World Transactions on Engineering and Technology Education
Vol.2, No.3, 2003

International perspectives in water resources management: the Paraná River watershed

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ABSTRACT: The University of Iowa's IIHR - Hydroscience & Engineering (formerly the Iowa Institute of Hydraulic Research) offers a multidisciplinary course that focuses on the global nature water resources management. *International Perspectives in Water Resources Planning* is a two- to three-week study abroad course that encourages an interdisciplinary group of participants (including students and faculty from the host region) to study the effects of major water resources projects on society and the environment. A hallmark of the course is close and in-depth interaction among a diverse group of students, researchers, practitioners and government officials in order to develop a better level of understanding of the impact of cultural diversity and global situations on decision-making. To date, this course has travelled to India (1998), Taiwan and Japan (1999), China (2000), Central Europe (2001), and Argentina and Brazil (2003). The article summarises the overall course organisation, activities and student reactions with an emphasis placed on the recent 2003 Argentina and Brazil course.

INTRODUCTION

¿Querés mate? Sebastián, a 22 year-old undergraduate hydraulic engineering student from the University of Buenos Aires, Argentina, asks Yoshihiro Katsuhama, a graduate student from Japan as he offers him a cup of traditional Argentine tea. Diversity has become the catchword of the modern global marketplace and universities are rapidly developing new tools for increasing students' understanding of and ability to work in diverse situations with people from various cultural and geopolitical backgrounds.

As corporations increasingly seek employees who can succeed in a diverse international workplace, universities around the world are challenged to find ways to prepare students to meet that need. This challenge is particularly significant for engineering students who often have few, if any flexible credit hours or time to diversify their curricula and gain international experience [1].

One way to assess student's intellectual development is that developed by Perry, who conducted open-ended interviews on students after each of their four academic years [4]. Perry constructed a nine-stage scale tracing the students' sequential development in relation to problem solving skills. The scale begins with students' perceiving learning in terms of dualist absolutes (eg right or wrong), positions 1 and 2, and ascends to positions 7 through 9 where students appreciate the relative complexity of major projects, and that multiple solutions can exist for one problem, enabling them to make conscious commitments about their choices.

Traditionally, engineers have ranked low on Perry's scale due to the absolutist nature of the disciplines upon which engineering is founded. However, a paradigm shift is currently occurring. As societal challenges become increasingly complex and global, a broader range of problem solving skills and greater sensitivity to cultural diversity is warranted for today's engineers.

At the University of Iowa, Iowa City, USA, one study-abroad programme is addressing this need with a unique 0-3 credit, two- to three-week study international experience wherein students and faculty from North American universities live, travel and work with foreign students, colleagues and faculty in the host country. The experience is designed to bring together engineering students in North America with their *counterparts* in the host region to promote a better understanding of the professional, economical, social and cultural similarities and differences that impact upon the planning and management of large water resources projects. These activities also expose participants to the realities of international decision-making [3].

PROGRAMME OVERVIEW

The University of Iowa course *International Perspectives in Water Resources Planning* was created in 1998 as an initiative of the IIHR - Hydroscience and Engineering (formerly the Iowa Institute of Hydraulic Research). The IIHR is known around the world as a research centre in fluid mechanics, water resources engineering and hydrology. During its 80-year history, it has attracted international students, many of whom have returned to their home countries and made notable contributions in academia, government, industry and private practice. These international students have left a stamp on the IIHR [5].

However, except for the occasional foray into foreign cuisine and movies, local students have had little opportunity to gain an appreciation of the lands and cultures their international colleagues came from and returned to practice their profession. The *International Perspectives* course was designed to remedy

this imbalance. For the IIHR, it made eminent sense to focus the course on water resources, a subject that, in today's world, requires keen appreciation and respect for historical, cultural, social, economic, environmental and ethical issues to design and execute a successful project. Since 1998, the course has focused on particular water resources projects in selected world regions, in particular:

- India (1998);
- Taiwan and Japan (1999);
- China (2000);
- Central Europe (2001);
- Argentina and Brazil (2003) [2][6].

Many of these projects have been – and still are – subject to worldwide scrutiny, and it is proper that today's student and tomorrow's water professional have first-hand knowledge of the relevant issues. In all cases, the IIHR has relied on its extensive international alumni network for logistic support.

By exposing students to the international and multi-faceted issues surrounding the management of major water resources projects, the IIHR seeks to increase student's sensitivity and awareness of global issues and to enhance their understanding of international processes and decisions. By emphasising the importance of both the technical and cultural aspects of water resources planning, the course gives students technical experience while helping them to better grasp the geopolitical and cultural context that influences resources management decisions; an element more common in the liberal arts curriculum than in engineering sciences.

In order to reinforce the interdisciplinary goals of the course, the programme's itinerary includes technical lectures and site visits, as well as activities meant to experience the unique cultural characteristics of the host region. For example, the most recent programme to South America included tours of the Itaipú Dam, one of the seven modern wonders of the world, and of Iquazú Falls, one of the seven natural wonders of the world.

Students are assigned to group projects that are based on their experiences abroad. This year's projects included the following:

- A comparative analysis of the Mississippi and Paraná watersheds;
- A research proposal for a more detailed comparative analysis of the Mississippi and Paraná rivers to support ecological engineering goals and to learn about the future or past of one river by studying the other;
- The creation of a course Website: http://www.iihr.uiowa.edu/education/international/argentina/index.html;
- Writing an article presenting the unique aspects of this course. This article is based on information gleaned from a post-trip survey of students and faculty from Argentinean and US institutions.

One aspect separating the IIHR programme from other study abroad courses is the academic and cultural diversity of the participants. This year's participants included students and faculty from environmental, civil and hydraulic engineering at the University of Iowa, the University of Illinois, Colorado State University, Argentina, Brazil, Costa Rica, Japan, Nicaragua, Romania, Turkey and Venezuela. This year's course also included graduate students in urban and regional planning from both the USA and Argentina.

Diversity and soft skills are further emphasised in the University of Iowa programme by sponsoring a group of hydraulic engineering students from the host country who accompany the group for the entire trip. The constant interaction allows for an experience similar to longer cultural immersion programmes, but with a condensed timeframe more manageable for time-constrained engineering students and faculty.

This experience not only benefits students and faculty from the USA, but also has a dramatic impact on the international students and faculty that interact with the IIHR group. For example, this was the first experience for many of the Argentinean and Brazilian students to actually meet a person from the USA. In post-trip surveys, Argentine students credited the course for dissipating many of their previously held negative stereotypes regarding people from the USA. One Argentine student wrote, *Without doubt, the best part was the interaction with other students, and the good relationships within the group helped to break down certain prejudices I previously had.*

2003 COURSE: THE PARANÁ RIVER WATERSHED

The 2003 course to the Paraná River watershed of Argentina, Brazil, Paraguay and Uruguay provided students with a unique perspective on water resources planning issues along one of the world's great rivers. Figure 1 shows the itinerary map and activity schedule for the 2003 course.

The Paraná, with an average flow similar to that of the Mississippi River, and 1,600 miles in length, is the second largest river in South America after the Amazon. The course provided a kaleidoscope of experiences with the Paraná by exposing the group to the river from a multitude of perspectives. By foot, the group was given access to the inter-workings of the great dams at Yacyretá and Itaipú.

Walking through the massive Itaipú structure and standing inside a dewatered unit at Yacryrta gave the group a new respect for the enormous scale of the two projects. Figure 2 shows students inspecting the massive Francis turbines for generating electricity at Itaipú, the world's largest hydro-power dam.

The group was also impressed by the diplomacy involved with the international projects: Yacyretá is shared between Argentina and Paraguay, while Itaipú divides the electrical output between Paraguay and Brazil. In the latter, electricity is generated at two different frequencies for the two partner nations! Figure 3 shows the spillway at the Itaipú hydro-electricity dam.

Just as the dams emphasised the power of sound engineering and technological advance, the Iquazú Falls highlighted the incredible force of nature unbridled. Figure 4 displays the majestic Iguazú Falls viewed from the Brazilian side. About 275 waterfalls spanning a 2.7 km-wide arc fall 70 m in a breathtaking spectacle designated as one of the UNESCO World Heritage sites. The majority of the group listed walking throughout the scores of waterfalls at Iquazú as one of the three most enjoyable and valuable experiences of the course.

1. Buenos Aires: Days 1,2,3,11,12,13,15,16 &17
Tour Delta del Tigre, Meetings: University of Buenos Aires, Water National Institute (INA), Visits: Palacio San Martin, estancia, Soccer Museum; Attended: tango show and soccer game

2. Santa Fe: Days 4 & 5
Seminar at Facultad de Ingenieria y Ciencias Hidricas (FICH), View of Parana alluvial valley, Boat tour of the Parana river

3. Posadas: Days 6 & 7
Visit Yacyreta Dam and "Ruinas Jesuiticas"

4. Iguazu: Days 8, 9 & 10
Visits: Iguazu Falls and Itaipu Dam

5. Colonia: Day 14
Boat trip on the Rio de la Plata, Colonia city tour, Visit Plaza de Toros

Figure 1: Itinerary map and activity schedule of the 2003 course.

Figure 2: Students at the Francis turbines (18 × 715 MW each), which generate electricity at Itaipú, the world's largest hydro-power dam.

Figure 3: View of the spillway at the Itaipú hydro-electric dam.

Figure 4: The majestic Iguazú Falls as viewed from the Brazilian side.

The group noted the admirable regional environmental protection initiatives, including the establishment of natural parks on both Argentinean and Brazilian sides of Iguazú falls and of a modern specialised research centre at the Itaipú dam focused on the fauna and flora inventories, reforestation, handling and administering the use of the impounded hydraulic resource and its protection belt.

Buenos Aires

Argentina's capital, Buenos Aires, a megalopolis of 11 million inhabitants located at the Rio de la Plata confluence with the ocean, fascinated the group by its elegant and active environment, the warmth of its people, and the variety of attractions. Meetings of the American students at the University of Buenos Aires and INA facilitated a bi-directional flux of information on water resources management. Lectures given by both sides were followed by discussions within smaller, specialised groups on focused areas of interest that sparked an exchange of publications and future collaborative plans.

By boat, the group toured the wealthy Buenos Aires suburb of El Tigre, where the river housed the famous Argentinean crew teams. They saw, firsthand, how the river provides food and serves as the kitchen, bathroom and laundry for people along the river's banks in the city of Paraná. The poorly kept, low quality buildings along the river in Paraná were a stark contrast to many of the grand structures along the Delta del Tigre. These obvious differences raised the issue of the influence of stakeholders in political decisions affecting the river and its inhabitants.

The issue of stakeholders and their political capital in water resources planning in Argentina were highlighted in the recent flooding in Santa Fe, located to the east of the Paraná River. Just before the students arrived in Argentina, this provincial capital was inundated by the worst floods in the history of the colonial city, and over 50,000 people were evacuated. A levy that would have prevented the tragedy had not been completed, apparently because it would have obstructed the view of the river from a golf course. This tragedy provided students with a very real example of the high potential for social impacts and political aspects of water resources management. Figure 5 shows some of the tremendous damage in the wake of the flood at the soccer stadium of Colón de Santa Fe.

Figure 5: Flood aftermath at the soccer stadium of Colón de Santa Fe.

Bus travel was the most common form of transportation and long rides, such as the 20 plus hour drive from Iguazu Falls to Buenos Aires, provided students with extensive views of the northern Argentinean landscape. Many of the students commented on how similar the terrain was to their own midwestern vistas. Realisations like this help emphasise the global commonalities among people and places and are unique to the study abroad experience.

CONCLUSIONS

Being able to work alongside people from diverse backgrounds has become a necessity for graduating students entering the global workforce. Where *International Perspectives in Water Resources Planning* excels is in the constant interaction between diverse groups of students. Living with fellow engineering students from other countries provides a greater understanding of different cultures and perspectives than is possible in a typical short-term study abroad experience.

In the post trip survey, 98% of the participants, both Argentinean and those from US institutions, listed social interaction as the most valuable element of the course and many credited this interaction with significantly increasing their understanding of key issues. Indeed, it was stated that:

> *Both the students and faculty were open, knowledgeable and always available for us. Most of what I learned about environmental issues was gained from discussions with Argentine faculty and students.*

The *International Perspectives* programme is valuable in addressing and offsetting the clustering of people with similar backgrounds that is common on university campuses, despite *diverse* student populations. Figure 6 exhibits a group photograph of participants from the 2003 course.

The programme format is essential to increasing cultural sensitivity about water resources planning and to better the cultural and political contexts influencing resources management decisions. The IIHR course is a successful example of one university's attempt to provide students with the soft skills and real life experiences needed for success in an increasingly global workplace.

Figure 6: Group photograph at the ruins of a Jesuit mission.

ACKNOWLEDGEMENTS

The authors are very grateful for the gracious hospitality of their local hosts, namely: Dr Angel Menendez (INA), Dr Claudio Baigún (IB-INTECH), Prof. Carlos Vionnet and Prof. Leticia Rodriguez (Universidad Nacional del Litoral), Dr Rodriguez Fernandez (Central Hidréletrica de Itaipu), Dr Raul Lopardo (INA), Ing. Luis Marcelo Cardinal and Lic. Alfredo Fortuny (Yacyretá Dam), as well as Prof. Roberto Lotero (Universidade Estadual do Oeste do Parana).

Special thanks are also due to Dr Larry Weber and Dr Allen Bradley (University of Iowa) for their participation in the course and the technical presentations at University of Buenos Aires and INA.

This course could not have been conducted efficiently without the logistic support provided by Mercedes Menegazzo of Interfly, Argentina, and Autumn Tallman and Ryan Baumert of the University of Iowa.

It should further be noted that all photos were taken by Mr Yoshihiro Katsuhama.

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UNESCO INTERNATIONAL CENTRE FOR ENGINEERING EDUCATION

4th Global Congress on Engineering Education

The *4th Global Congress on Engineering Education*, to be held in Bangkok, Thailand, from 5 to 9 July 2004, will debate important global issues in engineering education and industrial training. King Mongkut's University of Technology Thonburi (KMUTT), Bangkok, Thailand, is the host and principal co-sponsor, and Menam Riverside Hotel, Bangkok, will provide the venue for the Congress.

The objective of the Congress is to bring together educators, professional organisations and industry leaders from around the world to continue the dialogue about important issues and challenges in engineering and technology education for the 21st Century. Moreover, it is anticipated that the Congress will further enhance the UICEE's links and networks, and will set the stage for more innovative and collaborative ventures. The Congress will address experiences and ideas within the international community in the context of rapidly changing technology and production processes. It is anticipated that Congress contributions will concentrate on the three major themes as follows:

General Issues in Engineering and Technology Education:

- Effective methods in training engineers and technologists,
- Current issues and trends in engineering education and industrial training,
- Curriculum design and evaluation and the relevance of liberal education,
- Application of new technologies in engineering and technology education and industrial training,
- Education for the protection of the environment; sustainable development.

International Collaboration in Engineering and Technology Education:

- Transfer of information on engineering and technology education,
- Recognition of foreign qualifications and accreditation systems for engineering and technology courses,
- International mobility of academic staff and students,
- Technology linkages between developed and developing countries,
- International collaborative programs and systems.

Academia/Industry Collaboration in Engineering and Technology Education:

- Social and philosophical aspects of engineering and its impact on modern societies,
- Academia/industry interaction programs,
- Promotion of continuing engineering education and industrial involvement,
- Cooperation between engineering deans and industry leaders,
- Management of academic institutions and engineering faculties.

Other topics for Congress papers are welcome as they relate to the main Congress themes or as they intend to contribute significantly to engineering and technology education. It is anticipated that proposed papers will present research findings describing the effectiveness of new approaches to engineering education and the achievements of engineers and educators in improving engineering education in general, and engineering curriculum, instruction and methods of training in particular. The needs of industry are of particular interest, especially as they relate to matters concerning the methods and effectiveness of training in further and continuing engineering education. The implementation of special collaborative programs, novel methods and modern approaches to industrial training are of particular relevance to the Congress theme.

2004 marks the 200th year anniversary celebrations of the birth of King Rama IV, King Mongkut, Patron of the KMUTT. Hence, a decision was made to coincide these celebrations with the Global Congress. It is thus envisaged that a half-day session, including some special events, will be held at the University in conjunction with the Congress.

You can visit the UICEE's Conference Website for more information and key deadlines at:

http://www.eng.monash.edu.au/uicee/meetings/index.html