



Editorial

Science, Training and Career

Higher Education Policy (2004) 17, 129–133. doi:10.1057/palgrave.hep.8300046

Until recently, the postgraduate and postdoctoral training function of higher education and its relationship to the job market for young researchers was not a matter of special concern. The doctoral degree recipients consisted of a rather small group of higher education graduates and the ‘training’ has been characterized as one in which the selected few were expected to emulate the scholar as master. This practice was seldom contested and rarely an explicit object for policymaking.

In the last decade, however, this situation has changed drastically. Higher education policy has extended its scope and has included the area of advanced research training as well. Governments worry about the future recruitment of research talent and training of new generations of researchers. Policies were aimed at a new structure of the research training in graduate schools or otherwise, in order to assure that the research system will continue to produce appropriate numbers of PhD graduates for the knowledge economy. Moreover, policies for doctoral education are changing indecisively at a time when the governments are making determined efforts to change science policy.

Along with this growing attention from the side of policy-makers, there is an increasing concern about the aims and status of doctoral training. Is doctoral education the reproductive mechanism for the new generation of the academic estate or should it also equip its holders for a larger category of jobs outside academia? If the emphasis is on the reproductive function of doctoral education, the concern is not only quantity in the sense of producing too many PhD recipients for the academic positions available, but also whether they are properly prepared for academic jobs. At the same time, pressures have grown to reconsider doctoral education not only as a preparation for an academic career but also to make it more relevant for a broader variety of other careers outside higher education, in particular, to meet the demand for high-quality scientists and engineers across the knowledge economy. This has led to controversial debates on the status and function of the doctoral degree and on the conditions and the best practice to prepare doctoral candidates for their professional future.

This issue of *Higher Education Policy* is devoted to the changing nature of doctoral education. The articles in this journal reflect on the state of the theoretical work, they seek to develop the conceptual field and discuss the



dilemmas involved and the challenges for the future. They all provide evidence of the changing expectations about the relevance of doctoral training to both the academic world and the world outside academia. This present debate must be viewed in the light of a number of issues, which separately and in combination put pressure on current practices and attitudes towards doctoral education.

The first issue concerns the job market for doctoral graduates that has become more diverse. Growing numbers of PhD holders are finding employment at a wider array of careers than the traditional academic profession. Doctoral education is criticized for being excessively narrow and specialized, and students seem to be ill prepared for the rapidly expanding job market. The close link of doctoral education to the research enterprise, especially to basic research, casts doubt on the extent to which doctoral students are well prepared for a changing academic labour market. This puts pressure on doctoral education to redefine its role, away from its historic purpose as the exclusive instrument for renewing the academic profession.

A second set of challenging issues is inspired by changes in the overall university and science systems and the changing dynamics of knowledge production. It is a commonplace to state that in the knowledge society, the production of knowledge is not confined to a special institution, but is distributed throughout society. Universities cannot claim the monopoly of knowledge production since universities have become part of a wider and globalized knowledge market with a great variety of actors. In addition to this, the knowledge for which universities are renowned has become contested. A new 'mode' of knowledge production has come on the forefront of the discourse that stresses transdisciplinarity as opposed to disciplinarity, and knowledge in the context of its application as opposed to pure knowledge. The academic-industrial relations and the growth in the commercialization of academic science are mechanisms for bringing about this mode of knowledge production. Apart from the short-term contract research some sectors of industry are increasingly prepared to enter into long-term strategic research alliances. It is evident that this development affects the nature of doctoral training.

Third, the international dimension has gained much importance in higher education and has been extended to include doctoral education. The Bologna process towards the European Higher Education Area as well as the initiatives towards the European Research Area will certainly affect the research training function as well as the career prospects of younger academics in an increasingly internationalizing context. Stronger exchange and cooperation in international networks and larger consortia in order to be able to take part effectively in European Framework Programmes is the trend. This involves a greater mobility of researchers and career development opportunities following



doctoral studies. Furthermore, the introduction of Bachelor- and Master-structure raises questions on the place, structure and financing of doctoral training programmes.

Finally, the blurring of borders between fundamental research, applied research and development, and the mixture of public and private research funding require a reappraisal of public policy and its relationship to other stakeholders for the research training function of higher education. Governments feel the need to enhance the position of university research in the outside world by setting mechanisms for quality assurance and by linking budgets to research achievements and research priorities. Since doctoral education is becoming increasingly embedded in the research system, questions arise about the links between the public responsibility for education and training on the one hand and for research and science policy on the other.

These issues open an agenda for exchange of what we know about the various and changing faces of doctoral education and training. In the opening article, Enders and De Weert address these issues in more detail. They describe the contours of a new regime in higher education and science that will bring the training-career trajectory of researchers a step further. New institutional arrangements are emerging, but this does not mean that traditional concepts of scholarly work and training are disappearing.

Next, Rip digs deeper into changes in the nature of scientific research to which universities are subjected and explores what these mean for research training. Functional distinctions between universities, public labs and industrial research are disappearing which in his view entails that doctoral research training can also become diversified in terms of its content and its location. For universities, the key challenge is to diversify and recombine, both cognitively and institutionally, into what Rip calls a postmodern university, which includes overlaps and alliances with centres of excellence, public labs and various private organizations.

On a similar line Henkel highlights how current science policies, which stress strategic or exploitable research and innovation, advance the emergence of hybrid forms of collaboration. For scientists this means that they have to manage a more varied institutional environment, more flexible and open structures and less predictable career trajectories. This development questions what research training is all about: it may mean the competence in research design and research techniques, but it may include generic skills as well.

The following three articles focus on the situation of doctoral education in different national contexts: the US, France and Nordic countries. The US system that probably more than any other national system has formally organized its research training in graduate school is much under attack. Nerad exemplifies how present critique on doctoral education has generated national attention to reevaluate whether it measures up in content, structure and



processes to prepare researchers for present and future societal needs. The critique is fierce: doctoral education is too narrow, creating problems for PhD recipients as they enter an increasingly differentiated and complex job market both outside and inside academia. The critique provides much food for thought at a time when the American system is a model for European higher education systems, creating educational sequences from undergraduate to graduate and advanced levels that parallel the main breakpoints found in the American case.

Dany and Mangematin take us into the realm of the life sciences in France where PhD students should be trained and prepared to enter not only the endogenous academic market but also a wider variety of careers. In order to achieve this, students should circulate between different organizations inside and outside academia during or after their PhD, exemplifying what Rip calls the postmodern university where doctoral students can wend their ways through the types of locations, just as it is to be expected in their later career. This opens new directions for career management away from academic tenure, which as the authors argue is not the only possible option for young academics. This is a challenging view since doctoral students are conceived as the vehicles for the production and dissemination of knowledge. By stressing this function of doctoral education, it seems that the mere training component of doctoral education with a view to producing an independent researcher remains in the background.

Finally, Bleiklie and Hostaker discuss changes in research training policies, based on a comparative study of reform and policy change in higher education in England, Norway and Sweden. They demonstrate how the introduction and standardization of PhD research training programmes developed differently in the three national systems. The strong localism in the development of disciplinary traditions and the lack of mobility that characterize the doctoral training system in the Nordic countries appear resistant to change.

All articles question the appropriateness of doctoral education as a preparation for the professional future and consider the implications for the place, structure and content of doctoral education. Arguably, doctoral programmes are organized differently in national contexts, varying from individually organized training to standard training programmes for groups of doctoral candidates in related fields, or through research schools or graduate schools that may involve 'taught courses' as well. Also major differences among disciplinary settings would demand a particular structure, which fits into their respective cultures and modes of operation.

Clearly, an ideal overall structure that encompasses all these differences cannot be the aim. New pathways and more hybrid forms are emerging that result in a variety of roles and relationships. Some question whether the conventional PhD thesis is still the only or best way to generate the research needed for the knowledge economy or to train researchers. Others are more



reserved and adopt a more pluralistic view, including alternative forms of doctoral education. In such a view the all-embracing life's work of say a historian or mathematician could well exist alongside a doctorate obtained in a postmodern training–career trajectory.

A central element in this debate is a general recognition of the need to increase the attractiveness of higher education systems and research institutions in Europe and worldwide. A decline of interest among graduates in certain disciplines to enter further academic training and career can be observed. The options and directions offered in this journal may inspire future debates and policies which are focused on encouraging a large group of young talented people to resume their research training and career trajectories.

The texts were originally prepared for the international workshop '*Science, Training and Career: Changing Modes of Knowledge Production and Labour markets*', organized by the Centre for Higher Education Policy Studies at the University of Twente, the Netherlands on 21 and 22 October 2002. The purpose of the workshop was to discuss the changing nature of doctoral training with scholars from Europe and the USA and to stimulate an exchange of views between researchers and representatives from the policy field. The workshop was supported by the German Federal Ministry of Education and Research. The texts have been brought up to date and have undergone major revisions for publication in this issue.

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