

**PART II**

**WOMEN'S PARTICIPATION IN SET**

# WOMEN'S PARTICIPATION IN THE PUBLIC SECTOR SCIENCE, ENGINEERING AND TECHNOLOGY WORKFORCE

The study begins with an overview of women's overall participation in the public science system from the point of view of the current and future employment of men and women as instructors and researchers in the higher education sector, and as R&D personnel in government SETIs. The study also considers the gender profile of publishing scientists in South Africa and differences in the publication outputs of men and women.

## Enrolments and graduations in the higher education sector

The future science, engineering and technology (SET) workforce will be drawn from the current stock of students, especially from universities and technikons, and particularly at the Doctoral level, given that the PhD in South Africa is an advanced research degree.

In the period 1992 to 2001, there was a marked shift in the representation of women in both enrolments and graduations in the higher education sector. In 1992, women constituted 43% of all student enrolments, but in 2001, this percentage had increased to 53% (Figure 1). Similarly, in 1992, 48% of all graduates were women and in 2001, this percentage had increased to 58% (Figure 2). Female students, then, were in the majority in 2001 as far as enrolments and graduations are concerned. In addition, it appears that the gap between women and men is widening and, perhaps surprisingly, widening at a faster rate in terms of graduations. Female students are evidently more successful in their studies than their male counterparts!

However, while this is a very positive trend in terms of women's participation in higher education, these figures mask some glaring disparities in particular facets of the higher education experience.

Firstly, there are significant differences in the participation of women in different race groups, and particularly at the Doctoral level. In 2001 in the university sector, 65% (1570 out of 2402) of all female Doctoral enrolments (Figure 3) and 76% (221 out of 292) of all

female Doctoral graduates (Figure 4) were White women. While the picture amongst male Doctoral enrolments and graduations is very similar, it is interesting to note that African males have a greater share of total Doctoral enrolments and graduations (31% and 25%, respectively) than African females do (21% and 15%, respectively).

The percentage increases in Doctoral enrolments and graduations among Black<sup>5</sup> female students are impressive, although the numbers remain significantly low. Between 1992 and 2001 there was a percentage increase in Doctoral enrolments among African women of 847% (from 53 to 502), and among Coloured female students of 700% (from 16 to 128). The number of African and Asian female Doctoral graduates increased between 1992 and 2001 by 1400% (from 3 to 45) and 800% (from 2 to 8), respectively. By contrast, while the number of Doctoral enrolments and graduations amongst White males decreased over the same period, the numbers remained relatively high: enrolments decreased from 3117 to 2152 (-31%) and graduations decreased from 421 to 324 (-23%).

Secondly, it is also apparent that the more advanced the level of study, the fewer female students and graduates there are. Within the university sector in 2001, women were in the majority in both enrolments and graduations at the undergraduate and lower postgraduate levels. However, women were in the minority at the upper postgraduate (Masters and Doctoral) level: 42% (16084 out of 38131) of upper postgraduate enrolments and 43%

---

<sup>5</sup> The term "Black" is used here to refer collectively to African, Asian and Coloured students.

(2912 out of 6829) of upper postgraduate graduations were women (Figures 5 and 6). This is, however, a marked improvement on the 1992 figures, where women constituted only 32% of upper postgraduate enrolments and graduations.

Within the technikon sector, between 1995 (when the first Masters and Doctoral degrees were awarded) and 2001, there were also marked improvements in the percentage of women enrolled for postgraduate degrees: from only 17% (107 out of 621) of

postgraduate enrolments in 1995 to 39% (995 out of 2573) in 2001 (Figures 7 and 8). The improvement in postgraduate graduations was less pronounced: 30% (32 out of 107) in 1995 to 34% (83 out of 246) in 2001.

### Notes about the data

The SAPSE/HEMIS data do not allow for an analysis of the distribution of female and male students by race and by level or field of study.

figure 3 University Doctoral FTE enrolments by sex and by race (2001)

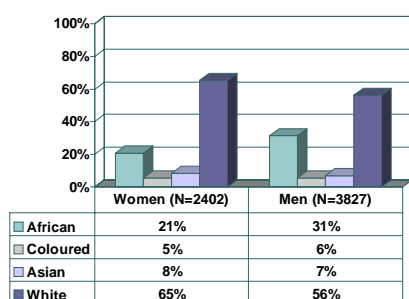


figure 4 University Doctoral FTE graduations by sex and by race (2001)

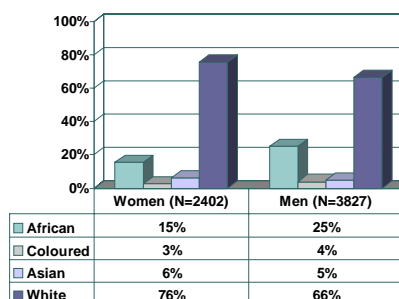


figure 5 University FTE enrolments by sex and by level of study (2001)

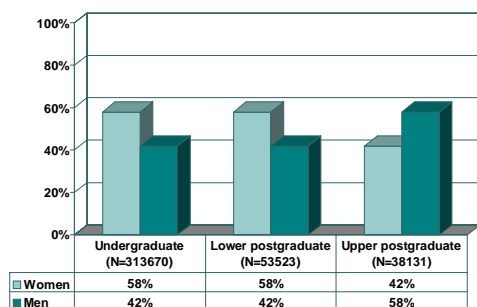


figure 6 University FTE graduations by sex and by level of study (2001)

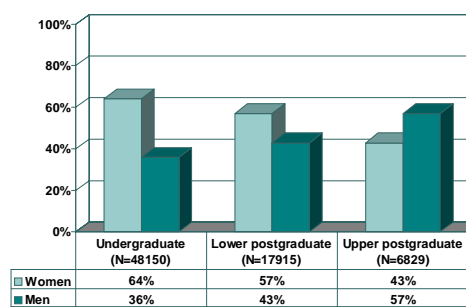


figure 7 | Technikon FTE enrolments by sex and by level of study (2001)

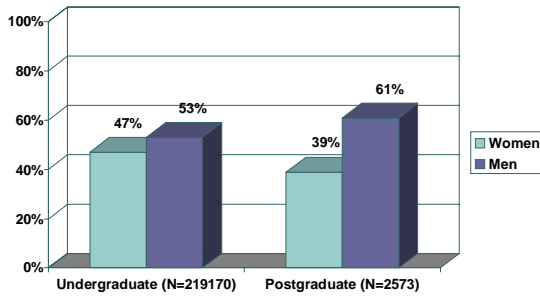


figure 8 | Technikon FTE graduations by sex and by level of study (2001)

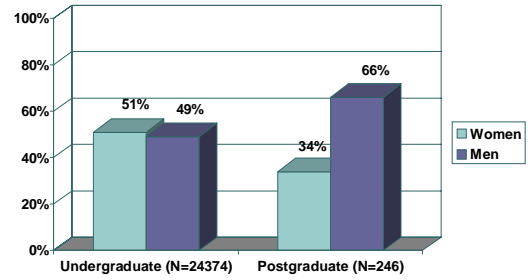


figure 1 | Annual higher education sector FTE enrolments by sex (1992-2001)

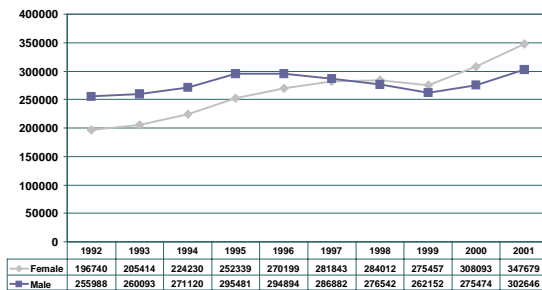
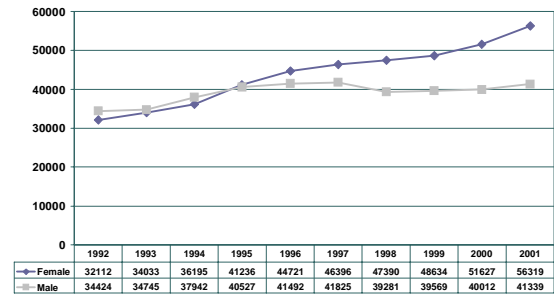


figure 2 | Annual higher education sector FTE graduations by sex (1992-2001)



## Instruction/research staff in the higher education sector

The instruction/research staff category within universities and technikons refers to those staff who spend at least 50% of their activities on teaching and/or research, and who have a minimum qualification equivalent to at least four years of study in higher education.

In 2001, women constituted 40% of permanent instruction/research staff, an increase of 10% from 1992 (Figure 9). There was a more even distribution of female and male non-permanent instruction/research staff in 2000 (50/50 split) and 2001 (46% female and 54% male).

The race distribution of both female and male instruction/research staff continues to reflect the legacy of apartheid. White female and White male instruction/research staff was in the majority in 2001: 70% (19161 out of 14409) of all female instruction/research staff and 68% (13528 out of 19996) of all male

staff were White (Figure 10). These are significant proportions given that in 2001, Whites only constituted 9.6% of the total population (Statistics South Africa 2003:10).<sup>6</sup>

There were marginal increases among African instruction/research staff: the proportion of African females increased from 17% (2310) in 2000 to 19% (2681) in 2001, and the proportion of African males increased from 20% (3981) in 2000 to 21% (4278) in 2001.

Female instruction/research staff are best represented in the younger age groups: in 2001, women constituted 60% (143 out of 240) of all instruction/research staff younger than 25 years of age, 50% (1559 out of 3124) of the 25-34 year age group, and 42% (1830 out of 4342) of the 35-44 year age group (Figure 11).

<sup>6</sup> The report does mention, however, that there is a possible undercount of the White population (Statistics South Africa 2003:v).

In terms of qualifications, female instruction/research staff tend to be less qualified than their male counterparts: in 2001, 51% (1812 out of 3550) of all instruction/research staff in the higher education sector with lower postgraduate degrees (i.e. Honours degrees or postgraduate diplomas) were women, but only 27% (1292 out of 4777) of those with Doctoral degrees.

### Notes about the data

The sex and rank breakdown of instruction/research staff in the higher educator sector only include permanent staff, and is based on datasets derived from existing

SAPSE table templates. The analysis by race and by qualification is based on a different dataset that involves all full-time and part-time instruction/research staff.

The non-permanent data is based on figures provided by 9 technikons and 13 universities. The data is subject to some degree of error as differences occurred in the way that non-permanent instruction/research staff was defined.

figure 9 Sex distribution of permanent instruction/research staff in the higher education sector (1992 and 2001)

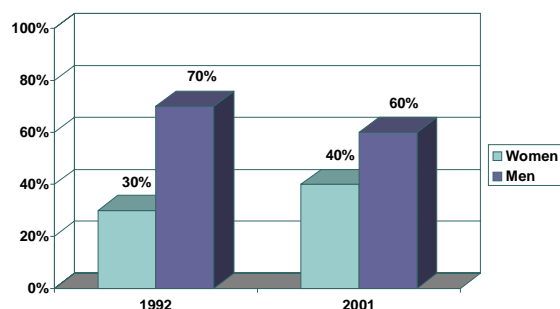


figure 10 Race distribution of female and male instruction/research staff in the higher education sector (2001)

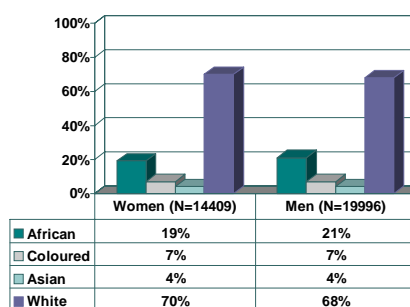
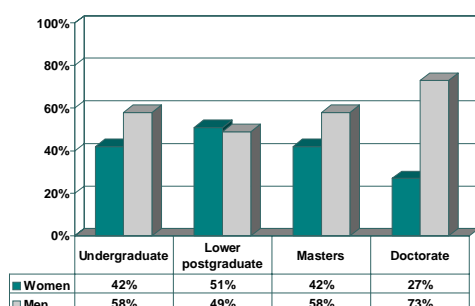


figure 11 Qualifications of female and male instruction/research staff in the higher education sector (2001)



### R&D personnel in government SETIs

R&D personnel refer to that category of staff in science councils and other government SETIs who are involved in producing new knowledge, as well as the technicians who undertake technical tasks in support of R&D.

Women are slightly better represented amongst permanent R&D personnel than they are amongst instruction/research staff in the higher education sector: in 2001, women comprised 42% (996 out of 2378) of all R&D personnel, which was an increase from 35% (714 out of 2032) in 1996 (Figure 12). In comparison with staff in the higher education sector, only one third (34%, or 71 out of 211)

of all non-permanent R&D personnel were women in 2001, compared to 37% (25 out of 67) in 1996.

The race distribution among female and male R&D personnel mirrors that amongst staff in the higher education sector, with the majority of both sexes in the White race group. In 2001, 67% (665 out of 995) of all female R&D personnel, and 68% (936 out of 1382) of all male personnel, were White (Figure 13). Both Coloured males and females are better represented among staff in the science council sector, each comprising 10% of the R&D personnel.

As with female instruction/research staff in the higher education sector, female R&D personnel in the science council sector in 2001 were best represented in the younger age groups: 50% (316 out of 633) of all R&D

personnel in the 20-29 year age group, and 48% (379 out of 798) of the 30-39 year age group, were women.

In terms of highest qualifications, female R&D personnel are generally less qualified than their male counterparts, and especially at the Doctoral level: in 2001, just less than a third of all R&D personnel with Doctorates were women (32%, or 82 out of 257), an improvement on the proportion of 29% (79 out of 274) in 1997 (Figure 14).

### Notes about the data

The analyses of permanent R&D staff in government SETIs exclude data for five science councils/national research facilities. They are the HSRC, NRF, Mintek, SABS and HMO.

figure 12 Sex distribution of permanent R&D personnel in the science council sector (1996 and 2001)

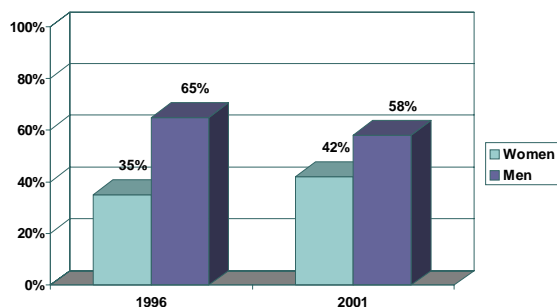


figure 13 Race distribution of female and male R&D personnel in the science council sector (2001)

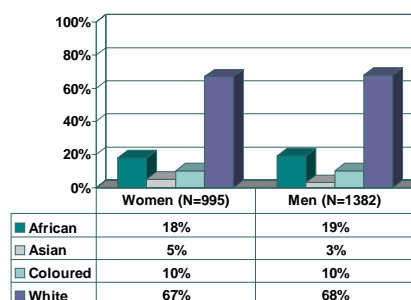
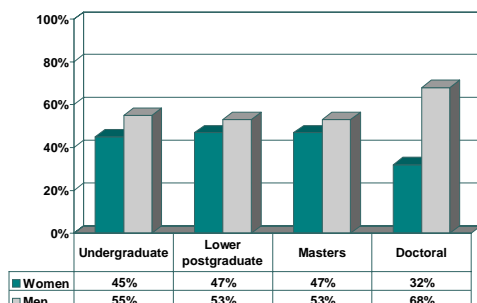


figure 14 Qualifications of female and male R&D personnel in the science council sector (2001)



## Publishing scientists in South Africa

It is interesting - and of concern - that while more than two fifths of the professional staff in the higher education and science council sectors are women, less than one third (29% or 2187 out of 7574) of all actively publishing scientists in SA Knowledgebase are women (Figure 15).

A comparison of the age distributions of female and male publishing scientists reveal some interesting differences. In the period 1990-2001, 60% (965 out of 1589) of female actively publishing scientists were younger than 50 years of age, compared to only 40% (1738 out of 4308) of male scientists. Conversely, 40% (641) of female scientists were 50 years or older, compared to 60% (2570) of the male scientists.

There are similar differences between female and male publishing scientists in terms of their qualification profiles. Between 1990 and 2001, only 51% (824 out of 1625) of female scientists held Doctorates, compared to 70% (3122 out of 4466) of the men (Figure 16).

In terms of publication output levels, the majority of female scientists (44% or 926 out of 2187), but only 29% (1564 out of 5385) of male scientists, falls into the low publication output category (Figure 17). By contrast, almost two fifths (38% or 2061) of male publishing scientists, but only 21% (467) of female scientists, are in the high output category.

Looking within the group of publishing scientists who have Doctoral degrees, the study see that these scientists – both male and female – are high output producers (Figure 18). However, this tendency is much more pronounced among the men: 39% (324 out of 824) of the female publishing scientists with Doctorates were in the high output category compared to 52% (1631 out of 3120) of the male scientists.

During the period 1990 to 2001 as a whole, women scientists on average contributed to just less than one-fifth (19%) of all the output produced in South Africa, while men published the remaining 81% (Figure 19). However, since 1990 women scientists' contribution has increased – albeit in small increments – from 16% in 1990 to 23% in 2001.

The fact that sex differences in research production have narrowed in South Africa corresponds with international evidence that shows a continual increase in women scientists' publication output and a decrease in the gender gap in various countries. It has to be noted, however, that the approximately 1:3 female-to-male ratio in publication output in South Africa is higher than in most other countries, where the ratio is approximately 1:2, as women publish, on average, 50-60 percent of the papers produced by men.

---

### Notes about the data

SA Knowledgebase contains articles from the Institute for Scientific Information (ISI) journals and accredited South African journals which are not indexed in the ISI. This means that no citation analyses can be undertaken on the data in SA Knowledgebase.

Since the linking of biographical information of authors to publications in SA Knowledgebase was still incomplete at the time of the study, the researchers had to conduct each analysis – sex by age, sex by highest qualification, and so on – on those records for which both variables were known. This means that for each analysis, a different subset of the larger dataset was utilised. The total number of female and male publishing scientists is therefore indicated in each of the graphs relating to publication output.

---

figure 15 Female and male publishing scientists (1990-2001)

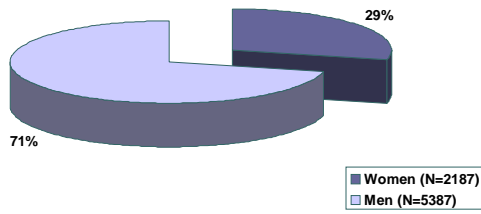


figure 16 Qualifications of female and male publishing scientists (1990-2001)

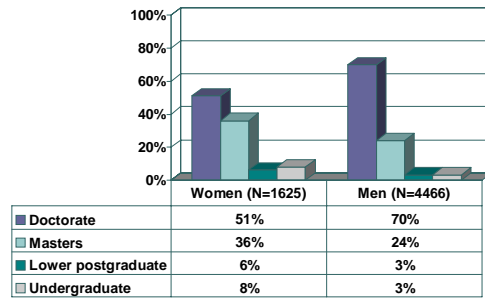


figure 17 High, medium and low publication output amongst female and male publishing scientists (1990-2001)

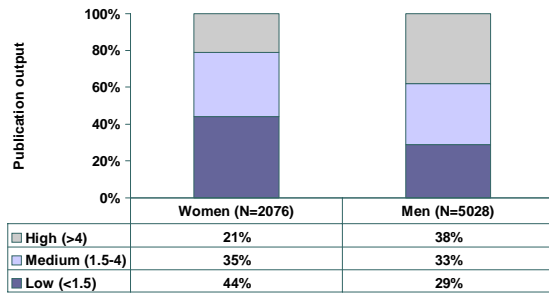


figure 18 High, medium and low publication output amongst female and male publishing scientists with Doctoral degrees (1990-2001)

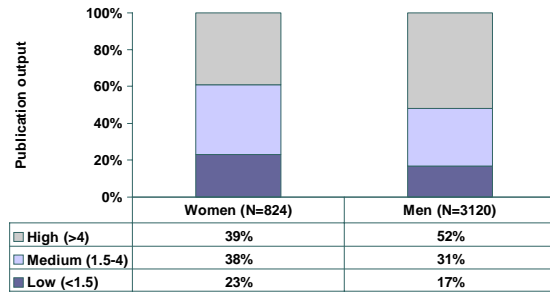
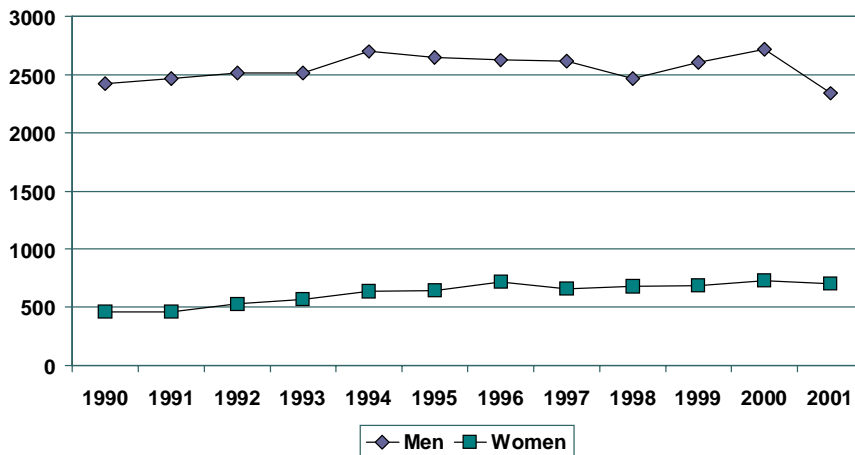


figure 19 Distribution of published article equivalents among female and male scientists (1990-2001)





## INITIATIVES TO INCREASE THE PARTICIPATION OF WOMEN AND GIRLS IN SCIENCE, ENGINEERING AND TECHNOLOGY

---

### In South Africa ...

The **South African Association of Women Graduates** is a non-profit association in South Africa which has a funding mechanism to promote women's participation in higher education studies.

The **Database of Senior Women in Higher Education Institutions**, housed by the Committee for Technikon Principals, is a database resource for use by potential employers in business, higher education and government.

The **Association of South African Women in Science and Engineering** is a non-profit association for individuals who support the idea of strengthening the role of women in science and engineering in South Africa.

The **Forum for African Women Educationalists in South Africa**, based at UCT seeks to bring together female educationalists, policy-makers, researchers, and practitioners to provide gender equity in education and training through addressing policy-making and implementation in education at all levels. FAWESA co-ordinates programmes for the professional development of women in higher education.

The **Carnegie Corporation's International Development Programme: Enhancing Women's Opportunities In Higher Education**. The Corporation endeavours to enhance opportunities for women to access higher education in South Africa in two ways. Firstly, they have initiated a female scholarship programme run by the National Department of Education and, secondly, they have woven gender into their two "requests for proposals" as a key criterion for selection of funding projects. These have resulted in three specific programmes, one of which includes a specific S&T focus

### Internationally ...

- The Loreal/UNESCO For Women in Science Program
- The Global Alliance for Diversifying the Science and Engineering Workforce
- The Women's International Science Collaboration Programme (partnership between the American Association for the Advancement of Science and the National Science Foundation)
- African Women in Engineering and Science (pilot study in Egypt, Mali and Nigeria)
- Female Education in Mathematics and Science in Africa (project of the Association for the Development of Education in Africa's Working Group on Female Participation)
- Women in Science, Engineering and Technology in European Countries
- The Women and Science Unit of the DG Research of the European Commission
- The Kiriri Women's University of Science and Technology in Kenya
- The Association of Women Engineers, Technicians and Scientists in Uganda
- The Promoting Science, Engineering and Technology for Women Unit of the Office of Science and Technology in the United Kingdom, and
- The Association for Women in Science in Washington DC.

# REWARDS AND RECOGNITION FOR WOMEN IN SCIENCE, ENGINEERING AND TECHNOLOGY

*“Over the past two decades, women have made gains as students and professionals in science and engineering. Yet women continue to lag behind men in the number of doctoral degrees attained, and even more so, in levels of professional participation, position, productivity, and recognition ... This gender disparity in science and engineering has been a policy concern in at least two ways: first, in the use (or under use) of women and other groups as human resources ... and, second, in terms of principles of social equity, rooted both in democratic ideology ... and in the ideal that scientific careers “be open to talent.”*

– Mary Frank Fox (1998:201)

The discussion thus far has highlighted the fact that women’s participation in SET within the higher education and government SET sectors has improved markedly over the past decade. However, the study showed that parity between the sexes is generally found in the younger age groups, at the more junior ranks and qualifications, and in certain fields of research and study. Conversely, men – and especially White men – continue to form a large proportion of Professors, Doctoral degree holders, and Natural Scientists and Engineers in South Africa. The implications of this are broader than the under-representation or under-participation of women in SET, and what this means for the human resource base. This vertical segregation is most felt in the areas of scientific decision-making, resource allocation, recognition and rewards.

The study now explore three dimensions of the recognitions and rewards in the public science system from a gender perspective, namely rank distribution, funding allocations and scientific rating.

## The seniority of women in SET

Women continue to be under-represented at the more senior ranks in higher education institutions. Of the total 3894 female instruction/research staff in the university sector in 2001, the majority (47% or 1821) were Lecturers and 24% (950) were Senior Lecturers (Figure 20). The rank distribution among the 5896 male instruction/research staff was more evenly spread, with around a quarter each at the rank of Lecturer (26% or 1528) and Senior Lecturer (27% or 1600). Only 7% (260) of the women, compared to 26% (1535) of the men, had reached the rank of Professor.

Within the technikon sector, the majority of *all* instruction/research staff are Lecturers. In 2001, 67% (951 out of 1409) of female staff and 55% (1188 out of 2160) of male staff were in this category (Figure 21). In the same year, only 1% (18) of female instruction/research staff, and 3% (70) of male staff, held the rank of Director.

Similarly, within the population of actively publishing scientists, 38% (316 out of 836) of female scientists, but only 17% (372 out of 2245) of male scientists, were Lecturers (Figure 22). By contrast, only 14% (119) of female publishing scientists, but 44% (996) of male publishing scientists were Professors.

Amongst both male and female publishing scientists, the highest proportion of scientists with a high publication output were in the ranks of Associate Professor and Professor, while the majority of the low output producers were in the rank of Junior Lecturer (Figures 23 and 24).

## Notes about the data

The researchers were unable to undertake an analysis of the seniority of female R&D personnel in government SETIs since each institution has a different ranking system of their staff, and these systems are not comparable.

figure 20 Sex and rank distribution of instruction/research staff in the university sector (2001)

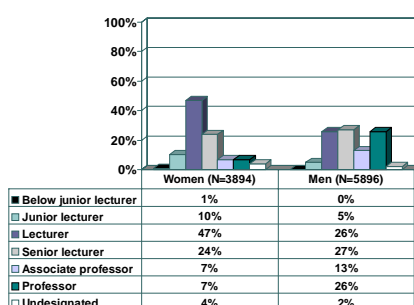


figure 21 Sex and rank distribution of instruction/research staff in the technikon sector (2001)

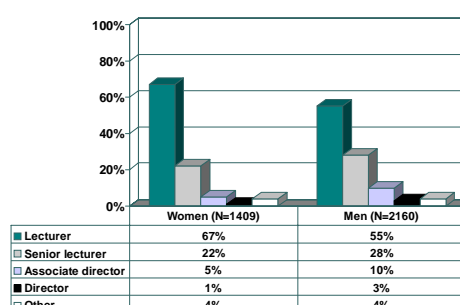


figure 22 Rank distribution of female and male publishing scientists in the higher education sector (1990-2001)

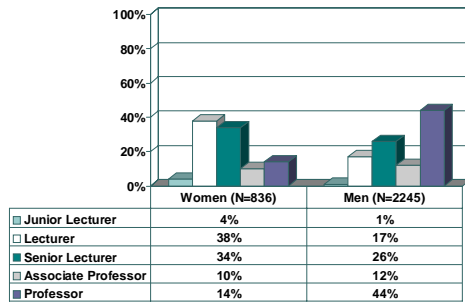


figure 23 Publication output of women in different higher education instructor ranks (1990-2001)

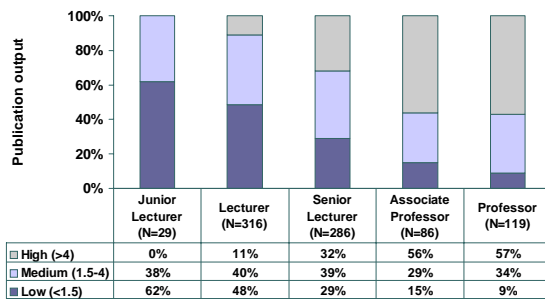
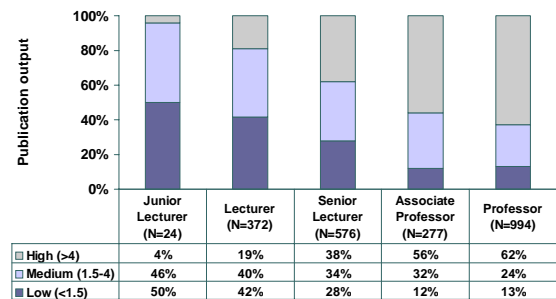


figure 24 Publication output of men in different higher education instructor ranks (1990-2001)



## INITIATIVES TO INCREASE THE NUMBER AND BUILD THE CAPACITY OF SENIOR WOMEN IN SET IN SOUTH AFRICA

**HERS-SA** is a managed network to improve the status of women in higher education in South Africa. It has grown from HERS Mid-America, which has been running professional development activities for women in higher education in the United States since 1975. The Andrew W. Mellon Foundation, perceiving the need to improve the status of professional women in higher education in South Africa, provided funding for HERS Mid-America to work with women in the Western Cape. To date over 38 Western Cape women have participated in HERS programmes in the United States and over 120 women have attended professional development workshops in the Western Cape.

The **Australian Assistance for International Development (AUSAID) Women's Executive Development Programme (WEXDEV)** was

established in 2001 to develop women in executive positions in higher education. The Programme's objective is to develop women through technology-driven networks. The original focus on women already in executive positions has been broadened to include female staff members at lower levels, with a view to fast-tracking their progress into senior positions. Women from institutions around South Africa have participated in the project activities, including a visit to the AMT institutions in Australia, a national conference in South Africa, and national and regional training programmes in mentorship and research capacity development. The South African partnership originally included Peninsula Technikon, the Forum for African Women Educationalists in South Africa, and the University of Technology, Sydney. It has now been located within the Projects Directorate of the Committee of Technikon Principals, which has established a

database of women in senior management positions and a website to serve the programme.

The Employment Equity policy of the University of Port Elizabeth details steps to be taken to promote and encourage gender equity in senior academic and non-academic positions. This is achieved via an

annual **leadership training programme for women**, a new entry-level training programme for leadership, as well as mentoring programmes and development scholarships for women in technical positions and other fields in which women are under-represented.

---

## Women as beneficiaries of funding resources

The study now consider the allocation of funds by two of the major public funding agencies in South Africa, namely the National Research Foundation and the Medical Research Council. The two NRF funding categories include scholarships for Masters and Doctoral students, and research grants for researchers in higher education institutions and science councils.

Between 1995 and 2001, women consistently received far fewer research grants and scholarships from the NRF than did men: in 2001, women were the recipients of 21% (364 out of 1736) of the research grants (Figure 25) and 42.5% (1062 out of 1437) of the Masters and Doctoral scholarships (Figure 26).

Female recipients of NRF funding – both in the research grant and scholarship categories – received a slightly smaller share of the funds than they did of actual number of grants. In 2001, while 21% of the NRF grant-holders were women, women only received 19% of the funds. In the same year, 42% of the scholarship recipients were women, but women only received 40% of the funds (Figures 25 and 26).

The two Medical Research Council funding categories included here are scholarships for local Masters and Doctoral candidates, and grants for self-initiated research. The MRC (as the name suggests) only awards funding within the Health Sciences and women are well-represented in these disciplines.

It is perhaps not surprising, then, that in 2002, the MRC awarded more Masters and Doctoral scholarships (57% or 33 out of 58), and self-initiated research grants (59% or 20 out of 34) to women than it did to men (Figures 27 and 28). Interestingly, however, female Masters

and Doctoral scholarship recipients received a slightly smaller share of the funds in monetary terms, than they did of the grants (Figure 27).

---

## Notes about the data

Although sex-disaggregated figures on funding applications, awards and their monetary value were requested from all institutions in the original sample, very few institutions had these data available. In addition, the figures that the researchers did receive were incomplete and incomparable, since they covered a range of different years, funding categories and variables.

The researchers did, however, receive reasonably complete funding data, for selected years, from two of the science councils that have a funding agency function, namely the National Research Foundation (NRF) and the Medical Research Council (MRC), and these data were analysed in the main report.

It should be noted that the funding categories of the NRF and MRC analysed here only represent a portion of all funding offered by these agencies. Readers should therefore bear in mind that these findings are not necessarily representative of the funding profiles of the institutions in general.

---

## Women as beneficiaries of scientific ratings

In the early 1990s, the erstwhile Foundation for Research Development introduced a rating system for researchers in the Natural Sciences & Engineering. This system was taken over by the NRF which, in 2002, also began to rate researchers in the Social Sciences & Humanities. The ratings are largely based on publication outputs and the international standing of researchers.

There are six rating categories: three are restricted to established researchers (A, B & C) and the remainder to young researchers (P & Y) and researchers within a previously

disadvantaged context (L). Researchers who are rated by the NRF are eligible for funding for a period of five years with every successful application to the NRF. There are thus considerable advantages to being rated, especially if one is an A-rated researcher (the most prestigious of all rating categories).

Between 1996 and 2002, the vast majority of rated scientists (all categories) in the Natural Sciences & Engineering were men. Women's share of NRF ratings did, however, increase from 13% (126 out of 974) in 1996 to 16% (162 out of 998) in 2002 (Figure 29). In 2002, women were under-represented in all the rating categories, but especially in category A (5% or 2 out of 44) and category B (9% or 24 out of 256) (Figure 30).

figure 25 Distribution of NRF research grants, and their monetary value, by sex (1995, 1998, 2001)

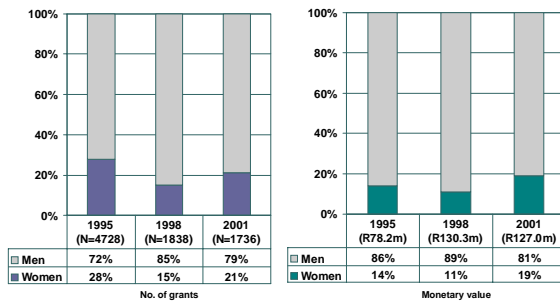


figure 26 Distribution of NRF Masters and Doctoral scholarships, and their monetary value, by sex (1996, 1998, 2001)

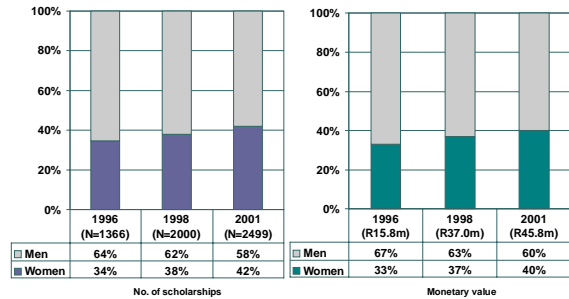


figure 27 Distribution of MRC local Masters and Doctoral scholarships, and their monetary value, by sex (2000-2003)

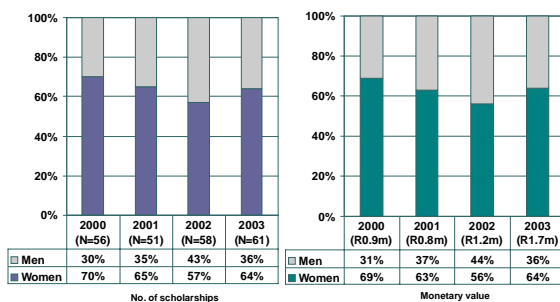


figure 28 Distribution of MRC self-initiated research grants by sex (2000-2002)

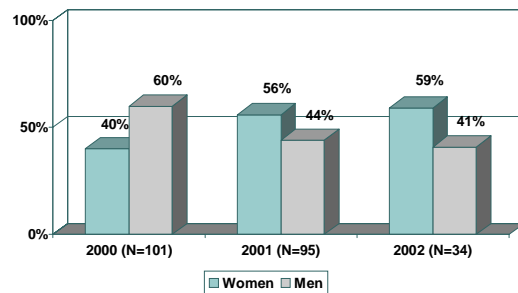


figure 29 Sex distribution of NRF-rated scientists in the Natural Sciences & Engineering (1996-2002) (all rating categories)

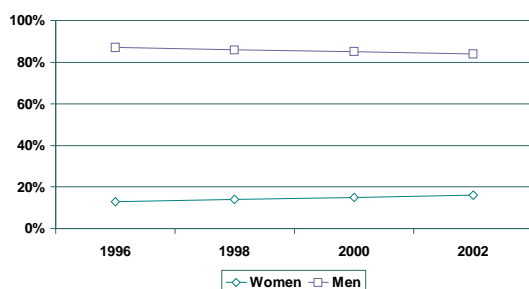
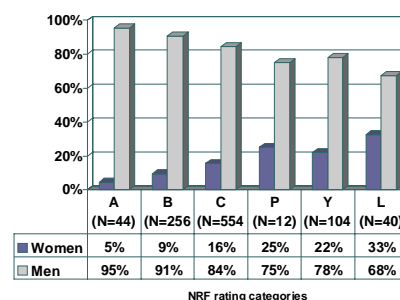


figure 30 NRF-rated researchers in the Natural Sciences & Engineering by sex and by rating category (2002)



## PREFERENTIAL FUNDING MECHANISMS FOR WOMEN IN SCIENCE, ENGINEERING AND TECHNOLOGY IN SOUTH AFRICA

The National Research Foundation's **Women-in-Research programme (Thuthuka Programme)** represents the most significant source of funding for women in SET in South Africa. In 1996 the former CSD (Centre for Science Development) established an award for Women-in-Research, and a database of women researchers in the social sciences and humanities, in an attempt to redress gender imbalances in the human resource base of science and research. This programme was reviewed in 1999 when the CSD and Foundation for Research Development combined to form the NRF. The Thuthuka Programme was established in response to recommendations from that review, a subsequent programme evaluation report of the Royal Society/NRF on SET, and the NRF Women-in-Research audit of 2001. This was specifically "intended to assess the needs of women researchers in the higher education sector" and made recommendations to higher education institutions as well.

The WiR programme intends to serve individual women who have experienced "career advancement limitations", as it recognises that women are "still significantly under-represented in almost all fields of science", in spite of advances made on the education front to raise this proportion. There is the acknowledgement that although this group holds doctorates, they may not hold a rating, as their careers may have been interrupted due to the responsibilities that typically fall to women like "child rearing or care of the elderly or the relocation of a partner". Therefore, the target group of the WiR programme includes women who do not have an NRF rating, who wish to undertake postdoctoral research, and whose applications have the

authorised approval of their home institution (which in turn must already have a demonstrated commitment to research support). In addition, successful applicants are expected to "demonstrate high potential to become active, independent researchers at higher education institutions" and to be able "to provide coherent career-development plans" (Thuthuka Programme Framework 2000:25).

The Water Research Commission (WRC), in conjunction with the Department of Water Affairs and Forestry and the Water Institute of South Africa, has introduced the **Women in Water Awards**. This initiative aims to honour and celebrate the contribution of women in general, and to highlight the participation of professional and community-based women in poverty eradication, education and sustainable development in both the urban and rural settings. The launch of the Women in Water Awards on the 19 March 2002 marked the beginning of an important tradition in the water sector in South Africa. Each year awards will be presented to women who have played leading roles in five categories: Policy; Management; Research (over 35 years old); Research (under 35 years old); and Community development. Nominations for these categories can be represented either by an individual or group. The awards are presented to women of stature, who have excelled in their field and who have made a significant contribution to the water sector in South Africa.

The **South African Awards for Women in Science** were introduced by the National Department of Science and Technology in 2003. The awards are in recognition of the contribution of outstanding women in scientific research and the contribution that they make to economic growth

and to the ultimate improvement in the quality of life of South Africans.

The Council for Scientific and Industrial Research (CSIR) recently implemented a **new bursary**

**strategy** (in line with their Employment Equity policy) that states, among other things, that a minimum of 40% of their corporately-funded bursary recipients over the next five years must be women.

---

# WOMEN'S PARTICIPATION IN DIFFERENT SCIENTIFIC DOMAINS

Research in other countries into the distribution of women across scientific domains indicates that women tend to be under-represented in the Natural Sciences & Engineering (see Helbing, Verhoef & Wellington 1998:255; Lane 1999; Link & Link 1999:437; Oldham 2000:346). The findings presented below reflect this international trend, with fewer female students, staff and publishing scientists studying or working in these disciplines, and the over-representation of women in the Social Sciences & Humanities and the Health Sciences. Furthermore, the data reveal a very skewed distribution of women within the Natural Sciences & Engineering.

In this section, the study consider the sex distribution across the scientific domains, and within the Natural Sciences & Engineering in particular, amongst instruction/research staff and Doctoral students in the higher education sector, as well as actively publishing scientists and their publication output.

## Student enrolments and graduations in the higher education sector

In 2001, female Doctoral students were best represented in the Health Sciences with 47% (470 out of 991) of all Doctoral enrolments and 49% (62 out of 128) of all Doctoral graduations in that year (Figures 31 and 32).<sup>7</sup> By contrast, 69% of Doctoral enrolments and graduations in the Natural Sciences and Engineering were amongst men.

Within the Natural Sciences and Engineering disciplines, the vast majority of female Doctoral enrolments (75%, or 500 out of 669) and graduations (73%, or 66 out of 91) in 2001 were in the Life Sciences and Physical Sciences (Figures 33 and 34). Only 7% of female Doctoral enrolments and graduations were in Engineering, compared to 23% of male enrolments and graduations.

---

<sup>7</sup> The SAPSE/HEMIS data for the Health Sciences are not further disaggregated into sub-fields. However, it might reasonably assume that most of these female students are in health-related fields such as nursing or physiotherapy, rather than medicine.

## Instruction/research staff in the higher education sector

On the whole, the majority of instruction/research staff in universities and technikons are located in the Social Sciences and Humanities. However, this skewed distribution is far more pronounced amongst women: in 2001, 61% (3370 out of 5514) of female staff were in the Social Sciences and Humanities, compared to 50% (3970 out of 7938) of the male staff (Figure 35). There was also a reasonable proportion of male instruction/research staff in the Natural Sciences and Engineering (38% or 3020) compared to their female counterparts (21% or 1154).

Within the Natural Sciences and Engineering, female staff is best represented in the Computer Sciences and Data Processing: in 2001, 46% (251 out of 544) of female instruction staff and 40% (or 28 out of 69) of female research staff were in this category (Figure 36). Women are least represented in Engineering: in 2001, only 9% (75 out of 831) of instruction staff and 14% (33 out of 230) of research staff in Engineering were women.

Based on some additional data requested from the National Department of Education, the study looked at the participation of women in the university sector, within the Natural

Sciences and Engineering, from their early years at the undergraduate level, to the level of Professor for those who pursue academic careers (Figure 37). The findings were clear: as women climb the rungs – from undergraduate through to the Doctoral level, and from Lecturer to Professor – their numbers decline considerably.

### Publishing scientists and their publication output

Within the population of actively publishing scientists, the majority of female scientists (47% or 970 out of 2076) work within the Social Sciences and Humanities, while the majority of male scientists (44% or 2203 out of 5028) are in the Natural Sciences and Engineering.

Among female actively publishing scientists, the highest percentage (23%) of high output producers (i.e. more than four published article equivalents) is among those whose field of specialisation lies within the Social Sciences & Humanities, while among male publishing scientists, the largest proportion of high output producers is in the Natural Sciences and Engineering (41%) (Figures 38 and 39).

### Notes about the data

The number of Doctoral enrolments and graduations in the technikon sector were too small to warrant an analysis across scientific domains.

figure 31 University Doctoral FTE enrolments by sex and by broad field of study (2001)

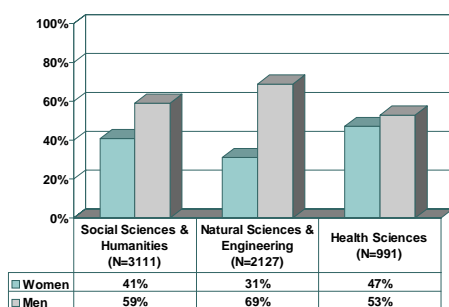


figure 32 University Doctoral FTE graduations by sex and by broad field of study (2001)

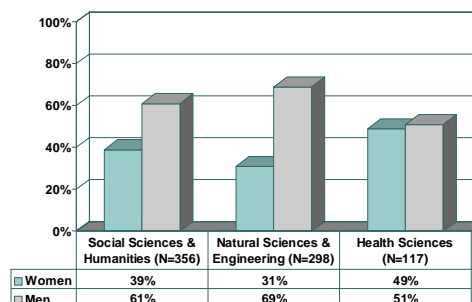


figure 33 University Doctoral FTE enrolments in the Natural Sciences & Engineering, by sex (2001)

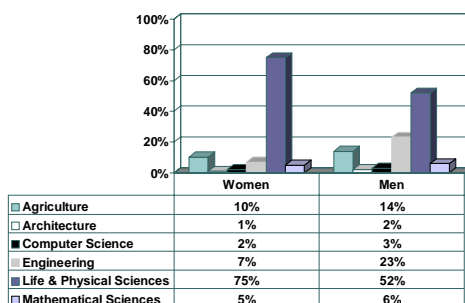


figure 34 University Doctoral FTE graduations in the Natural Sciences & Engineering, by sex (2001)

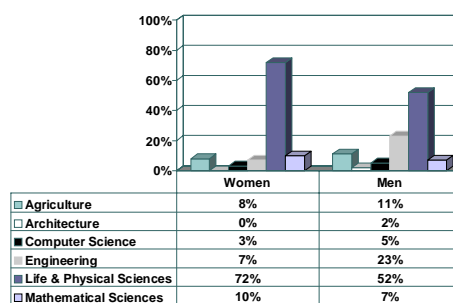


figure 35 | Distribution of female and male FTE instruction/research staff in higher education across scientific domains (2001)

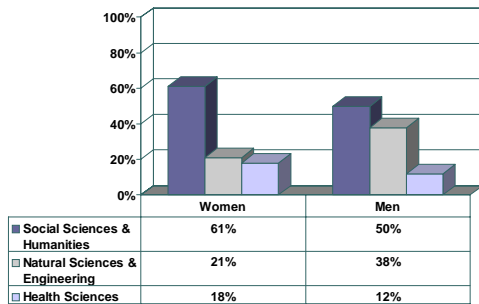


figure 36 | Women as a percentage of FTE instruction and research staff in the Natural Sciences & Engineering (2001)

Natural Sciences & Engineering	Women as % of instruction staff	Women as % of research staff
Agriculture	23%	27%
Architecture	28%	30%
Computer Sciences	46%	40%
Engineering	9%	14%
Life/Physical Sciences	32%	31%
Mathematical Sciences	35%	29%

figure 38 | Publication output of female scientists in different scientific domains (1990-2001)

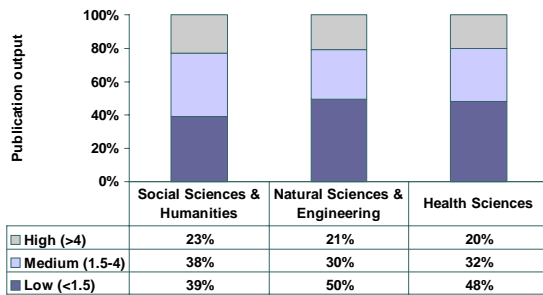


figure 39 | Publication output of male scientists in different scientific domains (1990-2001)

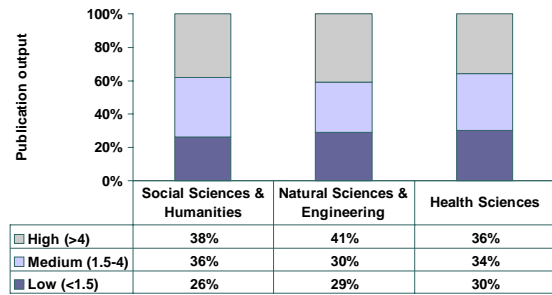
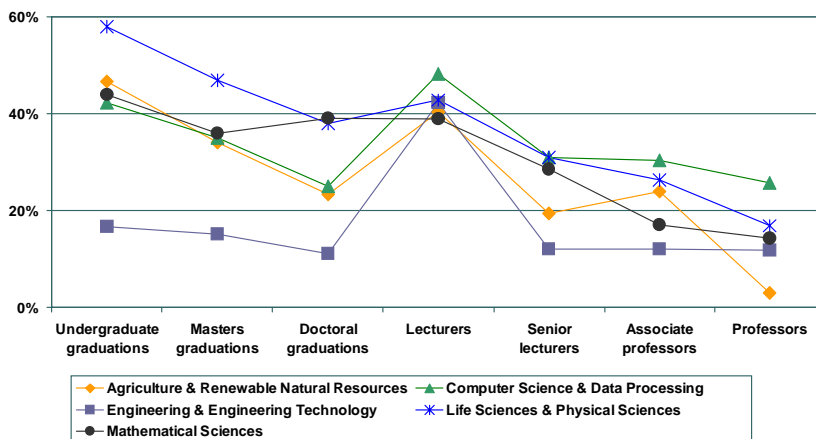


figure 37 | Percentages of women in the Natural Sciences & Engineering in the university sector by sub-field (2001)





## INITIATIVES TO ENCOURAGE WOMEN'S PARTICIPATION IN THE SCIENCE, ENGINEERING AND TECHNOLOGY DISCIPLINES

---

### In South Africa ...

The Peninsula Technikon hosts an annual **Women in Engineering Day**. Initiated in 1998, this is now an annual event to which female learners in Grades 11 and 12 are invited. The invitation is sent to high schools in the area that offer the SET prerequisite subjects of mathematics and science, and about 200 learners attend each year. The full-day programme includes a tour of the Technikon's engineering facilities, interaction with female students currently studying engineering, interaction with women employed in the engineering industry, industry exhibits and motivational addresses by role model speakers. The Technikon also provides **five full bursaries to female students annually**, in each of their engineering disciplines, in order to encourage women students to choose engineering as a field of study.

In 2003, a **Women in Engineering Forum** was set up at the Vaal Triangle Technikon to foster the interest of young women in engineering courses and careers, and to offer encouragement, support and mentoring to women in engineering at the institution. The Faculty of Engineering at the Technikon has responded to the shortage of female engineers for the labour market by establishing the **Malesela Taihan Electric Cable Women in Engineering Awareness Project**. The project aims to host an engineering awareness event for Grade 11 and 12 female learners during the school holidays, and to obtain bursaries from companies to assist female engineering students. The specific objectives of the project are to increase the intake of female engineering students, to introduce women to all the engineering fields available, and to introduce female engineering role models to learners.

The **Science, Engineering and Technology Stars Programme** is a joint venture between the Chemical Industries Education and Training Authority, and the Foundation for Science and Technology. The Programme is an intervention for female learners from previously disadvantaged communities in South Africa, in mathematics, science and computer science.

### Internationally ...

- The AED/Cisco Gender Initiative (women in computer networking and information technology)
- The Association for Women in Mathematics
- The International Institute of Women in Engineering (hosted by the International Services Department, EPF Ecole d'Ingenieurs in France)
- Women in Neuroscience
- European Women in Mathematics
- The Women in Engineering Unit (Royal Melbourne Institute of Technology)
- The Women in Engineering and Information Technology Network (Australian National University)
- The Canadian Distributed Mentor Project (Computing Research Association Committee on the Status of Women in Computing Research)
- The Award for the Support of Women in the Engineering Profession (offered by the Canadian Council of Professional Engineers)
- The Association of Professional Women Engineers of Nigeria
- The Women in Physics Professional Group (Institute of Physics in the United Kingdom)
- The Society of Women Engineers (Chicago)
- The Association of Women Geoscientists (United States), and
- Women in Endocrinology.

# PREFERENTIAL POLICIES, PROGRAMMES AND FUNDING MECHANISMS FOR WOMEN IN SET

The sex-disaggregated statistics presented thus far reveal that there have been improvements in women's participation in public sector science, engineering and technology (SET) as postgraduate students, researchers and scientists. The study have also shown, however, that glaring disparities remain in terms of race, rank, scientific domain, funding allocations, scientific rating and publication outputs. In thinking about what can be done to mend these problems, the study present a brief overview of policies and interventions which seek to improve women's participation, retention and progress in SET, in South Africa and internationally.

## Initiatives for women in SET in South Africa

Higher education and government SET institutions were surveyed to find out whether they have any policies, programmes and funding mechanisms designed to increase the participation of, and to retain and promote women in SET. A number of institutions reported having gender equity policies in place, or that they were in the process of developing such policies. However, it became clear that where these policies were in place, they were often the only policies favouring the advancement and promotion of women in SET. The study found no evidence of separate policies that focus solely or explicitly on women as academics, scientists or postgraduate students. In some cases there was clearly a tension between preferential policies for women and the practice of non-discrimination – whether it be on the basis of sex or race – as enshrined in the principles of equality.

Of the few initiatives that were reported, most focused on the provision of professional development or leadership training for women in higher education institutions, often by international agencies. Another smaller group of initiatives focused on increasing the participation of girls and women in engineering fields of study or careers.

The most significant preferential funding for women in SET is provided through the Thuthuka “Women-in-Research” Programme of the National Research Foundation. Funding

is provided to women with Doctorates, who do not have an NRF rating, but who wish to undertake postdoctoral research.

A more focused preferential funding mechanism for women in SET is the Women in Water Awards, awarded by the Water Research Commission in conjunction with the Department of Water Affairs and Forestry. Each year, the awards are made to women who have played leading roles in water research in South Africa.

## Initiatives for women in SET internationally

As an adjunct to the survey of the South African landscape in terms of policies, programmes and preferential funding mechanisms for women in SET, the researchers conducted a web-based survey of initiatives and opportunities for women in SET in other countries. The result of this investigation was the development of a searchable database of initiatives for women in SET in selected countries. The database includes, amongst others, the title of the initiative, the host organisation, the geographical reach of the initiative, the activities, resources and target group(s) of initiative, and contact information where available.

A total of 92 initiatives are included in the database, operating at either the global, regional, national or institutional levels.

Initiatives range from non-profit organisations operating in multiple countries and engaged in a variety of activities, such as information dissemination, funding, professional

development and science awareness campaigns, to small informal groups located within universities, targeted at women in specific disciplines such as Physics.