

**ESRC Science in Society workshop on
diversity in science education and training
1 – 2 February 2005**

Workshop report

Overview

The purpose of the workshop was to identify issues surrounding concerns about the future science workforce, focusing on diversity, opportunity and training in the sciences for women and members of ethnic minorities. This was with the intention of identifying what we already know about the difficulties in this area, what constitute the main gaps in our understanding of this area, and finally to agree on two or three key research questions that could be adequately addressed with the support of a small grant of c £45k.

Session One

Objectives

Steve Rayner welcomed everyone to the meeting, noting that this workshop was one of the opportunities developed by the programme office to bring members of the Science in Society research community into closer contact with decision makers in government, non-government organisations and industry. It is hoped that by forging relationships in this way it will be possible to bring research to the attention of those who most want to put it into practice. To that end, the DTI would be able to fund two or three small grants and the award-holders would be integrated into the Science in Society programme research community.

The participants considered the aims of the workshop and the difficulties that were facing them; namely the ways to deal effectively with the constrained opportunities for women and minorities in science education and training, other branches of academia and industry. It was agreed that a focus was needed on what research is currently being undertaken, how we can improve upon the knowledge base we have, and what research is not being done which would allow significant change to be implemented to reduce these problems.

The government representatives from the DTI and DfES acknowledged that government is doing a lot already to resolve the problems experienced by women and minorities in education and the workplace, in response to the Greenfield Report, but that the bigger picture needed to be painted to bring cohesion to the many initiatives that were already in place. Many of these initiatives are devised using assumption and anecdotal evidence and it was recognised that there is a need for a body of data to support policy development and implementation in this area. It was hoped that by initiating contacts with researchers working on these issues that it would be possible to collect such data and that government departments working together would be able to make strides forward in creating measures to really tackle the identified problem areas.

Although some problems in both schools and in the workforce have already been identified, it was clear that the underlying reasons for these problems had not been researched and that further work was needed in such circumstances, to provide a practical set of tools for dealing with issues both in the classroom and in the workplace.

The risks in science and the governance of risk

1. Contextual framework

Nick Pidgeon spoke to the workshop about the work that he had done on public perceptions of risk and the work he was about to undertake as part of a new project on the different perceptions of risk reported by men and women. This raised the issue of essentialist divisions between men and women and the participants agreed that, because of its simplistic nature, an essentialist framework was not necessarily the most appropriate way to approach the issue of diversity.

Nevertheless, the discussion of essentialism shaped the discussion of the apparent discrepancy between the way men and women perceive risk, particularly in the work place. This was because the needs of women differed from men, not in an essential way, but because of the fact that, in addition to work roles, the majority of women bear the responsibilities for care of dependents as well as those of the traditionally defined female role of housekeeper and cook. Their needs in the labour market therefore need to reflect both stability and flexibility, to allow all these roles to co-exist. Men, on the other hand are primarily concerned with pay and the differences in contractual statuses of men and women reflect these concerns. Women are more likely to be in part-time, and therefore frequently lower-paid and lower-status jobs, and men are more likely to be in full-time work and higher-status jobs. This reflects the demands of scientific careers, an environment in which scientists are expected to work in the lab for very long hours, and in which working 40 hours or under is considered to be not pulling weight. The scientific disciplines displaying these symptoms the most severely are the biosciences, in which field the majority of female scientists work. It would appear that the feminisation of a profession leads to a decline in status of the profession.

Diversity and equity in science education

1. Schools

Similarly in schools the problems of male domination in the sciences exist and the pattern of difficulty in retaining the levels of female participation has already begun. Two major difficulties were identified here: the attitudes that 'sciences are for boys' and that 'science is boring'. The former reflects the difficulties experienced by women post-education and is difficult to overcome once it has been instilled at the secondary level. The latter suggests that the curriculum content of science in schools is no longer adequate to capture the interest of technologically advanced children, whose experience of technology was frequently more far-reaching than the scope of the curriculum. The view of science education as being more closely related to 'science history' or 'science studies' than innovative and contemporary scientific advances was debated, and that schoolchildren might be more drawn to the difficulties, controversies and uncertainties in current science rather than the certainties of what was discovered about the world in the past. It was suggested that a more sophisticated attitude towards children's perception of risk might resolve some of the problems with the outdated image of science in schools and that, with this in mind, the possibility of extending the existing Science Ambassadors Scheme should be considered, in order to invite scientists from NGOs and consumer organisations to talk to pupils about the uncertainties and controversies in science.

The main difficulty to emerge from these discussions was the importance of defining the purpose of science education. Jonathan Osborne spoke to the workshop on the difficulties in the secondary education system. The current system was devised as an appropriate way to educate the scientists of the future and the question is now whether this is an adequate use of resources when the majority of school children will not become scientific practitioners. The question is how to educate lay citizens to an acceptable understanding of science and how to

make this central to the mission, usually inferior to that of training tomorrow's scientists, of teachers in the classroom.

Interest in science is declining and the factors affecting this include the increasing interdisciplinarity between arts and sciences in the real world and the absence of this mixed and vocational approach in the classroom. To engage pupils, the curriculum must respond to their needs by making scientific principles relevant to their everyday lives and this it is failing to do. The value of science as perceived by pupils has therefore fallen and the increasing irrelevance of the curriculum means that pupils find it increasingly difficult to identify the inherently enriching qualities of studying science for its own sake.

A major barrier to the uptake of science at school level would appear to stem from the socio-economic group of children's parents. As far as ethnic minorities were concerned, it was suggested that culture per se might influence the attitudes of them towards science, but it was demonstrated that the positive or negative attitudes held by ethnic minorities towards science education and training were reflected in the white majority according to the prevailing class structure. Children from middle class backgrounds were likely to display interest in science, and those from working class backgrounds were predominantly disinclined towards uptake of scientific education. This pattern was replicated across all ethnic groups, indicating that cultural references were not of great importance when describing why children from ethnic minorities do not succeed in school. Even amongst different minorities, the uptake of science education differed according to the class of the children – for example, the more middle class-integrated Asians being more likely to be successful in science and the less integrated Afro-Caribbean population being less successful.

2. Higher Education

Science at HE level also reflects similar concerns, with curricula in the sciences being difficult to adapt at institutional level because of the need to provide degrees accredited by professional institutions. Such professional bodies are very prescriptive about the content of courses, as well as the style and delivery of course content, leaving very little room, if any, for individual departments to innovate and experiment. This creates a self-perpetuating system in which scientists are obliged to prove their worthiness to enter the club by means of conforming to the pattern of what has gone before. It will be crucial to involve the professional bodies in order to effect change of any sort in science education in universities.

Session one – summary of questions

The following questions were of importance to the discussion:

- What is science education for?
- What does good science teaching look like?
- What do degrees in science lead to?
- What stereotypes affect the number of students beginning science degrees?
- Is there a way to deal with this?
- Do the sciences have to fundamentally change to redress this imbalance?

Session Two

Labour markets, mobility and dual science careers

Louise Ackers presented to the workshop her work on mobility between countries in the European Union. The discussion highlighted many of the areas that had been touched on in the first session, particularly the affect of the traditional gender functions of women and the influence on these on the amount of time that can be devoted to a career as an academic scientist. In industry, the working time directive has had a major influence on the time that business can expect scientists to work in the laboratory, but the same is not true of

academia, where careers depend on writing papers, attending conferences and marking student work, the majority of which is done outside the time spent on research in the lab. Success also depends upon moving institution, either because of promotion or because the end of a contract has been reached and securing continued employment is contingent on moving to another research group. Women, therefore, are less likely to be able to balance this with the other responsibilities that they also have. In cases where women are married to, or in relationships with, other scientists, it was more likely that the woman would move in order to facilitate the career prospects of her partner and thereby lose some of their labour market value.

Ackers' study for HEFCE on junior researchers found that the scientific workforce is mainly foreign in certain disciplines, and foreign student in particular are less likely to be women than men. It is unknown whether a foreign workforce is sustainable, whether that workforce can be maintained, and what its quality is. Science in Britain is becoming increasingly reliant on foreign labour to remain buoyant, and can be said to be enjoying a brain gain to the disadvantage of the sending countries. What is currently unknown is whether it matters at what point in their scientific education people leave to come to the UK and what the volume of mobility is. Also a critical factor is the integration into the system of foreign workers and whether they achieve the promotion and recognition that would be expected after a certain amount of experience and education.

The question arose of whether, in such cases, it is wise to promote fellowship schemes and other positive action programmes, such as the Royal Society Dorothy Hodgkin fellowships for women, which encourage part-time and other flexible working arrangements. Research has shown that, whilst specific programmes for women might allow them to concentrate on research to further their careers, they also have the negative effect of segregating women from the 'real' job market and thereby diminish their chances of competing in the open market against men. They were seen by many women as being a subversion of merit rather than being a method of restoring gender balance to the system and some men felt that the discrimination was against them rather than against women because of such arrangements.

This area is one which RCUK will be taking forward, as the approach to women, and in particular, women returning to the scientific labour market. There were also lessons that could be learned in the access area from the Open University, the *raison d'être* of which has always been to promote access to underrepresented sections of the community and encourage them to participate in education. It was noted that not all courses offered by the OU were degree level, with several thousand under 18 year olds taking courses and thereby being introduced to the OU at an earlier stage than is the case at other HE institutions.

Academia and industrial relations

Jonathan Brown and Pooran Wynarczyk began the discussion about the experiences of academic women and ethnic minorities and their engagement with enterprise in the UK. This discussion touched on many of the themes that had been considered in connection with mobility of scientists, including the experiences of women and ethnic minorities, which, it was suggested might not actually be negative experiences for these constituencies alone, but which might be merely the first symptoms of a deeper problem, engendered by industry itself, of not supporting its own endeavours through investment in skills training and professional development. Such training initiatives would be more likely to appeal to women, who are more willing to move to employment with mentoring schemes and personal development training.

There is not enough work on this area of organisational behaviour and the success of training and development activities has not been adequately monitored. More work would be needed to observe the effects of encouraging more uptake of employment among women

and ethnic minorities. It is not known what percentage of the workforce these sectors constitute, or the status of the employment they accept.

The higher education reviews undertaken by Lambert, Roberts and Greenfield do not consider both gender and ethnicity in any great detail although this is an area of great concern and one with which the higher education sector needs to engage. One example to follow might be the ESF approach to refuse funding where there appears to be discrimination in the work proposed or undertaken. This would discourage the use of the 'old boys' network', which currently deters many women from liaising with industry or becoming involved with intellectual property activity.

A more integrated approach on the parts of both academia and industry would be to the benefit of both sectors and would increase understanding and reduce the frustration that each sector finds in the attitudes of the other. This could be most effectively pursued through the student population, who will form the next generation of academic and industrial scientists. They should be encouraged to see each sector as an open resource to be tapped into and exploited to mutual advantage. The role of the Regional Development Agencies could also be expanded as a means of encouraging liaison between industry and academia. The next round of the Higher Education Innovation Fund (HEIF 3) will place more emphasis on this role, as one way for the the RDAs to develop their outputs for science and innovation development. Many of the RDAs currently run schemes which aim to promote the participation and integration of women and ethnic minorities in to industry, but the success of these need to be evaluated so that more appropriate policy can be developed for future initiatives.

It was noted that the RDAs generally accepted that scientific research and development would generate economic growth, and many of their policies were based on this concept. It was far from clear, however, that this is indeed the case, and not the inverse, namely that economic growth provides the best environment for the research and development. Industry's role in the improvement of the economy was not definite and how industry could provide for the needs of the future rather than seeking to exploit advantage in the current markets was also unclear. This message needed to be debated more formally.

Conclusions

It was agreed that the most pressing difficulty facing current science policy was the future of science and the scientific workforce. To this end, it was important to begin to develop a long-term science policy, and one which would look further than the 10 year *Science and Innovation Framework* initiated by the government and currently in its opening stages. It was acknowledged that it would be more appropriate to look at a timeframe of at least 20 years, over which period significant change could be envisaged and potentially implemented.

One of the main conclusions reached was that it was vital to consolidate what was already known about research in this area, as well as considering the need to conduct new research into perceived gaps in policy. It was suggested that a valuable exercise and valid use of available funds would be to conduct a literature review which would synthesise the research that has already been published in this area. This would allow a more coherent picture of the current state of science policy research to emerge which would inform thinking on further research and future policy development.

An alternative would be to commission new research that would look at specific research questions identified by the delegates in the light of their discussions over the two sessions of the workshop.

Firstly, it was agreed that the main areas of concern and uncertainty focussed on the secondary and higher education years, forming the decade of education undertaken by those aged between 11-21. This was the period where research in science, engineering and

technology education was perceived to be at its most vulnerable because of a lack of understanding of developing scientific, technological and knowledge horizons and of the ability of the system to manage the changes that will occur as a result of these.

Secondly, it was acknowledged that there was a lack of data concerning the effects of cultural difference (taken to include class differences, ethnicity and gender) on the experience of SET education by women and ethnic minorities during this educational period, and that it was not currently possible to describe how cultural differences of this nature might either facilitate a change in approach to science and science education, or be exploited to alter the existing rigid and self-perpetuating system.

Thirdly, it was noted that educational experience had a profound effect on labour markets and the careers and mobility of scientists. More research needed to be done in this area to increase the understanding of the factors influencing the uptake of careers in scientific disciplines following the completion of secondary and higher education and also the understanding of issues surrounding the retention of female and ethnic minority scientists during their life course. A major concern emerging from the discussions was the recognition of the possibility that the factors affecting the integration and retention of women and minorities in science careers might in fact be a reflection of a broader fundamental difficulty occurring in the sector as a whole and of which the barriers experienced by women and minorities were but a symptom.

In brief, there were two differing branches of research development which could be funded with a long-term focus:

1. Overview of the existing research base, publications and results surrounding science policy and diversity issues.
2. Concentration on gender and diversity issues in specific research topics:
 - a. Secondary and higher education (11- 21)
 - b. Cultural differences and effect on the approach to science
 - c. Labour markets, scientific careers and mobility

It was suggested that it would be possible to adequately address these issues with up to three grants of around £30k each.

AMM
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