The Gendered Construction of Scientific Excellence

TERESA REES
School of Social Sciences, Cardiff University, UK

Academics sign up to the concept of promoting excellence in research by valuing ‘objectivity’, independence, theoretical frameworks and an evidence base, even while we might argue about meanings of these concepts and how they should be operationalised. We share a commitment to peer review, even though some may have concerns about invisible biases which may be built into some of the mechanisms we employ to conduct it. So, how do we explain the extraordinarily robust and sustained role that gender continues to play in organizing the academy? Moreover, how do we understand the neglect of the gender dimension in so much research? This paper considers the ways in which gender cuts across the allocation of academic opportunities. It raises questions about the implications of the gendering of the academy on who decides who and what is ‘excellent’. It then outlines concerns about the neglect of the gender dimension in research processes. It concludes with recommendations on how to address the gender imbalance in the academy and enhance the attention to gender in research.

KEYWORDS Scientific excellence, Research excellence, Gender in science, Gendered construction, Academic ability

Introduction

Universities and research institutes are regarded as liberal, meritocratic institutions united in a commitment to academic excellence. Indeed, in the UK, universities are currently preparing for the 2014 Research Excellence Framework, where the academic community reviews the sector’s performance to guide the allocation of Government funding for research, ensuring it follows ‘excellence’. Its predecessors, the Research Assessment Exercises, attracted few if any criticisms of the decisions made on the allocation of grades for quality of research. Indeed, there is a high level of consensus in the community that such exercises are broadly fair. Similarly, the use of peer review internationally by the boards of journals, funding bodies, promotion panels and learned societies is widely accepted as fair if not perfect. Rarely are there complaints. This prompts the question that if systems of
adjudication are largely acceptable and if we accept that academic ability is equally distributed between the two sexes, then why are there so few women among the recipients of accolades in the academy, such as fellowships of learned societies, medals or Nobel Prizes? Why, indeed, are there still so few women professors?

Historically, women were largely excluded from the academy. Cambridge University, for example, did not allow women to receive degrees, even if they had attended courses and passed their examinations, until 1949. Indeed, a special graduation ceremony was held in 1999 to celebrate 50 years of awarding degrees to women, at which over a thousand women of a mature age finally received their degrees. The discourse of the academy (Bachelors, Masters and Fellows), the dress (gowns with hoods designed to be attached to the top button of a waistcoat) and the culture remain androcentric.

Since admitting women, universities have been characterized by three kinds of gender segregation: horizontal, vertical and contractual. While women now constitute the majority of undergraduate students in the European Union, they are less evenly spread across disciplines than men. They may comprise the majority of early career researchers but they are a small minority of principal investigators and senior staff.

One of the few challenges to the consensus that the peer review system is gender neutral in its judgements was by made by Wenneras and Wold (1997). The authors investigated why the Swedish Medical Research Council allocated twice as many postdoctoral positions to male applicants than to female ones. They utilized the open access that citizens in Sweden have to documents in the public sector to analyse the scoring of the Medical Research Council in its judgements. They found that the successful women had to publish 2.6 times as much as the successful men to be regarded as being at the same level of ‘competence’. Moreover, links between candidates and members of the panel, such as having been in a supervisory relationship, played a role in determining what is ‘excellent’. The Swedish Medical Research Council tightened up its procedures and many other funding bodies reviewed theirs to ensure that peer review was operating fairly. However, this case throws up questions about board members’ knowledge of applicants, the impact of male networks and the measurement of ‘excellence’, ‘competence’ and ‘potential’.

Gender is still a significant organizer of the academy. But gender is also an important variable in the organization of the broader society which researchers study, whether they are medics, engineers, scientists, social scientists or from any other discipline. In deciding what is excellent, to what extent are those decision makers allocating research funding or opportunities to conduct research or evaluating completed projects taking this into account?

This paper explores the gendered construction of scientific excellence. It begins by examining the patterns of gender distribution in the academy in the European Union. Who makes the decisions about what is regarded as ‘excellent’? How do they reach the position of being such a decision maker? How transparent are the recruitment mechanisms to boards, panels and committees? It then discusses the implications of ignoring the gender dimension in research for the quality of the science. Clearly, other
characteristics such as ethnic origin and disability are also significant for both employers of researchers and for research itself; however, the focus of this paper is on gender. I conclude the paper with some recommendations for promoting gender equality in the academy, thereby improving the quality of science by reducing the impact of gender in the social construction of excellence. I also make some recommendations for ensuring more attention is paid to gender in research.

I draw upon research conducted for the European Commission Directorate-General for Research and Innovation on women and science, and as a partner in a Framework Programme project on knowledge economies. I combine this with my personal experience as Pro Vice Chancellor Research in a UK research-intensive university.

A political arithmetic of gender in the academy

The paper begins by exploring the role of gender in the allocation of academic positions, and indeed in academic opportunities such as the award of research grants, research accolades and published papers. It considers the ‘political arithmetic’ of gender in the academy and some of the explanations for the all-too-familiar patterns of gender segregation.

In 2001, the European Commission published a review of the position of women in science, engineering and technology, drawing together for the first time, statistics from across the world (Osborn et al. 2001). It showed that in recruitment, whatever the discipline, whatever the country and whatever the rank, men are selected disproportionately to their number in the base recruitment pool. Overall, this pattern is represented in a ‘scissors diagram’, where large numbers of female graduates diminish to become a very small percentage of professors, while members of the relatively smaller number of male graduates ultimately become the vast majority of the professoriate. This pattern is repeated in all the European Union member states and associated countries (Rees 2002). Where the crossover occurs, and how open or closed the scissors may be will vary by country, and by discipline, but with a few exceptions, the pattern remains remarkably consistent, as successive reports on statistics and indicators on gender equality in science from the European Commission have shown (2003; 2006; 2009a).

Highlights from the most recent figures published by the European Commission in She Figures 2009a, which reports on the proportion of women in research in the 27 Member States of the European Union in 2006, are presented in Table 1.

While progress towards gender equality in higher education is slow, the female rate of growth per annum among PhD graduates in the 27 member states of the European Union between 2002 and 2006 was 6.8%, compared with 3.2% for males (European Commission 2009a, 39). The number of women researchers in higher education has also been increasing at a faster rate in the EU 27 than that for men, at an average annual rate of 4.8% between 2002 and 2006, compared with 2.0% for men (European Commission 2009a, 23). Even though progress in science, technology, engineering and mathematics remains slower than in other subjects, women now outnumber
TABLE 1
WOMEN IN RESEARCH IN THE EUROPEAN UNION

Women comprise:

- 45% of all PhD graduates in EU 27 (2006):
  - 41% for science, maths and computing
  - 25% for engineering, manufacturing and construction

- 30% of scientific researchers in EU 27 (2006):
  - 37% in Higher Education
  - 39% in Government
  - 19% in Business

- 19% of *Grade A* Professors in EU 27 (2007):
  - 7.2% of Grade A Professors in engineering and technology (2007)

Source: Compiled from European Commission (2009a).
* The highest grade/post at which research is normally conducted.

... men among all researchers combined in the under-35 age group (European Commission 2009a, 24). At more senior levels, there has been less progress. Nearly a fifth of all male academics (18%) are Grade A staff, compared with just 7% of all women academics (European Commission 2009a, 68).

The scarcity of women in decision-making positions in the academy is illustrated by the fact that only 13% of heads of higher education/research institutions in the EU are women, and only 9% of heads of those universities which can award PhDs (European Commission 2009a, 93). Of the members of those boards that organize the conduct of research, such as allocating research grants, just over a fifth (22%) are women in the EU 27 (European Commission 2009a, 95). This is despite the fact that legislation requires a gender balance of at least 30% or 40% of both genders on public bodies in three of the member states.

Overall in the EU, the majority of undergraduates are female and the postgraduate population is approaching 50/50 as the proportion of females continues to increase. However, significant differences by discipline remain with relatively few women in physics, mathematics and engineering particularly. Among the older, more established academics, who trained when there were relatively few women in the academy, few are in senior grades or leading institutions or on boards that shape and fund the science agenda.

Causes, consequences and questions

Gender clearly plays a role in the distribution of posts in the academy by rank, discipline and type of contract, notwithstanding the best efforts of institutions to adhere to equalities legislation and indeed develop their own good practice to promote equality. It is those in the senior positions, on boards and on science committees, whose careers developed when there were fewer women academics, who determine what is regarded as excellent. They are the guardians of quality and the custodians of academic standards. How do academics reach these positions of influence?

To gain access to a university to read for a degree, and indeed to secure a place to study for a PhD, candidates pull what Crompton (1990) has called a
'credentials lever'. Women operate well under this system, as the statistics presented earlier demonstrate. However, at the postdoc phase, the process can become muddier. Such opportunities are not always advertised. Senior academics may make a selection from among their own PhD students, or those of others on personal recommendation. This stage in the career is the main outlet source from the 'leaky pipeline' of women in academic careers. Following the postdoc and perhaps a second postdoc phase, qualifications, experience, publications and references are critical for securing a more long term, established post. Here, spending some time researching abroad, for those with the flexibility to do so, can be highly beneficial. Processes of recruitment become more transparent after the postdoc phase. However, by that time, the proportion of women in the recruitment pool has shrunk.

While internal promotion schemes vary in the extent to which a Head of Department's view can wield influence, referees and assessors play a significant role in the process whereby a promotion panel, which may have no experts in the candidate's field, comes to a view. Recruitment to a Chair or to be the Head of a University may involve headhunters utilizing their networks to identify potential candidates. To what extent does gender play a role in these procedures and processes? How gendered are the networks accessed for views at the different levels of the hierarchy? Who is determining what is 'excellent' and what frameworks of reference are they using?

The ETAN report (Osborn et al. 2001) conducted a gender count of the membership of strategic international research bodies, those which determine the agenda for science development and priorities for funding. It showed that there were very few women on such bodies 10 years ago, even in the European Union where the 'mainstreaming communication' from the European Commission's Research Directorate-General made a commitment to moving towards a better gender balance on science committees. Indeed, it specified that scientific committees should have at least 40% of both genders as a target (European Commission 1999). To what extent do major EU research bodies have a gender balance on their boards now? Has that target been reached?

In 2011, the new European Research Council had a budget of 1170 million euro to allocate for 'starting grants' and 'advanced grants' to the best scientists in the world who wish to do research projects in the EU. It has six women members on its Scientific Council of 22, just below the 40% target. The Council of the Joint Research Centre is the 'scientific and technical arm' of the European Commission, and provides science-based policy options to the European Commission to assist in the development of EU policies. It employs 2750 staff in its seven institutes and laboratories and has a budget of 330 million euro. Its Council currently (2011) has five women among its 39 members and participants, well below the gender balance target but an improvement on its tally of no women at all in 1999, as reported in the ETAN report (Osborn et al. 2001). The European Molecular Biology Organisation (EMBO) has the best gender balance of the three, with a women director and four women among 15 members — a perfect gender balance.

The critical issue is how do people get selected to become Council members of these and other international science bodies and those of individual
countries? What are the recruitment mechanisms for membership of prize committees and learned societies? Who are the gatekeepers to accessing these powerful positions who determine what is deemed to be excellent? By what criteria are they operating? What roles do networks and ‘knowing’ potential candidates or those who recommend them play in the process? A lack of transparency and evidence-base in the vetting of candidates raises concerns that contacts, networking and cloning may have a disproportionate impact.

Some boards of journals and research councils have moved to advertising vacant positions: this prompts the identification of required characteristics, skills and qualifications and should yield a better fit with meeting the needs of the organization than relying on networks and more informal methods of recruiting. It enables potential candidates who are not known to existing members to assess their own fitness for the role and apply accordingly. This should facilitate boards to be presented with a more diverse range of candidates than relying on the knowledge of the field of existing members. Many potential eligible candidates can be ‘invisible’ or under-promoted, despite having relevant skills and competencies. Limiting terms of office on such boards allows new blood to circulate: some boards do not regularly refresh themselves. Headhunters can be required to ensure they include women in the names they generate for consideration for long-listing, ensuring that they move beyond close-knit circles of known potential candidates. Utilizing practices recommended by the Office for Civil and Public Appointments in the UK for Non Departmental Public Boards (quangos) for recruitment, as appropriate, would enhance fairness, transparency and openness. Some of the older learned societies have processes of identifying new fellows that are deeply mysterious to those outside the organization. In contrast, the Academy of Social Sciences is much more transparent, specifying its criteria for the process followed whereby an individual may become elected as an Academician.

**Gender and the process of peer review**

Peer review is a vital part of the development of science. It facilitates the testing of ideas, the scrutiny of scholarship and the rigorous critique of new work. Journals, research funding bodies and recruitment and promotion boards rely heavily upon the system, which is highly valued and deeply embedded in the research culture. Given that there are so few challenges to this system, does gender play a part in peer review?

In 1999, Valian sought to address the question about why there are so few women in senior positions in her book entitled *Why So Slow?* (Valian 1999a,b). She argued that men and women are socialized into operating with implicit assumptions about gender differences, which she calls ‘gender schemas’. The consequence of the influence of these embedded assumptions means that men are over-rated and women under-rated consistently. In a series of experiments, she demonstrated how both men and women make assumptions about who is in charge of a meeting, for example, by making presumptions based on gender rather than reading other signals, for example, where the chair of a meeting is sitting. This is similar to what has been described as the ‘Matthew’ effect (St Matthew said for those that have, more shall be given).
whereby established, successful researchers benefit from a halo; their contribution to a project is consistently overestimated because of past successes, while the contribution of others is overlooked (Merton 1968). Valian argues that it is not so much that women are discriminated against or disadvantaged, but that men benefit from a ‘male bonus’ of assumptions made about them, because they are male. Similarly, Merton is suggesting that established researchers are consistently given more credit than they are necessarily due.

So, do gender schemas and the status of the academic play a part in peer review? Studies from the US have explored the impact of the name of the author (male, female and unclear) of a journal article on assessments made of them and conclude that the presumed gender does make a difference (Goldberg 1968; Paludi and Bauer 1983). Foschi (2004, 51) draws a distinction between bias that modifies ‘how a given performance is evaluated’ when the sex of the performer is known, from bias in ‘how much competence is inferred from performances’ by scholars already deemed to have been successful, or not, in the past. Foschi’s experiments revealed that both men and women operate double standards in assessing competence and she recommends both making assessors more accountable and providing them with explicit standards that universally define competence in the task at hand (2004, 54). She has also demonstrated how ‘lower status performers are treated with stricter ability requirements than higher status actors, even when members of these two categories have performed at the same level’ (Foschi 2006, 129). These biases resonate with the points made by both Valian (1999a; 1999b) and Merton (1968).

In their analysis of letters of recommendations for academic posts, drawing on social role theory on sex differences, Madera et al. (2009, 1592) came to the conclusion that women are portrayed as more ‘communal’ (concerned with the welfare of others, helpful, etc.) and less ‘agentic’ (ambitious, aggressive, self-confident, independent) than men. They also report that a second study showed that communal characteristics have a negative relationship on hiring decisions (Madera et al. 2009), which may be a surprise to those hiring faculties looking for ‘good citizens’. Academic leadership is associated with agentic characteristics, they argue, asserting that this may be a partial explanation for the failure of many women to reach top positions.

Certainly a study of over 300 letters of recommendation for faculty positions for a US medical school found that gender schemas appeared to influence the language used to describe male and female candidates (Trix and Psenka 2003). Notably, 85% of the letter writers and 96% of the gatekeepers who had requested the letters were male. Some clearly knew each other and used first names in the correspondence. Trix and Psenka (2003, 215) summarized their findings as follows:

... a higher percentage of letters for women are very short (10% fewer than 10 lines), whereas a higher percentage of letters for men are very long (8% over 50 lines). Letters for female applicants are lacking in basic features to a statistically significant greater degree, and letters for women include doubt raisers at a statistically significant higher rate that is double the rate for males. We also found that there is a greater frequency of reference to terms of praise and the status category
of ‘research’ in the letters of recommendation for men, as opposed to the letters for women. Finally, we found that when the possessive phrases relating to the applicant are grouped semantically, as a group the women’s refer most to ‘her teaching’, ‘her training’, and ‘her application’; whereas those for men as a group refer most to ‘his research’, ‘his skills and abilities’, and ‘his career’. (original emphasis)

The issue of gender and peer review is a highly contested one, with research from different disciplines, nations and types of scholarly activities all producing data and interpretations which at times are contradictory. In 2007, Bornmann and colleagues published a paper reporting that men have statistically significantly greater odds of receiving grants than women by about 7% (Bornmann et al. 2007). However, in 2009, they combined with Marsh and O’Mara to re-analyse the data on the impact of gender in peer reviewing grant proposals in an international study, and concluded that it did not make a difference (Marsh et al. 2009). There is a lively debate in some of the science journals, such as Nature and Scientific American, about whether double blind marking is ‘fairer’. The European Commission’s Research Directorate-General focussed attention on this issue in Europe at a workshop in Florence (Brouns and Addis 2004). This brought to wider attention studies that examine some of the subtleties of the ways in which gender can play a role in the academy, for example, in the recruitment of academic staff (Thoraldsdottir 2004) and in processes of gatekeeping (Husu 2004). More recently, Sagebiel has argued for more training in gender awareness in order to overcome the indirect discrimination that results from gendered organizational cultures and networks (Sagebiel 2010). Enhancing the understanding of the role of gender in the allocation of opportunities to become researchers and do research is vitally important; it entails challenging the ‘neutrality’ of the status quo.

One of the clear lessons from the research cited here, and from other studies, is that the more transparent the system is, and the more benchmarks are used to indicate what are regarded as levels of competence, the more likely it is that gender schemas and past performance will have less of an influence on reviews than an assessment of the evidence presented. Making the competencies required explicit assists both decision-makers to make evidence-based decisions but also assists candidates to ensure that they have appropriate skills to apply. Of course, the competencies and standards required themselves need to be assessed for gender bias. Indirect forms of gender discrimination can become institutionalized if there are no gender impact assessments on the selection of the criteria. Using ‘length of service’ as a surrogate measure for ‘merit’, for example, will favour men, who are less likely to take career breaks. Assessing what competencies are required and what evidence is necessary to establish they exist and ensuring that they will not favour one gender more than another can be challenging. However, it is necessary in order to ensure excellence is valued over contacts, networks and, in the case of research grant applications, past glories.

Gender in research

Gender is not only a key organizing principle of the academy, it is of course a highly significant variable in the organization of society. It should therefore
be a crucial element of the design of many research projects. But to what extent is gender taken account of in the design, conduct and evaluation of research? The paper now turns to its second theme, gender in research.

The European Commission conducted a post-hoc review of the extent to which gender had been considered as a variable in the research that it had funded through the 5th Framework Programme (1998–2001). The conclusions were that it had not received adequate attention in all projects and that the research was therefore not as good as it could have been (Klinge and Bosch 2001; 2005; European Commission 2010). In the 6th Framework Programme (2002–6), the Commission insisted upon a better gender balance among research teams, and that each research team should include in their proposals a Gender Action Plan, stipulating how the gender dimension would be addressed in the project. However, this was not regarded as a successful approach, and Gender Action Plans were dropped for the 7th Framework Programme (2007–2013). Consideration is currently being given as to how to address the gender dimension in the 8th Framework Programme.

One of the conclusions of the 6th Framework Programme experience was that there was a lack of awareness about how to do gender analysis among the researchers involved in the projects (European Commission 2010, 186). As a consequence, the Research Directorate-General commissioned Yellow Window Management Consultants, Engender and Gender at Work to develop a toolkit on gender in research (European Commission 2009b) and to provide training on request for participants in and potential applicants for projects in the 7th Framework Programme. The experience raises the issue how can gender to be embedded more effectively into the undergraduate curriculum, to raise awareness of its significance?

Why is it important that researchers are aware of the significance of gender when they conduct research? After all, despite popular mythology, the brains of men and women are extremely similar in their ability to learn and develop skills and competencies, due to their plasticity (Vidal 2009). However, men and women have unequal opportunities for learning or practising certain skills. For example, Vidal cites a study carried out in 2008 on 300,000 adolescents, in 40 countries, which showed that

... the more the socio-cultural environment is favourable to male-female equality, the better the girls score in maths tests. In Norway and Sweden, the results are comparable. In Iceland the girls beat the boys, while the boys outperform the girls in Turkey and Korea.

(Vidal 2009, 1, citing Hyde et al. 2008).

Moreover, heart disease works differently in the two genders. Clinical trials that are only conducted on men may well produce medication that is not particularly effective, and indeed, may even be dangerous for women. Trials using rats and mice frequently do not include females (Wald and Wu 2010). The reporting of pain has a gendered dimension (see Holdcroft 2007; Holdcroft et al. 2011). Equally, male breast cancer patients are expected to use mammogram X-ray machines designed only to accommodate the average height of women. Schiebinger’s website (http://genderedinnovations.
stanford.edu/) and that of Yellow Window (http://www.yellowwindow.be/genderinresearch/) have abundant examples of the importance of including a gendered dimension in research not just in medicine but in engineering, the environment, climate change and so on. Gender affects what individuals are likely to study at school, their job, their wages, and their cause of death, inter alia.

A major difficulty here is that if researchers are not aware that the gender issue may be relevant to their research, they may ignore it in a way that compromises the validity of their research. If those who adjudicate on research grant proposals and papers for publishing do not realise this, then research they may deem to be excellent may in fact be flawed. Moreover, as Schiebinger has powerfully demonstrated (2008), not only is ignoring the gender dimension potentially dangerous, it also means that exciting potential innovations may be missed (see also Schiebinger and Schraudner 2011).

In the US, in 1993, the National Institutes of Health Revitalization Act mandated that women and ethnic minorities should be included in clinical research. More recently, the German Research Foundation and BMBF now insist that gender and age group-specific aspects should be taken into account in all trials. The Swedish Research Council obliges research application evaluators to examine whether gender aspects are considered in research proposals. The Council for International Organizations of Medical Sciences has produced international ethical guidelines stipulating that pregnant women are eligible to participate in biomedical research (they are often excluded for cost reasons). Legislation currently being passed in Spain has the intention of mandating that the gender issue is addressed in all Government funded research.

Some academic journals now insist that papers submitted for publication should provide information about the gender of participants in clinical trials, for example, the Journal of the American College of Cardiology, Circulation (the Journal of the American Heart Association) and The Journal of the National Cancer Institute (which also includes a requirement to report on differences among ethnic groups). Indeed, contributors to this special issue have pointed to these as examples of good practice in a letter in The Lancet (Buitendijk et al. 2011).

Conclusion

The first policy implication of this paper, relating to the gendering of the scientific community, is that in order to promote excellence in research quality, it is necessary to mainstream gender equality into scientific cultures and institutions. This would ensure that the excellence of science is privileged over the indirect advantages currently being provided to men. Excellent male academics would have nothing to fear from gender equality; it would further legitimize their position. Excellent female academics would benefit from the removal of indirect discrimination. The ultimate winner would be the quality of science.

How could this be done? Promoting equality means ensuring that processes are transparent and evidence-based, rather than relying on networks and
patronage. It means providing good quality training for academics in gender equality, including those who may feel that it is irrelevant. It involves employers of academics integrating gender equality mechanisms into management of their organizations and using gender disaggregated statistics and gender equality indicators to measure performance. Gender proofing documents, gender impact assessments, gender audits of committees and gender pay reviews are useful tools of evaluation. Addressing work-life balance policies should be routine for all staff, not simply those assumed to have caring duties. In short, universities, research institutes, funding bodies, learned societies and editorial boards would all need to take seriously the promotion of gender equality. All member states of the European Union are committed to gender mainstreaming through the Amsterdam Treaty, so this recommendation is about activating a principle already agreed upon.

The second policy implication from this paper is that the gender dimension of research should be addressed where appropriate. How can this be done? Schools and curriculum bodies could begin the process by ensuring more attention is paid to the role of gender in society in the curriculum. Universities should ensure that the undergraduate and postgraduate curricula educates and trains students on the significance of gender as a dimension in everyday life. Existing staff would benefit from training to enable them to be better able to address the gender dimension in research that they design, conduct and publish and in the peer reviewing they do. Funding bodies and journals can follow the example of those in the medical field that have already made stipulations about addressing the gender dimension. Peer reviewers should be trained in gender awareness. Access to board and research council membership should be transparent and criteria based, and for a fixed term.

Implementing these policies would mean that scientific excellence was no longer gendered in its social construction.

Bibliography


**Notes on contributor**

Teresa Rees is a Professor in the School of Social Sciences at Cardiff University, where she has recently completed a 6 year term of office as Pro Vice Chancellor. She is also an Associate Director of the Leadership Foundation for Higher Education. A long term expert adviser to the European Commission on women and science, she was the rapporteur for projects such as the ETAN report (2000) *Science policies in the European Union: Promoting excellence through mainstreaming gender equality*. She is an Academician of the Academy of Social Sciences and has been awarded a CBE for her work on equal opportunities and higher education.

Correspondence to: ReesTL@cardiff.ac.uk
INTERDISCIPLINARY SCIENCE REVIEWS

Special Issue: Gender in Science

VOLUME 36 NUMBER 2 JUNE 2011

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GUEST EDITORIAL

Why Gender should be a Priority for our Attention in Science

Elizabeth Pollitzer
Portia, UK

In the report, ‘Recommendations for action on the gender dimension in science’, published in Spring 2010 (genSET 2010), a group of 14 science leaders from across Europe consider the role and status of women in science and propose 13 specific, evidence-based actions for institutions to take. In this unique ISR collection — unique because it examines gender as a dimension of scientific excellence — are presented nine different perspectives on how gender and science interact. Drawing on a thorough gender research scholarship and on their own extensive expertise and experience, the authors examine a variety of gender issues that interconnect and impact on scientific quality. As a relationship between biological sex and behaviour governed by social norms, in the context of science, gender both shapes and is shaped. Its influences are created, reinforced and cross over at three key junctions of scientific activity: participation, which governs how women and men are organized within and across different disciplines; scientific culture, which determines attitudes to gender roles and differentiates treatment of women and men; and research process, which controls how the similarities and differences between men and women are regarded in science knowledge-making. Current understanding of the role of gender in science has evolved over time from the early and oppositional associations of ‘gender’ with women and men to gender as an organizing principle for both institutions and scientific disciplines, then further to gender as biological and social factors affecting research itself. Weeding out errors in the knowledge base is one of the core conditions of scientific excellence. It has been said that such weed-control could be made easier and more robust by diversifying the values of the participants in scientific discourse (Allchin 1988). This is the strongest justification for bringing more women into research areas and top decision-making positions, where they are a minority; and for training both women and men on the correct ways to address sex/gender issues in the context of investigation and innovation. The historical betterment of women in society has been partly due to scientific advancements, and we could venture that therefore science is good for gender equality. With the evidence presented in these pages, we can also put forward a bolder proposition that gender equality is good for scientific quality.
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Notes on contributor

Elizabeth Pollitzer gained her PhD in Information Science from University of London, having previously studied Biophysics. She spent over 20 years at the Department of Computing at Imperial College, London, working in the area of Human-Computer Interaction. She is co-founder and director of Portia (www.portiaweb.org.uk), which promotes gender equality in Science, Engineering and Technology, and the lead partner in the FP7 Science in Society funded project genSET (www.genderinscience.org) involving over 100 science institutions in capacity building activities to address gender issues.

Correspondence to: ep@portiaweb.org.uk
21 maart 2013

Veerle Draulans

Synthesecollege