Skill acquisition and practice for managing and completing the assessment process.
6. Academic advising.

In addition to classroom observation, the senior faculty member assists and/or co-teach a class with a UH professor.

Junior faculty from HU pursue the master's program at UH

Currently, twelve junior faculty members from HU are pursuing their masters' degrees at the University of Hartford. Of the twelve, seven in civil engineering, two in civil with emphasis in architecture and three in mechanical engineering/mechatronics. Another six professors are scheduled to come to Hartford in July 2009.

Through the English Language Institute at UH, these students received intensive classroom and laboratory instruction. Courses emphasize oral/aural skills, reading comprehension, vocabulary development, grammar, and writing skills development. While at UH, HU junior faculty will shadow Hartford professors during the academic year, develop on-line courses, to be used at HU, under the supervision of a UH professor, and participate in a project related to Afghanistan.

UH and HU Partnership: Faculty Exchange and Joint Design Projects

UH faculty members travel to HU

Under the partnership agreement, engineering faculty members from UH travel to HU during UH summer term (second semester HU) and/or as part of a leave or sabbatical. Their role is to co-teach courses at HU, assist in curriculum revision, provide ongoing faculty enrichment, conduct research, help develop an assessment process, and provide refresher courses.

These activities will be accomplished through co-teaching courses and through conducting seminars, workshops and short courses. Some of the refresher courses can be made open to the general public and other departments at Herat. Additional offerings/courses are scheduled for 2009, as part of summer term/sabbatical. These activities will be coordinated with the HU Faculty of Engineering so that HU faculty members can co-teach a course with a UH professor.

Joint senior design projects

Another component of the UH to HU partnership is working to establish joint senior design projects through different initiatives at UH. These joint design projects will be established via distance learning, and led by faculty from UH, HU, and individuals from Connecticut industry. This partnership will reinforce the distance-learning aspects of the HU strategic plan and will also ensure sustainable collaboration between faculty and students from HU and the UH beyond the current plan.

CRITICAL INFRASTRUCTURE DEVELOPMENT FOR THE PHASE I PARTNERSHIP

Computers have been placed in the library for access to digital library resources such as engineering and academic research databases through the e-Quality alliance (funded by USAID). This resource will be operational once Internet access is available.

Students also will be able to use these computer work stations for completing homework assignments and class projects.

Laboratory facilities at HU include Soils, Asphalt, Concrete and Metals, Surveying, Hydraulics, and Computer laboratories

UH continues to assist in integrating laboratory experience with theoretical and textbook learning throughout the curriculum. However, an ongoing obstacle is that the current lab space, although aesthetically pleasing, is not well-designed for conducting labs. For example, it is extremely difficult to conduct the soil laboratory in the space provided, and the marble floor in the concrete lab are not up to the wear and tear this lab entails.

Computer Laboratory and IT Resources: As of June 2008 furniture has been purchased and is being installed in the third-floor computer lab and second-floor library of the HU engineering building. Originally it was proposed that each engineering classroom contain a smart board and related computer connection. However, the cost for such a setup makes equipping each room prohibitive, and not every classroom requires an electronic setup. The ANGeL Center (housed in the HU administration building) and the third-floor computer lab will have projector and other electronic instructional tools.

Classrooms: Classroom space at the former HU campus was inadequate. Classroom space at the new HU campus is well constructed and adequate for students' needs. A drafting room with tables and equipment is in place, and two sections of drafting classes meet twice each week. Some ongoing engineering laboratory improvements are required.

PHASE II: ADDITIONAL PROGRAM DEVELOPMENT

Phase II, expanding the engineering curriculum to areas beyond civil engineering that are critical for continued development of infrastructure and capacity in Afghanistan, can begin as soon as the Ministry of Higher Education approves the initiation of these programs at HU. Preliminary steps toward the creation of the programs such as curriculum development, faculty training, and planning for these programs have begun concurrently with Phase I activities.

Undergraduate Architecture Program

Architecture applies the skills of a number of engineering disciplines to the design, construction, operation, maintenance, and renovation of buildings, with particular attention to the buildings' impacts on the surrounding environment.

An undergraduate program that develops practicing architectural experts fits well with the interests of HU and the City of Herat and can help meet the need for orderly rebuilding of the city's infrastructure. About 20 existing civil engineering courses (approximately two years' worth) will be shared between the Architecture and Civil Engineering programs.

Development of the architecture program also conforms to the Ministry of Education's goal of increasing enrollment of female students. A complete (four-year) curriculum for the Architecture program has been developed and submitted to HU for review.

Undergraduate Mechatronics Program

Mechatronics combines the strengths of electrical and mechanical engineering, and graduates from a Mechatronics program function well in both the mechanical and electrical engineering job markets. Students in such a program can select courses to emphasize either electrical or mechanical engineering, or both. Of particular benefit to HU, an undergraduate Mechatronics program is an alternative to separate electrical or mechanical engineering programs and will greatly augment the current offerings in civil engineering. A complete curriculum for a Mechatronics Engineering program has been submitted to HU for review.

Additional faculty training and development

As soon as the proposed Architectural and Mechatronics programs are approved, it will be necessary to train HU faculty to teach specialized courses in these areas. To that end, the five top HU civil engineering graduates are being trained at UH for assuming faculty positions in the Architecture and Mechatronics programs (three in Mechatronics and two in Architecture). The Mechatronics group will spend two years at UH—one year devoted to taking any needed undergraduate courses to prepare for graduate level work, and a second year to work toward a master's degree in Mechanical Engineering.

In a similar manner, the Architecture group (two faculty members) will spend a total of two years at UH. However, due to limitations in the partnership period, they will not complete a master's degree in Architecture, but a master's degree in civil engineering with heavy emphasis on architecture. They will take enough architecture courses, both undergraduate and graduate, to prepare them to teach Architecture courses at HU.

To move toward gender equity in line with the HU Strategic Plan, the two architecture faculty members being trained at Hartford are female.

Infrastructure for Phase II

The implementation of Phase II will require the addition of the following labs at HU:

1. Electrical Engineering (EE) Lab
2. Mechatronics Lab
3. Architecture Studio

It was decided that the Electrical Engineering (EE) lab would be combined with the Mechatronics lab. Current no architecture students are enrolled, but that is expected to change when the curriculum is officially approved and courses scheduled. In addition, the president of HU is working to acquired laboratory space that will be dedicated to architecture labs.

Conclusions

A partnership between Herat University and University of Hartford was established to modernize engineering education at Herat University. This activity was funded by the Ministry of Higher Education, Islamic Republic of Afghanistan through grants from the World Bank, and some of the activities were also partly funded by the USAID.

As a result of this partnership, the civil engineering curriculum has been updated, a new curriculum in architecture and one in mechatronics engineering have been proposed. Twelve faculty members from Herat University are pursuing their masters' degrees at University of Hartford. Seven of them in Civil Engineering, three in Mechanical Engineering/Mechatronics, and two in Civil Engineering with emphasis in Architecture. In addition, one senior faculty member from Herat spent a month at Hartford shadowing a faculty member from the University of Hartford. University of Hartford professors have also been visiting Herat University during the summer months.

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