A multidisciplinary, multicultural short course giving young engineers a global perspective on professional practice

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Abstract*: Since 2001 The International Institute of Women in Engineering (IIWE)at EPF, a Grande Ecole, France, has conducted a short course aimed at final year undergraduate or recently graduated engineers. The objectives of the course are to introduce students to the broad concepts and global issues they will encounter in their career and to initiate cultural awareness and communication skills required for the ever changing workplace. To demonstrate the success of this initiative, candidates were required to complete the same questionnaire prior to the commencement and at the conclusion of the course. This paper reports on some of the strategies used to engage international students in the course activities, and discusses the results of the 2006 before and after- course surveys.*

Introduction

Every July since 2001, the International Institute of Women in Engineering (IIWE) at EPF, a Grande Ecole in France, has conducted a three week short course bringing together final year or recently graduated culturally diverse engineering students. The aim of this course, that has a prescribed theme every year, is to introduce young engineers to broad global concepts and issues relating to professional practice. In 2006 the theme was sustainability, and in 2007 it was energy efficiency. These issues require contributions from many disciplines for viable solutions to be achieved.

The multidisciplinary nature of the course has encouraged participants (both male and female) from many fields of engineering, as well as from many different countries and cultures**.** In 2006 "… IIWE welcomed 66 students from 49 countries including: *South Africa, Australia, Austria, Bolivia, Denmark, Spain, the United States, Great Britain, Ghana, Israel, Indonesia, India, Mexico, Norway, Palestine, Pakistan, Poland, the Czech Republic, Rwanda, Sweden, Tunisia, Turkey, Zimbabwe, Jordan and Canada.* There were also 8 core faculty members and a further 20 visiting speakers from: *Afghanistan, Germany, Austria, Australia, the United States, France, Great Britain, Mexico, Nigeria, the Czech Republic and Croatia.*"(About IIWE 2006).

The uniqueness of this course lies in the cultural and disciplinary diversity of the participants. In describing their own Masters-level subject Buchan *et al.* (2007) report that: "There are only a few reports in the literature on subjects which combine the following three features: at postgraduate level; interdisciplinary; and based on an international view of sustainability."

Course structure and content

The course is delivered by a combination of short lecture presentations, break-out sessions (with small groups), site visits and industrial visits. The lectures are presented in English by both the course participants, faculty members and by invited guest speakers with expertise in a particular specialist area.

The lectures are deliberately short (20-30 minutes) in recognition of the fact that for the majority of participants English is their second language. This is also true for many of the faculty members and guest speakers.

The break-out sessions are regarded as providing important opportunities for peer learning and discussion. In each break-out session the groups, with participants from a variety of cultural and geographic backgrounds, are given questions to consider and also provide an opportunity to clarify issues raised in the lectures. These questions are meant to initiate discussion about different aspects of a topic rather than to come to any particular pre-designated conclusion. Trigwell and Prosser (1996) report that discussions are an effective way of encouraging students to actively engage with the content in order to effect conceptual change in the students' understanding. The small size of the group is designed to encourage active involvement of those participants who may not be confident speaking in English. A different member from each group reports on deliberations. This can lead to further discussions especially if the session is prior to a designated break

The course is supported by industrial visits to companies such as IBM, Schlumberger and EADS who operate at an international level and value and deliberately cultivate diversity in their staff. The industrial visits allow a progression from the general to the specific to help participants integrate what they learn in the more traditional lecture sessions. The course participants are provided with information about the company's function and processes, and sometimes recruitment possibilities.

IBM also hosts an entire day including a forum session on achieving work-life balance. The panel members are IBM female technical staff at various life and career stages, who answer questions in an open and forthright manner. Other companies also host career related sessions such as 'interview skills' and 'how to ask your boss for a pay rise'. Attending the course shows the companies that the participants were aware of the need to function in an environment of cultural diversity. This is one of the attributes global companies are increasingly seeking in their employees. These industrial visits also provide an opportunity for companies to assess the attributes of the course participants in an informal setting. Companies, who are recruiting at the time, collected resumes from course participants. On the course feedback survey these industrial visits were rated highly by the participants. In response, in 2007 additional industrial visits were added including visits to Peugeot, L'Oreal, and Société General. As well as the additional industrial visits, as the 2007 theme was "energy", guest lectures were added from companies such as Areva and Gaz de France.

The 2006 course included sessions on:

- Women and Sustainable Energy
- The Sustainability Showcase
- Engineering Education Worldwide
- Women in Management
- Ethics
- Corporate Responsibility
- Project Management
- International Standards
- Risk Assessment
- The Importance of Networking
- Intercultural relations

Participation in this course is also supported by an alumni association which helps to maintain networks developed during the course and provides further insights into international professional protocols.

Assessment tasks

Participants are graded based on their performance in several assessment tasks. These assessment tasks include a poster, two group presentations (geographic area and project) and an individual reflective learning journal. Awards are presented at the end of the course to the three highest ranked participants and best three posters.

The poster is the initial task, chosen because young professionals are generally asked to present in this way at professional conferences. The aim of the poster format is to introduce each participant to each other and the staff and to initiate confidence in speaking English. Participants are asked to include relevant details of their background, reason for their attendance and what they hope to achieve from the course and their aspirations/goals for the future. Each participant has three minutes to present to the group, based on their poster. The posters are assessed on visual impact as well as content. The three minute oral presentation accompanying the poster means that at the very start of the course each participant is up on their feet in front of the rest of the group, encouraging participants to contribute to the course sessions from the very beginning.

For the first of the group presentations the participants are assigned on their geographical areas eg. Australasia, North America, South America, Middle East, Europe, and Africa. Each member of the group is encouraged to present part of the material. Groups are also encouraged to think laterally for their presentation style, such as quiz show formats and role playing. This assessment task gives the participants an opportunity to practice working in a team and to deliver the required information in a specified timeframe. In 2006 groups were asked to focus on engineering education and women in engineering in their geographic region.

For the second of the group presentations the participants were arranged so as to provide a mixture of disciplines and cultural backgrounds. This "project" group task builds on the teamwork and project management skills used in the previous group presentation by introducing the additional challenge of working with people from different cultural backgrounds. This is of increasing importance in an engineering workplace where multinational companies or multinational consortia are becoming more common for the delivery of large projects. For the 2006 course groups were asked to identify a specific problem involving sustainability, and suggest a potential solution. From these project presentations participants were expected to demonstrate through discussion, evaluation and recommendations, increased knowledge of sustainability concepts and issues.

The final assessment task is a reflective journal. For this task participants are expected to write extended responses to demonstrate their learning over the duration of the course. Descriptions of the day's activities are not sufficient, the journals are expected to contain critical evaluation and other evidence to show that participants have actually processed the information presented in the course.

The assessment tasks were framed to allow participants to practise and develop their English communication skills, but also from a "…need for graduates to develop a 'literacy' in sustainability" (Thomas, 2004). The nature of the conference theme, sustainability, also demands evaluation from various cultural, geographical, and disciplinary perspectives for 'robust' solutions to be developed (Buchan *et al.,* 2007; Eagan *et al.,* 2002). This close alignment between *what* the students were learning about and *how* they were being asked to go about this learning was meant to encourage a 'deep' approach involving active engagement with the course material (Ellis *et al.,* 2004).

2006 Pre and Post-course Surveys

At the start of the course participants were asked to complete a self assessment survey containing questions to determine how much the participants already knew about sustainability – the theme of the 2006 conference. Of the 66 course participants in 2006, 59 responded to the pre-course survey, ie 89% of participants. The participants were asked to complete exactly the same self assessment survey at the conclusion of the course, and 55 participants responded giving a response rate of 83% for the post-course survey. The differences between the answers provided in the pre and post-course surveys indicate the impact of the course on the participants' knowledge of sustainability.

Survey Results

The results of six questions in the pre and post-course surveys are shown in Figures 1- 6.

Participants were asked how much they knew about the definition and concepts of sustainable development. The responses to this question are plotted in Figure 1. In the pre-course survey the most popular responses were 'heard of, but could not explain' (37% of respondents) and 'have some knowledge' (36% of respondents). In the post-course survey the most popular response is overwhelmingly (76% of respondents) 'know a lot'.

Participants were asked if they knew about the components of sustainable development. The responses to this question are plotted in Figure 2. The most popular response from the pre-course survey is 'heard of, but could not explain' (53% of respondents), while the most popular response from the post-course survey is 'know a lot' (65% of respondents).

Figure 3 shows the responses to the question regarding how much the participants knew about the various approaches to sustainable development. The most popular response from the pre-course survey (48% of respondents) is 'heard of, but could not explain'. This is different to the post-course survey where 56% of respondents assessed themselves as being in the 'know a lot' category.

Figure 4 shows that most respondents (53%) had some knowledge of the concept of the social responsibility of engineers and organisations at the start of the course. However, by the end of the course the most popular response (51%) was 'know a lot'.

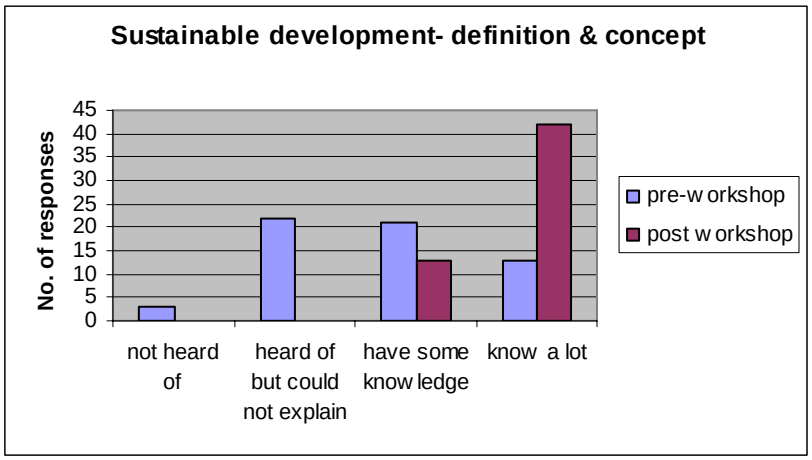

Figure 1: Sustainable development – definition & concept

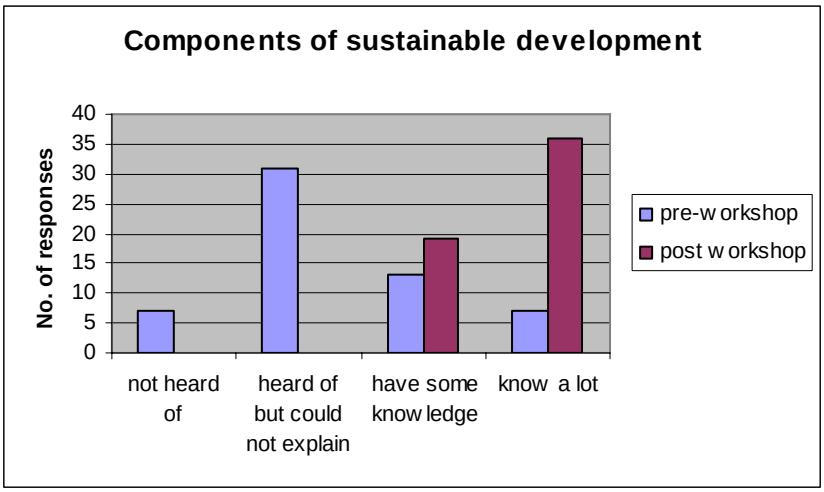

Figure 2: Components of sustainable development

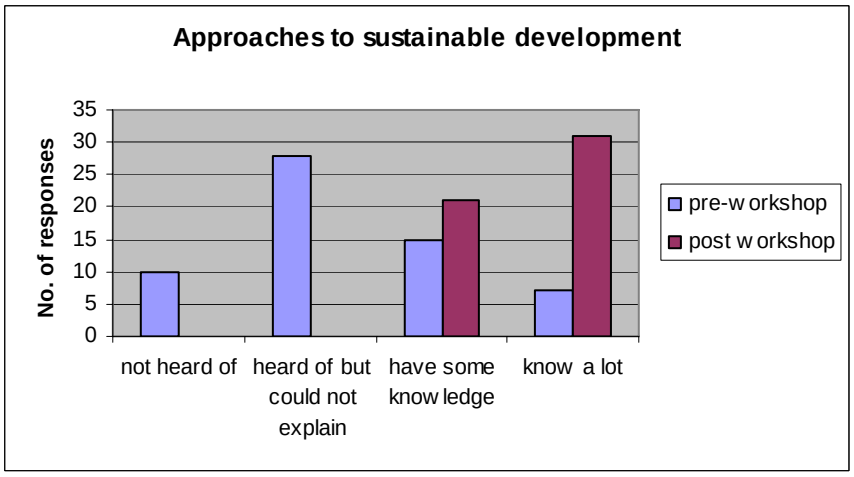

Figure 3: Approaches to sustainable development

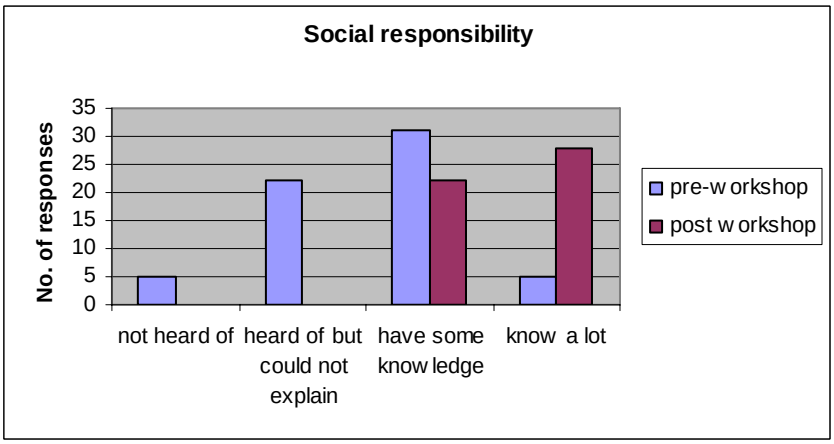

Figure 4: Social responsibility

Participants were asked how much they knew about the engineering community's response to sustainable development. The responses to this question are plotted in Figure 5. This figure shows that at the start of the course the most popular response to this question (44%) was that they had 'heard of, but could not explain' how the engineering community had responded to sustainable development. At the conclusion of the course most respondents (58%) felt they 'knew a lot'.

The participants were also asked if they knew of the actions of companies and engineers to promote sustainable development. Figure 6 shows the responses to this question. At the start of the course the most popular response (49%) was 'have some knowledge'. At the end of the course the most popular response (55%) was 'know a lot'.

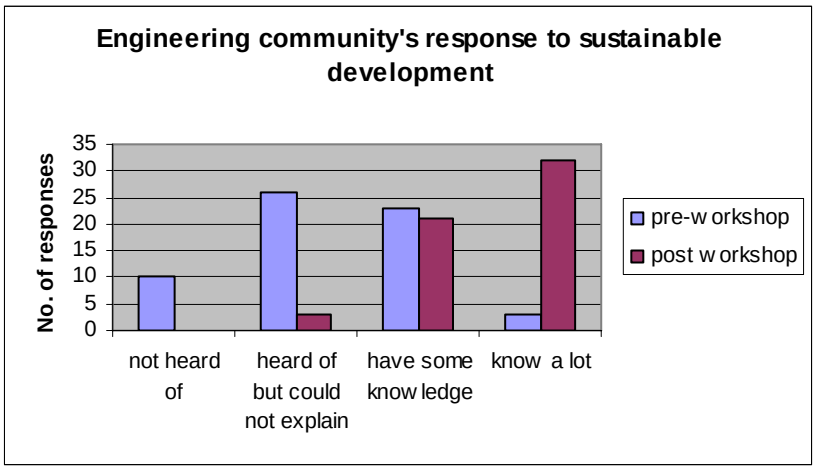

Figure 5: Engineering community's response to sustainable development

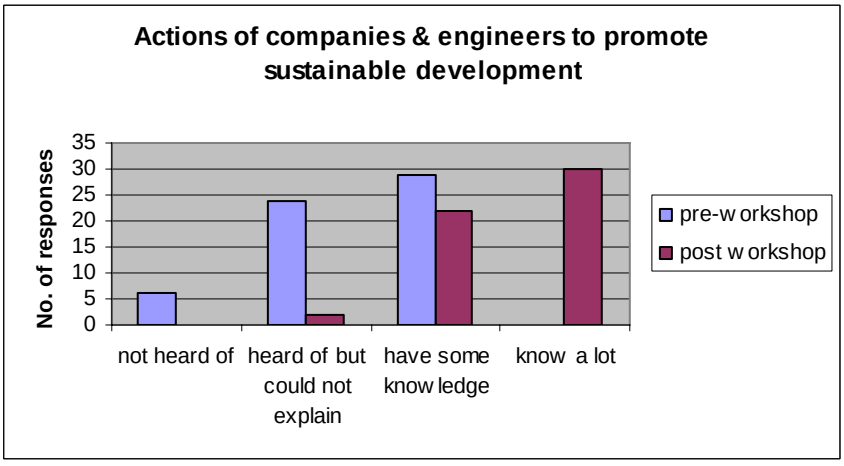

Figure 6: Actions of companies and engineers to promote sustainable development

Discussion of Survey Results

The first three questions (definition of sustainability, components of sustainability, and approaches to sustainable development) assess how confident the participants are that the course has provided them with a framework to analyse sustainable projects. For these three questions there is a significant difference between the pre and post course survey results.

For Figures 1 though 4 the **pre**-course responses for the sum of the lower two categories 'not heard of' and 'heard of but could not explain' are 42%, 64%, 64% and 46% respectively. The **post**-course responses to these questions are zero for these two categories, meaning respondents assessed themselves as either ' have some knowledge' or 'know a lot' as a result of their experiences during the course.

The survey results show that, for every question reported, the majority of participants felt that they knew 'a lot' by the end of the course. This response was up from 'heard of, but could not explain', or 'have some knowledge' at the start of the course. Although the survey results are not definitive as they rely on self-assessment by the participants, they do indicate that the participants felt that they had learnt more about sustainability by attending the course, and had gained some tools to analyse sustainable projects. These results encourage us to continue with the course format that purposely supports active learning including short lecture sessions, many opportunities for peer learning and discussion, all integrated with industrial visits.

Conclusion

The IIWE short course aims to present the challenges faced by international engineers and to prepare them for the diverse cultural context within which much of modern engineering is practised. The IIWE program includes examples of engineering in a variety of countries and geographic areas. Participants are expected to actively engage in these presentations and are assessed on their contributions and ability to reflect. The theme of the 2006 course was sustainability and the pre and post-course surveys demonstrate that participants felt that they had learnt more about the global concept of sustainability by their attendance. Following this very positive feed back by participants and from discussions with industry partners the theme of "energy efficiency" was adopted for 2007.

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