

Gender Experiences in an Engineering Classroom

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Abstract: *There has been a significant amount of research into the culture of engineering faculties at Australian Universities and it is clear that it remains dominated by masculine values and attitudes. If this is the case in the environment of faculties then what is happening in the classroom? Engineering has been the domain of men since its inception and thus as would be expected their perspectives and paradigms have dominated its practices. Yet today even if unintentionally, the promotion of masculine values, experiences and interests within the engineering education system has left women feeling uncomfortable and different.*

This paper focuses on the gendered expectation and perceived advantages identify by both female and male students within an engineering classroom. It investigates the effect of the known faculty culture within the classroom environment and identifies some aspects of the classroom experience that needs to be taken into account when understanding the influences it has on students.

Keywords: *engineering classroom experiences, gender*

Introduction

There has been a significant amount of research into the culture of engineering faculties at Australian Universities and it is clear that it remains dominated by masculine values and attitudes (IEAust. Review, 1996; Tonso, 1996; Copland & Lewis, 1998; Johnson, 1999; Burrowes, 2001). If this is the case in the environment of faculties then what is happening in the classroom? What aspects of this faculty culture need to be taken into account when understanding the experiences of female and male students within an engineering classroom? Engineering has been the domain of men since its inception and thus as would be expected their perspectives and paradigms have dominated its practices. Yet today even if unintentionally, the promotion of masculine values, experiences and interests within the engineering education system continues to leave women feeling uncomfortable and different.

Tonso (1996) and others believe that it is the engineering education sector that must change first before inclusion of women can be realized within the engineering profession. Engineering remains largely (if unconsciously) defined by men, and can be an uncomfortable environment for women (Johnson, 1999). However, it is not only the way technology and engineering are defined but also how the profession is practised and taught that clearly discourages most women – and some men (Johnston, 1999).

This paper presents some results of a broader study which focuses on the expectations and comfort levels of students from a gendered perspective within an engineering

classroom. It has only investigated the student perspective of these aspects of the classroom and has not presented any other aspect related to the content and presentation of material of the course used in the study.

Literature

Gender difference and sex stereotyping within the classrooms of mathematics and science (and to a much lesser extent engineering) have been studied at secondary and tertiary levels. This research has shown that men and women often experience the classroom differently and that teachers have been shown to inadvertently treat genders differently.

A few of the studies which relate more closely to the areas presented in this paper include a study by Ware which highlighted that female students are “more likely to fix the blame internally - to cite their own inadequacies as the source of difficulty” (Ware, 1985, pg 73-84) when encountering problems within a program of study; whereas men tend “to place responsibility for difficulties outside themselves”. For example, in response to a poor exam mark or failure in a subject, women tend to believe that it is their poor preparation or intelligence that is the cause and therefore are generally much less confident of their performance and will even transfer out of the course and career. A male student is more likely to blame the system whether it is the academic who has not helped them in their preparation or the examination, which was obviously a poor judge of their knowledge, and will therefore persist and re-sit exams and subjects if given the opportunity. In fact, Seymore (1992) identified that between 70 and 80% of females transferred out of science programs because they felt discouraged and even developed low self-esteem despite their grades being on par with the male students in the class. Improving self-esteem and expectation, particularly for first year university students, who are coping with a new learning environment, have been well documented across a broad range of discipline areas (DETYA, 2000b; Pfatteicher, S., 1999), however for women in sciences and non traditional areas in general there are additional, often unexpected, pressures which can further reduce their self confidence.

Seymore (1992) also discussed how women tend to place a higher value on what others in society think of them and were found to be more dependent on encouragement and personal feedback from teachers at High School. They have felt that learning is more difficult as a result of less close contact with their teachers at university. In a study, *Students' Perceptions of Problems in Undergraduate Teaching*, Hewitt (1991) found that 30% of women (0% of men) listed ‘professors don’t care about you’ as a significant problem for them.

The Study

The results presented in this paper are a section of a much larger study performed to investigate the gender dynamics in an engineering classroom. To do this both the learning environment and social world of an engineering classroom was studied and the complex interactions between student behaviour, their knowledge, and learning experiences within that classroom was investigated (Burrowes, 2001). An ethnographic research methodology was used to obtain an understanding of the behaviours and socio-cultural activities and patterns of a group of engineering students, from their perspective, in a ‘typical’ engineering classroom setting. Ethnographic research is

designed to present a dynamic picture of the student group and their interactions and provide an alternative, more humanistic research paradigm to the traditional empirical scientific method.

The process of ethnographic research is essentially to collect descriptive data as the basis for interpretation and analysis of the research questions. Data for this research study was obtained primarily through fieldwork, which involved both observations of the engineering classroom setting and interviews of participants within that setting. Surveys were also used and have provided some quantitative measures to increase the reliability of the results. Thus, three data collection techniques were used: observation, focus groups and surveys to produce the empirical findings.

The classroom used in this study was a second semester first year course, MECH 102, taken by students in the Mechanical, Environment, Surveying and Civil discipline areas. There were 136 students who participated in each of the two surveys conducted at the beginning and end of the semester, 122 male students and 14 female students (10.3%), which reflect the female average participation in engineering classrooms at the University. Three groups of 6 students participated in the focus groups sessions that were held twice during the semester. There were 12 male students and 6 female students in these focus group sessions. The researcher was also a second tutor in one of the large tutorial groups and so was able to make observations during class sessions as well as in assignment work.

Results

Expectations and General Experiences in Studying Engineering Courses

“Everyone says engineering is incredibly difficult, but I don’t know. I don’t want to do anything else,it becomes a time management problem, there is so much work and there is only so much you can fit in” (Female Student, Focus Group).

Workload was a continual topic of discussion among students as they tried to rationalise and find the ‘balance’ of work/study and social activities. There was considerable frustration based on both male and female student inexperience in time management and a need to find someone/something to blame “*you’ve got these semester assignments, laboratories due all in the one week usually*” and that “*if it (course material) is not necessary then they shouldn’t be teaching it*” (Male Student, Focus Group). In fact there was a feeling from one student that there should be “*more humanities in engineering programs*” (Male Student, Focus Group). However this raised concern among other students as to “*what is going to get the squeeze*”. A suggestion from a male student was “*series. Get rid of series*” (Male Student, Focus Group). ‘Series’ is a topic in mathematics for which this student had not yet found a use in his engineering courses.

Students were asked at the beginning and end of the semester, what their expectation was of MECH102 and their rating of other courses which they had completed. The differences in female and male student expectations of MECH102 is interesting to compare. The survey results showed that women and men thought quite differently at the initial stages of the course yet ended the course with similar responses. This is despite the trepidation that accompanies the rumors that are passed down from year to year of the difficulty of MECH102 and the course, which follows MECH102 in the following year. Female students' expectation of MECH102 at the beginning of semester was that it was going to be 'difficult' (44%) or 'reasonably difficult' (50%), thus a total of 94% of female students were prepared for a difficult topic area. This compares to only 16% of male student indicating 'difficult' at this stage and 62% saying 'reasonably difficult', combining to a total of 78%. Only one female student felt that it was going to be 'relatively easy' compared with 21% (or 26) male students. By the end of the semester, 97% of male students indicated that the course was 'difficult' or 'reasonably difficult' which brings it in line with the female students. A total of only three male students indicating that it was 'relatively easy' or 'easy'. These figures are illustrated in Figure 1. The distribution between easy and difficult remained unchanged for the female students however, as with the male students there was a shift to 70% of both sexes indicating that the course was 'difficult'. The response to what their comfort level was in attempting MECH102, women generally felt uncomfortable in the initial stages of the course becoming more comfortable as the semester progressed. Male students however went in the other direction, with a transition from a comfortable position to an uncomfortable position.

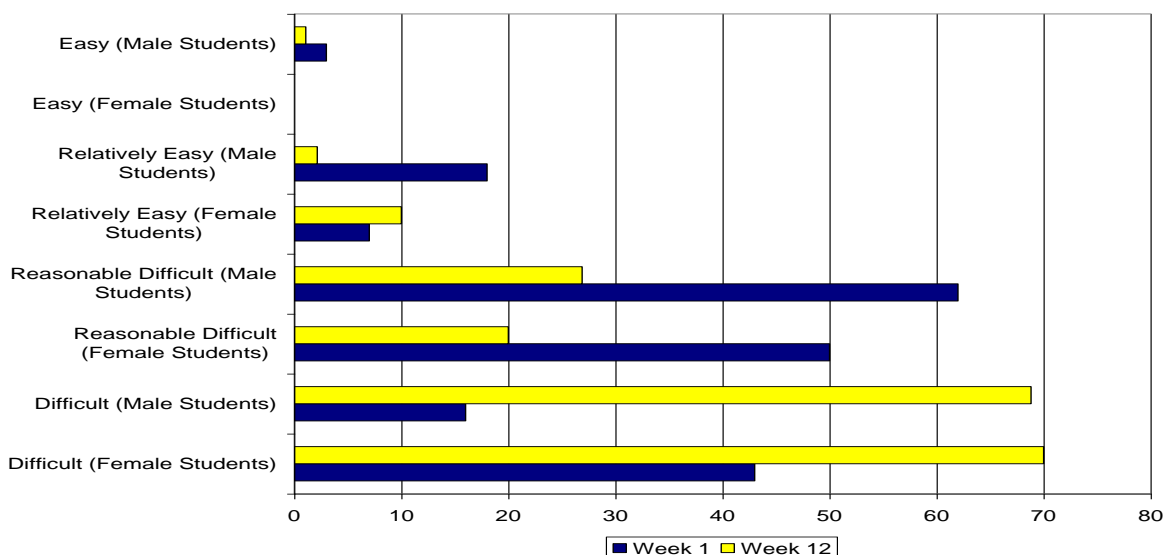


Figure 1: Comparison of Students Expectation of Difficulty of MECH102 by Gender and by Time of Semester

As a comparison, students clearly nominated MECH102, as the course considered most difficult in their program at this stage of their studies with other courses being rated generally between 'reasonably difficult' and 'relatively easy'. When discussing what is 'difficult' about the course a number of aspects of the learning environment were highlighted, however, the reputation of the course also appeared to have a strong influence deterring many students who were continually expecting the worst.

Student Perceptions Of Their Place Within The Classroom

Students' perception of lectures was that they were not an important part of the learning process in the course. A number of male students actually suggested "*lectures make the difficult courses harder*" (Male Student, Survey 2). They also felt very intimidated in asking questions or giving technical opinions during the lectures. Figure 2 provides the results of the confidence that each gender had in giving technical opinions in lectures and tutorials. Female and male students were approximately equally lacking in confidence in giving technical opinions in lectures with 70% of female and 75% of male students indicating this feeling of apprehension. For MECH102 the problem with lectures was compounded by the fact that the lecture basically followed the lecture notes given out to students and did not expand on these significantly. "*It is the tutorial where you learn everything*" (Male Student, Survey 2). "*I don't think they are tutorials, I think they are lifesavers*" (Female Student, Survey 2). Despite this, even the tutorials were not formats in which students felt confident to participate fully. This is illustrated in Figure 2 where 70% of female students and 48% of male students felt 'not very confident' to give a technical opinion during the tutorial session. A female student did say she felt that "*Help from tutors was always there when required. It was just a matter of overcoming an initial feeling of being stupid*" (Female Student, Survey 2). This was also illustrated during the observation sessions where it was often difficult to get students to explain what they had done because usually they did not appear confident to do so. Whether this was a result of not being confident in their solution or their approach was unclear. In many cases however by explaining what they had done so far was enough for them to work out where to go next and how to improve or solve the problem that they were working on. This was a positive process for many students, but a number of cases identified during observation showed that this did not follow through to the next time they were in trouble.

When investigating the similar percentage of female students feeling unconfident in both lectures and tutorials it was confirmed that it was the same group of female

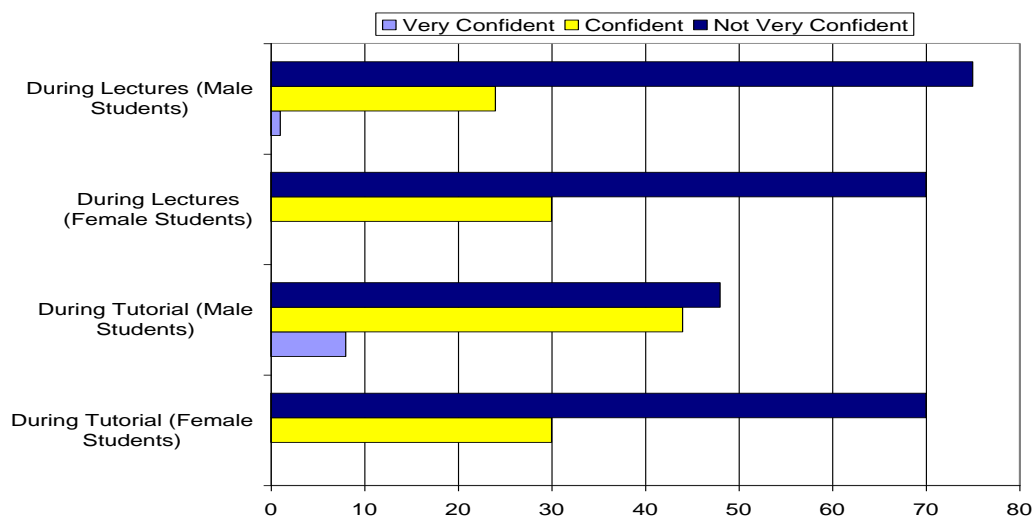


Figure 2: Confidence Level By Gender In Giving Opinions In Lectures And Tutorials

students who felt unconfident in both environments. During the focus group discussion and tutorial observations the mature age women appeared to be more confident to speak up in general and felt confident to raise technical issues in a larger forum. The difference between the confidence level in the tutorials and lectures by male students

was expected with higher confidence levels when speaking out in smaller groups. It is interesting to note also that it is only male students who felt ‘very confident’ in either environment with 8% being very confident in tutorials.

Students were also perplexed by the assumption that if students pass a course that they should know it. Mathematics was used as a typical example, although one, which had the worst repercussions. Mathematics courses “*create a lot of difficulties further on which reflect in a lot of other unhealthy situations and low marks. They assume that because we passed Maths we got 70 or 80 percent but we haven’t*” (Male Student, Focus Group).

There was also a feeling that academics were not interested in students’ progress and in fact suggested that “*the topic level is well above first year standard and the lecturer seems to have fun and enjoys exploiting this fact*” (Male Student, Survey 2)

Perceived Advantages Caused By Gender Within The Classroom

The general response from both female and male students was negative to whether they perceived that a particular group of students were more advantaged in various aspects of the classroom, Figure 3a & 3b. Students felt that they were on an ‘*equal footing*’ had ‘*equal opportunity*’, ‘*equal attention*’, and ‘*everyone has a fair chance*’. Basically they ‘*can’t see any bias*’.

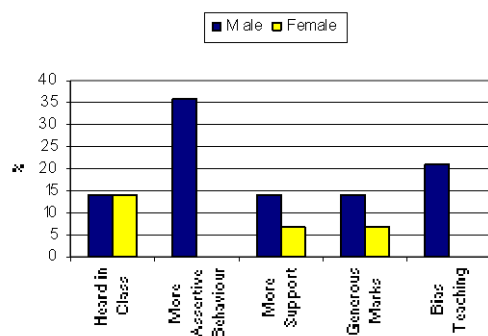


Figure 3a: Female Student Response to: Do you feel that a particular group of students is currently more advantaged through:

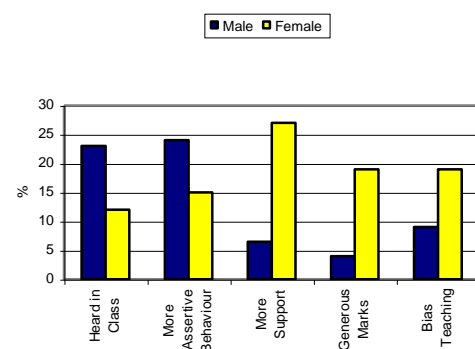


Figure 3b: Male Student Response to: Do you feel that a particular group of students is currently more advantaged through

Male student responses, however, showed that they felt somewhat advantaged by being heard in class and that they showed more assertive behaviour, whereas female students were given more support and were given more generous marks and that the teaching was biased for them.

All the female student indicated that they believed male students had much more assertive behaviour in the classroom which correlated with the male responses. Yet, contrary to the male student perception, female students felt that they were equally heard in class. Male students generally believed that they were heard in class above the female students. In addition female students felt that males were given more support and more generous marks than they were given which was in direct disagreement with the

male students. As with assertive behaviour, all female responses said that the teaching was biased towards the male students.

“...male students do not want to put their hand up because they are too macho. If you’re female you can ask anything. They don’t expect you to know it, they have this low picture of your intelligence level so you can ask anything and they just go yeah, yeah, really condescending of course, but you just use it to your advantage. Which is bad and I mean, I’m sure all the males do get annoyed about that but it is what you do” (Female Student, Focus Group)

A female student recited a story in the focus group session of a male student upset at her for getting a higher mark. She asked him how long had he spent on the assignment and his answer was ‘a couple of hours not much’, although she believed that he had spent more time on it than he admitted. She declared that she had worked solidly for two weeks on it and had enjoyed understanding it. The male student’s response was that she must be unintelligent to have to spend so much time on it.

Female students did feel that the male students would try and find other ways of getting around their studies and assessment tasks and believed that *“advantage is only gained by students working hard on the course”*. A supportive male student admitted that *“occasionally a female will be given greater attention but they usually work harder in any case.”*

A number of male students recalled stories and situation where female students used their gender advantage.

“It may seem sexist, but as most lecturers are male, female students are generally treated better” and *“the lecturer was present in the tutorials and these two young ladies were very attractive so I mean he’s only human so he is going to hang around isn’t he. We got a bit cheesed off, but I thought well he’s doing his job and he’s letting his personal feelings come into it a bit and they were using their gender to their advantage. That’s life.”* (Male Student, Focus Group)

A male student also suggested that it was worth giving female students a bit of a helping hand; *“ Well I think that the guys in mechanical think that (because) there are so few women doing the program that they like to give them a bit of extra chance so (that) they keep hanging around, and (also that) they are easy on the eye”* (Male Student, Focus Group).

Discussion

It is interesting to note the clarity with which both female and male students did not want to engage in the discussion of gender in an engineering classroom. In fact it was clear that both genders remain unable to comfortably engage with the topic to the extent of often denying that there is a problem. This has been shown to be true in other research that has focused on gender in engineering (Jolly, 96; Stonyer, 99). It is thus difficult to unravel some of the different and contradicting comments in this research area and why it is important to use more than one method of data collection. However, it

does identify the very important need that the barriers to discussion on gender must be the first to break down.

Generally, students would stress the opinion that there were no inequalities between genders yet contradictions within the results gave the impression that this was simply a result of not wanting to engage in the discussion. There were however high ideals espoused relating to 'fairness' when it affected them personally but this did not emerge in terms of gender 'fairness'. Students were unable to challenge paradigms, which reflected the gender topics and attitudes because they simply could not or would not see them. This was particularly due to individuals feeling unable to speak up in the group situations due to fear of being laughed at or put down. This was also what was felt when having to ask teaching staff for help.

Often students, and in particular male students, took on a negative approach to their studies. They felt that they would achieve in spite of the teaching staff and the system. There was no theme of a 'working together' relationship but instead an 'us against them' mentality. The educational environment was a battle to be fought and won. This combined with the competitive atmosphere of the classroom blended to enhance a military attitude. A male student felt that, "*Everyone should look after themselves and not whinge*". It was therefore surprising to hear so much 'whingeing' about the poor teaching environment and staff. In an unusual twist these factors actually emerge as a positive environment for male students, as men were able to motivate themselves within this framework.

The study found that workload and the reputation for the difficulty of the program was an issue for potential students. It also identified that there was a perspective from some students that the program was a set of disjointed courses, where individual courses were not connected in any way. The system thus expected students to negotiate their own way through the system with the guidance given by the teaching staff only being within the boundaries of the course and not across the program. Despite this issue being raised by a male student there was more agreement among the female students that this did not create a positive learning environment for all students. As educational literature has suggested, female students prefer to understand the broader context of the course material and therefore are at more of a disadvantage in this disjointed course/program structure.

Conclusion

This paper presents some results of students perspective of their expectations and comfort level when working within an engineering classroom. It shows how the masculine values and culture of an engineering faculty are reinforced in the classroom and how both genders attempt to work within it.

The environment of a classroom however is a place where individual values and belief systems can be influenced and therefore stereotypes can be broken down. This is where individuals are at their most vulnerable, and students need to prove their academic ability. This means for women that they need to prove in most instances to a male academic in a male system. Also, it suggested that students through their interaction with a 'male' academic come to understand his actions as part of being an engineer,

which sent narrow messages about who engineers are and what engineers might be. Unsurprisingly the classroom met the male student's expectation of the world whereas women's viewpoints could only be injected under certain rarely existing conditions.

For these reasons among others illustrated in this paper, academics have a very important role to play in the environment. Their understanding of the gender dynamics and interactions that are happening in the educational environments in engineering faculties is critical in supporting cultural change and ensuring that female students have the same opportunities as their male peers.

Finally, from a broader perspective, if in the engineering classroom the presentation of a set of values which include the feminine as well as the masculine were presented, then it is likely that this will lead to a more humane and balanced engineering profession and society.

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