

# Preliminary report on two meetings designed to promote international collaboration in engineering education research

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***Abstract:** We report preliminary results of two international engineering education workshops. In order to foster an international engineering education research community and collaborations, the authors have organised three workshops on the following topics: PBL; gender and diversity; and e-learning. In this paper, we report preliminary results from the first two, which took place in summer 2009 in Europe. Background information about the workshops and participant feedback are presented and discussed. We then analyse features of the workshops that contributed to significantly different outcomes and feedback for each of the events. We conclude with implications and recommendations relevant for those interested in planning, funding, or attending similar international events in the future.*

## Introduction

In many nations and regions, engineering education is emerging as a vibrant research field. For example, The Australasian Association for Engineering Education (AAEE) has developed an Educational Research Methods group, and The European Society for Engineering Education (SEFI) has formed an Engineering Education Research working group (EER-WG) (AAEE, 2008; SEFI, 2009). Since 2001, a series of Global Colloquia on Engineering Education have been held by the American Society of Engineering Education (ASEE) and its partners in diverse locales, and the Society's *Journal of Engineering Education (JEE)* is now distributed in Australasia, the Caribbean, Europe, India, North America, Russia, and South America (Lohmann, 2008). In 2007 and 2008 *JEE* and SEFI's *European Journal of Engineering Education (EJEE)* partnered on an initiative called Advancing the Global Capacity for Engineering Education Research (AGCEER) (Lohmann & De Graaff, 2008). And in many local contexts, engineering education research is being supported by a diverse and growing array of conferences and workshops, graduate courses and degree programs, university centres for faculty development and research, funding sources, and publication outlets (Jesiek et al., 2009a; Jesiek et al., 2009b).

Yet because engineering education is a relatively new field, its international profile remains underdeveloped. Extensive networks are not currently in place to connect researchers from different countries who share an interest in similar topics and approaches. Authors have begun to identify key research areas likely to benefit from international collaboration, yet we know relatively little about how various theories, methods, and findings might translate – or not translate – across national and

cultural boundaries. As other scholars warn, fields that fail to develop an international profile run the risk of being populated by isolated scholars working on similar problems using relatively elementary approaches, seriously impeding the field's growth and development (Lemaine et al., 1976).

Having recognized the many benefits of internationalisation (Borrego, Jesiek, and Beddoes, in review), we organised two workshops in summer 2009, one on gender and diversity and the other on problem- and project-based learning (PBL). Although these two topics were identified because of their relevance across national boundaries, international research collaborations around these two areas have to date been scarce (Beddoes, Borrego, and Jesiek, 2009; Beddoes, Jesiek, and Borrego, 2009). The workshops therefore had the following major goals: 1) support the development of an international research community, and 2) foster international research collaborations. A third workshop on e-learning is planned for December, 2009 immediately after the AAEE conference.

In this paper we discuss preliminary results from the first two events. After briefly presenting background information, we discuss participant feedback and evaluations, as well as our analysis of key factors that shaped the character and expected outcomes of each event. We then briefly discuss the importance of shared understandings as a prerequisite for collaboration, and conclude with recommendations for others who are interested in planning, participating in, and/or funding similar initiatives in the future. A more detailed report on the PBL symposium and an analysis of the global state of engineering education research on gender are forthcoming (Beddoes, Borrego, and Jesiek, 2009).

## Background information: Participants and agendas

The one-and-a-half day International Symposium for Research on PBL in Engineering Education was organized in conjunction with the Engineering Centre for Excellence in Teaching and Learning (engCETL) and the Engineering Subject Centre at Loughborough University in Loughborough, UK on June 24-25, 2009. It was organized in conjunction with another meeting titled Enhancing Project Based Learning in Engineering, held June 23-24 at the same venue. Participants included six US researchers, approximately ten UK researchers (depending on the day), one Irish, and one Australian researcher. US participants, the Australian and Irish participants, and many UK participants attended both Enhancing Project Based Learning in Engineering and the symposium. The one-and-a-half day US-Europe Workshop for Research on Gender and Diversity in Engineering Education was held at Delft University of Technology (TU Delft) in Delft, The Netherlands, June 30-July 1, 2009, just prior to SEFI's Annual Conference in nearby Rotterdam. Participants included seven Americans and four Europeans. Reasons for and consequences of the underrepresentation of Europeans are discussed below.

## Participant feedback

We asked participants to anonymously evaluate the symposium and workshop by answering questions on a five-point scale, from poor (1) to excellent (5). The results are summarized in Appendix 1. We also asked seven open-ended questions, which inform our analysis below. Knowing that the enthusiasm and momentum initially gained at many similar events has a tendency to fade once the event is over, we also asked participants to identify at least one action item they were committed to completing after the event, along with a deadline for completion.

In summary, participant feedback from the PBL symposium was overwhelmingly positive. Participants particularly appreciated the structure of the symposium, commenting that, "The structured agenda focused the discussion toward deliverables but within an environment where open discussion was welcomed;" "The logical flow of the activities...led us from ideas to actual product;" and "The discussions and timely advancement of each task to move things forward and ensure discussions did not stagnate."

Participant feedback from the Gender and Diversity Workshop, on the other hand, was mixed. More participants stated that their goals were not met and that not enough was accomplished. It is worth noting here that, according to their evaluations, symposium and workshop participants had similar goals and expectations going into the two events. Several participants perceived the workshop as disorganized, saying that it had "no structure" and that it should have been "organized properly." Four

Americans lamented the fact that there were not enough Europeans present and that Americans dominated the conversations, as reflected in comments such as: “I was very happy with my interactions with the Americans, but felt the conversations were overly dominated by Americans.”

## Analysis

Based upon participant feedback as well our observations of the symposium and the workshop, we believe that the differences in the two events may be attributed to a variety of factors, all of which offer insights for those wanting to plan similar events or collaborations. Here we discuss how the timing, populations, and topics of the two events affected their outcomes. We also briefly discuss the importance of shared understandings for international collaborations. Recommendations from these insights, as well as from our experiences planning the symposium and the workshop, are detailed in the concluding section.

## Timing

Participants at the PBL symposium were afforded the opportunity to spend significantly more time together as compared to the Gender and Diversity participants. Because many participants also attended the engCETL event on Enhancing Project Based Learning in Engineering, they had numerous advance opportunities to work and talk together, both formally and informally. They dined together the first and second nights as well, whereas not all Gender and Diversity participants chose to dine with the group on the first evening of the symposium. The Gender and Diversity workshop also started late due to a facilities problem (a leaky ceiling in the meeting room). The significant difference in the amount of time participants spent together prior to the meetings is likely one reason for the observed differences.

Another aspect of timing that proved crucial was coordination with pre-existing events and networks and use of university facilities. The high number of international participants at the PBL symposium was guaranteed by organizing in tandem with engCETL’s other PBL event, and with enough advance notice for attendees to adjust their travel plans. We benefitted from established local and regional networks that the Engineering Subject Centre and engCETL already had in place, which ensured a large number of participants (Arlett et al., 2009). We similarly tried to organize the gender and diversity meeting in coordination with a European event, but for several reasons were not quite as successful. First, due to holiday travel schedules, the workshop was scheduled before the larger conference. Although some attendees stayed for the SEFI conference, the workshop obviously did not benefit from any prior interaction. Second, the SEFI conference is focused more broadly on engineering education than our topic of gender and diversity, so identifying the ideal conference and contacts was more complicated. Third, since the SEFI conference was too large to be held at a university, we had to cultivate additional contacts at a local university (to avoid facility rental charges) and move the workshop to a nearby, but different, city. Fourth, more complex coordination limited the advance notice to European invitees, and several simply could not adjust their travel schedules. These timing issues meant that we only had a small number of European researchers, which was troubling for both organizers and participants.

## Population of participants

The population of PBL participants was more homogeneous in terms of geographic origin and educational background as compared to the Gender and Diversity population. At the PBL symposium, all participants were from an institution in either the UK or the US, with the exception of one Australian and one Irish participant, so it was easier to reach shared understanding of the educational systems and context in each country. Additionally, participants were primarily focused on sharing and explaining those differences most germane to the workshop topic, such as specific characteristics of PBL as implemented at their individual institutions. At the Gender and Diversity workshop, on the other hand, participants seemed very concerned about developing a more thorough understanding of one another’s educational systems and terminology, especially before moving forward with specific plans for collaboration. This proved especially challenging given that participants were affiliated with institutions in the US, Denmark, Germany, Switzerland, and the UK. Some participants also had substantial knowledge of educational systems in China, India, and Romania.

Furthermore, a large majority of PBL participants were engineers focused on PBL implementation and research at the undergraduate level, including many with extensive experience using PBL approaches in their own classrooms. By contrast, the backgrounds of Gender and Diversity participants were much more varied in terms of both disciplinary background and research methodologies. The focus of their work was also much more disparate, including across career levels of the women they studied (from pre-college through professionals) and specific types of research questions. In addition to providing greater homogeneity, the larger engineering population at the PBL symposium could account for the success of the PBL-like meeting structure and the ease with which participants broke into groups and worked together. It is much less likely that the diversity of disciplines and career stages represented at the Gender and Diversity meeting produced such a common understanding of how a workshop should proceed.

## Topics

As noted in earlier work (Beddoes, Borrego, and Jesiek, 2009), the wide range of topics and contexts under investigation by gender researchers is evidence of the complex and multifaceted nature of issues surrounding gender in engineering. In comparison to the PBL symposium, participants' work was based on a much wider array of contexts, problems, and, importantly, theoretical underpinnings. These dynamics are partly connected to the geographic and disciplinary variations noted above, but we also suggest the topic of gender and diversity itself is much broader, variegated, and theoretically diverse as compared to PBL. As a result, shared understandings – and multi-national collaborations – are more difficult to develop.

## Outcomes

The timing, populations, and topics contributed not only to different levels of participant satisfaction, but also to different outcomes for the meetings. Participants left the PBL symposium having met their goals and collectively developed four proposals or research projects, along with concrete plans to continue working on them. As suggested in the Population section above, participant enthusiasm for breaking into groups and producing proposals as concrete outcomes may be the result of their homogeneity, including in terms of disciplinary background and first-hand familiarity with PBL implementation and research.

At the Gender and Diversity workshop, initial efforts by organizers to form breakout groups for proposal or abstract development were resisted the first day, and the time spent in breakout groups on the second day was insufficient to produce concrete outcomes similar to those developed at the PBL symposium. Not surprisingly, the commitments and timelines submitted at the end of the Gender and Diversity meeting were much more vague and non-committal. In contrast to the PBL symposium, Gender workshop participants' responses tended to focus on ways to incorporate new sources or perspectives into their own individual work.

It is also interesting to note that while most of the self-selected PBL groups included a mix of US and UK participants, one of the two groups formed on the second day of the Gender and Diversity workshop was composed entirely of Americans. However, the other, multi-national group discussed more specific opportunities for collaboration, including plans to expand one participant's existing project by collecting data at institutions outside the US. A second meeting outcome was the possibility of developing a primer that includes descriptions of gender and diversity dynamics and research interests in specific national locales, as a way to share information and orient colleagues across national boundaries. A third possible outcome, which stemmed more from organizers' than participants' initiative, is a second gender and diversity workshop held in conjunction with the SEFI Women in Engineering working group at the 2010 Annual Conference. Below we discuss why a second workshop is needed, along with some other possible reasons for the significant differences we observed in the process characteristics and outcomes of these two events.

## Shared understandings

What became clear through these events is that international collaborations will demand more than simply bringing together people interested in the same topic. There needs to be some kind of shared understanding, trust, or respect as a foundation for building international collaborations. As discussed

above, the timing, population, and nature of the topic facilitated such shared understandings at the PBL symposium in ways that it did not for the Gender and Diversity Workshop. This is not to say, however, that international collaborations cannot be formed around gender and diversity, only to suggest that they will likely require different strategies and more time and effort to be achieved.

## Conclusion and recommendations

We conclude with a series of valuable lessons for others interested in planning, funding, and/or participating in similar events can. First, there need to be incentives for attracting international participants. Since our funding was from the US government, we could only support travel expenses for US participants. The PBL symposium, on the other hand, was added on to an already large UK meeting, which helped ensure a large contingent of UK participants. The Gender and Diversity workshop, however, lacked sufficient numbers of Europeans. In the absence of such incentives, organizers should try to coordinate with other, complementary events that international participants are already planning to attend, and well in advance so that participants can make appropriate travel plans.

Second, the relative breadth and depth of some research topics, such as gender and diversity, will likely demand more time to lay solid foundations for international collaborations. A day and a half meeting was simply insufficient to achieve the desired goals. We hope that a second workshop held in conjunction with SEFI in 2010 will be a step in this direction. A primer on gender research in various countries could also provide crucially important scaffolding for future international collaborations, although we are still gauging interest in moving forward with such a project.

Third, organizing events with international colleagues can be a complicated process, requiring delicate negotiations and attention to the proper channels of communication. Planning an event in another region should occur in cooperation with regional leaders in the given topic area who can attract other top scholars. Moreover, working with *multiple* international partners is even more challenging and time consuming. Yet good timing and communication is essential because delays in preliminary planning beget delays in meeting announcements and difficulties with travel arrangements, ultimately resulting in low turnout.

The third workshop in December will allow us to apply lessons learned, including planning well in advance in conjunction with the AAEE Annual Conference, holding it after the Conference, and ensuring a large population of Australasian participants. The results of the third workshop will also provide richer comparative insights across all three events. These lessons are important for the continued development of engineering education as a formative international research field.

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## Appendix

### Summary of Symposium and Workshop Evaluation Data

Question	PBL average (n=14)	PBL S.D.	Gender average (n=10)	Gender S.D.
How would you rate the following:				
Overall quality of the workshop?	4.9	0.4	3.0	1.0
Overall importance of topics?	4.8	0.4	4.0	1.0
Opportunities to be actively engaged?	4.9	0.4	4.0	1.0
Amount of time allocated for working in groups?	4.6	0.6	4.0	1.0
Opportunities to interact with other participants?	5.0	0.0	5.0	1.0
Opportunities for future collaborations?	4.8	0.4	3.0	1.0
To what extent do you think the following meeting goals were achieved:				
Describe important future directions for research on [PBL/gender] in engineering education?	4.6	0.5	3.0	1.0
Identify important ways to connect research on PBL and practice or (implementation) of PBL in engineering education? [PBL only]	3.9	0.8	3.0	1.0
Describe important theories or theoretical frameworks for research on gender in engineering education? [gender only]				
Describe important methodologies for research on PBL? [PBL only]	4.0	1.0	3.0	1.0
Increase participants' understanding of diverse cross-national perspectives on [PBL/gender] in engineering education?	4.5	0.52	4.0	1.0
Develop collaborative relationships between US and European research on [PBL/gender] in engineering education?	4.9	0.4	4.0	1.0
Increase participants' understanding of the intersections of gender with other aspects of diversity? [gender only]	N/A	N/A	4.0	1.0

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