Internationalisation of undergraduate civil engineering students: a collaborative European network

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Abstract
Internationalisation in higher education can be defined as the process of integrating an international and intercultural dimension to teaching. The need for preparing civil engineering graduates to work in an increasingly international society combined with the demand from employers for employees who can manage international markets has led to a greater emphasis being placed upon the role of internationalisation in civil engineering undergraduate degrees. A European Universities Civil Engineering Departments network has been established with the objective of delivering an annual International Project Week (IPW) for students from a range of European nations. The IPW has been designed to assist the students in understanding the European context of their studies and to boost their command of spoken, written and technical English. The network comprises five core European universities: Hogeschool van Amsterdam, Edinburgh Napier University, Lyon IUTA Universite Claude Bernard, the Frankfurt Fachhochschule and the Engineering College of Copenhagen. To date two IPWs have run: Amsterdam (May 2007) and Copenhagen (April 2008) to phenomenal acclaim by the profession. In May 2009, Edinburgh is the host city and over 300 European civil engineering students will participate. This paper presents a review of the previous IPWs together with details of the forthcoming event in Edinburgh. Based upon these findings, some recommendations are provided for the development of the international components of civil engineering education.

Keywords: civil engineering, undergraduate, internationalisation.

1. INTRODUCTION

The term 'internationalisation' is defined herein as a range of teaching processes that are designed to assist undergraduate civil engineering students in understanding the international context of their profession, the civil engineering challenges faced by other European countries and developing the skills that will be required to operate effectively beyond their home nation. It is essential that undergraduate students within the engineering profession are prepared for working in an increasingly international society. Engineering colleges and universities must therefore develop strategies that provide the global perspectives and international experiences that will help graduates excel in this new world order [1].

The need to prepare students for working in an increasingly international society and workplace has been highlighted in other professions such a nursing and medicine [2]. Internationalising education is seen as playing a role in the empowerment of students through the acquisition of skills to help them become more independent, more able to participate in society and able to make the most of the opportunities which are presented to them [3, 4]. The direct contact with persons with different cultural backgrounds can form an efficient, effective and stimulating method to learn about the differences in geographies and teaching methods [5]. In light of recent economic events, preparing students for international travel to obtain work in their chosen profession has become even more critical.

In 1996, the Organisation for Economic Co-operation and Development (OECD) and its Centre for Educational Research and Innovation (CERI) initiated a survey entitled 'Internationalisation of Higher Education'. This survey proposed a typology of internationalised curricula of which 'Type 2' was identified as 'curricula in which the traditional/original subject area is broadened by an internationally comparative approach (e.g. international comparative education)' [6]. The proposed IPW programme can be considered as a Type 2 methodology for

broadening the understanding of the undergraduate student's appreciation for the challenges facing the international civil engineering profession.

The intention of this paper is to describe the historical development of the International Project Week (IPW) and the strategic collaborative network established to deliver an international element to the teaching of undergraduate civil engineering degree courses. The themes and successful elements of the IPW are identified and described to assist other European academic institutions in the development of similar activities.

2. IPW: HISTORICAL DEVELOPMENT

The Hogeschool van Amsterdam and Edinburgh Napier University have historically excelled in the provision of practical work experience as a core component of their civil engineering education. In combination with work placements and internships, both institutions also provide live project site visits to students with support from construction contractors and civil engineering infrastructure clients (public and private). These significantly contribute to the development of the practical awareness that undergraduate civil engineering students have of the ultimate goal of their professional activities, i.e. to design and construct our civilisations.

The Hogeschool van Amsterdam, due to their ideal geographical location, have undertaken site visits and study tours beyond the Netherlands for some time. These events have proven to be a valuable addition to lecture based teaching methods and have provided students with an awareness of their profession beyond the Netherlands.

In May 2006, 50 staff and students from the Hogeschool van Amsterdam visited Edinburgh Napier University for a week of site visits and lectures relating to critical civil engineering challenges facing both Scotland and the rest of the United Kingdom. This event was a complete success and as a result the IPW collaborative network was established.

In May 2007, the first IPW was held in Amsterdam with the Hogeschool van Amsterdam as the hosting institution. Edinburgh Napier University and the two other partners, Engineering College of Copenhagen and IUTA Université Claude Bernard descended on Amsterdam for a week long event. Approximately 120 students from the partnering institutions participated in lectures on Dutch civil engineering projects (Figure 1), visited coastal defense schemes (Figure 2) and live tunneling projects. Furthermore, the students undertook a range of tasks and activities that specifically encouraged them to socialise and interact with each other. One area of improvement identified from this event was the need to force social interaction and encourage the students to interact with students from the other institutions.

FIGURE 1. IPW 2007 Maeslant Storm Surge Barrier lecture by Michiel Horikx.

FIGURE 2. IPW 2007 Maeslant Storm Surge Barrier site visit.

In April 2008, the network enlarged to include the Latvian University of Agriculture Department of Civil and Rural Engineering. The 2008 IPW was hosted by the Engineering College of Copenhagen and saw over 130 students attend the event. The theme was transportation and water infrastructure and included site visits to live construction projects in Denmark and in Sweden. By this stage the IPW event was beginning to take on a familiar format: lectures from both academics and practicing civil engineers, project site visits, civil engineering infrastructure site visits (Figure 3.), student mini-projects (Figure 4.) as part of a contest between the student groups and an inspirational amount of interaction and socialising between the different student groups.

The event format has now established and, as stated in the student feedback received, the event prove to be a great success. The 2009 IPW event will enlarge to include visiting institutions from Spain and Paris. This will potentially see the collaborative network expand to include these additional institutions.

FIGURE 3. IPW 2008 Copenhagen pumping station site visit.

FIGURE 4. IPW 2008 Copenhagen student group research activity.

The standardisation of the programme required consideration of student timetables, staff availability, logistical planning, availability of suitable teaching venues, the availability of accommodation, access to computers and the matching of curriculum requirements in relation to the final output or award of credits in relation to the module or course concerning the IPW programme. The standardisation of the IPW programme has developed through a period of continuous improvement building upon the success of each annual event and learning from activities and events that were not so successful.

In relation to civil engineering, each participating university has common elements of teaching in relation to the core subject matter, i.e. hydraulics, fluid mechanics, structural mechanics, materials, geotechnical engineering and structural dynamics. The important learning experience from the IPW is the application of these core subjects to the varying challenges faced by the host country.

3. IPW OBJECTIVES

The overall objectives of the IPW are:

- to provide future European civil engineers with an awareness of civil engineering education and industrial practice beyond their home nation;
- to provide the students with a technical insight into civil engineering projects addressing major future issues facing the profession: e.g. protection of the environment, urban transportation, flood defense and sustainability;
- to provide the students with the opportunity to experience working on projects (tasks) with colleagues from other European nations, ahead of doing so when employed in the industry;
- to assist European students in the development of their English language skills; and
- to provide the students with an international component to their civil engineering studies.

4. ORGANISATIONAL COMMITTEE

The core organisational committee consists of Edinburgh Napier University, the Hogeschool van Amsterdam, the Engineering College of Copenhagen, the Frankfurt Fachhoschschule and IUTA Université Claude Bernard. The IPW committee is chaired by its founding partner Peter de Klerk of the Hogeschool van Amsterdam (Figure 5). It is the intention to maintain the core principal partners of the international exchange group with the provision to bring in additional partners as and when they are identified and willing to participate.

The primary function of the collaborative network is for one of the participating universities to host an IPW event each year. Each year a different partner acts as the host institution. The host institution then forms an event organisational co-ordination team to undertake fund raising, gain industrial partners for the event, co-

ordinate the project site visits and organise the lectures. There are also various social events to be organised that aim to assist the students in interacting with the different nationalities of students.

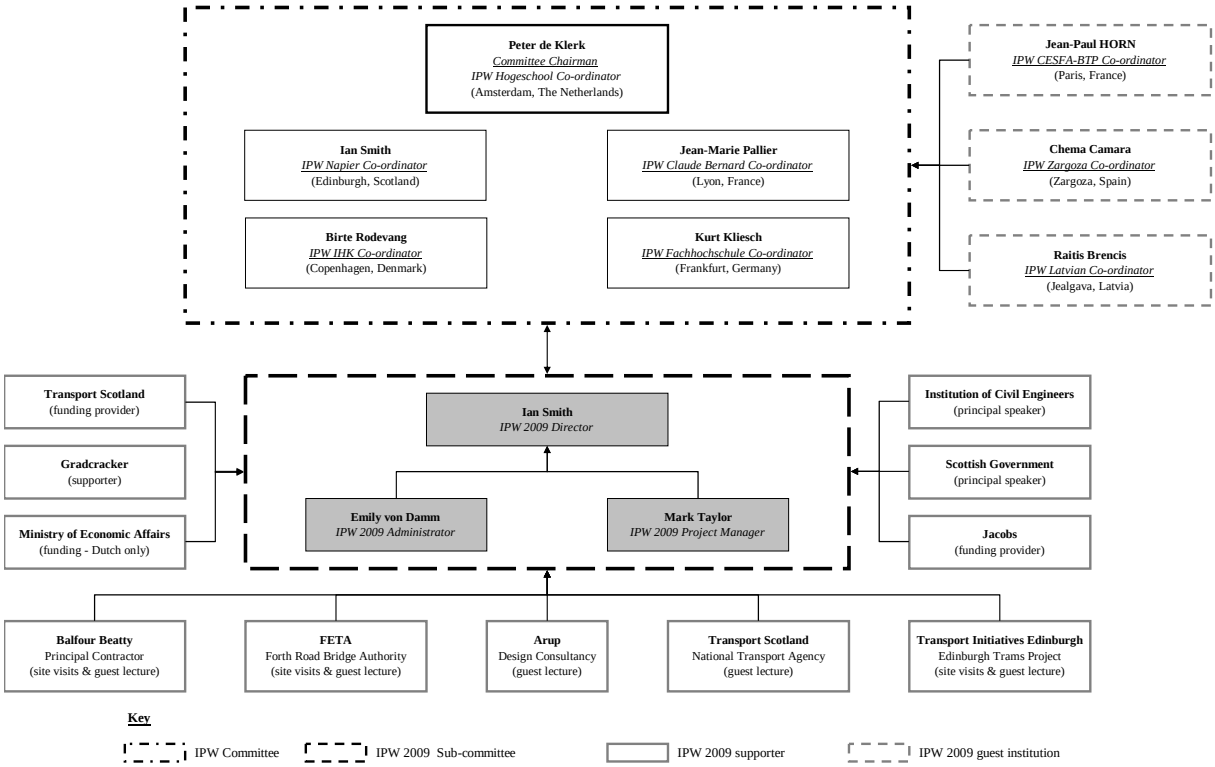

FIGURE 5. IPW organisational structure and funding bodies.

5. FINANCIAL SUPPORT

Financial support is a major factor in the success of the events and the IPW annual events only become possible if adequate funding is in place to compliment the small contribution requested from each individual student participant. All attendees (staff and students) are expected to pay for their own travel costs to the host country and their accommodation in the city for the duration of their stay. From the outset, it was intended that all other costs would be borne by the host organisation with assistance from any industrial sponsorship obtained.

Initially, companies were invited to contribute to the project fund or to become a sponsor of the event. Monetary contribution was considered to be either direct payment to the fund or payment 'in-kind' through the contribution of their staff as guest lecturers or through project site visits. Involvement in the event allowed the company a significant amount of exposure to over 250 European civil engineers of the future and potential recruitment resource for their operations both within the UK and in mainland Europe. A further benefit of sponsoring the IPW event has manifested itself in many of the students considering employment in the host country's civil engineering sectors subsequently seeking information on summer internships and graduate opportunities. One particular company, within the top five international civil engineering consultancy practices, noted that international students provided a good example to their domestic graduates and instilled a greater sense of competition and professional commitment to the company in light of the potential competition for mainland Europe.

The various companies contributing to the event consider it as an additional means of gaining new resource from the Europe-wide professional recruitment market. Furthermore, the need for civil engineering companies (contractors and consultancy practices) to operate beyond their domestic headquarters to remain competitive, positions such European exchange events as a means of gaining essential understanding of foreign civil engineering curricula and student knowledge and capabilities.

However, in light of the recent global economic down-turn, and the recession being experienced in the UK it has been essential to seek additional funding due to industrial sponsors significantly reducing their financial contribution to the event. It is expected that once the European civil engineering and construction sectors are

beyond the grasp of the current recession that industrial financial contributions and sponsorship will be re-instated to its original anticipated levels.

6. STUDENT FEEDBACK

Feedback was sought from all students who attended the Amsterdam IPW 2007 and the Copenhagen IPW 2008. This constructive feedback was considered as part of a continuous improvement process in the development of the programme of events for the Edinburgh IPW 2009. The participating students were asked to complete a short feedback questionnaire relating to their personal experience of the IPW event. These responses were collated and the most relevant and interesting points are summarised below:

- Site visits provided a greater understanding of how civil engineering theory is put into practice.
- Mixing with foreign students provided an opportunity to improve spoken communication.
- Working with foreign students provided an awareness of civil engineering education beyond our home nation
- We gained an understanding of civil engineering education in other European cities – I'm thinking about studying in The Netherlands as I liked their greater emphasis on practical work in design offices.
- New experience to work and mix with International students of different cultures and languages.
- I learned a huge amount about the host country which I wouldn't have otherwise.
- Site visits and tour of city and mixing with international students
- Meeting students from different countries and seeing how they did things in their universities
- The social integration with other students was great - I have made some new friends.
- The site visits complemented each other to give a good overview of Dutch water management engineering
- Experiencing a different culture.
- Being able to mix with different cultures and views, being able to see a new city and the developments around it.
- We did not get enough time to interact with the other students.
- It would have been good if we could have had more social events.

The IPW event provided the students with a unique experience in relation to understanding the working culture of the host countries civil engineering sector. The event not only improved their communication skills but their understanding of other European cultures. Many of the students commented that they would consider working beyond their home nation and look for potential employment throughout Europe. During the site visits, a selection of the Scottish students made comments referring to the fact that they had 'not seen anything like this in the UK'. With a greater awareness of civil engineering solutions beyond the UK, it is likely that this new generation of civil engineers will be more likely to look beyond their home nation for innovative design and construction solutions to adopt on their projects. This can only lead to improved knowledge transfer and a greater willingness to adopt design best practice from throughout Europe.

7. INTEGRATED PROJECT WEEK 2009

Edinburgh Napier University will be hosting the 2009 International Project Week in Edinburgh during May 2009. The week long event will involve over 300 participating students from civil engineering schools (departments) from the following institutions:

- Edinburgh Napier University, School of Engineering and the Built Environment, Scotland.
- Hogeschool van Amsterdam, Opleiding Civiele Techniek, The Netherlands.
- The Engineering College of Copenhagen, Denmark.
- IUTA Université Claude Bernard, Lyon, France.
- Latvia University of Agriculture, Civil and Rural Engineering, Latvia.
- CESFA-BTP Centre Supérieur de Fromation par l'Apprentissage, Paris, France.
- Escuela Universitaria Politécnica La Almunia de Doña Godina, University of Zargoza, Spain.
- Frankfurt Fachhochschule, University of Applied Sciences, Germany.

The entire event is being directed by Dr Ian Smith (Head of Civil and Transportation Engineering) and co-ordinated by Dr Mark Taylor (Lecturer in Civil Engineering) both full-time members of the Edinburgh Napier

University teaching staff. In addition the following people will be involved in the organisation, dissemination and publication of details relating to the event:

- Murray MacCallum, European Co-ordinator, Edinburgh Napier University.
- Derek Elder, Director, Institution of Civil Engineers Scotland.
- Andrew Wilson, Chairman of the Institution of Civil Engineers Edinburgh Area Branch.

Additional staff from Edinburgh Napier University will provide input as and when required. It is intended that a range of undergraduate students will undertake the role of ambassadors and participate in being hosts for the visiting students and ensuring that they enjoy their stay in Edinburgh. Participants from industry, especially those providing guest lectures and/or hosting site visits, will also be involved in the planning and organisation of the week's events.

The features which made the previous IPW events a success have been captured and will underpin the programme of events in Edinburgh. Additional features, unique to Scotland, will be incorporated to ensure that all participants experience a true taste of Scottish culture and its civil engineering achievement – both historical and current.

The outline programme of events includes:

- Welcome to Edinburgh Napier University – a keynote address by Professor Joan Stringer, Principal of Edinburgh Napier University.
- Welcome to UK Civil Engineering – a keynote address by Richard Coackley, Vice President of the UK Institution of Civil Engineers.
- Technical lectures from Transport Scotland, the Forth Rail Bridge refurbishment contractor (Balfour Beatty), the Forth Road Bridge maintenance team (Forth Estuary Transport Authority) and Transport Initiatives Edinburgh (Edinburgh Trams).
- Site visits to the Victorian Forth Rail Bridge – a technical tour including a walk over the structure, a visit to the Edinburgh Trams maintenance depot (currently under construction) and the Rosyth dock yard new dry dock for the new Royal Navy aircraft carriers.
- Social events which include a Scottish themed evening including highland dancers and music to be held at Murrayfield stadium conference facilities.

Additional social events and mixed student tasks and activities will provide the means by which much of the internationalising and networking amongst the students will occur. The outline programme has been established to ensure that students participate in a memorable week with a combination of academic studies and free time for tourism and socialising. The lessons learned from the previous events include; ensuring sufficient socialising and interaction, providing group tasks that assist in social interaction, engage with civil engineering clients, contractors and design consultancies to ensure high quality technical lectures and site visits. Furthermore, the development of a project programme (with adequate preparation time) and budget, seeking funding from industry sponsors, professional institutions and national government and the planning of logistics are fundamental the success of the project. The contribution of 'in-kind' support from industry in terms of site visits and the provision of staff time for the lectures is an essential element to the success of such a project. The Edinburgh Napier University students will engage with the visiting students to act as hosts and to maximise the networking and socialising opportunities.

8. MEDIA COVERAGE

The scale of the IPW 2009 event merits significant media coverage and exposure. Both Edinburgh Napier University's Marketing and Communication Unit and the Institution of Civil Engineers marketing department will be involved in ensuring adequate local newspaper and construction industry press coverage. Results of the IPW 2008 event were published in Civils Scotland in association with New Civil Engineer magazine (published by the UK Institution of Civil Engineers) [7]. Television and radio coverage will also be sought to ensure that the local community and the UK civil engineering as a whole are made aware of the event and the activities of partnering academic institutions in developing and shaping the careers of these future European civil engineers. It is intended that media briefing documents will be developed at the end of the IPW 2009 event to allow the participating organisations return to their home nations with photographs, DVD's and success stories which may lead to further publications and media coverage. These activities are deemed essential for the generation of future funding and sponsorship for future IPW events throughout Europe.

9. SUPPLEMENTARY BENEFITS & FUTURE WORK

As a supplementary benefit to the IPW event, the academic staff involved have actively pursued further scholarly activities in relation to visiting scholarships, guest lectures and assistance in establishing communication within civil engineering design consultancy practices to allow students in obtaining internships and work placement opportunities beyond their home nation. There has been discussion relating to the use of already established Erasmus agreements and the further exchange of best practice in teaching. For example, Edinburgh Napier University and the Hogeschool van Amsterdam are in discussion on the use of an internet based summer placement, internship and graduate opportunities database to allow Scottish and Dutch students access to information relating to such opportunities in each country. The existing Edinburgh Napier University system, currently known as Prospects, will be adapted to allow European employers to post information relating to employment opportunities and assist students in targeting employers.

There are various technical challenges associated with this proposed system. However, both potential employers and the academics responsible for student work placements have expressed interest in this proposal. It is intended to seek funding to undertake the development of this system in collaboration with European construction contractors and civil engineering design consultancy practices.

10.CONCLUSIONS

The process of collaborative working with the various European IPW partner institutions has led to discussion and work beyond that of the IPW delivery. The academic staff involved in the IPW events have gained valuable knowledge and experience of alternative methods of delivering undergraduate civil engineering qualifications through sharing examples of best practice and practical methods of student internationalisation.

The IPW programme represents an exemplar model of internationalising and broadening civil engineering education through a collaborative European network. The programme of events and activities presented provides those considering the development of the international component of degree courses with a platform for success. The IPW programme provides the undergraduate students with extended knowledge of their profession and leaves them with an open mind in relation to considering examples of European best practice as solutions to their home country's civil engineering challenges. At a social level, the students gain an important insight into how to communicate with people of different cultural backgrounds and assists them in coping with new and unfamiliar working circumstances. The companies supporting the IPW event consider their financial and 'in-kind' support to be a useful marketing tool and a means of proving their dedication and commitment to the future of the civil engineering profession. Many of the companies involved has expressed interest in further collaboration with the academic institutions in relation to other civil engineering education matters, i.e. internships, scholarships, work placements, training and employment opportunities.

Future work will include the development of a questionnaire survey mechanism for obtaining student and staff feedback relating to the IPW events which will assist in the process of continuous improvement and the future development of the IPW programme. Furthermore, it is essential that the IPW network considers the development of strategic partnerships beyond the European Union as part of the longer term growth. However, although this would contribute to the international element of the programme, significant costs would be associated with this type of expansion. Funding would become an even more critical element to such expansion.

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