

It takes a global village to develop the next generation of PhDs and postdoctoral fellows

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Preparing the next generation of PhDs to function successfully and contribute to the global world currently and in the future requires broadening the conceptual approaches to doctoral education beyond the apprenticeship model to a community of practice. It also requires coordinated efforts of many levels within and beyond a university. This next generation of researchers must acquire traditional academic research competencies, professional skills and intercultural competencies in order to work and function in a world of multinational teams and multinational settings. Learning at the doctoral level needs to be structured to allow for true discovery and intellectual risk-taking.

'n Globale dorp benodig vir die nuwe generasie van PhD's en nadoktorale genote

Die voorbereiding van die volgende geslag PhD's om suksesvol te funksioneer en by te dra tot die globale wêreld van vandag en môre vereis die verbreding van konseptuele benaderings tot doktorsale opvoeding – verby die vakleerlingskap model na 'n gemeenskap van praktyk. Dit vereis ook gekoördineerde pogings van baie vlakke binne en buite die universiteit. Die volgende geslag navorsers moet tradisionele akademiese navorsingsbevoegdheids, professionele vaardighede en interkulturele bevoegdheids verwerf om in 'n wêreld van multinasionale spanne en omgewings te werk. Doktorsale studie moet so gestruktureer word om ontdekking en die loop van intellektuele risiko's toe te laat.

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This article discusses the coordinated efforts of the many levels, both within and beyond a university, required to prepare the next generation of PhDs to function successfully in the global world currently and in the future, and to develop researchers who conduct research in an ethical, responsible way across disciplines, as well as national and cultural boundaries as they strive to solve societal problems or undertake basic research with yet unknown applications. Currently, with intensive national focus on innovations, it is a tall order to prepare PhDs who are intellectual risk-takers and innovators, in the midst of national and local pulls to increase efficiency and tighten funding schemes.

I argue that due to globalisation and recent national innovation policies, the next generation of PhDs must acquire the traditional academic research competencies of successfully undertaking research and publishing it; the professional competencies that assure effective dissemination and appropriate application of their research findings in various settings within and beyond the universities, and the cultural competencies that allow them to work with, and function in, multinational teams and settings.

Various conceptual approaches have been developed for the preparation of researchers, as will be discussed later. The majority of these approaches focus solely on the individual advisor or candidate level and conceptualise learning to proceed in an apprenticeship mode, passed down from the master to the apprentice. Other approaches focus on the wider learning context. I argue that it takes a global village – to paraphrase the Nigerian proverb, “it takes a village to educate a child” – to develop tomorrow’s PhDs and postdoctoral fellows. It takes the coordinated efforts of many levels of a university and a national research and innovation system to effectively prepare the next generation of researchers.

I caution that the current pressure by governments for research funds that produce short-term economic benefits may work against true discovery, which cannot be ordered on command. We need to better understand and develop research pedagogies that allow for ways of purposefully structuring the learning of true discovery, or, as an international network of experts, the Forces and

Forms of Change in Doctoral Education Worldwide, established by the Center for Innovation and Research in Doctoral Education (CIRGE) at the University of Washington, Seattle calls it, allow for intellectual risk-taking during doctoral and postdoctoral education and development (CIRGE 2009: 2011a).

1. The education and career path of PhDs

We need to know where our PhDs work after completion of their doctorate or postdoctoral training, and we need to know how they believe their doctoral or postdoctoral training prepared them for their careers within and beyond the university. These kinds of surveys and subsequent knowledge will allow us to assess how effective our university preparation is and to implement changes.

There have been few national studies of this kind. CIRGE was one of the first in the world to specialise in this kind of research and has undertaken three national USA PhD career and retrospective programme quality assessments in a wide array of fields, starting in 1999 with the PhD Ten Years Later study (Nerad & Cerny 1999), the Art History PhD a Decade Later study in 2003 (Rudd *et al* 2008a, Sadrozinski *et al* 2003), and the Social Science PhDs – Five Years Out study in 2007 (Nerad *et al* 2007, Rudd *et al* 2008b). We have found that the careers of doctorates are becoming more diverse; academic careers are changing, and PhDs increasingly go into, and are needed in, other economic sectors (Nerad 2009). In addition, survey respondents reported that their PhD programmes did not train them well in several professional skills important in academic and non-academic jobs. Studies undertaken in Australia (Western *et al* 2007), Germany (Enders 2004), Finland, and Britain (Roberts 2002) found, like the CIRGE studies, that graduates several years removed from their education had mostly had positive labour market experiences, but only after undergoing a transitional period of insecurity and uncertainty.

In surveying PhD recipients across major fields of study, we need to understand that not all disciplines have the tradition of postdoctoral fellowships. Currently, postdoctoral training takes

place mainly in the biological and physical sciences (85%-90%), regardless of whether the goal is to stay at the university or join industry (Nerad & Cerny 1999, 2002). In the USA, approximately 10% of PhDs undertake a postdoctoral fellowship in engineering, mainly if they intend to become professors (Nerad 2003). A similarly small proportion of PhDs in the social sciences, humanities and education choose a postdoctoral fellowship, mainly if they intend to shift focus within their field of study (Morrison *et al* 2011, Nerad *et al* 2007).

2. Globalisation context

We need to accept that we live in the context of globalisation, and that globalisation affects universities and the preparation of researchers (Altbach 2009).

Governments worldwide embrace economic theories of the knowledge economy. These theories argue that knowledge is crucial to national economic growth and increased prosperity, and locate the cause of economic growth as novel ideas leading to scientific, technical, organisational, environmental or health innovations (Slaughter & Rhoades 2004). Innovations and technical changes are considered the principal means of economic growth and sustaining international competitiveness. As the knowledge economy theory has spread around the world, national governments in many places have turned to master's programmes, doctoral education and postdoctoral preparation as a way of educating scientific and technical innovators. Postgraduate education and academic research are now global endeavours. Not only nations, but also supranational organisations such as the United Nations Economic, Scientific and Cultural Organisation (UNESCO) (Meek *et al* 2009), the European Union (EU) (Kehm *et al* 2009) and the World Bank (Bourguignon *et al* 2007) are developing policies to enhance the contribution of doctoral education to national and regional economic growth.

Within the context of hope for economic growth and national capacity-building, governments are allocating substantial funds

to increase the research and development capacities of their countries. The education of high-quality researchers, who are able to bring innovative changes to their workplaces, whether in business, government, academe or non-profit sectors, is increasingly considered part of research and development activities and included in national innovation policies. It is believed, and empirical evidence now suggests, that not only the supply of highly skilled individuals, but also how widely academic knowledge is disseminated has an influence on a nation's economic and social development (Dill & Van Vught 2010). Expressed differently, new knowledge must be effectively disseminated and absorbed if innovations and economic growth are to proceed from it.

Under such a concept, the number of researchers must increase, and the type of education they receive must be rethought.

2.1 Effects of globalisation on doctoral education and postdoctoral training

While internationalisation was pursued after World War II until the 1980s to foster peace, since the end of the Cold War, competition has become a driver, not only in the industrial and business sectors, but also among universities. Governments cite a number of their national universities among the top 100 or 200 world-class universities in the Shanghai Jiang Tong University Academic Ranking of World Universities or the *Times Higher Education Supplement* World University Rankings (Salmi 2009). Benchmarking and comparing with other similar institutions is a useful endeavour in order to stay on track and improve, but the main goal is to collaborate in order to solve the many problems worldwide and to push forward the boundaries of knowledge.

Globalisation has an effect on doctoral education worldwide, and the following can be observed:

- There is an increase in PhD production. More women, more international doctoral students, more part-time and more older doctoral candidates are pursuing a doctoral degree. The effects

on doctoral education are that universities have to educate a more diverse group of researchers.

- Given the new innovation policies, education and research training are increasingly organised with a problem-solving approach, using multidisciplinary teams, and including participants from various sectors of society. This brings into doctoral education a form of knowledge production that has become known as mode 2, in contrast to mode 1, the traditional way of learning from one master scholar within one discipline (Gibbons *et al* 1994). In mode 2, research not only operates around application in a transdisciplinary context, but the process also involves multiple actors: universities, industry, business and governments, sometimes in research triangles as in Silicon Valley, Stanford University and the Food Valley around the University of Wageningen, which focuses on food and health living. Knowledge production is becoming more socially accountable and, as a consequence, an emphasis on translational research has emerged (CCTS 2007, Feldman 2008, Woolf 2008). This means that the research process does not stop at basic research findings, but the basic findings are translated into applications that respond to societal or business needs.
- Consequently, new PhDs are expected not only to know how to do the research, but also to be competent writers, speakers, managers and team members who can communicate research goals and results effectively within and beyond the university. These competencies are called “professional” or “transferable” skills in North America, and generic or “soft” skills in the UK and Australia. I call them “translational skills”, as these skills are not only transferable from academic to non-academic settings, but also necessary to translate research findings into societal applications. The effects on research education are that the preparation of doctoral candidates and postdoctoral fellows, or early career researchers (ECR), needs to include many more competencies beyond the traditional academic ones (Harman 2008, Manathunga & Pitt 2009, Nerad 2004).

- Worldwide, there is increasing standardisation in doctoral education. Many universities offer more structured programmes, with clear, selective admission criteria, transparent benchmarks of examinations and a panel of advisors, to name a few (Nerad & Heggelund 2008). The standardisation of these trends allows greater mobility during and after the education of researchers.
- Another effect of more investment in higher education by governments and private funders is greater accountability. This means that the new researchers need to have good project management skills, including managing people and budgets, to be able to demonstrate effective use of funds.
- Spurred by technological innovation, communication across vast spaces is easier, faster and more widespread. As a result, scholarly networks are flourishing and are actively supported by governmental agencies (research councils) and international agencies such as UNESCO, the World Bank and the EU. Researchers need to learn to collaborate in international teams.
- Higher education is responding to market forces faster than before. This creates more competitive pressure on the research enterprise (Nerad 2010).
- Higher education has become commercial and generates revenue. The degree has become a commodity that has value beyond pure knowledge production. This means that there is worldwide competition for doctoral students as a source of revenue (for those states that allow the collection of fees).

National governments have responded to globalisation. They have established research training schemes, invited industrial representation on national PhD evaluations efforts, established doctoral sandwich programmes that exchange both doctoral candidates and professors, and established major national grants that foster innovation, interdisciplinarity and theme-orientation in doctoral programmes, as will be discussed later.

Do these developments cause challenges for doctoral and postdoctoral education? Of course they do. The issue of “brain drain”, which represents “brain gain” for others, is now viewed

in a longer term perspective and talked about as “brain circulation”. The fact that English has become the current *lingua franca* of scholarship, and many scholarly journals are in English, poses challenges. Universities offer doctoral education in English, because they want and need to prepare their domestic students for participation in the international scholarly community and they want to attract international students. However, this further distances science and research from local populations.

3. More is asked from the next generation

I have shown that more competencies are required of the next generation of researchers. Can we reach agreement on what these competencies are?

3.1 Common definition

A group of experts from the network of the Forces and Forms of Change in Doctoral Education Worldwide, organised and coordinated by CIRGE, which I founded and direct (CIRGE 2011b), investigated this and agreed on three points (Bernstein *et al* [*s a*]):

- A research doctorate must contribute to knowledge through original research.
- A research doctorate must have substantial knowledge in his/her area of study.
- Research doctorate training should include the development of transferable and translational competencies.

Expressed differently, a PhD must have:

- Traditional research skills

These skills include in-depth knowledge of one field; knowing how to develop conceptual frameworks and research design; knowing of and applying appropriate research methods writing and publishing one’s findings; critical thinking; analysing and synthesising skills, as well as learning to conduct research with integrity in an ethical manner.

- Professional competencies

As explained earlier, the new generation of researchers need professional competencies. They need to be able to communicate complex research findings to diverse audiences; work in multi-, trans- or interdisciplinary teams; write grant applications; apply knowledge in commercially viable, socially responsible ways; manage people and budgets, and assume leadership roles in complex organisations (Bartelse & Huisman 2008, Enders 2004, Nerad 2008).

- Cultural competencies working in multi-national settings

The preparation of the next generation of PhDs needs to include multicultural competencies in order to be able to work collaboratively in international teams on solving societal problems in multinational settings.

4. Approaches to conceptualising the development of doctoral students and postdoctoral fellows

How do we turn doctoral candidates into independent researchers who possess these three sets of competencies? Let me now link the research competencies with the learning approaches in doctoral education:

- Apprenticeship model – a one-to-one approach

The oldest and most widely accepted approach is the apprenticeship model (recently called the “signature pedagogy” of doctoral education in a recent Carnegie study (Walker *et al* 2008). Under the apprenticeship model, teaching and learning take place in a one-to-one apprenticeship between the doctoral candidate and the professor. The master passes on this knowledge to the apprentice, but is the master always around and the best person who knows how to pass on all the additional competencies?

- Professional socialisation

Another conceptual learning model is a developmental model of professional socialisation. The PhD candidate moves in stages from a knowledge consumer to a knowledge producer, from novice to junior colleague (Bieber & Worley 2006). Professional socialisation is the process whereby one learns and adopts the values, skills, attitudes, norms, culture and knowledge of one's disciplines.¹ The professional socialisation concept is criticised as being a top-down, rigid approach in which the doctoral candidate is considered an open vessel into which information is poured, regardless of who the candidate is or what s/he brings to the process (*cf* Flores 2011).

- Community of practice - widening the perspective

In the late 1980s, scholars such as Lave & Wenger (1991) and Resnick (1987) challenged the assumption that learning is an individualised process, independent of context. They proposed a theory of situated learning that viewed learning as a function of the activity, context and culture in which it is situated (Lave 1988). They found that newcomers became part of a "community of practice" by gradually acquiring knowledge and skills from experts through participating in everyday activities. The new participants would move from the periphery to the centre of the community, as evidenced by their taking on more complex tasks and assuming greater responsibility for outcomes.

- Mentoring - the panacea for everything?

At least in the USA, Britain and Australia, mentoring by professors of their doctoral candidates and postdoctoral fellows seems to be regarded as the panacea or remedy for all ills in doctoral education. It is argued that, if professors would just better mentor, all problems would disappear. This is an individualistic approach and puts the entire burden of the education and preparation on the shoulders of one person.

1 *Cf* Merton 1957, Tierney & Bensimon 1996, Tinto 1997, Van Maanen 1976, Weidman & Stein 2003.

What if the doctoral candidate or postdoctoral fellow does not find a mentor who takes the novice under his or her wings? What if our professors of immigrant background and women professors in engineering are overburdened and burnt out because all doctoral candidates of immigrant background and women engineering candidates want to be mentored by them?

The effects of all professors becoming better mentors would be positive, but we cannot currently afford to rely solely on this approach, given the multiple demands on professors.

I argue that “it takes a global village” to develop the next generation of researchers in our universities, using the Nigerian proverb, “it takes a village to educate a child”. It takes the coordinated efforts of many levels of a university and a national funding agency to effectively prepare the next generation of researchers.

4.1 Global village approach

This section combines the three sets of skills needed by the researchers of the future with existing conceptual learning models and shows how a combination of three organisational units of a university – the professor/student, the department and the graduate school, ideally a central graduate school such as exists in USA universities – need to collaborate with government funding schemes so that new researchers are effectively trained for the tasks of the future:

- At the grass-roots level, the professor passes on the traditional academic research skills to the PhD candidate and the postdoctoral fellow via the apprenticeship approach. This is done in seminars or weekly laboratory meeting, or during advising hours.
- At the departmental and laboratory levels in a community of practice approach, disciplinary professional competencies are taught by means of programmes and professional development workshops, as well as social community-building activities. In this way, the novice researcher can become a junior colleague.

- At the third level, at the central graduate school (in the US model), professional competencies and multicultural awareness are passed on in several learning communities, including career development (career centre); learning of teaching; professional skills workshops; intercultural awareness training for ECR before they leave their home country and for international scholars when they arrive, and creating and fostering postdoctoral networks.
- Lastly, the global village approach requires a coordinated effort beyond the university by the national research and innovation system.

4.2 Conditions for a successful global village approach

What works against coordinated efforts as described in the global village approach?

First, at the grass-roots level, professors need to encourage their students to venture out of the laboratory and the department. An attitude that activities outside the laboratory and the department are a waste of time will deter doctoral candidates and postdoctoral fellows from acquiring professional skills offered elsewhere on campus. Departments with “chilly climates” that provide little social interaction and few social community-building opportunities deprive researchers-in-training of space and occasions to become junior colleagues and to socialise more deeply into the discipline. In times of budget crisis, extracurricular workshops are easy prey to cuts. However, such workshops and training centres are relatively inexpensive. They require staff time, tea and biscuits, and space for network building. Lastly, governments in financial crisis too often reduce or completely cut innovative doctoral education grants and scholarships.

However, there are already a number of very successful national grant programmes that aim at innovative, interdisciplinary, theme-oriented doctoral programmes and that also include postdoctoral fellows in the pedagogical design. Through these funding

mechanisms, a number of national research councils have contributed a great deal to the changes in doctoral and postdoctoral education.

For example, in Germany such grant programmes, the Graduiertenkollegs, are funded by the DFG. In the USA, similar programmes, the IGERTs (Integrative Graduate Education and Research Traineeships) are funded by the National Science Foundation (NSF). In Australia, there are the government-funded Collaborative Research Centres (CRCs) (Harman 2008, Manathunga & Pitt 2009, Nerad 2010). In these programmes, the funding of the student is not linked to an individual professor, but to the programme. Through this mechanism, the programme hopes for dissertation topics that are interdisciplinary. The programmes must provide access for doctoral students to network with professionals in their field who work outside academia. These programmes must ensure that doctoral candidates acquire the necessary professional skills such as working in interdisciplinary teams, team teaching and grants management. In addition, these programmes must place an emphasis on the learning environment and on building a learning community. Increasingly, national funding agencies encourage international collaboration with peers from other countries who are working on similar topics.

For example, the Urban Ecology IGERT at the University of Washington in Seattle worked closely with several Berlin universities in the Stadt Ecology programme. Students and faculty from both programmes published a textbook on urban ecology, held annual conferences and organised joint field trips to urban centres in countries other than the USA or Germany.

These innovative and interdisciplinary programmes have become catalysts for change on individual campuses, providing positive examples of interdisciplinary approaches to doctoral education. Not all doctoral education, however, needs to be interdisciplinary.

5. Tensions in times of innovation

Beyond these exceptional approaches of flagship programmes funded by a number of national governments, we need to foster socially relevant research and create room for basic research. Do our structures (funding schemes and efficiency measures) allow for intellectual risk-taking?

5.1 Intellectual risk-taking

What is risk? What do we mean by encouraging risk-taking? The definition of risk is “to expose to danger, to experiment or to venture”.

Currently, researchers must cross disciplinary, national, institutional and cultural boundaries. The advancement of knowledge requires willingness on the part of some to pursue risky but potentially transformative research projects. Yet in some instances, existing academic reward structures discourage both boundary-crossing and high-risk research projects. As relative newcomers to research, doctoral researchers may be ill-advised to address interdisciplinary questions or to undertake risky research. Nevertheless, I argue, together with colleagues from the international CIRGE network, that there are several ways in which doctoral education can help equip candidates to consider risky research projects (CIRGE 2011b). We recommend (Nerad & Rudd 2009) that doctoral candidates be admitted, trained and rewarded for innovation and risk-taking; doctoral programmes develop procedures for doctoral students to learn about and from risk-taking early in their programme; universities develop programmes to explicitly train doctoral supervisors in the recognition and management of risk for their students; universities, departments and programmes develop a research culture that values and rewards innovation and creativity, and that every doctoral curriculum train candidates to be aware of the limits and strengths of their disciplines by exposing them to other disciplines through team-building opportunities.

In organising the education of researchers in our universities in coordinated collaborations with national, local and

international agencies, we can prepare researchers who conduct responsible research that solves societal problems, work across disciplines and embrace cultural diversity. We need to accept that it takes more than one professor or mentor, but a global village to develop the next generation of competent researchers:

PhD programs that prepare students only for research and writing as lonely scholars in purely disciplinary context are providing inadequate preparation for many research careers (Nerad *et al* 2008).

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