Tinkering, Tailoring, and Transforming: Retention of Scientific Excellence of Women Researchers through WiSER mentoring

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Abstract

Women are under-represented in academic grades in Higher Education, but more so in science, engineering and technology (SET) disciplines. This under-representation of women undermines the potential gains the community of science can attain by utilising the skills, talents and knowledge of all those who are trained to work in SET. The European Union statistics show that women are equally represented at undergraduate stage but become progressively more under-represented in the more senior academic positions. This article presents a case study of a mentoring programme in the Centre for Women in Science and Engineering Research (WiSER) at Trinity College Dublin. Its aim is the recruiting, retaining, returning and advancing women in academic science, engineering and technology. WiSER seeks to develop sustainable practices to ensure that women can compete in research in an equitable manner with male colleagues using their scientific expertise, knowledge and potential. The outcomes of the programme are reported for mentors, mentees and Trinity College and retention data are given for the women a year after the programme ended.

Key Words: higher education, inequality, mentoring, science, women,

Introduction

The Centre for Women in Science and Engineering Research (WiSER) was established in late 2006 with an aim of *'recruiting, retaining, returning and advancing'* women in academic science, engineering and technology (SET) in Trinity College Dublin. The Women in Science and Engineering Research (WiSER) mentoring programme, launched in 2008 was designed to align with the overall goal of retaining women researchers in the science, engineering and technology (SET) disciplines. This is a study of the first mentoring programme which ended in October 2009 and an investigation of whether mentoring in the programme makes a difference to the organisation and individuals involved.

Women are under-represented in academic grades in Irish Higher Education, but more so in science, engineering and technology (SET) disciplines (European Commission, 2009). The under-representation of women in these disciplines undermines the potential gains the community of science can attain by utilising the skills, talents and knowledge of all those who are trained to work in SET (Grimson and Roughneen, 2009). The equal proportion of men and women who qualify with a doctorate is not reflected in the proportion of women working as academic scientists after qualification. This is diagrammatically shown the in the pipeline diagram in Figure 1, (European Commission, 2009).

Figure 1: Pipeline Diagram: Percentage of men and women in a typical academic career in science and engineering, students and academic staff, EU-25, 2002-2006
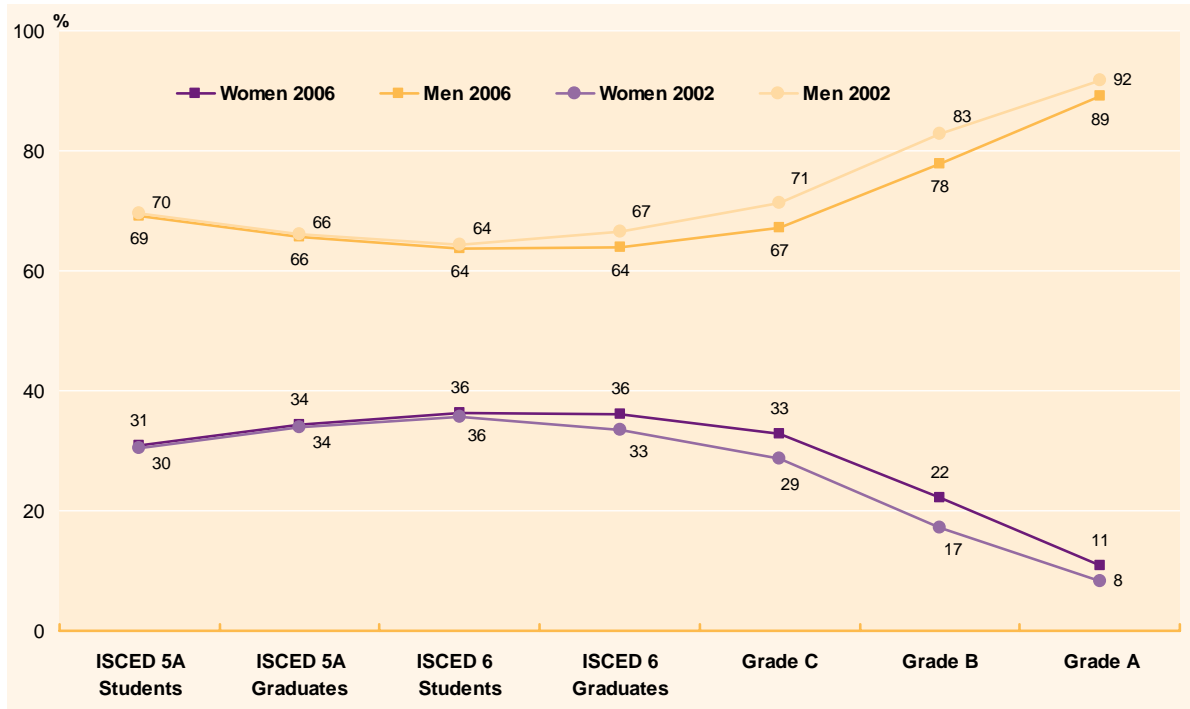

Source: European Commission 2009: 73

Grade C academic staff indicates the first grade/post into which a newly qualified PhD graduate would normally be recruited. Grade B academics are researchers working in positions not as senior as top positions but more senior than newly qualified PhD holders and Grade A academics is the highest grade/post at which research is normally conducted. In the context of Ireland, Grade C is Contract Lecturer, Grade B is Post Doctoral Fellow and Grade A refers to Associate and full Professor.   In the case of SET students, women are underrepresented from undergraduate grade (ISCED 5A). Women's representation in SET peaks at PhD graduate level (36% women PhD graduates in 2006). They then become progressively more under-represented as the seniority of academic positions increases, e.g. in 2006, the EU average was 89% male professors and 11% female professors. Trinity College Dublin (TCD) replicates this pipeline diagram (Figure 2). Data from Trinity College Dublin shows that the situation at TCD is even more disappointing than the EU data.

Trinity data reflects leakage of women from TCD at the Research Fellow and lecturer staff categories (n=99, 40% women research fellows; n=19, 16% women lecturers in 2007) but also shows that very few women reach senior positions in academia (n= 10, 16% women associate and full professors in 2007; n= 64, 84% male associate and full professors in 2007). While this indicates that Trinity College has a greater proportion of women in SET compared with the EU average, the actual numbers of women professors is very low.

Figure 2: Pipeline Diagram: Percentage of men and women by academic grade in science and engineering, students and academic staff, Trinity College Dublin, 2007- 2010
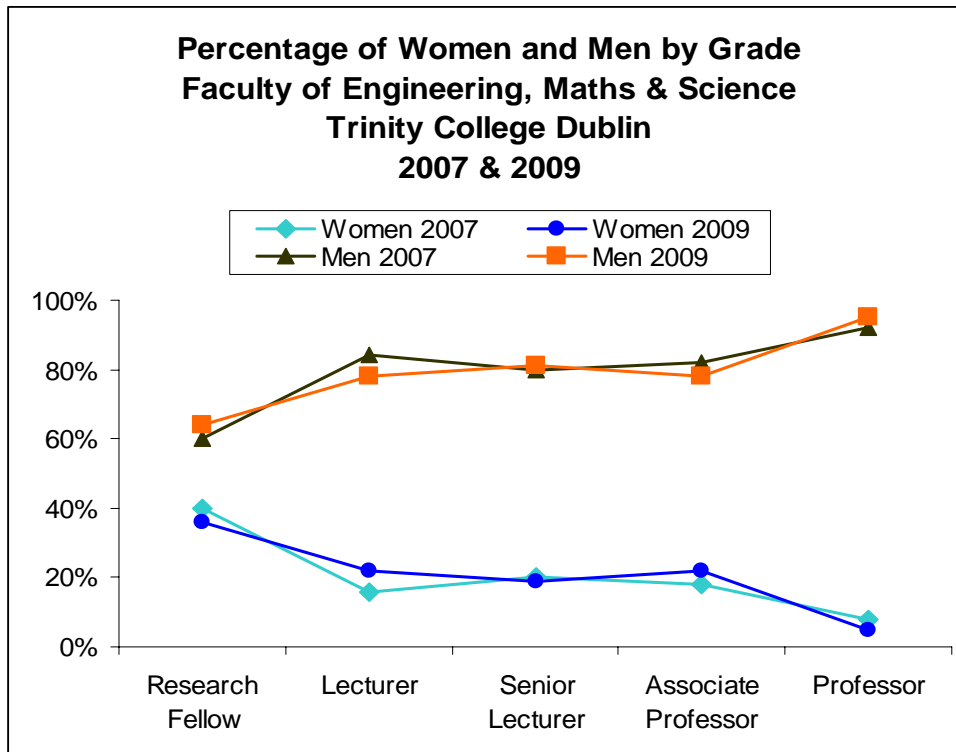
Source: TCD 2009 Data
Source: WiSER 2007 Data

Studies in the UK, Europe and the USA over the last 20 years have identified some causes for women's under-representation in SET which include:

- Unconscious bias against women in favour of men (Valian, 1998 and 2005)
- Lack of confidence by women working in a male-domain environment (Peters, 2002)
- Lack of visible role models (Peters, 2002)
- Lack of networking opportunities and/or exclusion from networks (Committee on Women Faculty in the School of Science, 1999).
- Women's style of leadership, management and communication deviating from the male 'norm' that has been developed in SET (Fine, 2008)
- Isolation, both in terms of working long hours in the lab, but also being a minority in the academic science domain (Valian, 1998 and 2005; Peters, 2002).

Trinity College Dublin addressed the under-representation of women in SET in the WiSER programme and its mentoring programme.

Background to the Centre for Women in Science and Engineering Research

Under the Women in Science Programme (SFI, 2005), funding from the research body Science Foundation Ireland, investigated the causes of the under-representation of women in SET, in Trinity College Dublin (Grimson and Roughneen, 2005). The researchers, Grimson and

Roughneen found similar situations in Europe (European Commission, 2009) and in the USA (Committee on Women Faculty in the School of Science, 1999). Based on the findings, in 2006 Science Foundation Ireland awarded Trinity College Dublin further funding to establish the Centre for Women in Science and Engineering Research (WiSER), with the proviso of the commitment of matching funding from TCD to house and maintain the Centre.

WiSER seeks to develop sustainable practices to ensure that women can compete in research in an equitable manner with male colleagues. WiSER endeavours to correct gender imbalance and aims to:

- increase the retention of women by providing direct support to women researchers and academics in science and engineering
- create a sense of community within the workplace and the field as a whole by facilitating networking amongst women and stimulate institutional and cultural change in order to create a more gender-balanced, and ultimately more productive, environment
- collect gender disaggregated data relating to all aspects of an academic's life including number of students, postgraduates, post doctorates, academic staff, those at management level; those in contract or permanent positions, success rates in publications; success rates in grants awarded; and report annually to the general governance committee within the College.

WiSER uses a framework of employment equality to inform its approach to programmes designed for women in SET.

Tinkering, Tailoring and Transforming: The WiSER Centre

WiSER uses a theoretical model (Rees, 1995) which incorporates Rees' taxonomy of 'tinkering, tailoring and transforming' to describe how higher education institutions can address employment equality. The taxonomy is described in the following way.

- Tinkering: the legislative approach

The 'tinkering' or legislative approach argues that everyone should be treated the same and aims to remove any direct form of gender discrimination which leads to the unequal treatment of men and women. The tinkering approach is enshrined in law. Legislation in Ireland includes the Employment Equality Act 2004; Workplace Equality Act 2004; Equal Status Act 2000 and 2004 and the University Act 1997.

- Tailoring: the positive action approach

The 'tailoring' or positive action approach recognises that the differences between men and women which exist within the workplace are due to a complex range of social, historical and economic reasons and have led to unequal choices of and access to careers. The tailoring approach seeks to address these differences by ensuring a 'level playing field' for women in the competition for jobs, promotion and career advancement. The main focus of this approach is to target women specifically. The WiSER work programme addresses four different key career transition points for women in academia. These are 'recruit, retain, return and advance' and they focus on the ways women's careers differ from men's careers at similar points. While the 'tailoring' actions may have some impact on certain areas of the culture of the organisation, it does not address systematic culture change.

- Transforming: the gender mainstreaming approach

Gender mainstreaming is defined as

> the (re)organisation, improvement, development, and evaluation of policy processes so that a gender equality perspective is incorporated in all policies and at all stages by the actors normally involved in policy-making (Council of Europe, 1996).

Underpinning the 'transforming' or gender mainstreaming approach is the idea that existing structures and institutions are not gender-neutral but favour one gender over another, usually men, in a variety of subtle and often invisible ways. This approach also recognises that differences exist between the sexes yet embraces these differences as bringing added value to the working environment and also recognises the vital contribution that women, as women, can make to academia.   All policies and practices are informed by the knowledge of the diverse needs, expectations and perspectives of their beneficiaries: men and women. The main focus of the 'transforming' approach is the organisation as a whole, which includes the structures, values, customs, policies and practices that make up it. In the WiSER work programme, the 'transforming' activities address areas of cultural change relating to mainstreaming gender in the institution and within the local academic units. This action focuses on addressing the culture of the University as a whole, as well as understanding the local cultures of academic units (e.g. Faculties, Schools or disciplines) in the context of gender.

In order to achieve both tailoring and transforming aspects of employment equality, WiSER included a mentoring programme for women to align with its overall strategy of retaining scientific excellence of women in SET.

Mentoring: tailoring and transforming in action at TCD

Mentoring has been long identified as a 'good practice' process to help address issues arising from women's under-representation in academia (Fort, 2005; Advance project, 2008; Boyle and Boice, 1998). Men receive more informal mentoring and support than women which can help their professional development and advancement (Ragins and Cotton, 1991; Ragins and McFarlin, 1990).

WiSER designed a pilot mentoring programme for women researchers in SET in TCD as part of the tailoring strategy: targeting women specifically while recognising that cultural change does not happen instantaneously. There have been several informal mentoring programmes for academic staff in Trinity College but mainstreaming has not moved beyond informal mentoring. Queen's University Belfast and the University of Limerick have established programmes for women academics which informed the WiSER mentoring programme.

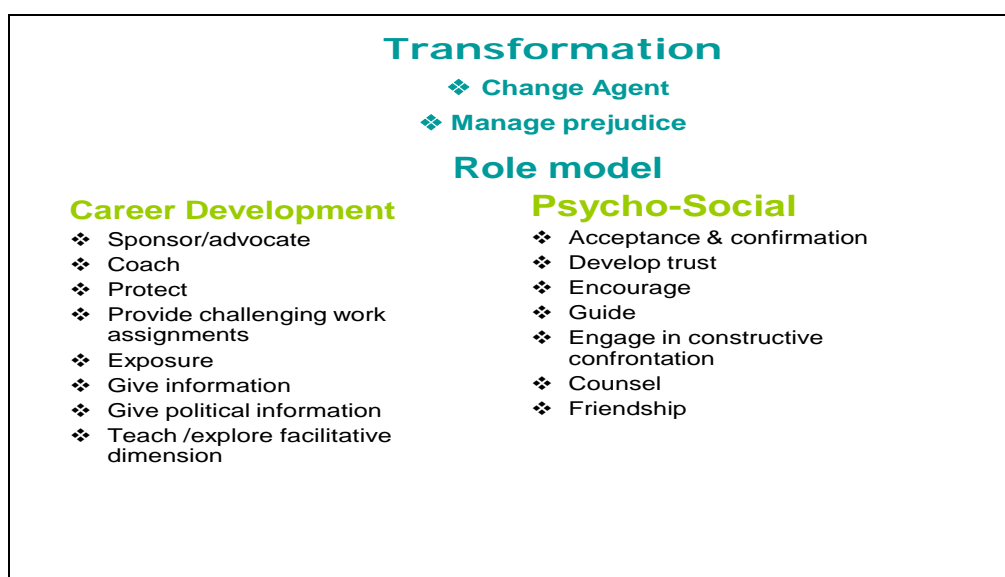- Political Territories: Putting forward the WiSER mentoring proposal

The WiSER mentoring programme was a one year pilot from October 2008 - October 2009. The mentees fall into two distinct groups: women lecturers in permanent posts and contract researchers employed for a fixed term of two or three years. The 'pipeline' diagram (Figure 1) illustrates that these are the two critical career transition points where women leak from the academic pipeline. The mentors were women (35%) and men (65%) academics in the Faculty of Engineering, Mathematics and Science (FEMS). They volunteered to mentor the women and were all qualified PhDs.

Mentoring, as part of the WiSER programme, was fully endorsed by senior management and senior academics in the institution. The mentoring programme was initiated in the second year of the WiSER work programme.

Academic institutions often assume that the higher degree or doctoral supervisors develop the skills of doctoral students, thoroughly preparing them for using these skills throughout their careers (Betz, 1997). Although research (Sorcinelli, 2002) suggests that support from senior academics, chairs, deans and other campus administrators is critical to the success of early career academics, many of the department chairs interviewed by Boice (1992) believe in the ''sink or swim model'' of career advancement. Ollis et al. (2002) maintain that they can get young engineers and mathematicians up and running within one to three years from the start of their academic careers. Boice (1992) says that the norm for universities in the USA is usually four to five years. He maintains that early career academics and their managers can do several things, including mentoring, to enhance their productivity. Flinders University has undertaken a longitudinal study of the effects of mentoring on junior female academics (Gardiner et al., 2007), important because longitudinal studies like this are rare.

Mentoring with a transformation emphasis is particularly important in gender equity development programmes where women are offered development opportunities in order to help them achieve requirements for promotion to more senior levels. One model for considering gender equity development is through the transformational mentoring model (see Figure 3) which evolved as result of a study of early career academics at several South African universities (Geber, 2004). Transformational mentoring involves the establishing of learning alliances for professional development and a commitment to social and organisational change (Geber, 2003). The literature affirms that the two major functions of mentors are career development and psychosocial support for individual development. In the transformational mentoring model (Figure 3) role modeling is an overarching function in the context of social and organisational change and it includes mitigating prejudice and acting as a change agent. The transformational approach to mentoring is congruent with WiSER's gender mainstreaming in SET. The argument for using this model is that transformation needs to be clearly articulated in the mentoring agenda and integrated carefully into it. Unless it is, the chances are that the changes which happen during the mentoring process will be limited to personal and some professional development and will not effect the overall transformation of the organization.

Figure 3: Transformational Mentoring - Source: Geber, 2004.

Transformation
❖ **Change Agent**
❖ **Manage prejudice**
Role model

Career Development
❖ Sponsor/advocate
❖ Coach
❖ Protect
❖ Provide challenging work assignments
❖ Exposure
❖ Give information
❖ Give political information
❖ Teach /explore facilitative dimension

Psycho-Social
❖ Acceptance & confirmation
❖ Develop trust
❖ Encourage
❖ Guide
❖ Engage in constructive confrontation
❖ Counsel
❖ Friendship

With this research in mind, WiSER consulted each head of unit in the Faculty of Engineering, Mathematics and Science (FEMS) prior to launching the programme. WiSER introduced the mentoring programme as a career development process for ambitious and talented researchers and lecturers to enrol in. It gained support for the programme and encouraged Heads of Schools to act as champions and promote the programme. There were varying degrees of interest and support ranging from direct endorsement of the programme to resistance towards gender specific programmes which were seen as "social engineering".

Overt disregard of the benefits of gender-specific programmes meant that some mentees were fearful that established academics in their discipline would regard their participation as 'remedial' career interventions. These participants were happy to be on the programme as long as WiSER kept their participation private.

The culture of a unit can affect how mentoring is perceived (Gibson, 2006). If mentoring is perceived as a positive mechanism to advance one's career, more people are likely to enrol. Mentoring will be seen as a visible tool for successful career development. If mentoring is perceived as a support mechanism for women who need assistance in their careers, fewer women will sign up and are less likely to become prolific researchers (Bland et al., 2005). Hiding partnerships from general view weakens the transformative approach to gender mainstreaming.

Setting up the Programme

The Dean of the Faculty of Engineering, Mathematics and Science and the Dean of Research endorsed the programme through an email of encouragement to both target groups. Postal packs were sent to women containing a letter of introduction to WiSER, its mentoring programme and why women researchers were target mentees; a brochure explaining the benefits, expectations and criteria of mentoring; and an Expression of Interest form.

- *The participants*

The participants were lecturers and contract researchers with a year or more remaining on their employment contracts. Twenty women mentees and twenty-one mentors received mentoring training during the first academic term in 2008. After the training, partners were matched by the WiSER Director. The matching criteria were explained to the participants in order of importance:

a. No partnerships would be formed within the same School
b. The mentor would be a more senior academic to the mentee
c. Where possible, the gender of the mentor would be matched to the preferred request by the mentee
d. Areas in which knowledge or assistance was sought by the mentee

Good practice suggests that partnerships should be formed with partners from separate disciplines where power relationships are neutralised (Ragins and McFarlin, 1990). A mentoring partnership within the same unit can cause a hierarchical conflict (Darwin and Palmer, 2009) so nobody was matched within their School for WiSER's partnerships. Once the partnerships were established, the mentoring meetings began and the mid-programme review was scheduled.

Methodology

In the following section the methodology for the review and evaluation of the programme is set out. This is a qualitative interpretative study of mentoring partnerships of women in the WiSER programme at TCD. The authors asked participants to provide information about their mentoring partnerships and how they experienced the transformational nature and the context of the partnerships. The twenty women and their mentors gave intensive, rich and in-depth data about the partnerships. Patton (1990) suggests using few, information-rich cases in order to learn a great deal about concerns central to the purpose of the research.

Data collection and analysis

The data was collected in a number of ways at different times during the programme. An initial survey was filled in by participants to obtain baseline data before the mentoring for WiSER's database. The thematic content analysis of all later interviews was conducted according to the constant comparative method described by Maykut and Morehouse (1994). The method allows the researcher to construct categories or themes by 'continuous comparison' of items of data with each other in order to find recurrent patterns (Merriam, 1998). Four main categories of data were uncovered in this process and these are discussed in the section detailing the findings of the study. In order to check the validity of the categories, three colleagues were asked to peruse the raw data and check the consistency of the categories that had been constructed.

Mid-programme review process

WiSER obtained feedback from the partnerships in a mid-programme review in May 2009. Two sessions were arranged, one for mentors in which 14 mentors participated and one for mentees, 12 of whom attended.

End of programme Evaluation

The evaluation at the conclusion of the programme consisted of two main data gathering activities: a focus group with mentees and a follow-up written questionnaire and later, a focus group with mentors. The data was analysed for common themes and some quantitative outcomes.
The findings of the mid-programme review and end of programme evaluation in 'recruiting, retaining, returning and advancing' women in academic science, engineering and technology (SET) in Trinity College are discussed in the next section.

Findings

The data was collected through interviews with participants and documentation on the programme. The data analysis was informed by the theoretical perspective of transformational mentoring used in this study and the findings are reported according to the four major themes which emerged.

Mid-term review process

The four main findings at the mid-programme review concerned the frequency of the meetings arranged by the partnerships, goal setting for the year, networking activities and the common global issues which were raised with mentors.

- *Frequency of meetings*

The mentees met their mentors twice, on average, in the first six months, although one pair met six times. This is less than optimal for productive mentoring, as frequent meetings are characteristic of successful mentoring (Cohen, 1999). The mentors expressed concern at not being utilised fully and

expected mentees to contact them for more meetings. It can lead to 'irritation' if mentors have to make all the effort in contacting mentees, especially as the programme was 'mentee-led' (Clutterbuck, 2004). Mentors were concerned that longer meetings may make mentees feel that they are imposing too much on their mentors.

- *Goal setting in the programme for the year*

The women mentees liked setting goals using the documents distributed during the training and found them useful in setting goals for the year. It focused them as they thought about their goals. Some found it hard to set goals although others who had had done goal setting previously in WiSER's 'Springboard' programme found that subsequent goal setting a year later was beneficial.

- *Networking and Communities of Practice*

Some of the women in the programme had participated in the first year of the WiSER programme, had been involved in the 'Springboard' programme and wanted to include all WiSER mentees in monthly work meetings, writing groups, in seminars like 'How not to get ahead', research grant writing, and a panel session with mentors with small children. They requested quarterly social events for networking and peer mentoring. Several activities were added to the mentoring programme in the last six months of the programme.

- *Global issues for contract researchers*

There was frustration for contract researchers about global issues exerting significant external pressure on them such as: lack of opportunity to apply for funding, end of contract, and expectations of academic mobility. They perceived these issues as pervasive in the global academic culture, rather than just at Trinity. Mentees question the benefit of having mentors unable to assist in such situations.

The end of programme evaluation was conducted six months later and more comprehensive findings were gathered from all participants.

End of programme evaluation

The end of programme evaluation findings from the focus group with mentors are discussed first and then the findings from the focus group with mentees and their follow-up written questionnaires.

Mentor evaluation of the programme

Mentors provided valuable feedback on the mentees' development during the programme. They also reported on their own learning as mentors and the way in which this enabled them to develop mentoring skills. Mentors identified four major areas where the mentees' sense of isolation hinders their progress as academics:

- *Isolation in terms of organisational 'know how'*
- *Isolation by being a minority*
- *Isolation of a unique work position*
- *Isolation of location*

Mentees often feel isolated because they do not have enough knowledge of how academic careers or College structures work. One typical need in overcoming 'know how' isolation was voiced by a woman who said:

*'I wanted to gain an understanding of the administrative and academic organisation
at TCD. I wanted to know how to get things done within the institution'*

De Janasz and Sullivan (2004) point out that the career competencies of knowing why, how, and whom and signaling to others about these competencies, help early career academics in their career development once they have located mentors. The WiSER mentors admitted that very few academics understand the whole TCD system and many Heads of Unit lack an understanding of college structures and are unable to assist entry level academic staff. Obviously, this' know how' need applies to all early career academics but it is compounded for women who also experience the isolation of being a minority in SET.

Gibson (2004) states that it is important that mentoring programmes address the feelings of isolation and loneliness and that mentors provide reassurance that participants are not alone in the transforming university milieu. She also points out that politics is always evident and that it is difficult to change or surmount.

As Figure 2 shows, there are far fewer women in SET disciplines in general at TCD. Some WiSER mentees were the only women under 40 years of age in their departments. In addition, some women were in unique positions in TCD, being the only subject specialist in a particular field of study. Entry level women in TCD, with few women colleagues or role models, have to contend with the isolation of having few colleagues for discussing work issues, or where to get help. The need for internal and external sources to obtain necessary opportunities, connections and visibility is not always clear where women in academic roles experience this kind of isolation. It is a hindrance to their visibility in the workplace and their ability to climb the academic ladder through promotion (de Janasz and Sullivan, 2004).

Some of the women were located in the Trinity's major teaching hospital, quite a distance from main campus in central Dublin, and experienced organisational and geographic isolation in managing research and mentoring relationships.

All mentors agreed that mentoring had addressed issues of isolation and the mentees' sense of isolation had eased although geographical isolation was particularly challenging.

Mentee evaluation of the programme
One of the ways of evaluating the effectiveness of the programme is to look at the tangible outcomes. These are shown in Table 1.

Tangible outcomes
Tangible outcomes of the programme resulted from explicit goal setting at the start of the mentoring programme and are grouped into several broad categories as shown in Table 1 below.

Table 1 shows the tangible outcomes for about 33% of the mentees in the programme. This subset of mentees' outcomes is encouraging as it shows that mentoring had a profound effect on their outputs. Most of the mentees' tangible outcomes lead directly to increased visibility, emphasised by Coleman (2005), through publications in international journals, presentations, research collaborations and networking with other important researchers in their disciplines, through working in laboratories, giving oral presentations and seminars, bringing an Ethiopian researcher to Ireland to give seminars. Some mentees uploaded Web content about their work or a link to another Website, increasing their international visibility. The successful writing of funding proposals is also an important achievement. The women used the mentoring experience to plan their

careers more strategically and apply for promotion to senior positions at TCD or make career choices to remain in research positions in other institutions. There is ongoing tracking of all mentees' outputs.

Table 1: Tangible outcomes of the WiSER programme

Supervision of higher degree students and others	4 supervise 9 PhD students. 2 supervise post doctoral fellows
Research collaborations outside Ireland	1 collaboration in two African countries. 4 collaborations: Germany (article writing); UK (research); EU Cost Action; and Norway. 3 collaborations in USA and Australia.
Research collaboration within TCD	3
Promotion	1 in TCD, 1 in Wales
Funding:	5 Irish grants -SFI RFP, IRCSET – 2PD/IPG, FP7, EPA ; 5 Industry grants (Interchange Ireland) 1 Marie Curie for 2 year fellowship in Australia.
Paper presentations at conferences	4 in Ireland 8 International oral presentations and 1 poster
Seminars	3 at HEIs in Ireland
Committees:	3 committees: 2 at TCD and 1 for EU Cost Action MC 1 Social Partnership 1 Biodiversity Platforms
Journal articles	5 have 11 published international journal articles and 1 co-edited book 3 articles under review

Intangible outcomes

The less tangible achievements are more difficult to assess and self-report by the women and their mentors was used to do so. Some women report that they have made huge strides in their professional, career and personal goals and self confidence.

Based on the work of Coleman (2005), the WiSER Director encouraged women to become more visible and confident by getting known to academic colleagues, by showcasing their work, raising their academic profiles and building contacts. A woman in SET may do a great job, have the appropriate professional image, but if influential academics do not know that she exists, she is less likely to get the recognition for her work. Increased visibility was achieved by the women in the programme through expanding their organisational 'know how' and getting to know more influential academics and researchers both within College and in the broader SET research domain.

▪ *'Know how'*

Mentoring helped participants in knowing how to access to visible positions in their academic departments with colleagues, departmental heads, and students.

> *'It's not just mentoring; it's the whole WiSER thing. You get a greater awareness of things you should be doing. It is discovering that things are done in different ways, not just as outwardly stated, and continuing to probe until you find the answer. It is getting political information! '*

Organisational 'know how' contributes to a feeling of being able to operate effectively within the College structure and results in a greater feeling of assertiveness.

- *Assertiveness*

Assertiveness for the WiSER women meant being proactive, asking for meetings with Heads of discipline to discuss bothersome issues; making requests for certain lecture hours and personal workspace; finding more productive lines of communication when the Head of discipline could not resolve a teaching and learning problem and getting a satisfactory result. One woman expressed this improvement when she said:

> *'I felt I was looking at other people who had better achievements, could manage their time better, but I took a chance to teach new courses, and tried writing a course. I wouldn't have had the confidence to do that before. I thought all my self-doubts were just me. But I learned through WiSER and talking to other women that these experiences were not just mine.'*

Women said that being assertive in achieving small victories suggested by their mentors leads to more confidence in tackling bigger and riskier goals.

The findings of this study have several implications for institutions and programmes which are designed to support the recruiting, retaining, returning and advancing women in academic science, engineering and technology.

Discussion

The evidence in this study points to a number of areas of best practice in mentoring and shows improvement in the situation for women in SET. It is challenging to develop sustainable programmes across all universities. Grimson and Rougheen (2009) argue that strong legislation and professional gender expertise at universities are essential. There must be a senior individual who is responsible and accountable for the implementation of gender mainstreaming within institutions and national initiatives to tackle the problem in a holistic, systematic and comprehensive way.

The WiSER initiative is set firmly within these recommendations and also monitors progress so that TCD can set realistic targets for the recruitment and retention of women in science, engineering and technology at all levels.

In the academic setting mentors help their mentees set goals and standards and to develop the skills necessary to succeed. It is an intentional process that is supportive, nurturing, and protective, providing structured experiences to facilitate growth (Girves et al., 2005). They also note that successful mentoring programs have a clearly defined purpose, flexibility in implementing and modifying activities for individuals, visible support from the top, paid staff, and are housed in a stable support unit.

Table 2: Functions of Successful Mentoring Program Offices

1. Administrative support
2. Coordination to foster and monitor activities
3. Development of a pool of mentors and mentees
4. Marketing and communication about the program
5. Evaluation and tracking
6. Recommendations for institutional policies and practices that support mentoring
7. Workshops and training seminars
8. Orientation
9. Social activities

Source: Girves, Zepeda and Gwathme, 2005

The WiSER mentoring programme has certainly fulfilled these requirements and is a model of good mentoring practise for women in SET.

Goal setting in career advancement

What was a really important part of the mentoring process at TCD was the opportunity it provided women in SET for explicit and overt goal setting. The women set priorities and looked at the big picture, their long term career objectives and visualised what they could do within the year, to start addressing them. One of the most valuable aspects was building in some internal accountability to mentors in a systematic way. The mentoring was invaluable as it made it easier for mentors to keep participants on track, guide them and assist them in adjusting priorities when necessary. The tangible outcomes of the programmes show what the women achieved when they were focused and had the support of mentors and the programme Director.

In the WiSER mentoring programme, goal setting and clear and careful management of the programme lead to more speedily achieved outcomes than mentees expected. Women themselves said that they would probably have achieved their outcomes but not as quickly, without too much stress and are more strategic in their career choices.

Retention of women in SET

The retention of women in SET was the primary goal of the WiSER programme and it has been successfully achieved in this programme. All of the women in lecture posts at TCD are still employed there. Three contract researchers are still employed at TCD. Six of the researchers whose contracts ended in 2009 are working in research institutes and universities in Europe and Scandinavia.

> *'Thanks to the advice, confidence and experience gained through the Mentoring programme, I finally took the next step in my career. I initially gained experience in writing modules and lecturing to undergraduates students at TCD. On the basis of this experience I applied and gained employment as a university lecturer at the University of Glamorgan in South Wales, UK.'*

Only one woman has left her career temporarily as a result of a 5% cut in staffing throughout TCD in 2010. She commented on this when she said:

> *'Due to monetary constraints and against both their (her department's) and my expectations, my contract was not extended by TCD and I am no longer working here, I'm essentially on a career break. However I am a research associate and remain on a TCD committee.'*

There has been no leakage in the academic pipeline for lecturers and minimal leakage for contract researchers. The effectiveness of the mentoring programme is endorsed by these results.

McGuire and Reger (2003) view mentoring as a process for transformation and suggest that traditional mentoring models be changed for women because traditional concept s of mentoring are based on a hierarchical model grounded in male concepts of competition and objectivity. They argue that a new model based on feminine values of cooperation, development, and egalitarianism, in which co-mentors foster and sustain growth in one another, is a more appropriate model for women and other underrepresented groups in academia. One woman in the programme said this about the gender specific WiSER mentoring:

> *'I learned a lot from group meetings with mentees, having a support system of other women and I gained awareness that you're not the only woman in engineering. Mentees don't see each other when they're working, but at WiSER events it's a chance to see others.'*

Mentoring can and does make a difference in equity development programmes provided it is integrated into equity development programmes and mentors are committed to the process, have sufficient expertise as mentors and spend enough time with mentees. Pervasive organisational changes can be made through mentoring in the long term but this requires considerable effort on the part of the organisation and commitment to the long term outcomes (Geber, 2010).

Mentoring facilitated significant shifts in thinking for the women; by the end of the programme they realised they had changed views of themselves as academics and as people. They reported that they had become aware of, and resolved boundary issues with, colleagues, line managers and students. They gained awareness of their personal responsibility in being assertive, balancing career and family demands, and asking colleagues for help. Organisational 'know how' and knowing who to talk to have resulted in gains in assertiveness which allowed them better control of their careers than before the mentoring programme.

Mentors' learning and mentoring practice

As mentoring is a process of reciprocal learning, the mentors indicated that the mentoring programme had been a learning opportunity for them. They learned about the obstacles experienced by women who were not in their departments and identified how isolated many of the women were.

However, it is significant that the mentors did not reflect on their own ways of mentoring. Their reflective practice was very limited as mentors themselves did not make as much of this opportunity as they could have, bearing in mind that their mentoring training did not mention this as good practice. Reflective practice has been linked to effective mentoring practice as a way of transforming experience into learning (Cox, 2005). Mentoring stimulates individuals to self-assess and reflect, to become more conscious learners, applying knowledge of their learning needs and styles to their own development (Hine, 2008). Mentoring encourages systematic reflection and can greatly enhance the process of making tacit knowledge explicit (Nicholls, 2002). Cox (2005) argues that reflection-on-action promotes reflection-in-action. Critical reflection promotes mentors' increased self-awareness so they can make better use of experiences and learn more effectively. Geber and Nyanjom (2009) show that reflective practice proved crucial in enhancing mentor development. This contributed to mentoring knowledge by providing solid evidence that mentors using reflective practice improve their mentoring capacity. It would be beneficial if mentors in future mentoring programmes could be encouraged to reflect on their mentor training and practice.

Conclusion

The WiSER mentoring programme has demonstrated its effectiveness in retaining, returning and advancing women in academic science careers in SET at Trinity College Dublin. There was minimal leakage of women from the academic and research areas in SET, which will attract and recruit women to these careers in future and transform the demographic in SET careers in line with public and institutional policy. They have become increasingly visible in their disciplines and have established sustainable networks internationally and locally through mentoring. Trinity College benefits directly from this heightened academic profile of women.

Trinity College has acknowledged the transformative value of the programme and has embarked on a mainstream approach to mentoring of early career academics. In 2010, based on the WiSER good practice and transformation model, academics in all three Faculties were offered mentoring. TCD has moved from the tinkering and tailoring aspects of equality to the transforming of its development of women in SET.

There have been some interesting ripple effects from the programme particularly for mentors who have been made greatly more aware of issues facing women in SET. Mentors have used this heightened awareness in their dealings with colleagues and some have used their positions of authority to change the system so that there is less covert and subtle gender discrimination in the institution. The transformative impact of the WiSER mentoring programme is being felt at all levels.

The mentoring of young women researchers in the WiSER programme stands out as an innovative example of good practice in mentoring in a mentoring programme for the recruiting, retaining, returning and advancing women in academic science, engineering and technology. Mentoring of women in SET in Ireland and worldwide can benefit from using the WiSER model in their mentoring programmes.

References

Advance Project (2008) Conference Report 'Supporting Women in Scientific Careers' Encouragement to advance- supporting women in European science careers. Accessed 26 January 2011 at: http://ec.europa.eu/research/research-eu

Athena Swan portal, UK Accessed 26 January 2011 at: http://www.athenaswan.org.uk/html/athena-swan/ and http://www.athenaswan.org.uk/html/athena-swan/good-practice/swan-factsheets

Betz, N. E. (1997). Increasing research involvement and interests among graduate students in counseling psychology. *The Counseling Psychologist*, 25, 88–93.

Bland, C. J., Center, B. A, Finstad, D. A, Risbey, K. R and Staples, J. G . (2005).'A Theoretical, Practical, Predictive Model of Faculty and Department Research Productivity'. *Academic Medicine*, 80 (3) pp. 225-237.

Boice, R. (1992). *The New Faculty Member*, San Francisco: Jossey-Bass.

Boyle, P, and Boice, B. (1998). Systematic mentoring for new faculty teachers and graduate teaching assistants. *Innovative Higher Education*, 22 (3), 157-179**.**

Clutterbuck, D. 2004. *Everyone Needs a Mentor: Fostering talent in your Organisation, 4e,* London: Chartered Institute of Personnel and Development.

Cohen, N. (1999). *Mentoring adult learners: A guide for educators and trainers*, Florida: Krieger Publishing Company.

Coleman, H. (2005), *Empowering yourself: the organizational game revealed*, Indiana: Kendall Hunt Publishing.

Committee on Women Faculty in the School of Science (1999). A Study on the Status of Women Faculty in Science at MIT. The MIT Faculty Newsletter, 11, 4, March 1999. Accessed 26 January 2011 at: http://web.mit.edu/fnl/women/women.html

Council of Europe, (1996). *Gender equality portal*. Accessed 26 January 2011 at: http://www.coe.int/equality

Darwin, A. and Palmer, E. (2009). Mentoring circles in higher education. *Higher Education Research & Development*, 28, 2, 125–136.

de Janasz, S.C. & Sullivan, S.E. (2004). Multiple mentoring in academe: Developing the professorial network. *Journal of Vocational Behavior*. 64, 263–283.

European Commission, EU (2009). She Figures: Women and Science, Statistics and Indicators. Accessed 26 January 2011 at: http://ec.europa.eu/research/science-society/document_library/pdf_06/she_figures_2009_en.pdf.

Fine, M.G. (2008). Women, collaboration, and social change: an ethics-based model of leadership. In J.L. Chin, B.L. Lott, J.K. Rice, & J. Sanchez-Hucles (Eds.), *Women and leadership: Visions and diverse voices*. Boston, MA: Blackwell.

Fort, D. (2005) *A Hand Up. Women Mentoring Women in Science*, Washington, D.C: Association for Women in Science.

Gardiner, M., Tiggemann, M., Kearns, H., & Marshall, K. (2007). Show me the money! An empirical analysis of mentoring outcomes for women in academia. *Higher Education Research & Development*, 26, 4, 425-442.

Geber, H.M. (2010). Equity Development Programmes: Does mentoring make a difference in individual and social transformation for South African WonderWomen? *International Journal of Learning and Change, 4, 2, 99-118.*

Geber, H.M. (2009). Research Success and Structured Support: Developing early career academics in Higher Education. *South African Journal of Higher Education*, 23, 4, 673-688.

Geber, H.M. & Nyanjom, J.A. (2009). Mentor development in higher education in Botswana: how important is reflective practice? *The South African Journal of Higher Education* 23, (5)2, 673–688.

Gibson, S.K. (2004). Being mentored: the experience of women faculty, *Journal of Career Development*, 30, 3, 173–188.

Gibson, S. K. (2006). Mentoring of women faculty: the role of organizational politics and culture, *Innovative Higher Education*, 31, 1, 63-79.

Girves, J. E., Zepeda, Y, & Gwathmey, J.K. (2005). Mentoring in a Post-Affirmative Action World, *Journal of Social Issues,* 61, 3, 449-479.

Grimson, J and Roughneen, C. (2005). IPG report for Science Foundation Ireland. Accessed 26 January 2011 at: http://www.tcd.ie/wiser/about/background/WISER@TCDSelf-AssessmentReport.pdf

Grimson, J and Rougheen, C. (2009). Diversity in engineering: tinkering, tailoring, transforming, eds. Hyldgaaard Christensen, Bernard Delahousse and Martin Meganck in *Engineering in Context,* Denmark, Academica, 197 – 220. Accessed 26 January 2011 at: http://hdl.handle.net/2262/30986

Hine, A. (2008). Mirroring effective education through mentoring, metacognition and self reflection'. Accessed 26 January 2011 at: http://www.aare.edu.au/00pap/hin00017.htm

Maykut, P. and Morehouse, R. (1994). *Beginning qualitative research: a philosophical and practical guide*, London: The Falmer Press.

McGuire, G. M., & Reger, J. (2003). Feminist co-mentoring: A model for academic professional development. *National Women's Studies Association Journal,* 15, 1, 54–72.

Merriam, S.B. (1998) *Qualitative Research and Case Study Applications in Education*. San Francisco: Jossey-Bass.

Mott, V. (2002). Emerging perspectives on mentoring: fostering adult learning and development, in C.A. Hansman (Ed.), *Critical Perspectives on Mentoring: Trends and Issues*. Ohio State University, Columbus.

NSF. (2008). ADVANCE projects. Accessed 26 January 2011 at: http://www.portal.advance.vt.edu/ and http://www.portal.advance.vt.edu/index.php/categories/diversity/gender.

NSF National Science Foundation. (2008). ADVANCE: Increasing the Participation and Advancement of Women in Academic Science and Engineering Careers (ADVANCE). Accessed 26 January 2011 at: http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5383

O'Neill, R.M. (2002). Gender and race in mentoring relationships: a review of the literature, In D. Clutterbuck, B.R. Ragins and L Matthewman (Eds.), *Mentoring and Diversity: An International Perspective,* London: Butterworth-Heinemann.

Ollis, D. F., Felder, R.M., & Brent, R. (2002). Introducing New Engineering Faculty to Multidisciplinary Research Collaboration. Proceedings, Annual ASEE Conference, June 2002.

Patton, M. Q. (1990). *Qualitative evaluation methods 2ed*, Thousand Oaks, CA: Sage.

Peters, J. (2002). 'SET fair: A report on women in science, engineering and technology.' Department of Trade and Industry United Kingdom. Accessed 26 January 2011 at: http://hdl.handle.net/10068/487393

Queen's university Belfast mentoring programme. Accessed 26 January 2011 at: http://www.qub.ac.uk/sites/QueensGenderInitiative/TheWomensForum/

Ragins, B. R & Cotton, J. L. (1991). Easier said than done: Gender differences in perceived barriers to gaining a mentor. *Academy of Management Journal*, 34, 4, 939–951.

Ragins, B. R., & McFarlin, D. B. (1990). Perceptions of mentor roles in cross-gender mentoring relationships. *Journal of Vocational Behavior*, 37, 321–339.

Rees, T. (1995). Women and Training Policy in the European Union. *Gender, Work & Organization*. 2, 1, 34–45.

Sorcinelli, M. D. (2000). Principles of Good Practice: Supporting Early-Career Faculty. American Association for Higher Education. Accessed 26 January 2011 at: http://www.umass.edu/cft/publications/top10_for_newfaculty.pdf

Sorcinelli, M. D., & Jung, Y. (2007). From Mentor to Mentoring Networks: Mentoring in the New Academy, *Change*, 39, 6, 58-61.

University of Dublin, Trinity College. (2009). Staff Office Network List. November 2009.

University of Limerick, Learning, Development & Equal Opportunities. Accessed 26 January 2011 http://www.ul.ie/

Valian, V. (1998). *Why so slow? The advancement of women*, Cambridge: MIT Press.

Valian ,V. (2005). Beyond Gender Schemas: Improving the Advancement of Women in Academia, *Hypatia*, 20, 3, 198-213.

Women in Science and Engineering Research. (2007) Data base. Accessed 26 January 2011 at: http://www.tcd.ie/wiser/stats/facts-figures/index.php

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