



UCD ENGINEERING GRADUATES ASSOCIATION TOWARDS GENDER BALANCE IN ENGINEERING



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UNIVERSITY COLLEGE DUBLIN ENGINEERING GRADUATES ASSOCIATION REPORT:

Towards Gender Balance in Engineering

Engineering Graduates Association Board
Subcommittee on Gender Balance

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PURPOSE OF THIS REPORT

The UCD Engineering Graduates Association is concerned about the continuing low representation of women in the Engineering profession and in particular about the low number of women Engineering undergraduates in UCD. The current annual norm is approx. 20%. This issue is seen as important for two primary reasons; the access to a larger pool of future engineers and access to a more diverse talent pool in the interest of enhancing creativity and innovation, the essence of the Engineering profession. Also, the business case for managing gender balance in the workplace and the competitive advantage it creates have been well established by luminaries such as Warren Buffet (as recently as 2013 in Fortune Magazine). We have looked at research and statistics in relation to why fewer women than men choose Engineering as a career. We propose actions specifically in relation to UCD.

The report has been split into three main sections:-

1. General research into the representation of women in the Engineering Profession
2. Specific findings in relation to UCD Engineering
3. Recommendations

SUMMARY OF LITERATURE REVIEW

The Engineering pathway can be broken into three phases; 'pre-Engineering education', 'Engineering education' and 'Engineering profession/career'. This report considers research on the three phases, the role of UCD and makes recommendations that impact the three steps. The key points from the research are:-

- No significant research that we can find looks at the problem in a systemic way encompassing the 'demotivating' factors of the 'pre-Engineering education' phase, the 'Engineering education' phase and the 'Engineering profession' phase. There is little research available with recommendations directed at the education phase.
- The drop out rate from Engineering education of women compared with men in UCD has been impossible to determine with any precision so it is not clear to what extent the 'education phase' itself in UCD deters women. There is unfortunately clear evidence that the 'Engineering profession' itself deters women.
- Increasing the number of women entering Engineering education may improve but will not, of itself, achieve balance in the profession.
- There is limited evidence as to the reasons for the exodus from the Engineering profession by women compared with other professions. One report states that "the most important driver of excess female exits from engineering is dissatisfaction over pay and promotion" and "Family-related constraints are not a factor".
- There is a view that, as the level of participation increases, a tipping point is reached, generally regarded as being between 30% and 35% at which the perspectives of members of both groups change and the character of the relations between the groups begins to change qualitatively. This is often referred to as 'the critical mass' at which sustainable change can be achieved. Kanter (1977a) cites 35% as the figure at which this happens.
- Women are underrepresented in Engineering in contrast to professions such as law and medicine; Ireland and UCD are not significantly different to other developed countries in terms of the percentages of men and women in the profession.
- Research points to 'motivation' as the primary determinant of gender imbalance in Engineering as opposed to 'ability' or 'opportunity'.

SUMMARY OF UCD ENGINEERING FINDINGS

- CAO Engineering applications have been decreasing, although UCD numbers are on the rise.
- In UCD Engineering the number of females has been relatively constant at around 20%.
- Society's perception of Engineering as a career for males is perceived as a deterrent to women entering Engineering, and was experienced by both UCD graduates of Engineering in industry and in the college itself.
- UCD Engineering could take more proactive steps to encourage women to adopt career choices to stay in the industry.

SUMMARY OF RECOMMENDATIONS

In essence the recommendations are directed at the Engineering profession and the education sector, UCD & UCD Engineering and the UCD Engineering Graduates Association. They focus on:-

- Working with Engineers Ireland.
- Marketing by UCD Engineering.
- Getting the right information to key influencers (parents, career guidance teachers).
- The Use of Social Media.
- The creation of the "Getting More Women into Engineering @ UCD" initiative by the UCD EGA.



LITERATURE REVIEW OF STUDIES INTO GENDER BALANCE IN ENGINEERING

Much research has been carried into the reasons for poor representation of women in the Engineering profession. Percentage representation of women in Engineering varies across the world. Studies have been carried out mainly into two phases of the Engineering stream; the 'education phase' and the 'work/career phase'. The metaphor of the 'leaky pipeline' (Alper, 1993) has been used to illustrate the fact that women leave the profession in larger proportions than men. Grimson and Rougheen (2009) use this metaphor to explore factors and causes impacting on this rate of loss with a particular emphasis on women in Engineering academia.

In Engineers Ireland the percentage of members who are women is 8.85% and in different membership categories the figures are:-

Table 1 Engineers Ireland Membership by Gender

MEMBERSHIP TYPE	% WOMEN
Fellow	3.37 % (48 of 1421)
Chartered Engineer	9.62% (556 of 5777)
Member	9.58 (926 of 9665)
Associate Engineer	5.02 % (9 of 179)
Engineering Technician	0 (0 of 30)
Technician	2.02% (7 of 345)

In contrast, Engineers Australia's membership in 2002 had 5,528 women members or 8.0%. By 2011, the number of women members had increased to 10,631 or 11.0%. In 2002, there were 2,422 women 'engineering team' members of Engineers Australia, 4.7% of overall membership. By 2011, women engineering team members had increased to 4,386 or 7.5%.

In the U.S. in 2011 women comprised more than 20% of Engineering School Graduates but only 11% of practicing Engineers.

The numbers entering the profession are determined by 'ability', 'motivation' and 'opportunity' and this is a useful lens through which to look at the number of women entering Engineering.

THE 'PRE-ENGINEERING EDUCATION' PHASE

Second level Mathematics and Science are seen to be important building blocks of a third level education in Engineering. Although the significant decrease in overall Mathematics performance between 2003 and 2009 (only The Czech Republic performance decreased by more than Ireland from the OECD countries) is of serious concern (OECD, 2011), the differences between boys and girls is not significant in either Mathematics or Science. Nevertheless in 2014 the percentage of girls achieving one of the top 5 grades in higher level Mathematics had decreased to 37% of those taking the paper from 47.5% in 2005 whereas boys had only dropped to 41.2% from 47.2%. This may relate in some way to the introduction of additional bonus points for Higher Level Mathematics as some 46% more students (50% more boys and 40% more girls) sat higher level maths in 2014 compared with 2005. Therefore it does not appear that second level proficiency or ability in these subjects should be a determinant of the differing levels of entry into Engineering education.

Accenture (2014) identify negative stereotypes, the lack of information for parents, fragmented information about STEM careers and a disconnect between industry's skills needs and students subject choices for Leaving Certificate Examinations as the key barriers to having more women with STEM skills in the workplace.

THE 'ENGINEERING EDUCATION' PHASE

The number of women in Engineering education in Ireland is c.20% (for level 8 Degrees) and for UCD is also c.20%. This figure reaches 27% nationally for all Universities across all 'Engineering, Manufacturing and Construction' courses.

In a study in 2009 by Franzway et al the range of percentages of undergraduate women in Engineering in Australia, Canada, the UK, and the U.S. were:-

Table 2 Women in Engineering

COUNTRY	% WOMEN	YEAR
Australia	14.1%	2004
Canada	18.5%	2004
United Kingdom	9.5%	2005-06
United States	19.3%	2005-06

It is interesting to note that in 2001 in Canada 21 % of students in Engineering programs were female but by 2009, this had fallen to 17 %. The portion of licensed engineers (we presume equivalent to our Chartered status) in Canada who are women has grown from 7 per cent in 2000, but the figure still sits at only 10 per cent, according to Ottawa-based Engineers Canada. The trend is not always upward.

The 'Education at a Glance 2013 OECD indicators' reports states that:-

'In all countries except Argentina, Estonia, Iceland, Italy, Poland and Slovenia, one-third or fewer of all graduates in the fields of engineering, manufacturing and construction are women. This situation has changed only slightly since 2000, despite many initiatives to promote gender equality in OECD countries and at the EU level.'

According to the same OECD report, in the distribution of tertiary new entrants, by field of education (2011), Ireland, with 11% female entrants into 'Engineering, Manufacturing and Construction', was behind both the OECD and the EU 21 averages of 15% but ahead of the UK figure of 8%. The report also points to significantly better outcomes for Engineering in terms of earnings

and unemployment levels than other professions. Although, as we will see later, pay and promotion opportunities appear to cause an excess exit rate of women over men from the profession.

'For example, in the United States in 2011, the average annual salary for 25-29 year-olds who had completed an ISCED 5A first degree was USD 44 800. However, this average ranged from USD 34 750 for those who had completed a degree in social work to USD 75 700 for those who had completed a degree in computer engineering. Other fields with annual earnings averages over USD 60 000 included several other engineering specialties, computer and information systems, and management information systems and statistics. In Sweden, the average 2010 salary for 25-29 year-old graduates in Engineering was 90% higher than the average for students who had majored in Arts and Humanities.'

The issue goes beyond Engineering.

'Science-related fields, which include Science and engineering, manufacturing and construction, are less popular. On average, only a quarter of all students enter these fields. This low level of participation is partly due to the under-representation of women: on average in 2011, only 14% of new entrants into tertiary education who were women chose these fields, compared with 39% of new entrants who were men. Among the new-entrant population, the proportion of women who chose Science-related fields ranged from 5% in Belgium and Japan to 19% in Greece, Italy, Indonesia and Mexico, while among men, the proportion in these fields ranged from 18% in Argentina to 58% in Finland (Table C3.3b, available on line).'

The OECD report also suggests that 'Contrary to what one might expect, tuition fees for studies in fields like Science and Engineering are only markedly higher in Ireland'. It is not clear whether this has any impact on entry levels to Engineering and/or related programmes at third level.

In the Report 'Stemming the Tide; Why women leave Engineering' (2011) University of Wisconsin-Milwaukee' Fouad and Singh offer 'Recommendations for Colleges of Engineering' i.e.

STRENGTHEN UNIVERSITY-INDUSTRY PARTNERSHIPS BY ALIGNING CURRICULUM WITH ORGANIZATIONAL EXPERIENCES

First, it is imperative that women engineering students are provided with networking opportunities with current engineering executives in order to get a realistic preview of engineering tasks and workplace cultures. This could be accomplished by designing internships, externships, and co-op programs that expose them to engineering workplaces. Such experiences could be instrumental in not only helping female engineering students get an up close and personal view of what to expect after they graduate, but could also set the foundation for important mentoring and role-modeling (sic) relationships.

CREATE CLIMATES THAT HAVE ZERO TOLERANCE FOR INCIVILITY

Similar to our recommendation that organizations need to develop policies that create a culture of civility, educational institutions need to have zero tolerance for rude or hostile behavior. Participants in our study provided a number of examples of classroom climates that were unwelcoming or hostile. Unfortunately, their examples included both faculty and fellow students' comments and behaviors in and out of the classroom. Universities need to convey to faculty that it is their responsibility to create the expectations that sexist behaviors and comments in classroom as well as outside the classroom (e.g., labs, outside groups, student organizations) will not be tolerated.

TEACH STUDENTS CAREER MANAGEMENT SKILLS

We strongly encourage engineering programs to consider incorporating career management courses that focus on workplace skills and behaviors for all students, and not just for women. For example, courses that focus on helping students learn how to work as part of a team, how to manage projects, how to communicate effectively, how to negotiate, and how to manage conflict and interpersonal differences, will help prepare students to pursue successful careers in engineering.

THE ENGINEERING PROFESSION/ CAREER PHASE

Despite making up about half of the workforce overall in the U.S., only about a quarter of workers in Science, Technology, Engineering, and Mathematics fields — otherwise known as STEM — were women in 2011, according to a 2013 report from the Census Bureau. Women's progress in breaking into these fields has slowed down in recent decades. After growing since the 1970s, it has tapered off since 1990, with most of the growth for women under 40 happening between the 70s and 90s. Women's share of computer jobs, which make up half of all STEM employment, has actually fallen since 1990. In 2011, women were 47% of mathematical workers, 41% of life and physical scientists, 27 % of computer professionals, and 13% of engineers while making up 61% of social scientists.

And while women are underrepresented among those who get STEM degrees — they are 53 % of all college graduates but just 41 % of those graduating from Science and Engineering programs — even those who do get degrees are less likely to end up in these jobs. As the report notes, "Among Science and engineering graduates, men are employed in a STEM occupation at twice the rate of women," 31% versus just 15% for women.

In their paper Fouad and Singh (2011) state that (in relation to the U.S.):-

Women comprise more than 20% of engineering school graduates, but only 11% of practicing engineers are women, despite decades of academic, federal, and employer interventions to address this gender gap... And that Preston (2004) reported that all engineers leave the field at a rate four times that of doctors, three and a half times that of lawyers and judges, and 15-30% more than nurses or college teachers. Specific to engineering, the Society of Women Engineers (SWE) recently reported that one in four women who enter engineering have left the profession after age 30, compared to one in ten male engineers (SWE, 2007)... There are many possibilities that have surfaced from anecdotal accounts but little research to offer some tangible evidence.

A study by McGill University economist Jennifer Hunt (2012) looked more closely at why women left Science and Engineering. She found

'that the exit rate for women compared to men is indeed higher from engineering than from other fields, due to excess exits to jobs in another field but that there is no similar pattern for Science... I found that the most important driver of excess female exits from engineering is dissatisfaction over pay and promotion opportunities, a factor explaining about 60% of the differential gender gap in exit rates.'

And also that

Family-related constraints are not a factor: while many more women than men cite family issues as the reason for leaving engineering, the gender gap is as large in non-Science and engineering fields.

In an earlier but very similar study Hunt (2010) found that women also left fields such as financial management and economics at higher than expected rates. The commonality? Like Engineering, those sectors are male-dominated. Some 74% of financial-management degree holders in the survey sample were male. Men made up 73% of economics graduates.

An Irish study by Engineers Ireland and HRM Recruitfound that:-

Female engineers are twice as likely to work as Individual Contributors, male respondents are almost twice as likely to work at Senior Manager or Function Head levels and three times more likely to operate at Company Director.

Buse et al. (2013) report that:-

'Women who persisted in engineering careers articulated high levels of self-efficacy, described themselves in terms of their identity as an engineer, and were motivated by the challenges and novelty of the profession. Women engineers' ability to adapt enabled them to persist and thrive despite working in a male-dominated culture characterized by difficulties associated with the workplace, including discrimination. Women who opted out of engineering were less likely to recognize options in navigating the workplace and some felt as if they were pushed into engineering. Persistent engineers were less likely to be married and had fewer children.'

The 'leaky pipeline' in Ireland is thus illustrated by the decline from women representing c.20% of undergraduates through 8.85% membership of the professional institution to 3.37% at the level of 'Fellow', the career apex.

SUMMARY

There is no discernible difference in the 'ability' of young men compared to young women that might contribute to the gender imbalance. Nor is there any evidence in relation to different levels of 'opportunity'. The key issue appears to be 'motivation'. There is little or no evidence that family and child centred responsibilities do cause more women to leave Engineering compared with other professions, although the range of research is limited. Yet, there is something about the Engineering profession which deters women. Other male dominated fields also exhibited a higher than expected exit rate of women. The one tangible profession or career related reason for the excess exit rate among women is dissatisfaction over pay and promotion opportunities.

Despite there being many initiatives taken to address the under-representation of women in Science and Engineering, there has been little evaluation to determine best practice.

AREAS FOR FUTURE RESEARCH

There is value in carrying out research specific to the Irish context, specifically in relation to the 'demotivators' to women entering the education phase and, separately, the career or professional phase of Engineering.

FINDINGS IN RELATION TO ENGINEERING IN UCD

This section of the report looks at the data trends in national and UCD data and also includes a summary of a discussion amongst recent UCD female graduates. The main trends established in this section are that more women than men apply for level 8 courses. However, within Science, Technology, Engineering and Mathematics (STEM) level 8 courses there is a low number of women participants. The levels of female students taking STEM leaving certificate subjects are low, in particular for Engineering related subjects. For UCD Engineering there has been little change in the percentage of female entrants, at between 20% and 25%, for the last eight years.

CENTRAL APPLICATIONS OFFICE & STATE EXAMINATIONS COMMISSION DATA

The data in this section has been taken from the annual CAO board of directors' reports from 2000-2012. Specifically, this report looks at applications to level 8 courses. The number of female applicants is consistently greater than their male counterparts in terms of total level 8 applicants; this is also carried through to net acceptances. For level 7/6 courses, males are shown to outnumber female applicants.

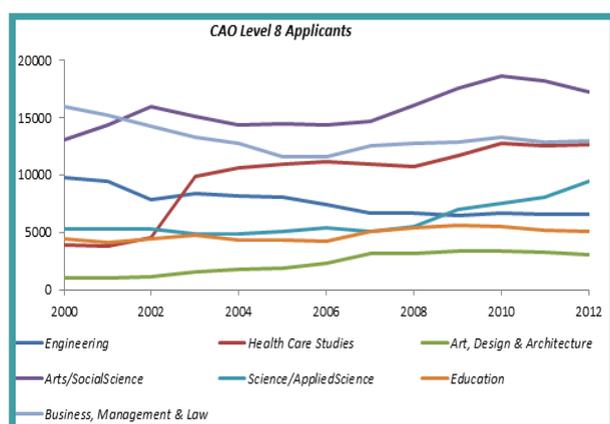


Figure 1

Figure 1 looks at the breakdown of CAO applications to level 8 courses, grouping the various categories into key third level sectors. It can be seen that the number of Engineering applicants has been decreasing over

the period of the available records. The other STEM subjects, categorised in Science/Applied Science have been on the rise. The CAO does not supply gender breakdowns for any of these categories.

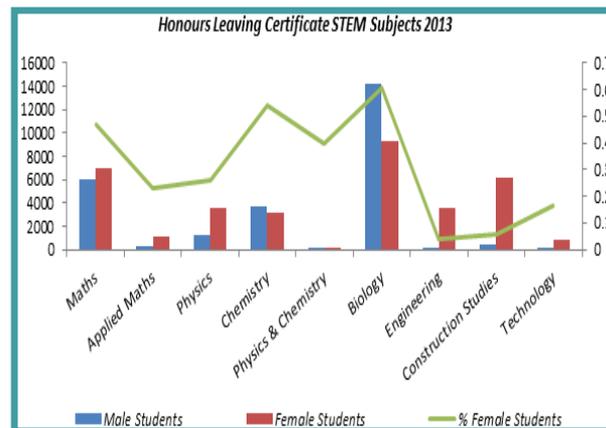


Figure 2

Further analysis was conducted on the Leaving Certificate data from the State Examinations Commission (SEC) looking at the numbers taking key STEM subjects. In Figure 2 it can be seen that Biology is by far the most popular STEM subject, and also the subject most popular amongst female students. Those subjects seen as useful prerequisite subjects for Engineering, such as Physics, Applied Maths and Engineering itself, have low levels of female students, with Engineering having as low as 4% of its total students being female.

HIGHER EDUCATION AUTHORITY OF IRELAND: UCD DATA

This section looks at all full-time undergraduate students by field of study for honours bachelor degree programmes for UCD, available through the Higher Education Authority of Ireland (HEA). The HEAI reports have the category for honours degree entrants for 'Engineering, Manufacturing and Construction'. This report further excludes the architecture figures to look purely at Engineering, as the gender balance for architecture typically has a much greater proportion of women than that of Engineering and can obscure some

of the trends. The percentage of females enrolled in the Engineering category has been virtually constant at 20%.

Figure 3 shows the number of male and female student entrants to UCD Engineering programmes year on year. The total number of entrants to UCD has been increasing, opposite to national trends in Engineering, but the percentage of female applicants has remained relatively constant with the percentage of female entrants fluctuating around 20%. The gender balance levels at UCD are consistent with the other three largest Engineering programmes, NUIG, UCC and TCD, who have percentage levels varying between 15-30% over the past ten years with no discernible trends of increasing or decreasing levels of female entrants.

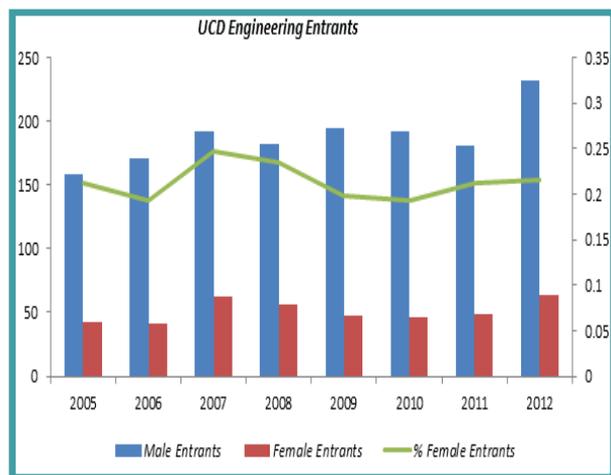


Figure 3

An interesting comparison to be made is in comparing the male and females enrolled in all STEM subjects at UCD such as Science, Mathematics and Computing (see Figure 4). These subjects have a much closer gender balance than Engineering. However, this aggregation of the STEM subjects hides some of the more worrying trends when the categories are further broken down.

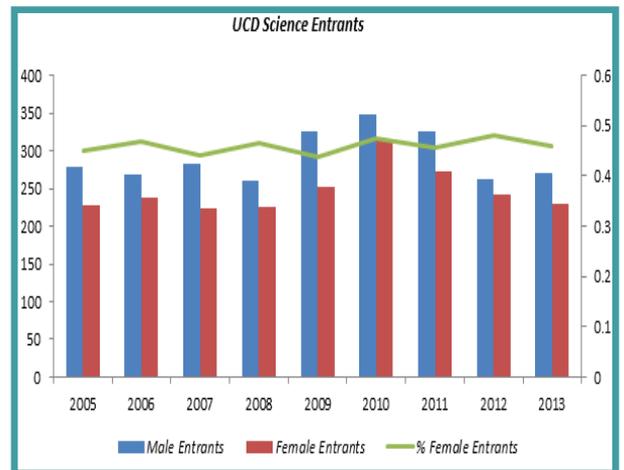


Figure 4

Figure 5 shows the full breakdown of those enrolled in Science, Mathematics and Computing honours degree programmes for 2013. It can be seen that the gender balance in individual STEM subjects can vary greatly, with much greater female enrolment in Biology and Combined Science programmes than in Physics and Mathematics.

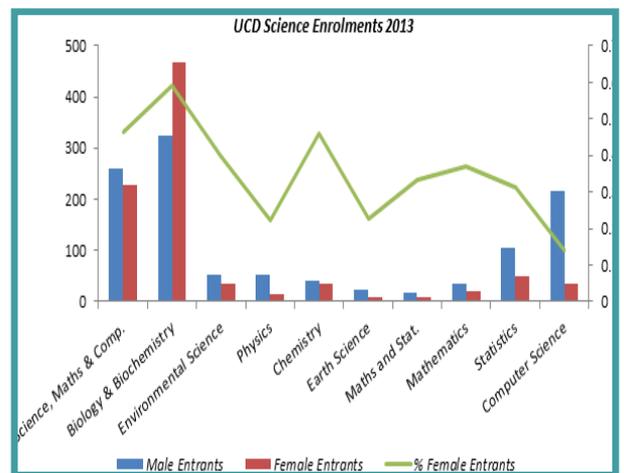


Figure 5

Overall UCD has gender ratios reflective of those seen in CAO applications. Figure 6 looks at enrolments in all UCD honours bachelor degree programmes for 2013. It can be seen that females are predominately going into areas such as Health Care, Social Sciences and Arts and Humanities. The gender balance issue is now much more complicated, as although Engineering has few female enrolments, Health Care and Welfare has precisely the opposite situation with too few male

enrolments. This raises the issue that nationally the numbers in third level courses are fairly balanced, with in fact slightly fewer males than females, so the issue is more about trying to attract applicants away from making traditional choices based on gender stereotypes across the board, which applies to both males and females. It can be seen that UCD enrolments in STEM subjects are a reflection of those made at Leaving Certificate level, as seen in Figure 2.

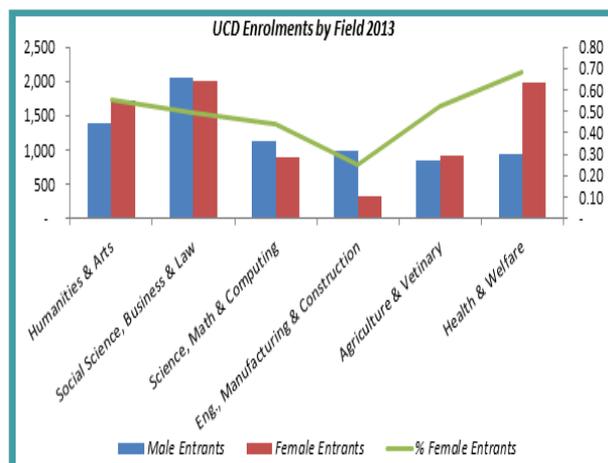


Figure 6

UCD GRADUATE DISCUSSION

A panel was created which consisted of 5 recent women graduates of the Bachelor of Engineering programme and 4 students currently enrolled in Engineering Master Degrees at UCD. Key points raised in that discussion were the following:

- Engineering related subjects are not widely offered at all female secondary schools.
- Presentations to secondary schools need to display the breadth of Engineering programmes and opportunities.
- Attitudes of society to women in Engineering are still a barrier to applying for Engineering programmes of study.
- Attitudes within UCD Engineering to women affect career choices to stay in the industry.
- Gender targets have both beneficial and negative consequences, and can affect self-confidence and self-worth of those chosen under such strategies.

- Engineering should be highlighted as a means of broadening horizons.

SUMMARY

- Female applicants outnumber their male counterparts in level 8 CAO applications.
- CAO Engineering applications have been decreasing, although UCD numbers are on the rise.
- In UCD Engineering the number of females has been relatively constant at around 20%.
- Overall UCD is close to the CAO female applicant percentages for third level courses, with around 52% of its total enrolled undergraduate students being female.
- Within UCD there are gender imbalances across the degree programmes, with the most prominent being female dominated Health and Welfare and male dominated Engineering.
- Within the STEM level 8 courses there are further imbalances, with Physics, Computing, Maths and Statistics all being male dominated.
- Engineering related subjects such as Physics, Applied Maths and Engineering itself are not offered to girl secondary schools as widely as they should be which is most likely a key cause in the low numbers taking Engineering at third level.
- There is low visibility and knowledge of Engineering in many girl secondary schools.
- Presentations on encouraging young women to enter Engineering should focus on the broad range of disciplines of Engineering and the intrinsic value of the profession to society in everyday life.
- Society's perception of Engineering as a career for males is perceived as a deterrent to women entering Engineering, and was experienced by both UCD graduates of Engineering in industry and in the college itself yet it did not deter them from finishing the course and working in industry.

RECOMMENDATIONS

This section of the report outlines recommendations aimed at three specific interest groups:

- The Engineering profession and the education sector.
- UCD & UCD Engineering.
- UCD Engineering Graduates Association.

THE ENGINEERING PROFESSION AND THE EDUCATION SECTOR

Excellent work has been done by Engineers Ireland through a range of initiatives to promote greater gender balance in the profession. The recent “Engineering Your Future: Women in Engineering” day held by Engineers Ireland in Dublin Castle was an interactive career event which showcased Engineering as an exciting career path for women. The first of its kind, the event aimed to inspire young women to consider Engineering as a career or a third level option. Over 370 students ranging from 13 to 16 years of age attended.

There has been a very significant impact of the Engineers Ireland TV Advertisement campaign over the last few years (“Will you come with me..”) in promoting Engineering as a profession (and the clever positioning of elements attractive to young women together with extent of female engineers participation in the advert).

TV media will continue to play an important role in encouraging more women into Engineering.

It is recommended that the UCD EGA forms a closer alliance with Engineers Ireland to:-

- Advise on and support the development of further advertisements that emphasise that the role of an Engineer is both an intellectual and dynamic role and show that the life of an engineer is both as appealing as, and opens up even more opportunities for career advancement (for both men and women), than any other profession.
- Lend active support through the EGA membership,

and in particular the Corporate Members, to Engineers Ireland’s STEPS programme series of career events on the topic of women in Engineering. As the Engineers Ireland website says these events are ‘Aimed at second-level female students and their guidance counsellors and teachers, the events will showcase women engineers at all stages of their careers, from third-level student through to CEO, and highlight the vital and varied work that engineers do’.

The EGA will form a volunteer subgroup of the members to work with Engineers Ireland to support these endeavours and also use their own further networks to get additional traction for these initiatives. The subgroup will also seek to get an input from and influence engineering industry partners who have a long term strategic interest in increasing the pool of talent available to them.

UCD & UCD ENGINEERING

UCD Engineering has many advantages over some other third level institutions offering Engineering programmes. These include foreign travel, the ‘Ad Astra Academy’, UCD horizons, clubs and societies, and importantly the wide variety of Engineering disciplines. These strengths need to be continually leveraged in attracting the best students of both genders.

MARKETING

UCD marketing is visible in social media, TV and other media. As the largest university in Ireland, the campaigns over the last number of years have been professionally delivered and have been effective. The campaigns have covered print and radio channels and extensive ‘undergraduate outreach’ programmes with tracked ‘conversion’ rates.

This success will form the basis for attracting more women into Engineering. We need to raise the profile of female UCD Engineers and increase awareness of the career options that Engineering provides to women. The key to raising the female Engineering profile is to

demonstrate that Engineering can provide a rewarding and fulfilling career. The UCD Engineering Marketing team can achieve this by using the weight of the UCD Brand to promote and to actively encourage women into Engineering. It is essential that this Marketing resource continues into the future, if not strengthened further. Specifically actions to be considered include:-

THE RIGHT INFORMATION

The marketing campaign needs to ensure that STEM teachers and guidance counsellors are given the correct information on Engineering courses and the Engineering Profession.

There needs to be specific webpages linked to the UCD Engineering pages that provide access to all of the media content as well as information on the Engineering profession, biographies of 'role models' and other relevant information. Furthermore, it would be useful here to link other campaigns similar to this on the website so as to provide more information. A link to Engineers Ireland, the UCD EGA and various industry partners of UCD that have a special interest in the campaign or run campaigns of their own should also be included in this website.

In the short to medium term it is recommended that UCD/UCD Engineering:-

- Identify the main UCD feeder schools and (importantly) potential feeder schools, team up with the Engineers Ireland STEPS programme and visit each school to address the Junior Cert and Leaving Cert cycles. It is important to address the junior cycle as this is the stage where subject choices and levels are made.
- Create a longitudinal annual survey, targeted at these feeder schools, that seeks to understand what motivates or demotivates young people to take up Engineering. This might include an assessment of whether these reasons change or evolve over time, as they progress through college and their career.
- The UCD Engineering Marketing team should carry out a review of the subjects on offer at girl only and mixed schools and associated take up.

- Provide prospective UCD Engineering students with networking opportunities which will give a realistic preview of Engineering tasks and workplace cultures and provide opportunities for mentoring and identification of role models. Ensure specific marketing on UCD Engineering websites using 'role model' female engineers at work. Appoint UCD Women Engineering Ambassadors for different disciplines and give these a high profile on the UCD website.
- As part of UCD College of Engineering Open Day have a focussed 'module' (brochure, video etc.) focussing on women in the profession.
- Ensure that there is a positive and diversity friendly learning environment in UCD Engineering across all grounds, including gender, creating a welcoming experience for all. This should be set as a specific responsibility for one member of the academic or administrative staff.

THE 'BRANDING' OF ENGINEERING IN UCD

To a large extent the title of the Engineering streams in UCD have remained unchanged for many years. There is anecdotal evidence to suggest that rebranding the Engineering streams could have a positive impact on attracting more women. It is recommended that further research be carried out into what has been done internationally in this area with a view to making changes in UCD Engineering.

SOCIAL MEDIA CAMPAIGN

One of the most effective forms of marketing in the world today is through social media; it is at the very core of modern society and as such is the most effective way of communicating to our target audience. As outlined in the previous section the strength of the UCD Marketing team has successfully created a strong UCD Brand with the media and has a significant presence across all forms of social media; YouTube, Instagram, Facebook and Twitter to name but a few. These portals can be leveraged to support our objectives.

A social media campaign should be used to promote the initiatives outlined in this report. It will promote

the 'Female Role Models' by featuring their profiles on advertisements and video clips and similarly will complement the 'focussing on women in the profession' module at the Open Day (see above) to ensure the message reaches as many prospective students as possible.

The social media campaign will span across all forms of social media but one of the most effective forms is through Social Media Advertising via YouTube. The UCD Brand is already heavily featured on the site as there are many videos advertising the wider university. YouTube advertisements are minimum five second long videos that are specifically aimed at the desired audience by airing them alongside videos and clips which have a large volume of traffic from the target audience. YouTube can guarantee the video will be viewed and reach the right people. An online publishing resource MediaPost has shown that some 700 YouTube video links are shared on Twitter every minute whilst 500 years of YouTube video content is watched via Facebook every day. This approach can reach a much wider audience than traditional more expensive media forms.

Facebook provides a similar springboard for the initiatives that works hand in hand with YouTube. A Facebook profile for the initiatives should be set up; from there the page can create a profile, advertise events, publish information and share photos with the pages' followers. Facebook adverts can also be purchased to increase the coverage on the sites, these adverts work along the same lines as YouTube, you pay for your coverage, you pick your audience and you can keep track of your progress.

The initiatives can be converted and transported into all the other social media outlets; for example an Instagram account can be set up, sharing the links to the other media pages and spreading the message in the form of pictures and hashtags (#tag). LinkedIn can also be used to spread the message but this form of communication is geared to an older more professional audience. It could however be a good way of getting the message to the Engineering industry and parents.

UCD ENGINEERING GRADUATES ASSOCIATION

CREATION OF "GETTING MORE WOMEN INTO ENGINEERING @ UCD" INITIATIVE.

This initiative requires a significant focused event (perhaps a launch of this report, the EGA Autumn Panel Discussion or Spring Lecture) that would receive national media coverage and act as a springboard to attract national attention to the challenge. The event could also be in the form of a seminar or lunch. Specific high profile women should be invited to attend and act as 'Ambassadors for Engineering' in UCD. They should be invited to speak at the event and play an active role in the campaign.

This event would be specifically tailored to Leaving Cert students, parents, teachers and guidance counsellors. The main objective of the event would be to leave the audience with the message that a world of fantastic opportunities is out there for men and also women in Engineering. The EGA could develop a poster to circulate to all girls and mixed secondary schools pointing out the positive career options within Engineering.

SHORT TO MEDIUM TERM RECOMMENDATIONS FOR THE EGA

- Host an open evening focused on attracting female students, their parents, teachers and guidance counsellors. This evening would be a smaller version of the above recommendation but it would still portray the same message.
- Offer a bursary to the highest grades obtained by female students in Leaving Cert STEM subjects; this would be a similar to the Gold Medal awards.
- Encourage members (incl. Corporate Members) to mobilise their organisations to speak to girls schools and mixed as part of the Engineers Ireland STEPS programme to promote the profession and the university. It would be important to include young male and female speakers whilst a company director or another senior level position might be more relevant for presentations to guidance counsellors and teachers.

- Encourage companies (particularly Corporate Members of the EGA) to open their doors to potential students and guidance counsellors. This will provide a very practical insight into the day to day operation of an Engineering firm.
- Introduce workshops within UCD Engineering that focus on:-
 - career development - what to expect, how to react, how to progress with a focus on confidence, networking, developing support structures such as mentoring and identification of role models.
 - workplace skills and behaviour which will help students learn a number of skills such as working as part of a team, managing projects, communicating effectively, negotiations and managing conflict and interpersonal differences.



CONCLUSION

The scope for encouraging females into the Engineering profession is wide ranging. The recommendations made in this report relate to a range of initiatives and have the potential to make a real difference to the female intake in UCD Engineering.

The collective approach involving the EGA, UCD Marketing and Engineers Ireland representing the industry as a whole will succeed in getting the message across in a clear and effective manner and should encourage more women into Engineering.

The EGA has the potential to play a very active role in this initiative, the benefits of this are not only to increase the intake of female students but increase the profile of the EGA as a whole.

The final word goes to Orla Feely, Vice-President for Research, Innovation and Impact at UCD (as quoted in the Accenture Report (2014).

“We need not only to direct more young women towards STEM areas, but toward particular areas of STEM. As an engineer myself I know this is an area where, in particular, we continue to suffer from misapprehensions and misconceptions about the nature of the profession. That is something that continues to need attention.

To me it is at least as important to target the parents and guidance counsellors as it is to target the schoolgirls themselves. We really need to bear in mind both those groupings. I think we have a window of opportunity just now. Even over the last 12 months there has been an extraordinary array of Irish women appointed to senior positions in Ireland and internationally. If we get a concerted push to highlight how women can build hugely successful and rewarding careers in this sector, I think we should be able to make considerable headway.”

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