

Enhancing Diversity in Engineering as part of an Action Plan – Work in Progress

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***Abstract:** This paper explores two strategies in the implementation of a Diversity Action Plan in the Faculty of Engineering. The first strategy is designed to increase diversity awareness amongst the 1st year undergraduate cohort and therefore create a culturally inclusive environment for all student equity groups. The second aims to redress the gender imbalance in academic staff numbers, with a view to attracting more women into engineering by increasing the number of female academic role models. Student feedback on the diversity awareness seminars was positive. The implementation of the second strategy is underway at the time of writing this paper. The strategies, their implementation, expected outcomes and feedback from students and staff are all addressed.*

***Keywords:** diversity in engineering, gender imbalance in engineering, transition to university, women in engineering*

Introduction

‘Diversity’ is recognised as an important aspect and a core value of the culture of the University of Melbourne. The University has acknowledged that it is fair and equitable to promote diversity for the benefit of all its students and staff. Diversity (or cultural diversity) in this context is recognised as encompassing differences due to all of gender, race, ethnicity, language, religion, age, sexuality, disability, belief systems and educational background (The Melbourne University, 1998). Wulf (1998) has discussed the notion of the ‘individual diversity’ of a person; the sum total of the work (and life) experiences of an individual. He has emphasised that engineering is a creative profession, and it is the diversity of experiences of an engineer that matter, in developing the best solution to a specific engineering problem. Therefore, if diversity in thinking and of people are not utilised, an opportunity cost is incurred in the cost of products not built and designs not considered, etc. Sinclair (1998) has used a similar approach to discuss the ‘business case’ for managing diversity, and the cost benefits of the effective use of diversity.

This concept becomes critical for an Engineering Faculty with a large gender disparity amongst its academic staff. For example, the proportion of women academics in Engineering (16%) is the lowest of any Faculty at the University of Melbourne. This proportion had remained at 12% for the past couple of years. However, some of the initiatives introduced

previously have resulted in the increase that is seen today. Past initiatives have included, the creation of the role of Assistant Dean (Transition & Diversity) and availability of flexible working conditions, such as, working from home, and the availability of part time employment for women returning from maternity leave.

With the growing push toward internationalisation of the campus, it is also important to promote social harmony, and eliminate all forms of discrimination or harassment toward an individual or group within the student cohort. To a large extent, this can be achieved by education. A study by Lawrence & Male (2001) found that the introduction of a compulsory lecture to 1st year engineering students on rights, responsibilities, equal opportunity, harassment and discrimination markedly increased their awareness and knowledge of these issues.

This paper describes two diversity related initiatives implemented at the University of Melbourne. It is an attempt at correcting the gender disparity amongst academics, and promoting a better understanding of other viewpoints, opinions and perspectives amongst 1st year students; summarised by the maxim “learning requires openness to difference and challenge” (The University of Melbourne, 2002).

Enhancing Diversity – The Action Plan

Current Gender Diversity

Staff

Table 1 shows the academic staff gender profile for the Faculty of Engineering, as at 5th February 2003.

Category	Female	Male	% Female
Teaching & Research and Research (all)	32	174	16
Research only	17	74	19
Teaching & Research only	15	100	13
Teaching & Research (level C & above)	7	77	8
Teaching & Research (continuing)	11	94	10

Table 1: Faculty academic staff gender profile (Faculty of Engineering statistics)

Of a total of 206 academic staff members (Teaching & Research and Research only) only 32 (or 16%) are women. Moreover, there are only a few women at the senior academic levels of Level C and above (7 women compared with 77 men). Of the 7 women, 5 are appointed at Senior Lecturer level and 2 at Associate Professorial level. Furthermore, just 11 Teaching & Research (continuing) positions are held by women, compared with 94 that are held by men.

Currently, there are no female Professors, and in the history of the Faculty there has not been a female Dean. The Head of one department currently is a woman. One other department however, does not have any women amongst their Teaching & Research academic staff.

University wide, there is a better gender balance with 41% of all academic positions held by women. Of these 35% are Teaching and Research positions and 27% are senior positions (Teaching & Research, at Level C and above).

Students

The gender profile for students; undergraduate (current) and postgraduate (2002), as well as, course completions by undergraduate students in 2001 are given in Table 2. Although there has been a steady increase in the percentage of women enrolling in undergraduate and postgraduate engineering programs over the past few years, currently the average female undergraduate student enrolment across all disciplines stands at 25% (the National Indicator for participation of women in engineering being 16%).

Female domestic postgraduate enrolments are slightly better at 28% with a relatively lower figure of 21% for female international postgraduate students.

Specific disciplines within engineering, such as, chemical engineering however, have consistently accounted for much higher female undergraduate enrolments (of nearly 50%) over the past few years. This is thought to be the highest nationally, and higher than the figure reported for chemical engineering in the USA, which is 37% (Dorland, 2003).

The total enrolment of women undergraduates at the university in 2002 was reported to be 57%.

Category	Female	Male	% Female
Undergraduate Domestic Students (all)	727	2179	25
Undergraduate Overseas Students (all)	274	805	25
Undergraduate Domestic Students (1 st year)	132	451	23
Undergraduate Overseas Students (1 st year)	56	199	22
UG Course Completions, Domestic (2001)	141	487	23
UG Course Completions, International (2001)	50	166	23
Postgraduate Domestic (all, 2002)	70	183	28
Postgraduate International (all, 2002)	45	165	21

Table 2: Undergraduate and Postgraduate student gender profile (Faculty of Engineering statistics)

Diversity by Country of Origin

As in many Engineering Faculties around Australia, undergraduate and postgraduate students in Engineering at The University of Melbourne come from a multitude of different educational and cultural backgrounds. International students alone represent over 55 different countries of origin. The top six countries of origin for students are Malaysia, Indonesia, China, Hong Kong, Singapore and India. Overall, 27% of undergraduates and 45% of postgraduates are internationals.

Equally, the Faculty academics are a very diverse group of people originating from many different parts of the world. For example, in the Department of Electrical and Electronic Engineering alone over 15 different countries are represented. Numbers for other departments are unavailable at this time.

Main Objectives of the Diversity Plan

The Faculty Staff Diversity Committee was formed in 2001 with the aim of providing leadership and consultation, to develop and implement diversity strategies in the Faculty of Engineering. Descriptions of the membership and structure of the committee, and its objectives in 2001 were reported by, Brown & Thomas (2002). The terms of reference and the reporting structure remains the same in 2003; the committee reporting through the Assistant Dean (Transition & Diversity) to the Management & Resources Committee comprising the Dean, Heads of Departments, Assistant Deans and other senior staff of the Faculty. In 2003, the following three overall goals were identified for the Faculty of Engineering (in the context of this paper, referred to as the Diversity Action plan). To achieve each of these goals a series of strategies were developed.

The overall objectives of the Diversity Action plan were:

1. *To provide a working/learning environment in which women and other equity groups enjoy a sense of respect, understanding and equal opportunity in relation to working/learning conditions, promotions and appointments.*
2. *Increase the number of suitably qualified women applying for academic positions to achieve a better gender balance amongst academics.*
3. *Make available Faculty wide Equal Opportunity for Women in the Workplace and Diversity related data, plans and policies to staff and students.*

A Student Centred Strategy

There were five strategies proposed to assist objective 1 of the Diversity plan. Here, the steps taken for implementing one of these strategies has been described. It involved a student centred strategy targeting undergraduate students in the 1st year of study.

“Educate the new student cohort in principles of diversity, social justice and equal opportunity via the 1st year level transition program to stimulate discussions and promote an understanding of social issues”.

The ‘culture’ of engineering has been recognised as one of the barriers to attracting more female students and those from other equity groups into engineering. Therefore, it was important to highlight the positive aspects of studying and working in a diverse environment. Furthermore, it was considered important to educate students on these issues at the start of their University career, at the 1st year level.

With this in mind, one seminar in the ‘school to university’ transition program was dedicated to introducing students to principles of diversity, social justice, equal opportunity and to their rights and responsibilities.

The School to University Transition Program (ENG101)

The new ‘school to university’ transition seminar program was developed and offered to all engineering students in semester 1, 2003. Over a 5-week period (1x1 hour seminar every week) this program introduced a series of individual topics or ideas to assist students with the transition to university. Students worked in groups thereby enhancing or developing certain generic skills, such as teamwork skills, oral communication skills and networking skills.

Enrolment in these seminars was optional but strongly encouraged, by having sessions timetabled into all individual student timetables. As there were over 800 students in the 1st

year of study, seminars were repeated six times every week. The seminars were held in a large drawing office capable of accommodating up to 150 students. The tables were arranged for groups of 10 to 12 students.

The following topics were offered:

- Week 1: Getting to know the University,
- Week 2: Diversity, Rights & Responsibilities,**
- Week 3: Academic Values & Teaching Goals,
- Week 4: Effective Study & Resources, and
- Week 5: Continuing Success.

In parallel to these seminars students participated in a ‘scavenger hunt’ in the form of a photo safari. The purpose of the scavenger hunt was for new students to get to know some of the interesting people, places and myths of the University of Melbourne.

Week 2: Diversity, Rights & Responsibilities

This seminar was in four parts as follows.

1. Introduction by a senior academic of the Faculty. Presentations included, personal perspectives on diversity, the development of the Melbourne University Cultural Diversity Policy (1998) and the business case for diversity.
2. “Stories to tell” by two students from different equity groups. For example, international and country students, both female and male, provided insights into some of their own work and life experiences during 1st year of university.
3. Three video clips depicting role-play of different university teaching scenarios, with situations of harassment, discrimination or inappropriate behaviour, were shown to students. These scenarios were selected from a video produced by Curtin University of Technology. The three scenarios depicted the following situations:
 - i) *“Two students from an English as a first language background are meeting with a lecturer. They are concerned they will be disadvantaged writing up and presenting a report as two other members of their group are from an English as a second language background”*;
 - ii) *“Two students are in a lab working together, but one student is not confident that she has followed correct experimental procedure and requests the help of the tutor. The tutor ignores the request and the second student declares he knows the correct procedure and suggests the other student takes notes”*; and,
 - iii) *“Drunk male students at a bar-be-que notices two women walking past and calls out in an inappropriate manner”*.

This part of the session was facilitated with the assistance of University Equal Opportunity Officers. After the screening each scenario, discussion (firstly, within groups and then with the whole class) was encouraged and promoted by asking questions such as:

- What issues does this scenario raise?
 - What do you feel about this situation?
 - If this happened to you, what would you do?
 - How could this situation be resolved?
 - What do think will happen if the conflict is not resolved?
4. The program concluded with University Anti-discrimination Advisers giving a brief outline of the ADA’s role, the resources available, and the complaints procedure.

Objectives and Outcomes of (week 2) Seminar

As well as increasing the knowledge of specific topics covered during the seminar, other aims of this seminar were to provide a forum for students from the different engineering disciplines to meet and make new friendships. It was hoped that interactions between students, both domestic and international, would improve understanding and promote a sense of community within the student cohort. It was also hoped that, instructing students on their rights and responsibilities, would help to avoid situations similar to those shown on the video clips or improve potential outcomes if such incidences did occur, in future.

Evaluation

The students were required to evaluate each seminar at the end of the Transition program. Preliminary results from the student evaluations will be presented in the section on feedback.

A Staff Centred Strategy

There were three strategies proposed to assist objective 2 of the Diversity Action Plan. Here, the steps taken for implementing one of these strategies has been described

“Recruit three full time (or equivalent part time) women candidates with excellent research/industry track records into three (3-year) Faculty funded Postdoctoral Fellowships”.

The recommendation by the Staff Diversity Committee to offer three Research Fellow positions to women candidates has been reported previously by Brown and Thomas (2002). Consequently, with the approval of the Management and Resources Committee, this recommendation was incorporated into the Faculty Operational Plan in 2003. Faculty funding for three years at Research Fellow Grade 2 level was approved for all three positions.

These positions are yet to be advertised. Applications will be sought from outstanding women candidates from any field of engineering and selection will be based on a range of criteria including, an ability to work in one of the strategic research areas of a department or research centre, a demonstrated research track record, and experience in working on industry funded research projects. In particular, selection for these positions will be based on a candidate's potential to work in an established area of research of a department or research centre, so that mentoring and collegial support can be offered to candidates by more senior staff. This will provide opportunities for collaborative work on well-funded areas of research with possibilities for higher research output and greater number of research publications.

The women who take up these positions will be offered other career development opportunities, such as, teaching in undergraduate or graduate programs within departments (comprising not more than 20% of their time). It is hoped that these appointments will provide a career path for women to become Teaching and Research academics. Following a favourable evaluation at the end of the first three years, the Research Fellowships will be either extended for a further period or the candidates will be considered for Lecturer or Senior Lecturer positions within departments as openings arise. By providing a clearly defined career path, these Fellows will be awarded tenure and eventually promoted to the ranks of Associate Professor and above.

The expectation is that, the appointment of three academic women would have an immediate positive influence on the ‘culture’ of the Faculty of Engineering. Moreover, these Fellows will provide role models for female undergraduate and postgraduate students and encourage more qualified women to consider a career in academia.

This would also be in line with one of the University's Performance Targets of improving the percentage of women in traditionally under-represented areas, such as engineering, and would draw attention to the community at large, the importance the Faculty places on improving the gender balance amongst academics.

(To advertise these special positions for only women, the Faculty has applied to the Victorian Civil and Administrative Tribunal for an exemption under the Equal Opportunity Act).

Expected Outcomes

As well as increase the number of female academics in the Faculty, it is hoped that this incentive would encourage more female students to consider careers in academia rather than in industry. These new positions are also expected to contribute towards attracting more female students and students from other under-represented groups into engineering. In the long term it is hoped that this would lead to more women in senior and continuing positions, and contribute to creating an academic environment that is inclusive of all equity groups.

Feedback on the Transition Seminar

Participation

Participation levels by students remained high with nearly 75% of the students allocated to each seminar actually in attendance. Overall, 624 students attended the (six) seminars on Diversity, Rights and Responsibilities.

As there were six sessions of each seminar, it also required the participation of several engineering academics. In all, six academics from various disciplines of engineering were in charge of running the different sessions. Their main role during the seminars was one of facilitation, as EO officers, Anti-discrimination advisers, guest speakers and later year students were involved in presenting and discussing (with students) the relevant material.

Many of the staff involved have so far given positive feedback on the participation of students, and have rated as high the interest shown by many students during the sessions.

The Evaluation Process

Evaluation was carried out at the close of the program in week 5, and in total 224 students returned the completed evaluation questionnaires.

The evaluation questionnaire included the following statements in relation to the seminar.

Statement 1: The content of the session was relevant to me

Statement 2: The information was covered in sufficient depth

Statement 3: Overall, the session met my expectations

Statement 4: The session provided opportunities to meet other students

Students were required to give a rating of 1 to 5 (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree and 5 = strongly agree) for each statement. The responses to each of these statements are shown in Figures 1 to 4.

Feedback Results and Discussion

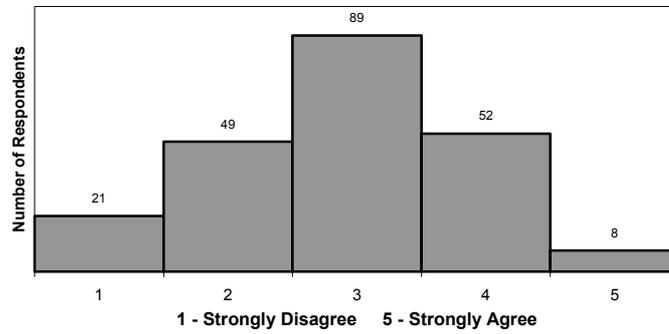


Figure 1: Feedback on relevance of seminar (# 1)

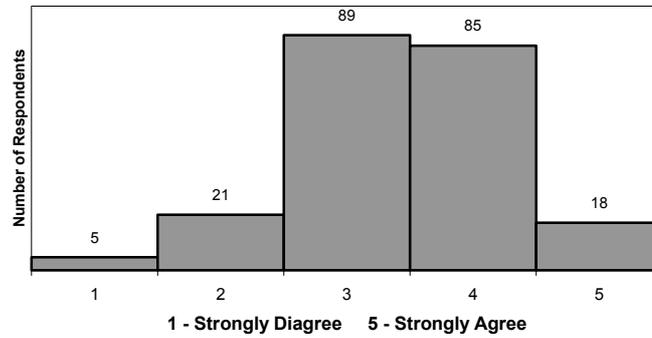


Figure 2: Feedback on sufficient depth of seminar (# 2)

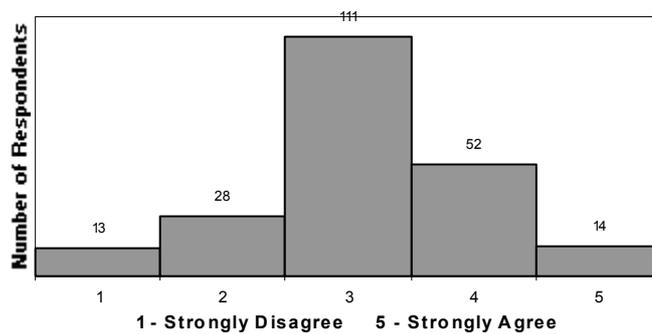


Figure 3: Feedback on expectation (# 3)

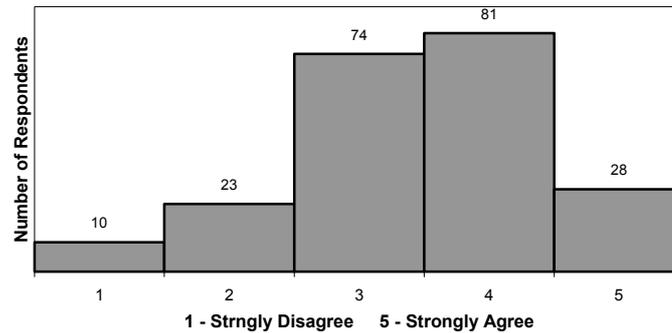


Figure 4: Feedback on opportunities for networking (# 4)

As expected the results show a normal distribution with respect to the ratings of each statement. Specifically the results show that only 12% thought the material was not covered in sufficient depth (a rating of 1 or 2 for statement 2) and 19% reported that the seminar did not meet their expectations (a rating of 1 or 2 for statement 3).

However, 32% said the material was not relevant to them (a rating of 1 or 2 to statement 1) with only 27% agreeing and strongly agreeing that the material was relevant (a rating of 4 or 5). This was contrary to the lively debate and discussion that was noted during most of these seminars. There was overall agreement with statement 4, with 85% of the students believing that the seminars created a good forum for meeting other students.

In response to a question referring to the entire program, “would you recommend this program to someone else?” the answer was positive, with 84% of respondents saying they would.

Comments made by students at the end of seminars indicated that they found the presentations made by staff and students to be very useful. For example, the ‘stories to tell’ section was reported to be particularly useful by some international students

The feedback results represent 36% of all students who participated in the seminars. To increase the level of feedback, it is expected that all future evaluations would be carried out immediately following the seminar, and not at the end of the program.

Conclusions

Two initiatives have been put in place in the Faculty of Engineering, University of Melbourne. Both these initiatives were part of an overall Diversity Action plan to enhance gender diversity amongst staff and increase diversity awareness amongst students.

A seminar on Diversity, Rights and Responsibilities was offered as part of the School to University transition program in the Faculty of Engineering. Well over 600 1st year students attended this seminar, and took part in discussions of the various topics raised during the session. Feedback from students and staff has been positive, with most students indicating the seminars met their expectations and that the material was covered in sufficient depth. The evaluations also showed that the sessions were a good forum for students of different cultural

backgrounds and different engineering disciplines to meet, providing opportunities for networking and making friends.

The second initiative aimed at increasing the gender diversity amongst Faculty academics, involved the establishment of three (3 year) Research Fellow positions for women candidates (yet to be awarded). These positions will encompass the possibility of articulation into Research and Teaching positions and is expected to attract outstanding women candidates interested in establishing careers in academia, in the long term.

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