

Design Competitions An Avenue For International Exchange

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Introduction

Globalization of the world is taking place. U. S. companies are finding themselves needing to know more and more about other countries and businesses that reside there, whether, to be able to sell products, establish manufacturing facilities, collaborate with foreign companies, assess competition there or here or some other reason. It is reasonable to expect that many of these companies would be looking for college graduates, including engineers, with some sort of international exposure. Hence, many universities and colleges have developed and are developing methods to expose their students to international culture, business and engineering practices. Traditional methods involve exchanges of students and/or faculty between a U. S. institution and a foreign one. Types of exchange include: the exchange of graduate or undergraduate students with another institution for part of their education; the exchange of graduate students for research efforts; and, the exchange of faculty for purposes of research or teaching. Other methods involve the teaching of globalized culture, business and engineering courses at the U. S. institutions, and providing cooperative education opportunities for U. S. students with foreign based companies, both here and abroad.

For years, U. S. institutions have had a large contingent of foreign graduate students and now we are seeing more and more. These numbers far exceed the number of U. S. students going to a foreign institution for their education. This imbalance also exists in most student or faculty foreign exchange partnerships. Many countries have English as a strong second language, while the U. S. is primarily a one-language country. A university is much more apt to find more foreign students or faculty to come to the U. S. than their students or faculty who would feel comfortable learning or teaching in a foreign university. The exchange of students or faculty for collaborative research is also apt to be a little one-sided. It is because of this that Old Dominion University's College of Engineering and Technology developed, with its sister institutions in Germany and Japan, a short term design competition that moves from institution to institution.

History

Old Dominion University is located in Norfolk, Virginia, home of the largest naval base on the east coast and the headquarters for NATO (North Atlantic Treaty Organization). As many other U. S. cities have done, Norfolk has established "sister city" relationships with several cities abroad including Wilhelmshaven, Germany and Kitakyushu, Japan. The sister city relationship

provides for visits both ways by city officials, public service groups, entertainers and others. As part of a “sister city” relationship, institutions in both cities have been designated a sister institution, with efforts to establish joint programs. ODU’s sister institution in Germany is the Fachhochschule Wilhelmshaven (1975) and in Japan, Kyushu Institute of Technology (1993).

In the late ‘70’s and early ‘80’s the College of Engineering and Technology explored efforts for exchange of faculty and students with the Fachhochschule. During that period the Fachhochschule sent two or three faculty members to teach a course in the summer while ODU sent one to Germany during that period. In 1985, the Fachhochschule began sending students to complete their junior or senior year at ODU, ranging in numbers from one to four each year. This continued for about 10 years and has slacked off recently when availability of German scholarships diminished. ODU has sent one student for research and two faculty members to teach short courses in technical English, during the past ten years.

In 1990, Professor Steve Wells, a mechanical engineering technology faculty member, and co-author of this paper introduced a competitive design component in his senior level kinematics course. The competition was based on the MIT Vehicle Design Competition, and became a regular part of the course. Utilizing a kit, students have to develop a vehicle that could perform a certain task while trying to prevent their “heads on” competition from achieving the same. This became very popular among the engineering technology students. In 1994, Professor Wells and the college expanded this competition to include a group of students from Fachhochschule Wilhelmshaven. Through contacts at the Fachhochschule, 12 students and a faculty advisor were invited during the semester break of the Fachhochschule. Each German student was paired with an ODU student making up 12 teams. Utilizing the kits provided, the teams had approximately 10 days to complete their design with a single elimination tournament at the end of the second week. Professor Wells called this competition “Hands Across the Water”. It involved opposing vehicles on a playing field, trying to move ping pong balls from one place to another while preventing the other vehicle the same. The team who had moved the most ping pong balls was declared the winner and moved up to the next competition. The entire competition took place in a two-hour period on stage in an auditorium with a large audience, consisting of students, the public, and the local and college press. Representatives of companies, providing financial support acted as judges. The Fachhochschule and German government provided transportation costs for the German students and advisor, while ODU provided for the “on-site” expenses, including competition kits, prizes, and activity expenses. Through the sister city association “home stays” were provided for our foreign visitors. The total on-site expenses were \$3000 which was provided by the College of Engineering and Technology, ODU's Office of International Programs, and solicited contributions from local industry.

This competition was followed, within a year, by a similar competition in Germany. The Fachhochschule Wilhelmshaven hosted the competition, providing the necessary “on site” expenses and “home stays” for the U.S. Students. ODU provided air fare for eight students and a faculty advisor traveling to Germany at a total cost of approximately \$5,000. Funding was provided by the Dean of the College of Engineering and Technology, and individual departments. A third competition was held at ODU the next year. During all of the competitions the participants experienced great interaction, both technical and cultural, and many became

friends. The exchange is not only between students. The visiting faculty member also brings his expertise into the host university classroom in the form of guest lecturers.

In 1994 and 1995, the Presidents of Old Dominion University and Kyushu Institute of Technology in Japan exchanged visits and worked to identify ways to develop relationships between these new sister institutions. An agreement was reached that a design competition would be held at ODU in the summer of 1996, and that the president of KIT would provide \$10,000 in seed money. Planning for the competition began early in 1996, with committees at ODU and KIT working together, the primary effort coming from ODU. It was decided to hold the design competition over a five week period in July and August when students from both institutions were between semesters. It was also decided that there would be four teams, each with one Japanese engineering student and one ODU engineering student, each student being selected by his or her institution. Each team would have one student with an electrical background and one with a mechanical background. The design competition would not be a “heads on” vehicle competition, but would involve an electro-mechanical design project that the teams could design and build in five weeks and have their solutions judged. It was also felt that the design of something meaningful to society would be appropriate. The goal was to have the project and teams identified at least a month before the competition so they could begin communication by email. (Actually, the project in 1996 was not completely spelled out until a week before the competition) A criterion for evaluation was developed by the ODU committee with input from the KIT committee. KIT provided transportation and food expenses for four students and a faculty advisor. ODU provided housing in the dormitory, materials cost of \$600 per team, prizes and special activities including field trips to local industry. The total cost to ODU for the first competition was approximately \$16,000, \$10,000 in seed money and \$6,000 ODU funding, supported primarily by the College.

The project selected for this first Japanese-American competition was to design and build a remotely controllable dead bolt door lock that would benefit the elderly and handicapped. At the end of the period, four distinct designs were presented for evaluation, with written and oral reports presented by each American and Japanese student. The public, press and students were invited to attend the final judging by industry representatives. Prize money was awarded as suggested by the KIT president at \$1500 each for first place, \$750 each for second place and \$250 each for third and fourth place, a total of \$5,500. Just as with the German-American competition, students exchanged cultural and technical views, and learned to work together as an international team. ODU was invited to send a group to Japan the next summer, 1997, to participate in a similar competition at KIT.

The second competition at KIT was similar to that at ODU, with the KIT committee doing most of the planning. ODU paid the travel expenses for four students and two faculty advisors. One faculty member went for the first two weeks and another for the second two weeks. (It was difficult to get faculty to give up four weeks of their summer research opportunities.) The design project this time involved a sensing/action device that would prevent a wheelchair from accidentally falling off a curb. The competition was extremely successful and the ODU students experienced Japanese culture firsthand. ODU students also enjoyed the three industrial field trips planned by the KIT committee. KIT students were invited back to ODU the summer of 1998 for the third design competition.

The Third International Design Competition

Because of the expense of sending our students and faculty to Japan we did not send a second team to Germany for that competition. (The Fochhochschule had expanded their competition to include other institutions in Germany and other countries of Europe.) In the early planning of the Third International Design Competition it was agreed that four Fochhochschule Wilhelmshaven students should be invited to participate with ODU and KIT students. Teams would be made up of three students, one from each of the three countries, and the competition would be truly international.

The competition at ODU was reduced to four weeks, from the middle of July to the middle of August. ODU's competition committee agreed on a project supplied by St. Mary's Home for Disabled Children in Norfolk, Virginia. Many children there did not have the ability to experience vestibular (the sensation of moving through space) motion due to their disability. They seemed to be happier when someone was moving or rocking them and the occupational therapist felt the children would learn better if they could experience some form of this motion. St. Mary's asked us to produce a platform on which the wheelchair could be placed, and a translating type motion provided. Because of the size required, the student teams were asked to develop a half-scale prototype. The device would provide four inch up and down motion and 12 inch side to side and front to back motion. In addition to providing the platform and motion, each team had to develop control panels for the child and an attending nurse. A desired characteristic was being able to vary the speed. St. Mary's personnel provided continuous advisement. KIT and Fachhochschule committees agreed on this project. Competition participants were selected by their respective committees and teams formed based on the participants' individual backgrounds. There were two mechanical engineering and electrical engineering student on each team. The ODU students were selected with one criteria being to provide balance on each three-person team. A preliminary project description was sent to the members of each team two weeks before the beginning of the competition so that they could begin communicating via email. The foreign students arrived on the 19th and 20th of July and the competition began on the 21st with a visit to St. Mary's Home for Children. This visit provided extra incentive to the students. No kits were provided, but each team had \$800 to spend on their design. (Shortly after the competition, one of the ODU students had a death in her family, which caused her to miss the middle two weeks of the competition. This severely handicapped her team, since the ODU student generally provides transportation for team members to purchase needed items. Upon her return, it was decided to break up this team and put its members on one of the other teams. This was not a perfect solution but reasonably accepted by all concerned)

This project proved to be an extremely difficult task, given the time frame of four weeks. Students spent many more hours than was generally expected, cutting into their free time, but they were very enthusiastic about developing a good product. Each of the three teams presented a working prototype and first, second, and third prizes awarded. The final designs were presented and judged by representatives of St. Mary's at the Home on August 13th. Design concepts from each prototype are being used to develop a full scale device this year. Motion factors were fine-tuned this fall in an ODU design capstone course, and a prototype will be built in the spring of 1999. ODU scheduled two field trips to local industrial facilities, but only one was taken because the students wanted to spend extra time on their project.

Partly from the students request to have additional funds for materials, prizes were substantially reduced from previous competitions. Monetary prizes were not awarded. For first place, prizes worth \$300 were awarded to the three students; for second place, prizes worth \$200; and for third place, prizes worth \$100. The total on-site expense for the third competition was approximately \$10,000. Most of their funding, (\$7,000), was provided by the Dean of the College of Engineering and Technology with the remainder coming from ODU's Office of International Programs and one local engineering company. Foreign students' travel and subsistence were supported by their respective institutions, with dormitory rooms provided by ODU.

Future Plans

The next competition is scheduled for Kyushu Institute of Technology, Japan in the summer of 1999. Both ODU and Fachhochschule Wilhelmshaven students will be invited. The following year the competition will move to Germany. It is expected that the competitions will continue and be refined into the near future and opportunities for including other foreign institutions in the competition will be sought.

Conclusions

Based on the several design competitions in which Old Dominion University has been involved, certain conclusions have been formulated. Short term design competitions provide excellent opportunities for interaction between U.S. and foreign institutions and their faculty and students. Language barriers are reduced substantially when team members are communicating one-on-one about a technical design problem. Sketches and drawings provide good communication tools. Cultural exchanges are enhanced because team members are working together for at least 25 hours per week for four weeks, in addition to spending time together socially. The visiting students have the opportunity to learn about purchasing materials and equipment in another culture. Participating students also learn alternate solution methods from each other, and how to function as part of an international team. Students may become interested in learning more about a new culture and language. Visiting students may also identify opportunities for further education. When field trips are scheduled, students have the opportunity to view firsthand how foreign engineering and manufacturing industries work. Private companies also have benefited from these competitions. One student was hired by a major international firm, when they were told about his involvement and exposure to working with international students on a "real" engineering project. A distinct advantage of short term design competitions is a smaller time commitment from students and faculty.

There are several challenges for successful design competitions. A primary concern for most institutions is providing funding for travel and on-site competitions. Generally, a competition similar to the ones described above may cost an institution approximately \$10,000 for either on-site expenses or foreign travel. There are few resources within a department, college, or institution to support this type of annual cost. Continued success of the competitions may well depend on our ability to get external funding to provide most or all of the funding. ODU is embarking on an effort to solicit sponsorship from local and regional companies, both domestic and foreign, to provide the necessary funding for future competitions. Another challenge is to

provide suitable guest housing. In some of ODU's initial competitions, foreign students stayed in people's homes (home stays). This arrangement may be satisfactory for a week or so, but longer competitions require the use of dormitories or other facilities. Continuing faculty involvement is also a challenge. It is difficult to get faculty to participate for four weeks or longer without a stipend, and to stay with it year after year. A more technical challenge is the ability to identify meaningful design projects that can be completed in a short time frame, without taking away important time for students (and faculty) to socialize and visit local industry and sights. A substantial amount of preliminary work must be spent in determining suitable projects. Planning for competitions should start at least six months before the scheduled event.

Biographical Information

GARY R. CROSSMAN

Gary R. Crossman, Associate Professor of Mechanical Engineering Technology at Old Dominion University, Norfolk, Virginia, has 29 years of experience in engineering technology education. He holds a Bachelor's degree from the U. S. Merchant Marine Academy and a Masters of Engineering degree from Old Dominion University. He has been very active in the Engineering Technology Division and the Engineering Technology Council of ASEE, holding several positions in ETD, including chair. He has also been active in TAC of ABET, as a commissioner and the American Society of Mechanical Engineers. Professor Crossman has been the administrative advisor at ODU for the design competitions with Kyushu Institute of Technology and Fachhochschule Wilhelmshaven.

STEVE WELLS

Steve Wells, Associate Professor of Mechanical Engineering Technology at Old Dominion University, has over 15 years of experience in engineering technology education and four years of industrial experience. He holds a masters degree in Mechanical Engineering from Old Dominion University. He is active in the American Society of Engineering Education and was recently elected a commissioner on TAC of ABET. He has been very active in home schooling and teaching courses via the Internet. Professor Wells has been the technical advisor at ODU for the design competition with Kyushu Institute of Technology and Fachhochschule Wilhelmshaven.

MICHIHIRO NISHI

Michihiro Nishi, Professor of Mechanical Engineering at Kyushu Institute of Technology, Kitakyushu, Japan, has over 30 years of experience in engineering education. He holds a Dr. Eng. in Mechanical Engineering from Kyushu University. He has attended several conferences in the United States and was a visiting professor at Stanford University in 1987-88. He is a member of several professional societies, including the Japan Society of Mechanical Engineers. Professor Nishi has been the main contact person at KIT for the design competitions with Old Dominion University.