International Collaboration in Engineering and Technology Education: A Case Study

Sohail Anwar
Penn State Altoona

ABSTRACT

This paper describes an engineering and technology education collaboration between the Institut Universitaire de Technologie (IUT) housed in the Bethune campus of the Universite′d'Artois in France and the Altoona College of The Pennsylvania State University (Penn State Altoona). This collaboration embraces faculty exchanges, short-term student industrial placements, teleconferencing, and curriculum development.

The Universite′d'Artois houses programs in engineering, engineering technology and management at its Bethune campus. As a new university located in the northern part of France, it has a strong commitment to internationalism. Graduates from IUT Bethune must satisfy a foreign language proficiency requirement and an industrial placement component in their curricula each year. Penn State Altoona offers the first two years of 182 majors available at the Pennsylvania State University, University Park Campus, as well as six associate degrees, and four bachelor degrees including a bachelor of science in electro-mechanical engineering technology, a bachelor of science in business, a bachelor of arts in letters, arts, and sciences, and a bachelor of science degree for registered nurses.

In carrying out collaborative activities with Penn State Altoona, the primary motivation of the IUT is to expand its faculty and student awareness of "American" English and American culture. The IUT provides financial support to its faculty for short-term exchanges to the United States. The IUT also provides limited support to the Penn State Altoona engineering technology faculty for short-term exchanges to Bethune. Because of the English language proficiency requirement at IUT Bethune, the US faculty members are expected to teach courses in English. The primary motivation of Penn State Altoona is to provide international experiences for its engineering technology faculty.

This paper completely describes the activities that are being conducted both at IUT Bethune and at Penn State Altoona as a result of collaboration between the two institutions. The paper also describes the obstacles encountered by both IUT Bethune and Penn State Altoona in carrying out the collaborative activities. Finally, the paper describes present success and future promises of the collaboration between the two institutions.

INTRODUCTION

Increasingly it has become obvious to leaders in education, business, and government that college and university graduates in the United States are inadequately prepared for the challenges posed by global competition, especially in sectors involving the development and management of sophisticated technologies. Throughout higher education curricular revisions and study abroad

programs are being introduced to remedy this shortfall. This trend to strengthen academic preparation in foreign languages and international studies, however, has had only marginal impact on the engineering curricula and even less of an impact on the education of engineering technology students.

This is unfortunate, for as organizations become more global in their operations and as technology becomes more sophisticated, American industry will need more people who can work in foreign countries. Engineering technologists with additional language skills and with an understanding of other cultures will be very valuable members of the engineering team in sales, service, maintenance, production, and installation of equipment, processes, and plants. The engineering and engineering technology graduates of The US educational institutions must be prepared to work in multicultural teams in multinational corporations, some of the education preparation they need will come from international collaborative experiences that develop abilities and familiarity with information technology, team work, international collaboration, and design methodologies in a global environment. The collaboration between Penn State Altoona and IUT Bethune, France is a unique initiative to create an early educational awareness of the global implications of engineering education - engineering professional through the use of international collaborative student teams and design projects.

THE IUT - PENN STATE ALTOONA CONNECTION

The University d'Artois is a new university in northern France. It is composed of four campuses which until the early 1990's were part of the University of Lille. Today the University d'Artois houses programs in engineering, engineering, technology, and management at its Bethune location, liberal arts and related disciplines at its campus in Arras, natural and applied sciences in Lens, and law programs in Douai . At the Bethune location the engineering programs are organized into the Institut Universataire Technologie (IUT) for the technology programs and the Institut Universataire Professionelle (IUP) for the engineering programs. As a new university in the French system the University d'Artois has a strong commitment to internationalism, which is also being directed from the Bethune location. Initial collaborations were focused on engineering and engineering technology but have since expanded to include other disciplines and locations of the university. In addition, it is important to note that both IUT and IUP graduates must satisfy a foreign language proficiency and an industrial placement component as part of their required curricula. For all engineering and technology majors, English is one of the required foreign languages.

Penn State Altoona is one of 24 campuses making up the Pennsylvania State University system. It is the second largest of the 24 campuses and is a full service residential campus located 42 miles from the research campus at University Park.

Penn State Altoona became a four-year college within the Pennsylvania State University system in 1997 and offers baccalaureate degrees in four majors (Bachelor of Science in Business, Bachelor of Science in Nursing, Bachelor of Science in Electro-Mechanical Engineering; and a Bachelor of Arts in Letters, Arts & Science). Penn State Altoona provides the first two years of course work for 182 Penn State undergraduate degrees. Fall 1997 enrollment at Penn State Altoona was more than 3500 students of which more than 3100 were in-state residents and over 400 were out-of-state. Enrollment also included students from more than a dozen foreign countries.

The initial motivation of the IUT Bethune was to expand their faculty and student awareness of "American" English and culture. To this end, they have committed significant financial resources to support the travel of their faculty for short term visits to the United States and for the limited support of Penn State engineering technology faculty for short term visits to IUT Bethune. Because of the English language proficiency requirement in both their engineering and engineering technology curricula, they expect the US. faculty members to teach courses in English.

The initial motivation of Penn State Altoona was to develop international experiences for engineering technology faculty. Some financial support has been available from the School of Engineering Technology & Commonwealth Engineering (SETCE) of the Pennsylvania State University for this initiative, however, considerable resources have been committed in time and support by the Penn State faculty, staff, and administration.

HISTORICAL OVERVIEW OF INTERNATIONAL COLLABORATION

The international collaboration between the Pennsylvania State University and the IUT Bethune was initiated in 1994 with the exchange of one faculty member each, between IUT and the University Park Campus of Penn State. Several exchanges of faculty followed and in early 1996 a Memorandum of Understanding was signed by both institutions outlining a broader range of collaborative activities including the exchange of students, the development of collaborative courses, the cooperative instruction of video conferences, and the exploration of the use of new information technologies for teaching, learning and distance education.

In 1996, three faculty members from the University Park Campus of Penn State, one faculty member from Penn State Altoona and one faculty member from Penn State New Kensington traveled to IUT Bethune to teach and observe in several departments. Two students from the University Park Campus of Penn State spent two months in industrial placements in Bethune and Lille.

Again in 1997, four faculty members from University Park and one faculty member from Altoona traveled to Bethune to teach lecture and laboratory sessions and to collaborate on a conference on the use of information technology for teaching. Two students form the University Park Campus had industrial placements in northern France. These placements were arranged through IUT Bethune. Three IUT Bethune students had industrial placements in central Pennsylvania, arranged through Penn State Altoona.

COLLABORATIVE ACTIVITIES BETWEEN IUT BETHUNE AND PENN STATE ALTOONA: PAST AND PRESENT

During May/June 1996, Professor Sohail Anwar who is the EET Department Coordinator at Penn State Altoona accompanied three faculty members from the University Park Campus and one faculty member from Penn State New Kensington, to IUT Bethune. During his two-week stay in Bethune, Professor Anwar participated in several lecture and lab sessions of the courses such as programmable logic controllers (PLCs), microprocessors, industrial electronic, and electrical machines. During the lecture sessions, he helped students in solving various engineering applications and design problems. During the laboratory sessions he helped the IUT Bethune instructors and students in organizing and conducting lab exercises. Although the

medium of instruction at IUT Bethune is French, due to the English language requirement in their curricula, most of the students had no difficulty in understanding English statements. These students were able to help those who had a difficulty in understanding English. It was observed during the lab sessions that IUT students were trained to work very well individually and in pairs but not in teams each consisting of more than two members.

During the same time when the Penn State faculty members visited IUT Bethune, two engineering students from the University Park Campus started two-month industrial placements in Bethune and Lille. These internships were arranged through IUT Bethune. Room, board, and local transportation for the students were provided as a minimum by the French employers. These students had some conversational abilities in French because they had taken at lease one undergraduate course in French as a part of their engineering curricula at Penn State. The students gained valuable practical experience while working in the French manufacturing organizations.

In April 1997, an IUT Bethune faculty member, Professor Ravalitera, who teaches microprocessors and control system courses at IUT visited Penn State Altoona for two weeks upon invitation from Professor Anwar. All the expenses associated with Professor Ravalitera's visit to Penn State Altoona were fully covered by IUT Bethune. During his visit, Professor Ravalitera taught a portion of Professor Anwar's microprocessors class. This course is a required course for the students in the BSEMET (BS in Electro-Mechanical Engineering Technology) program of Penn State Altoona. Professor Ravalitera has a very good command of the English language and he taught both the lecture sessions and the lab sessions in English. By conducting the class sessions and the laboratory sessions of Professor Anwar's microprocessors course for two weeks, Professor Ravalitera gained first-hand knowledge of the skills, attitudes, and abilities of the Penn State Altoona BSEMET program students. He closely observed the teamwork done by the Penn State Altoona students to complete the laboratory projects assigned to them. He also gained a working knowledge of the MOTOROLA 68000 microprocessor simulator used by the Penn State Altoona students in the microprocessors course. Professor Ravalitera introduced the Penn State Altoona students to the MOTOROLA 6809 microprocessor simulator used by him to teach microprocessors at IUT Bethune.

During the time when Professor Ravalitera visited Penn State Altoona, three engineering students from IUT Bethune started six to eight weeks long industrial internships at Conrail and the Altoona Hospital, two of the major employers in Altoona, Pennsylvania. These internships were arranged through Penn State Altoona. The internships did not carry any stipend for students. IUT Bethune paid for a major portion of room and board expenses for these students through a European Community (EC) grant. Penn State Altoona paid for the air transportation of these students from and to IUT Bethune. The three IUT Bethune students who completed the industrial internships in Altoona participated in various activities at Penn State Altoona. They attended several class sessions of the various engineering and French courses taught at Penn State Altoona. They developed valuable contacts with several Penn State Altoona faculty members and numerous Penn State Altoona students. As a result of the industrial internships and participation in activities at Penn State Altoona, the IUT students were able to develop an understanding not only of the American industrial environment but also of the social and cultural environment.

Professor Anwar from Penn State Altoona visited IUT Bethune in May 1997 along with four faculty members from the University Park Campus of Penn State. He participated in several lab

sessions of Professor Ravalitera's microprocessors course in addition to some of the class and lab sessions of the power electronics course taught at IUT. Professor Anwar also participated in a conference on the use of information technology in engineering and higher education organized and taught by the faculty members from the University Park Campus who were visiting IUT at that time.

COLLABORATIVE ACTIVITIES AND PROJECTS: THE FUTURE

Two specific collaborative projects will be conducted during 1998 to build upon the existing partnership between the Pennsylvania State University and the IUT Bethune. Additional projects will be developed in the next few years. Both projects involve team work, collaborative problem solving, group dynamics, and design. The first project involved collaboration between the University Park Campus of Penn State and the IUT Bethune. The second project involves collaboration between Penn State Altoona and the IUT Bethune. Details of each project are as follows:

Project 1 - *Collaborative Design Teams:* One section of a first year design class of Penn State University Park students (approximately 30) will collaborate with a similarly sized first year class of IUT students. Ten teams of six students will be formed; each composed of three University Park and three IUT students. All teams will be assigned a design project which comes from one of the surrounding industries of Penn State or the IUT. Faculty at Penn State have extensive experience in working with industrial partners to identify an appropriate project for this level of instruction. A series of team building and cultural awareness sessions will sensitize these cross culture teams to issues and concerns of their partners. Existing and new resources will be developed for these activities for delivery in an asynchronous mode. The language of communication between the team members will be English, however, each team will be provided language assistance by an upper division student in French-Engineering dual major. Teams will communicate electronically to solve the design problem. This will include electronic mail, the world wide web, chat groups, fax, teleconferencing and videoconferencing. They will also have available identical software programs and videoconferencing software with document sharing capabilities.

Project 2 - *Independent Design Teams:* Penn State Altoona and IUT students will be assigned an identical industrial based design project. Following a strong emphasis on the development of team skills, including such topics as working in teams, developing collaborative solutions, dealing with difficult team members, and evaluation of team colleagues, student teams will be formed at both Penn State Altoona and the IUT. These teams will be assigned a common design project. Periodic sessions, using various instructional technologies will be held for the students to exchange and discuss ideas relative to the design project. Hopefully, these will also lead to follow-up communications and activities using other technologies. In contrast to the previous project, this project emphasizes team building skills. Whereas, the former project emphases collaboration in a team effort.

In both projects the best design solutions will be determined following student, faculty, and industrial input. It is anticipated that the major motivating factor will be the award of travel certificates for the students on the teams with the best design solution to visit their colleagues in France and the USA.

DRIVING FACTORS

1. *A Strong Innovator Leads the Process* - The principal driver of this international collaboration has been Professor Lessene, the Director of IUT Bethune. His commitment to the collaboration is based on a requirement for the IUT Bethune students to gain a working knowledge of foreign languages. To fulfill this requirement, he has committed adequate financial resources to bring in faculty from other countries to teach in foreign languages, often English, about their specialties in their own countries. At the Pennsylvania State University, Professor Lessene's counterpart is Dr. Wayne Hager, the Head of the School of Engineering Technology and Commonwealth Engineering (SETCE) who has been quite successful in bringing Penn State resources into the international collaboration between IUT Bethune and Penn State.

2. *Endorsement from the Management at IUT Bethune,* the collaboration was initiated by the top management. At the Pennsylvania State University, the SETCE Head has had the authority to enter into this collaboration. Also, both the French Government and the Pennsylvania State University recognize the importance of international collaborations.

3. *Continuous Evaluations* - Assessments are conducted immediately after each activity and the planning for the next activity is carried out while the results of the previous activity are still fresh in everyone's mind.

OBSTACLES

1. The Penn State students who obtain industrial placements in France get paid for working in industry. The IUT Bethune students who get industrial placements in the USA usually do not get paid for their work. The industrial internship is an unpaid learning experience for them. Obviously, they would like to be paid for their work as the grant from IUT Bethune covers only a portion of their total expenses. This is a major problem for student exchanges between the two institutions.

2. Language is an issue. IUT Bethune requires all their students to gain a working knowledge of two foreign languages. Penn State tends not to recognize either the utility of working knowledge or profession specific language skills.
The French language skills of Penn State faculty is also a problem. Of the five faculty members who visited IUT Bethune in 1997, one is an expert in French, two have rudimentary skills, and two have none.

3. Information technology has also been an issue. The telephone and FAX is the preferred mode at IUT, but by 11:00 AM EST they are leaving their offices. At Penn State e-mail is extensively used. The Internet was initially resisted in France. This has now changed and IUT got its first Internet lab in the beginning of 1997.

CONCLUSIONS

International collaboration between IUT Bethune and Penn State Altoona was described in this paper. The collaborative activities span faculty exchanges, industrial internships for students, joint conferences, and team based design projects. The key factors driving this collaboration were described. The obstacles which still need to be overcome were briefly discussed. It is expected

that despite all the obstacles, this international collaboration will continue to grow and more innovative collaborative activities will be carried out in the years to come.

BIOGRAPHY

SOHAIL ANWAR - Sohail Anwar obtained a Ph.D. in Industrial and Vocational Education from The Pennsylvania State University in December 1995 and an M.S. degree in Electrical Engineering from the University of Texas at Arlington in May 1982. He completed additional graduate coursework in control theory and applied mathematical sciences at the University of Texas at Arlington during 1982-1984. Since August 1992, Sohail has been working as an assistant professor of engineering and Department Coordinator of Electrical Engineering Technology at Penn State Altoona.