

Professional Development for Doctoral Students: What is it? Why Now? Who does it?

Maresi Nerad

Nagoya Journal of Higher Education

Vol.15, pp.285-318, 2015

ABSTRACT

Today, governments worldwide want world-class research capacities in order to attract investment and create new jobs. In this context, the next generation of researchers needs more than traditional research skills. They need to prepare themselves to work in many sectors of society post-PhD. Therefore, in addition to acquiring traditional research skills, doctoral students also need to formulate clear career goals, be introduced to a variety of academic and non-academic career possibilities, and learn skills needed for managing post-PhD careers. They need to become versatile and equipped with transferable and translational competencies. Sets of workshops or training programs for doctoral students, known as “professional development,” are aimed at helping these students transition into professional careers.

This article focuses on the development and definitions of professional development in the US, Europe, and Australia, provides existing empirical evidence of the need of such competence training, presents a conceptual approach of integrating the additional skills into current doctoral education, and describes the central role graduate schools can play in such a training component.

INTRODUCTION

In today’s globalized economy, the emphasis on innovation is stronger than ever before. Now governments and research funding agencies expect the next generation of PhD students to be innovators and problem solvers. They also expect post-PhD researchers to work in many areas of society. In addition to academic research competencies, post-PhD researchers are now expected to possess professional skills that ensure effective dissemination of research and application within and beyond academia. They are also expected to acquire

cultural competencies for working with and succeeding in multinational teams and settings.

How can doctoral students acquire all of the competencies that are now deemed necessary, in order to succeed post-PhD? How can doctoral students, their advisors, and their doctoral program staff and professors work together to achieve such a comprehensive goal? What can be done at the university level to prepare doctoral students to find employment inside and outside academia?

In this article, as elsewhere, I argue that PhD-level education and training requires purposeful restructuring that allows for transformative doctoral education. A Nigerian proverb taught us that “it takes a village to educate a child;” and I argue that it takes a global village to develop tomorrow’s PhDs (Nerad, 2012). This is especially prevalent in today’s global economy, which demands a labor market of highly trained professionals. The proposed restructuring of doctoral education will take coordinated efforts at many levels, including within the university setting, as well as with national professional associations, and international conferences and internships. Most importantly, this restructuring also requires change at the micro-level; both doctoral students and their professors need to understand the importance of acquiring professional skills. With support from their professors, doctoral students need to actively seek out and pursue professional development opportunities throughout their doctoral studies.

This article will address the following questions:

- What constitutes professional development for doctoral students?
- How did professional development for doctoral students develop in the US, Australia, and Europe?
- What empirical evidence exists for the need and usefulness of professional development?
- What conceptual approaches for an extended doctoral education exist?
- At what time during a doctoral student’s education should professional development be offered?
- Who should initiate and coordinate professional development training?
- What programmatic models exist for professional development?

Examples from the US, Australia, and Europe will be provided to answer these questions. The article will end by discussing the challenges professional development programs at the doctoral level face.

PROFESSIONAL DEVELOPMENT FOR DOCTORAL STUDENTS: WHAT IS IT?

Definitions

A review of relevant literature from the US, Australia, and Europe reveals that there is not a uniform definition for professional development for doctoral students. The terms “skills” and “competencies” are used interchangeably in relevant literature. However, these terms have two distinct definitions. A skill is something “learned in order to...carry out one or more job functions” (see also Talentalign, 2012). A competency incorporates a skill, “but [is] more than the skill”; a competency “include[s] abilities and behaviors, as well as knowledge that is fundamental to the use of a skill.”¹ In the context of professional development, the terms “transferable skills,” and more recently, “translational skills,” appear most often. Transferable skills are generic professional competencies “equally applicable in all professional settings” (Bernstein et al., 2014, p. 13). In other words, transferable skills learned in the academic sector can be used, or transferred, in other employment sectors. Translational skills is a term borrowed from the medical sector that refers to a skill set needed to translate academic research into societal applications. A PhD researcher uses translational skills to maximize the impact of research.

United States

Most often the term “professional development” is used in the US (Bernstein et al., 2014; Bernstein; 2011; Solem, 2008; Nyquist, 2002; Feetham, n.d.) and refers to seminars and workshops that focus on the transition from PhD student to practicing professional. Such programs include:

- learning to recognize the transferability of skills gained in doctoral studies (from academic research to a variety of contexts),
- preparing for activities and tasks beyond disciplinary scholarship and academic research, and

- developing the knowledge, attitudes, and skills required to successfully manage any kind of post-PhD career, including the habit of self-assessment.

The Center for Innovation and Research in Graduate Education (CIRGE) at the University of Washington, Seattle defines “professional development programs” as initiatives that help students formulate clear career goals and connect with a variety of academic and non-academic career possibilities, as well as offer education skills training needed for managing post-PhD careers (CIRGE Spotlight #2, 2008). The skills’ list CIRGE emphasizes as part of professional development programs include:

- ability to communicate complex research findings to diverse audiences,
- ability to work in interdisciplinary contexts,
- ability to apply knowledge in commercially viable, socially responsible, and ethical ways, and
- ability to take on leadership roles in knowledge-rich environments within complex organizations (Bartelse & Huisman, 2008; Enders, 2004; Nerad, 2008; Nyquist, 2002; NSF, 2000).

These skills fall into two basic categories: development of skills and habits needed to complete a PhD, and training that prepares students to “engage in possibilities beyond the discipline” (Feetham, n.d.). CIRGE distinguishes between *PhD-completion skills* from *professional skills*. *PhD-completion skills* are those competencies and skills traditionally considered central in PhD education, such as analytical skills, writing and publishing (acquired during the course of fulfilling essential PhD requirements), and skills developed in the normal course of mastering specialized knowledge and contributing to original research. *Professional skills* are skills that are not traditional byproducts of completing a PhD. These include teamwork, communication to lay people, managing people and budgets, as well as competencies in personal effectiveness, career management and self-promotion.

Australia²

Key concepts connected with professional development in Australia incorporate the full array of skills that ensure success while earning a PhD as well as helping transition post-PhD researchers to professional careers. Relevant

Australian literature and official governmental documents use terms such as “generic,” “generic capabilities,” “graduate attributes,” and “transferrable” skills. This literature does not distinguish between skills traditionally seen as necessary to complete a PhD and skills that focus mostly on career development outside of academia (Manathunga & Wissler, 2003; Department of Innovation, Industry, Science, Research and Tertiary Education, 2012; Ward, 2013). The Australian Qualifications Framework (AQF), a national policy regulating qualifications in Australian education and training, identifies core skills that doctoral degree holders should possess. These skills include:

- specialized cognitive, technical and research skills in a specific discipline area that enable researchers to independently and systematically engage in critical reflection, synthesis and evaluation,
- ability to develop, adapt, and implement research methodologies to extend and redefine existing knowledge or professional practice,
- ability to disseminate and promote new insights to peers and the community, and
- ability to generate original knowledge and understanding to make a substantial contribution to a discipline or area of professional practice (Australian Qualifications Framework Council, 2013, p. 63).

Other Australian authors, as in the case of a recent dissertation, refer to “professional development” as training for skills that employers state they would like post-PhD researchers to have (Ward, 2013; Boud & Lee, 2009).

Organization of Economics Co-operation and Development

The Organization of Economics Co-operation and Development (OECD) published a report in 2012 with the results of a survey on the transferable skills that today’s researchers should possess. This report defines “transferable skills” as skills beyond the core competencies that apply in a broad variety of work situations. Results state:

Researchers today need skills relating to communication, problem-solving, team-working and networking, and business and management know-how. These [skills] give [researchers] workplace competencies that are relevant for a broad job market, although the skills they need may vary in different sectors.....Formal transferable skills training is one way to achieve these competencies (OECD, 2012, p.9).

Europe

In Europe, the term “professional development” for doctoral students is used by the European Alliance on Research Career Development (EARCD).

European Alliance on Research Career Development

EARCD is a forum of experts from 21 national research funding organizations is affiliated with the European Science Foundation (ESF). It defines professional development for doctoral students as:

a structured approach to the continuous development of researchers’ knowledge, expertise and attributes at all stages of their career to improve their competencies, employability and ability to pursue multiple careers paths. This [professional development] may be achieved by a variety of activities, whether formal and structured, or informal and self-directed (ESF, 2012, p 10).

European Commission

The European Commission identifies a full array of competencies that a PhD recipient and post-PhD researcher should possess in its report, *Towards a European Framework for Research Careers*, as does the Australian government. The list of identified skills includes:

- demonstrated, systematic understanding of a field of study and mastery of research associated with that field,
- demonstrated ability to conceive, design, implement and adapt a substantial program of research with integrity,
- demonstrated contribution through original research that extends the frontier of knowledge by developing a substantial body of work, innovation or application,
- demonstrated critical analysis, evaluation and synthesis of new and complex ideas,
- demonstrated ability to communicate with peers, specifically to explain the outcome of his/her research and value thereof to the research community,

- demonstrated ability to co-author papers at workshops and conferences, and
- demonstrated ability to take ownership for and manage his/her own career progression, to set realistic and achievable career goals, and to identify and develop ways to improve employability (ESF, July 2011).

“Professional development,” as defined earlier, is encompassed in the last competency identified by the European Commission in its 2011 report. The European Commission proposes “active support of researchers/doctoral students and postdocs to build up sustainable career[s]” in many sectors of the labor market” (ESF, 2011). To achieve this end, the European Commission identifies that the following skills be acquired:

- Communication/dialogue with non-technical audiences (public engagement),
- Project and time management,
- Research management and research leadership,
- Enterprise skills (entrepreneurship, commercialization, innovation, patenting and knowledge transfer),
- Understanding of the use of science in policy making,
- Problem solving,
- Negotiation,
- Networking,
- Grant writing and application submissions, and
- Career planning.

The League of European Research Universities

The League of European Research Universities (LERU) is an association of 21 leading, research-intensive universities in Europe. In a LERU paper published in January 2014, lead author David Bogle wrote: “a very important part of any doctoral program” is presenting a wide range of “possible career opportunities for doctoral graduates.” One example support is helping doctoral students identify and develop the specific skills they may need for the career options they plan to pursue (LERU, Advice Paper, 2014).

United Kingdom

The Research Development Framework (RDF) in the United Kingdom was developed by VITAE in 2009 as a result of the 2008 Concordat to Support Career Development of Researchers, which was issued by UK Ministry of State for Science and Innovation. This framework combines training for the development of traditional academic skills with training for career development. The RDF structures this framework into four domains:

- knowledge, intellectual abilities, and techniques necessary to conduct research,
- personal qualities and approaches to be an effective researcher, knowledge of the professional standards and requirements to conduct research, and
- knowledge and skills necessary to work with others to maximize the impact of the research undertaken (VITAE, 2008).

Institutions in the United Kingdom are encouraged to implement opportunities for “Personal Development Planning,” which offers graduate students and postdoctoral scholars guidance for self-reflection on both disciplinary and personal development, as developed by the RDF.

Differences Among Countries

As noted above, definitions of professional development vary by country. These differences can be attributed to the different historical development of the process and structure of how doctoral students are educated in North America, Australia, and Europe.

From the late 19th century on, doctoral students in the US studied within structured programs. In contrast, it was the tradition in Germany and in most of Europe from the 18th century on to create new knowledge by working individually under the supervision of a professor. Australia and New Zealand adopted this European tradition when it began offering doctoral degrees in the late 1940s.³

The demarcation of doctoral education in structured programs or unstructured doctoral education has become blurred in Europe, Australia, and New Zealand over the last fifteen years. National research funding agencies have designed calls for grant programs that focus specifically on doctoral education with some structured components. Following these government calls, research universities changed their traditionally unstructured doctoral education by

incorporating structured components. With grant funding from these national research agencies, universities supported new doctoral programs similar to Japan's Leading Programs in Doctoral Education.

A review of relevant research indicates that doctoral education in Australia and Europe was usually learned through a master-apprentice process of conducting research. Doctoral coursework in these countries was usually limited to learning research methods and techniques. Today in Europe, Australia, and New Zealand, there is a growing emphasis in doctoral programs for students to learn generic and transferable skills, with the result of an increase in stand-alone courses and workshops.

What was the catalyst for worldwide change in doctoral education? What external and internal forces enticed universities to shift doctoral education, and to include training beyond the reproduction of the professoriate?

WHAT LED TO THE EMERGENCE OF PROFESSIONAL DEVELOPMENT FOR DOCTORAL STUDENTS?

The onset of professional development for doctoral students in the US can be traced back to the National Academies Committee on Science, Engineering and Public Policy of 1995. This Committee revealed that doctoral students were ill prepared for professional work beyond undertaking research (COSEPUP, 1995). Three years later in 1998, the Australian government required all Australian universities to provide statements of the attributes expected of their graduates from all degree programs, including doctoral degrees. Seven years later in 2005, the European Commission in the European Charter of Researchers stated that career development of researchers must be assured (EC, 2005).

What has happened that PhD graduates were expected more and more to make effective contribution outside academia? A World Bank report in 2000 states:

Participation in the knowledge economy requires a new set of human skills. People need higher qualifications and [the capacity for] greater intellectual independence...Without improved human capital, countries will inevitably fall behind and experience intellectual and economic marginalization and isolation (Task Force on Higher Education and Society, 2000, p. 22; Bernstein et al., 2014, p. 8).

Globalization in the Context of Doctoral Education⁴

In today's global economy, knowledge is viewed as a critical national resource, and theories about the so-called "knowledge economy" are embraced by governments worldwide. These theories argue that knowledge is crucial to national economic growth and increased prosperity, and they identify the cause of economic growth as novel ideas leading to scientific, technical, organizational, environmental, or health innovations (Nerad, 2012; Slaughter & Rhoades, 2004). Innovations and technical changes sustain a country's international competitiveness. As theories about the knowledge economy spread around the world, many national governments have turned to graduate education and postdoctoral preparation as a way of educating innovators for many sectors of society.

As a result, doctoral education and academic research have become global endeavors encouraged and financially stimulated not only by nations but also by supranational organizations, such as the United Nations (UNESCO) (Meek, Teichler, Kearney, 2009), the European Union (Kehm, Huisman, Stensaker, 2009), and the World Bank. Subsequently, national innovation policies have been developed that include education of high-quality researchers, who can bring innovative changes to their workplaces across sectors (academic, nonprofit, government, or industry/business).

In addition, economic and social development of a nation is influenced not only by the supply of highly skilled people but also by how widely academic knowledge is disseminated (Dill & van Vught, 2010). New knowledge must be effectively disseminated and absorbed if innovations and economic growth are to proceed from it. In this line of thinking, the number of researchers in countries striving for economic growth was to increase, and the type of education they received had to be rethought.

Given the new innovation policies, education and research training had to be organized according to a problem-solving approach, which involved multidisciplinary teams and included participants from various sectors of society. This introduced a form of knowledge production into doctoral education that has become known as "Mode 2," compared with the traditional way of learning from one master scholar within one discipline, known as "Mode 1" (Gibbons et al., 1994). Research conducted in "Mode 2" operates according to trans-disciplinary application, as well as involvement from multiple sectors (universities, industry, business, and governments).

Knowledge has to become more immediately socially relevant. An emphasis on translational research consequently has emerged (Feldman, 2008). No longer does the research process stop at basic research findings; now research must be translated into applications that respond to societal or business needs.

Expectations for researchers have changed worldwide. Now new PhD graduates are expected to possess an array of skills in addition to the ability to conduct research. They are expected to be competent writers, speakers, managers, and team members who can communicate research goals and results effectively inside and outside universities. As a result, there is a need for doctoral education programs to respond by offering workshops and training that enable students to gain competencies beyond traditionally academic skills (Nerad & Evans, 2014; Harman, 2008; Manathunga, 2009; Nerad, 2004).

The History of the Professional Development for Doctoral Students

United States

Nearly two decades ago in the US, the influential National Academies' Committee on Science, Engineering, and Public Policy (COSEPUP, 1995) argued that PhD education should be restructured to provide students with a greater breadth of exposure to neighboring disciplines and non-academic career paths, and to equip doctoral students with better communication and teamwork skills. The report concluded that PhD education, as it existed at the time, was primarily designed to serve research interests, and was based on the assumption that its purpose was to replenish the ranks of academic researchers. However, COSEPUP pointed out that at least half of PhD holders in many fields went on to work outside of academia in business, government, or nonprofit sectors. This evidence also has been documented by the *PhDs-Ten Years Later* study, a US career path study of nearly 6,000 PhD holders in the fields of biochemistry, computer sciences, electrical engineering, English, mathematics, and political sciences (Nerad & Cerny, 1999). Due to the high number of doctorate researches working outside of academia, this study concluded the value in spending more time and money on career planning and placement activities for doctoral students (Nerad & Cerny, 2000).

Interest in professional skills for PhD students continued to grow along with concerns about the employability of doctorate holders and their suitability for a

variety of careers. Five national initiatives in the US had marked impact on the advancement of professional development activities for doctoral students, with a particular focus on career preparation.

The Pew Charitable Trust sponsored a study undertaken by Golde and Dore that identified a three-way mismatch between the “purpose of doctoral education, the aspirations of the students, and the realities of their careers within and outside of academia” (Golde & Dore, 2001).

In *Re-Envisioning the PhD*, another Pew Foundation-funded study, lead author Nyquist summarized the views of a large number of stakeholders in doctoral education (Nyquist, 2002). The final report argued that doctorate holders need a wider range of skills to function effectively, and as a result, called for a commitment to encourage informed career choices based on exposure to a broad array of opportunities. The report also stated that career exploration be included as part of the “core competencies of successful PhDs” (Nyquist, 2002).

While the *Carnegie Initiative of the Doctorate* (2003-2006) focused on creating “stewards of the disciplines,” its report noted that the “PhD is the route to many destinations, and those holding doctorates follow diverse career paths” (Walker, et al. 2008, p.8).

The Woodrow Wilson Foundation carried out the *Responsive PhD Initiative* between 2000-2005. Among other principles stated in the final report, the report states that doctorate education needs to become more cosmopolitan, less insular to the academy, and as a result, more attractive to a diverse doctoral student population (Weisbuch, 2005). In following these studies, all doctoral education programs were encouraged to include professional development activities.

Between 2002 and 2007, the Center for Innovation and Research in Graduate Education (CIRGE) undertook two national PhD career path studies. Findings showed that PhD researchers have versatile career paths that are seldom linear. Rather, there was a diverse vertical and horizontal mobility of career paths among study participants. On average, 75% of PhD holders secured permanent employment only four years after degree completion. In the social sciences, one quarter of all PhD recipients were employed outside academia. Based on these results, it can be concluded that PhD students need more career guidance in order to connect the knowledge and skills acquired during doctoral education to a variety of careers.

The US National Association of Graduate-Professional Students (NAGPS), founded in 1987, was not a passive by-stander in this emerging professional development movement. NAGPS was aware that the academic labor market at that time could not absorb the entire new generation of PhDs. Considering employment opportunities outside of academia, NAGPS was very interested that universities would offer transferable skills training during doctoral studies.

Australia

As mentioned earlier, in 1998 Australian universities had to provide graduate attributes in terms of professional skills and competencies. The University of Melbourne's statement in response to this mandate indicates: "doctoral degrees at the University of Melbourne seek to develop graduates who demonstrate academic leadership, increasing independence, creativity and innovation in their research, and encourage the acquisition of a wide range of advanced and transferable skills." Subsequently, the University of Melbourne's Graduate School developed the Advanced Leadership & Professional Skills (ALPS) seminar series, which aim to help graduate students develop a professional skills base that is transferable across industry and sector. Topics covered in the ALPS seminar series include writing for non-academic audiences and consulting (Graduate Studies of the University of Melbourne website, n.d.)

The 2013 version of the Australian Qualifications Framework (AQF), a national policy applicable to all Australian universities, followed suit by including professional skills and competencies necessary for careers outside academia.

United Kingdom

In the United Kingdom in 2002, recommendations for training in transferable skills were reinforced by the government in two ways (Roberts, 2002). First, expectations were established that new "threshold standards" should represent an essential minimum for high-quality doctoral research degree programs (Department for Employment and Learning et al., 2003). Second, the UK Quality Assurance Agency (QAA) Code of Practice for Research Degrees (QAA for Higher Education, 2004), stated that transferable skills are vital to graduate students' ability to successfully transition to professional employment and assume personal, long-term responsibility for managing their careers (Bernstein et al., 2014).

With significant UK government funding, in 2008 the UK Research Councils developed a comprehensive list of the skills that PhD students should acquire. This effort led to the development of the UK Grad program, and later to the VITAE organization, which characterizes itself as “championing the personal, professional and career development of doctoral researchers and research staff in higher education institutions and research institutes.”

Institutes of higher education and research were asked to implement opportunities for “personal development planning” that offered graduate students and postdoctoral scholars guidance for self-reflection on both disciplinary and personal development (UK GRAD Programme, 2005). For instance, the Imperial College in London required three-day residential workshops in research skills for first-year graduate students, in addition to disciplinary training (Ritter, 2008).

In all, interest in professional skills training for PhD students emerged in many countries. This interest is rooted in the observation that PhD holders are working outside of academia at increasing rates, as well as national governments’ new interest in PhD-level scholars as candidates for work in increasingly complex, knowledge-rich environments (Bernstein et al., 2014; Bartelse & Huisman, 2008). In consequence, PhD students need more than disciplinary training; they need more support than they are currently getting in meeting the expanded list of competencies.

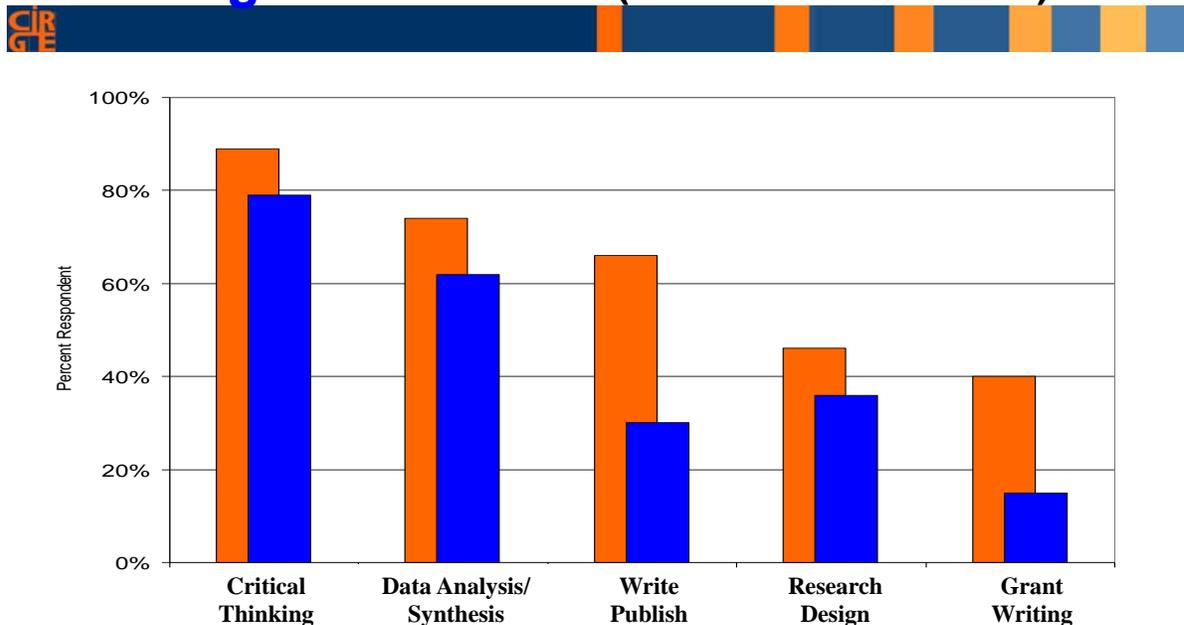
IS THERE EMPIRICAL EVIDENCE FOR THE NEED OF PROFESSIONAL DEVELOPMENT FOR DOCTORAL STUDENTS?

There is surprisingly little published empirical evidence on the need of professional development for doctoral students. From US national career path surveys of PhDs, we know that about half of science and engineering PhD recipients are working outside academia (NSF Science Indicators, 2012, 2014; Nerad, 2009; Nerad & Cerny, 1999). About one third to one fourth of humanities and social science PhDs work in business, industry, government or the non-profit sector. (Morrison et al., 2011; Nerad et al., 2008). This situation is not much different whether we assess PhD survey outcome data from the US (NSF Science Indicators, 2014), the UK (VITAE, 2013), Australia (Western et al. 2007), or data from the OECD PhD survey (Auriol et al., 2013). Government documents and interviews with stakeholders seem to indicate that PhD recipients lack the competencies to transition successfully to professional

status, particularly outside academia. But what empirical evidence do we have from doctoral students themselves about the need and the usefulness of this kind of training?

CIRGE conducted a national survey of PhD recipients in six social science disciplines to investigate the need for professional development during PhD education. Discipline areas of survey participants included anthropology, communications, geography, history, political science, and sociology. Graduates ranged from six to ten years post-PhD completion. As stated earlier, this analysis distinguished between “PhD-completion skills”—those acquired in the normal course of successfully completing PhD research—and “professional skills”—career competencies beyond traditional academic skills. The study assessed the value of both sets of skills in the career of survey participants who had become professors and those who had careers outside academia. The study also examined respondents’ evaluation of support from their doctoral program and advisor while completing their PhDs, as well as support while transitioning from student to professional. Key findings are summarized in the graph below and the text that follows.

Importance of Skill at Current Job versus Quality of Training in this Skill During PhD Studies (Social Science PhDs)



Source: M. Nerad, CIRGE, University of Washington, Social Science PhDs 5 Years- Out study

- Data analysis and synthesis skills are the most transferable PhD-completion skills. They are critical in 75% of careers and are equally important in professorial careers (referred to as “faculty” in the US), as well as in business, government and non-profit (BGN) careers, and in non-faculty academic work.
- Among professional skills, working with diverse groups in interdisciplinary contexts and in teams is critical in more than 33% of faculty careers and in nearly 66% of non-faculty careers. The study found nearly everybody needs effective presentation skills.
- PhD students need more career guidance in terms of connecting knowledge and skills acquired during doctoral education to a variety of careers.

The study concluded that doctoral students in the social sciences would benefit from enhanced opportunities to develop skills in the following areas:

- multiple data analysis and synthesis techniques,
- giving presentations,
- working with diverse groups,
- team work and collaboration,
- working in interdisciplinary contexts, and
- managing people and budgets

The study also showed that doctoral students would also benefit from:

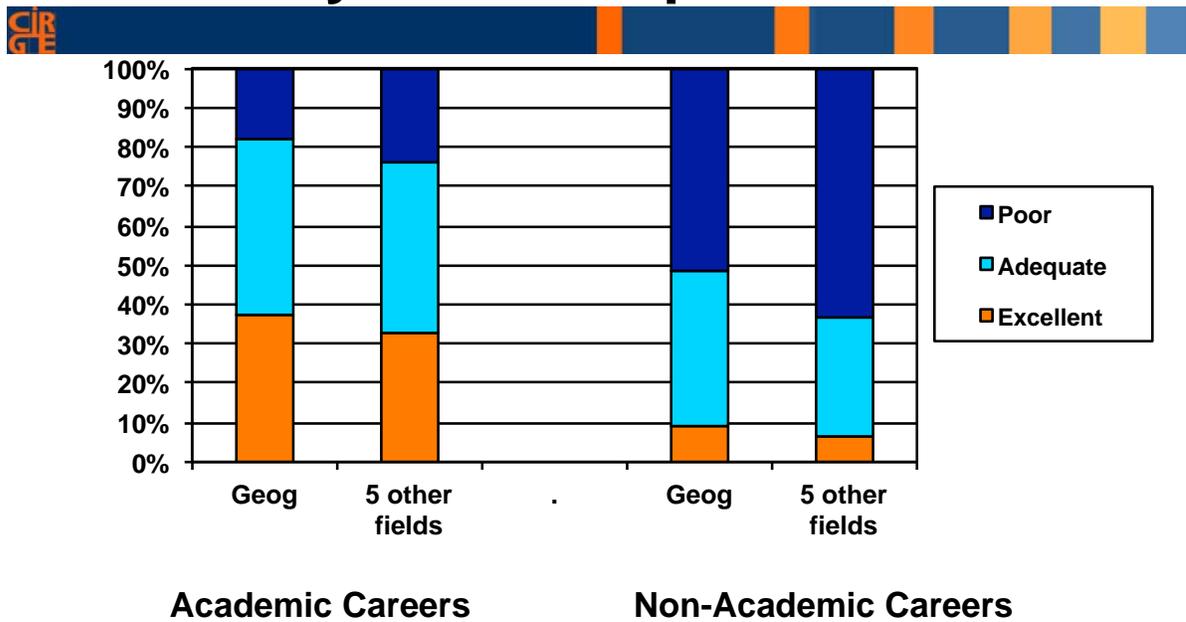
- learning how to recognize and articulate the transferability of PhD-completion skills,
- exposure to non-academic career options, and
- access to a variety of professional networks

In the study's open-ended survey questions, participants were asked to give advice to incoming doctoral students and doctoral programs in the participants' field of study. Responses to these questions show evidence of the need for student support and guidance in forging a viable career. Specific examples are as follows:

- An anthropology PhD, who became a professor, advised doctoral programs to:
[B]ring in applied professionals . . . to give students a sense of the possibilities of non-academic employment. Strengthen partnerships with community organizations in which applied professionals work . . . create internships for graduate students and undergraduates as well (CIRGE, Spotlight, 2008, p.11).
- A geography PhD recommended PhD students to:
Find out what resources are available to you at your university (in terms of professional and career development) and make use of these resources early and often—don't just bury yourself in your research. These other opportunities may lead you to your permanent career—either inside or beyond academia” (ibid).

The following graph illustrates overall satisfaction with career preparation by way of professional development in PhD education (comparing the field of geography to the five other social science disciplines).

Evaluation of Career Preparation by PhDs recipients



Source: M. Nerad, CIRGE, University of Washington, Social Science PhDs 5 Years- Out study

Based on the graph above, there are only a few disciplinary variations in the evaluation of career preparation by PhD recipients. In all, PhD graduates were more satisfied with the support they received in meeting program requirements than with the career preparation their program offered.

These findings suggest that universities and PhD programs could also enhance students' *awareness* of the transferability of skills acquired during doctoral education. Universities could achieve this by offering opportunities for students to learn how to recognize and articulate the transferability of PhD-completion skills, and providing much more in the way of career guidance, career preparation, exposure to a variety of career options, and access to diverse professional networks.

Clearly, the CIRGE study makes a convincing case for the need and usefulness of professional skill development for PhD students. But, where is the time for extending the existing doctoral education? How can one add on to traditional doctoral education and meet the increasing pressure of shortening the time it takes to complete a doctoral degree?

CONCEPTUAL APPROACHES FOR AN EXTENDED DOCTORAL EDUCATION⁵

Traditional doctoral education is based on the concept of the apprenticeship model, in which a doctoral student learns from one master—"the supervisor" (Shulman, 2004). But a closer look at current practices in doctoral education (Nerad & Heggelund, 2007) and at new empirical research (Flores, 2011; Flores & Nerad, 2012) indicates that apprenticeship, as the sole learning model, is too narrow an approach for today's PhD students to acquire the competencies they need in the twenty-first century. Therefore, a paradigm shift has occurred at a number of doctoral programs around the world: doctoral programs are beginning to move away from the one-to-one, top down, master-to-apprentice learning approach, and moving toward a structured learning process that takes place within a series of learning communities that operate at multiple levels inside and outside the university.

I argue in this article, as I did elsewhere, that it takes a global village to develop tomorrow's generation of PhD students, just as a Nigirian proverb states, "It takes a village to educate a child" (Nerad, 2012). This is especially the case in view of the economic and societal changes in today's labor market for highly trained professionals. Effective preparation of the next generation of

researchers requires coordinated efforts at many levels among universities, national and international funding agencies, and learning communities throughout the entire scope of doctoral education. In other words, to ensure that future researchers are trained for tomorrow's tasks, we need to combine the work of imparting traditional, professional, and cultural competencies with the use of conceptual learning models that encompass the entire learning context, including its various learning communities. This is what I call the "global village" approach (Nerad, 2012). This approach spans six levels of learning communities, all operating with different learning models and in different learning environments:

1. At the *grassroots* level, by way of the apprenticeship model, professors pass traditional academic research skills on to PhD candidates. This type of preparation takes place in seminars or in weekly lab meetings, and during advising hours.
2. At the *departmental* level—within an institute, or in a laboratory that forms the setting for a community of practice—the professional competencies pertaining to a discipline are taught by way of programs and professional development workshops as well as through social, community-building activities. In these ways, novice researchers have opportunities to become junior colleagues.
3. At the level of *formal and informal activities*, PhD students come together with their fellow students—their peers, or learning partners—both to provide emotional support and to share specific content knowledge and advice regarding one another's studies. The creation of a shared workspace for doctoral students at a university facilitates many forms of informal learning whereby students exchange information about resources, prepare together for exams, and discuss the need for professional development activities to transition from researcher to professional. This type of peer-to-peer learning takes a horizontal rather than top-down approach, and has its basis in reciprocity. When students are interacting, they are like colleagues who learn from each other—a model that Flores and Nerad (2012) conceptualize as a *learning partnership* approach.

4. At the level of the *central graduate school*, a typical model in American universities, PhD students learn to teach. They also attend workshops to acquire the skills of professional researchers outside the university, benefitting from the developmental offerings of career centers. Graduate schools also provide training in intercultural awareness.
5. Professional Associations, the Association of American Geographers (AAG) for example, provide career development workshops and career fairs at their annual meetings. Between 2005 and 2009, AAG focused on improving theoretical and practical approaches to professional development in the field of geography. As a result of these efforts, AAG educational staff, along with the Association President and a number of faculty, produced three books providing information on transitioning from student to career professional, both inside and outside the university. Specifically, these books included a resource book for graduate students who want to become faculty (AAG, 2009), a practical guide on teaching college geography (2012), and a book, on informing the academic geography community about careers outside academia, *Practicing Geography: Careers for Enhancing Society and the Environment* (AAG, 2013).
6. At the level of the *global village*, doctoral students acquire professional competencies. These global villages encompass international conferences and collaborations, joint degree programs, international internships, and other activities and arrangements that require coordinated efforts both within and beyond the boundaries of a single academic institution and country. As students participate in professional gatherings and interact with researchers from different countries, they also acquire cultural competencies.

Examples of the “global village” approach in action can be found in the US, Germany, Australia, the Netherlands, and the European Union (through its Madame Curie program for Initial Training Networks). In these countries, governments have sponsored multi-year grants requiring innovative, interdisciplinary, theme-oriented doctoral education that purposefully structures the learning process within a multitude of learning communities applying a variety of learning approaches. In the US, these initiatives are administered through National Research Training (NRT), formerly the Integrated Graduate Education Research Training, and are funded by the

National Science Foundation or by equivalent programs of the National Institutes of Health. In Germany, initiatives known as *Graduiertenkollegs* are funded by the German Research Council. Since 2005, there has also been special emphasis on and funding support from the German Excellence Initiative for umbrella graduate schools that offer professional development programs. In Australia, where these governmental initiatives are called Collaborative Research Centers (Nerad, 2010; Harman, 2008; Manathunga & Pitt, 2009; Kehm, 2008), funded programs are required to provide opportunities for doctoral students to network with professionals in their field of study, who work outside academia; and to ensure that PhD candidates acquire necessary professional skills.

LOCUS AND MODELS OF OFFERING PROFESSIONAL DEVELOPMENT FOR DOCTORAL STUDENTS

Locus: A Central Unit – A Central Campus Graduate Division

Many universities in the US, Australia, and Europe now offer professional development workshops (professional competencies) through their center of teaching and learning. More often now, these workshops are coordinated by campus-wide graduate schools.

US-based graduate schools are ideal places to implement professional development activities due to characteristics that are unique to this country. Specifically, two key functions of US-based graduate schools are:

- to assure the quality of master's and doctoral education across the entire university, and
- to provide support services for graduate programs and graduate students.

A campus-wide graduate school, which is both an educational and administrative unit, provides professional skills training that allow doctoral students to be successful in a variety of employment settings. This training is implemented by initiating and coordinating offerings among graduate student service units, such as a career center and a teaching and learning center.

Existing Models of Professional Development for Doctoral Students

Feetham examined a number of existing programs and activities that American graduate schools offer as part of professional development training (Feetham, n.d.). Of these programs and activities, Feetham identified six program models:

- those that employ a developmental framework,
- those that employ a competency-based framework,
- those that include practical experience,
- those that focus on interdisciplinary training,
- those that maintain a data-driven focus, and
- those that depend on off-campus partnerships.

The examples that follow provide a picture of the kind of programs and activities that are offered by a significant number of American graduate schools.

Examples of professional development programs that employ a developmental framework exist at the Graduate Schools at the University of Nebraska-Lincoln and Michigan State University. The graduate-level professional development program at the University of Nebraska-Lincoln is structured around the three stages of doctoral student development: “Moving In, Moving Through, and Moving On.” The University of Nebraska-Lincoln offers activities that support students at each stage; each activity focuses on the acquisition of a particular competency, which is deemed necessary for success in graduate school and beyond. At Michigan State University, the graduate-level professional development program is arranged into web resources, workshops, and a teaching certification program. Each aspect of this professional development program corresponds to a particular phase that students complete in their doctoral education (Feetham, n.d).

Examples of professional development programs that focus on acquisition of competencies exist at the University of Nebraska-Lincoln and the University of Melbourne. In this example, “competencies” refer to seven skill areas: self-awareness and support, communication skills, career advancement, research expertise, teaching expertise, engagement, and leadership. Each of these competencies is clearly defined in order to guide students’ understanding of the concept and how it might be acquired. Administrators of these professional development programs have built networks with academic departments that

address professional development issues. In these ways, graduate programs at the University of Nebraska-Lincoln and the University of Melbourne accomplish their goals by leveraging campus support through collaborations, particularly at the college/department level and several other resources. Duplication efforts are avoided, but experiences that supplement disciplinary-specific training activities are offered as complementary and supplementary. As mentioned earlier, the School of Graduate Studies at the University of Melbourne makes the development of professional competencies a key component in its offerings. An extensive selection of seminars, short courses, and short workshops address students' needs and concerns during all phases of graduate school—from beginning coursework to preparation for a professional life inside or outside the academy.

An example of a professional development program that emphasizes practical experience exists at the University of Colorado. Here, the Graduate School introduces graduate students to careers in academic librarianship by illustrating the benefits of combining a master's degree or doctorate with a master's degree in library science (Feetham, p. 26). Graduate students are mentored for 150 contact hours with a faculty member from the University's libraries. In this way, students can learn about a career as a library faculty member through direct experience in a university library setting. At the University of Texas, the Professional Development and Community Engagement Program (PDCE), located within the Office of Graduate Studies, offers students the opportunity to receive academic credit for different types of internship programs in the community surrounding the university. The PDCE also provides hands-on experience and capacity building in a variety of areas, from writing and communication to community engagement projects (Feetham, n.d.).

Other American graduate schools focus their professional development activities on interdisciplinary activities. One such example is the University of Washington's Institute on the Public Humanities for Doctoral Students, supported by The Graduate School and the (Simpson) Center for the Humanities. The professional development program here invites interested doctoral students from all disciplines to collaborate with community partners in a trans-disciplinary way. Each year for one week, eighteen fellows and two mentor fellows (returning fellows who have helped to plan and assist with the institute), explore how diverse forms of cultural work can generate communities of learning and inquiry across university-community divides. Program participants read, visit sites, invite guest speakers, and engage in

collaborative projects with the Asian History Museum or the Public Library, to name a few community partners (Feetham, n.d).

Many other graduate school's professional development programs are data driven. These schools collect data both as a base for planning, and as a means of evaluation for further improvement. Specifically, universities administer surveys or host focus groups to collect data on students' needs and interests. Post-event surveys help track usefulness of program activities as well as participants' demographics. This data helps program administrators tailor activities to the needs of the current student population. The University of California Berkeley and the University of North Carolina at Chapel Hill are two universities whose graduate schools use the data-driven model. At the University of North Carolina at Chapel Hill, program administrators learned from collected data that doctoral students prefer stand-alone workshops rather than entire seminars or fixed series of workshops.

A number of universities located in state capitals or in Washington D.C. take advantage of their unique geographic location as part of the off-campus partnership model. For example, Howard University, located in Washington D.C., employs the off-campus partnership model in its professional development program. This university invites speakers from higher education coordination boards, and professionals from the National Science Foundation, the National Institutes of Health, and the National Graduate or Postdoctoral Association to speak to their graduate student population.

By assessing the six models of professional development programs that Feetham identifies, we find that these programs use many different approaches and activities beyond traditional research training. Frequently, campus-wide training programs such as Centers for Teaching and Learning, manage these programs. More recently, many graduate schools provide opportunities and funding to travel to national international conferences and collaborative meetings between universities. They bring international graduate students together with domestic graduate students from various fields. In short, they initiate and support a variety of local, national, and international learning communities. Despite differences between universities, American professional development programs have a common goal. Specifically, these programs aim to provide skill-building tools and information for doctoral students to succeed as professionals in whatever sector they choose for their post-degree career, both within and outside of academia.

CONCLUSION

This article revealed the existing awareness for professional development through an analysis of definitions and history of its emergence. In many countries, today, universities (program administrators and professors), funding agencies, and students themselves understand the need to acquire more than traditional research skills in order to succeed post-PhD. Universities currently employ a variety of professional development activities that aim to help students achieve this goal.

However, in spite of this heightened awareness, tensions exist that challenge a smooth introduction of additional sets of competencies into doctoral education. Professors and dissertation advisors worry that their doctoral students will spend less time conducting research. Additionally, state and national governments provide universities with increasingly limited financial resources. Funders and university administrators are responding by increasing university efficiency. For students, this efficiency translates to fixed time-to-degree periods, either three or five year periods to achieve a doctoral degree. (The discrepancy of years is based on determination whether the doctoral degree includes time spent earning the preceding master's degree).

As a result, professional development training may be viewed with skepticism. However, using the “global village approach” discussed in this article will not extend the time-to-degree period of three to five years. In fact, a CIRGE study on the importance of time to-doctoral degree for the social science discipline found that doctoral students who had time-management training and who were encouraged by their advisers to pursue professional skill training had shorter time-to-degree compared to PhD students without such training (CIRGE, Spotlight #3, 2008).

Universities also face other challenges in implementing professional development programs. First, a common set of definitions for professional development is necessary across universities, countries, and government agencies. Second, it is important to develop effective means of assessment for professional development. For instance, mastery of each identified competency must be established—including at which educational level and which proficiency level students are expected to achieve a given competency (Bernstein et al., 2014).

Today, it is understood in many parts of the world that PhD preparation worldwide must include more than the traditional academic, disciplinary, analytical, and technical knowledge and skills. Transferable skills and translational competencies are also an essential element of PhD education. They provide the foundation for leadership necessary in the global knowledge economy.

REFERENCES

- Association of American Geographers, AAG. (2009). Solem, M., K. Foote, J. Monk (eds), *Aspiring Academics: A Resource Book for Graduate Students and Early Career Faculty*. Pearson Prentice Hall: Upper Saddle River, NJ.
- Association of American Geographers, AAG. (2009). Solem, M., K. Foote, Teaching College Geography: A Practical Guide for Graduate Students and Early Career Faculty. Pearson Prentice Hall: Upper Saddle River, NJ.
- Association of American Geographers, AAG. (2013). Solem, M., Foote, K., & Monk, J. (eds). *Practicing Geography: Careers for Enhancing Society and the Environment*. Pearson Prentice Hall: Upper Saddle River, NJ.
- Association of American Geographers, AAG. (2013). Enhancing department and graduate education in geography. Retrieved from <http://www.aag.org/edge>
- Aanerud, R., Homer L, Rudd, E., Morrison, E, Nerad, M., & Cerny, J. (2007). Widening the Lens on Gender and Tenure: Looking beyond the Academic Labor Market. *NWSA Journal*, 19:3.
- ACDDOGS. (2012). *Outcomes from a workshop to explore approaches to quality doctoral research training in our region: 15-16 February 2012*. Canberra: Australian Government.
- Auriol L., M. Misu, R.A., Freeman. (2013). "Careers of Doctorate Holders: Analysis of Labour Market and Mobility Indicators." *OECD Science, Technology and Industry Working Papers 2013/04*. OECD Publishing.

- Australian Qualifications Framework Council. (2013). *Australian Qualifications Framework*. Adelaide: Australian Qualifications Framework Council.
- Barnacle, R., & Dall'Alba, G. (2011). Research degrees as professional education? *Studies in Higher Education* , 36 (4), 459-470.
- Bartelse, J., & Huisman, J. (2008). In Nerad, M. & Heggelund, M. (Eds.). *Toward a global PhD? Forces & forms in doctoral education worldwide* (pp.101-116) Seattle, Washington: University of Washington Press.
- Bernstein, B., B. Evans, J. Fyffe, N. Halai, F. Hall, H-S. Jensen, H. March, S. Ortega. (2014). "The continuing Evolution of the Research Doctorate". Chapter 1. In Nerad, M. and Evans B. (eds.). (2014). *Globalization and Its Impacts on the Quality of PhD Education Worldwide. Forces and Forms of Doctoral Education Worldwide*. Rotterdam, Netherlands: Sense Publishers.
- Blumenfield, T. and Nerad, M. (2012). International Assessment: Developing a Research Agenda for (Post)graduate Education and Collaboration. *Australian Universities Review*, 54(1), 72-83.
- Boud, D., and Lee, A. (eds). (2009). *Changing Practices of Doctoral Education*. London: Routledge.
- Carter S. and Laurs D. (eds). (2014). *Developing Generic Support for Doctoral Students: Practice and Pedagogy*. London: Routledge.
- Chambaz, J. (2008). *Reforming doctoral education in Europe: A response to global challenges*. Paper presented at the European University Association Council for Doctoral Education Launch, June 1-3, in Lausanne, Switzerland.
- CIRGE Spotlight #2. (2008). Rudd, E., Nerad, M., Emory, M., and Picciano, J. *Professional Development for PhD student: Do they Really Need It? Findings from Social Science PhDs—Five+ Years Out*. CIRGE: Seattle, WA.
www.cirge.washington.edu
- CIRGE Spotlight #3. (2008). Picciano, J., Rudd, E., Emory, M. and Nerad, M. (2008). on Doctoral Education: Does Time-to Degree Matter? Findings

from Social Science PhDs—Five+ Years Out. CIRGE: Seattle, WA.
www.cirge.washington.edu

COSEPUP (1995). *Reshaping the graduate education of scientists and engineers*. Washington DC: National Academy Press. Accessed August 12, 2008.
http://books.nap.edu/openbook.php?record_id=4935&page=2

Department of Education, Science and Training. (2003). *Backing Australia's Ability: The Australian Government's innovation report 2003-04*. Retrieved from Commonwealth of Australia:
http://backingaus.innovation.gov.au/reports/03_04/innov03_04.rtf

DIISRTE. (2011, October). *Defining quality for research training in Australia: National consultations*. Retrieved November 20, 2014, from
http://www.hestandards.gov.au/sites/default/files/DefiningQualityforResearchTraininginAustralia_0.pdf

DIISRTE. (2012). *Selected higher education statistics 2012 staff highest qualification*. Retrieved November 20, 2014, from Australian Government Department of Education: <http://docs.education.gov.au/node/33887>

Dill, D. and F. van Vught (eds). (2010). *National Innovation and the Academic Research Enterprise: Public Policy in Global Perspective*. Baltimore: Johns Hopkins University Press.

Enders, J. (2004). Research training and careers in transition: A European perspective on the many faces of the Ph.D. *Studies in continuing education*, 26, 419-429.

European Science Foundation, ESF. (2012). *Developing Research Careers in and Beyond Europe: Enabling, Observing, Guiding and Going Global*. A report by the ESF Member Organization Forum European Alliance on Research Career Development (EARCD). Strasbourg: Strasbourg: an NSF publication.

European University Association. (2005). *Doctoral Programmes for the European Knowledge Society: Report on the EUA Doctoral Programmes Project 2004-2005*, p. 32, accessed at

http://www.eua.be/eua/sp/en/upload/Doctoral_Programmes_Project_Report.1129278878120.pdf

Feetham, E. (n.d.). Professional development programs for graduate students: Best practices. Unpublished ms., University of Washington Graduate School, Seattle, Washington.

Feldman, A 2008. Does Academic Culture Support Translational Research? CTS: Clinical and Translational Sciences 1,2: 87–88. Available at: <http://ccts.uth.tmc.edu/what-is-translational-research>.

Flores, E. (2011). Becoming a Researcher: A Qualitative Study of the Apprenticeship Model in Doctoral Education, unpublished dissertation, University of Washington, Seattle.

Flores, E. and Nerad M. (2012). Peers in Doctoral Education: Unrecognized Learning Partners. *New Directions for Higher Education*, 157 (Spring 201), 73- 83.

Gibbons, M, C Limoges, S Schwartzman & M Trow (1994). *The New Production of Knowledge: The Dynamics of Science and Research in Contemporary Societies*. London: Sage.

Gilbert, R., Balatti, J., Turner, P., & Whitehouse, H. (2004). The generic skills debate in research higher degrees. *Higher Education Research & Development*. 23, 375-388.

Golde, C. M., & Dore, T. M. (2001). *At cross purposes: What the experiences of today's doctoral students reveal about doctoral education*. Survey initiated by the Pew Charitable Trusts. Philadelphia: Pew Charitable Trusts. Available at <http://www.phd-survey.org/report%20final.pdf> (accessed April 4, 2012).

Harman, K. (2008). Challenging Traditional Research Training Culture: Industry Oriented Doctoral Programs in Australian Cooperative Research Centres. In Välimaa, J & O-H Ylijoki (eds): *Cultural Perspectives on Higher Education*. Springer Books. Available at: <http://www.springer.com/social+sciences/book/978-1-4020-6603-0>.

- Kehm, B. Huisman, J. ,Stensaker, B.(eds). (2009) *The European Higher Education Area: Perspectives on a Moving Target*. Rotterdam, Taipei: Sense Publishers.
- LERU (2014). Advice Paper. Bogle, D. (January). Good Practice Elements in Doctoral Training.
<http://www.leru.org/index.php/public/publications/category/advice-papers/>
- Manathunga, C, R Pitt et al. 2009. Research Students' Graduate Attribute Development: Cooperative Research Centre (CRC) Graduate Perceptions and Employment Outcomes. *Assessment and Evaluation in Higher Education* 34,1: 12.
- Manathunga, C., & Wissler, R. (2003). Generic skill development for research higher degree students: An Australian example. *International Journal of Instructional Media* , 30 (3), 233-246.
- Meek, VL, U Teichler & M-L Keraney 2009. *Higher Education, Research and Innovation: Changing Dynamics*. Report on UNESCO Forum on Higher Education, Research and Knowledge 2001–2009. Kassel, Germany: International Center for higher Education and Research.
- Morrison, R., Rudd E., Nerad, M. (2011). Early Career of Recent U.S. Social Science PhDs. *Learning and Teaching: The International Journal of Higher Education in the Social Science*, 4 (2), 6-29.
- Nerad, M. & Cerny, J. (1999). Postdoctoral Patterns, Career Advancement, and Problems, in American Association for the Advancement of Science, *Science*, 285, 1533-1535.
- Nerad, M. & J. Cerny. (2000). Improving doctoral education. *CGS Communicator* XXXIII (2), 6. Council of Graduate Schools, Washington. D.C.
- Nerad, M. (2004). The PhD in the US: Criticisms, Facts and Remedies, *Higher Education Policy*, 17(2), 183-199.
- Nerad, M., Aanerud, R. & Cerny, J. (2004). So You Want to Be a Professor! Lessons from the PhDs—Ten Years Later Study. In D. Wulff, and A. Austin (eds.), *Paths to the Professoriate: Strategies for Enriching the Preparation of Future Faculty*. San Francisco: Jossey-Bass.

- Nerad, M & Heggelund, M. (eds). (2008). *Toward A Global PhD? Forces and Forms in Doctoral Education Worldwide*. Seattle: University of Washington Press.
- Nerad, M. (2009). Confronting Common Assumptions: Designing Future-oriented Doctoral Education. In R. Ehrenberg and Ch. Kuh (eds.) *Doctoral Education and the Faculty of the Future* (80-89). Ithaca, New York: Cornell University Press.
- Nerad, M. (2010). Globalization and the Internationalization of Graduate Education: A Macro and Micro View. *Canadian Journal of Higher Education*, 40 (1), 1-12.
- Nerad, M. (2012). Conceptual Approaches to Doctoral Education: A Community of Practice. *Alternation*, 19 (2), 57-72.
- Nerad, M. & Evans, B. (Eds.). (2014). *Globalization and Its Impacts on the Quality of PhD Education Worldwide. Forces and Forms of Doctoral Education Worldwide*. Rotterdam, Netherlands: Sense Publishers.
- National Science Foundation NSF (2012). *Science Indicators 2012 and 2014*. Washington, D.C.: NSF Publication.
- Nyquist, J. (2002). The PhD: A tapestry of change for the 21st century. *Change: The Magazine of Higher Learning*, 34(6), 12–20.
- OECD, 2014, The PhD Bubble. ParisTechReview.
<http://www.paristechreview.com/2014/01/29/phd-training-outstrips-demand/> accessed via OECD website.
- Peseta, T., & Brew, A. (2009). Supervision development and recognition in a reflexive space. In D. Boud, A. Lee, D. Boud, & A. Lee (eds.), *Changing practices in doctoral education* (pp. 126-139). Oxford: Routledge.
- Quality Assurance Agency for Higher Education. (2004). Code of practice for the assurance of academic quality and standards in higher education, sec. 1: Postgraduate research programmes. Gloucester: Quality Assurance Agency for Higher Education. Available at <http://www.qaa.ac.uk/Publications/InformationAndGuidance/Documents/postgrad2004.pdf> (accessed April 4, 2012).

- Ritter, M. (2008). PhD education in the UK: Building transferable skills. Presentation for the 2008 CGS/NSF Workshop: A Fresh Look at PhD Education. National Science Foundation, Stafford I Board Room 1235, Arlington, VA.
http://www.cgsnet.org/portals/0/pdf/CGSNSF2008_Ritter.pdf.
- Roberts, G. (2002). *Set for success: The supply of people with science, technology, engineering and mathematics skills*. Report submitted to the Chancellor of the Exchequer. London: HM Treasury.
- Rudd, E. and Nerad, M. (2014) Career Preparation in PhD programs: Results of a National Survey of Early Career Geographers. *GeoJournal*, on-line journal, published 8-17-2014, Springer, (publication is available at link.springer.com).
- Shulman, L. S. (2005). Signature pedagogies in the professions. *Daedalus*, 134(3), 52–59.
- Slaughter, S., & Rhoades, G. (2004). *Academic Capitalism and the New Economy: Markets, States and Higher Education*. Baltimore, MD: Johns Hopkins University Press.
- Schlemper, B. J. Adams, M. Solem (eds) (2013). *The Professional Geographer. Geographers in Business, Government and Non Profit Organizations- Skills, Challenges, and Professional Identities*. London: Routledge.
- Solem, M., Cheung, I., and Schlemper, B. (2008). Skills in Professional Geography: An Assessment of Workforce Needs and Expectations. *The Professional Geographer*, 60(3): 1-18.
- Talentalign (2012) Skills and competencies <http://www.talentalign.com/skills-vs-competencies-whats-the-difference/> accessed 11/22/2014.
- Task Force on Higher Education and Society. (2000). *Higher education in developing countries: Peril and promise*. Washington, DC: Task Force on Higher Education and Society, World Bank.

UK GRAD Programme. (2005). Autumn update on emerging practice on the use of personal development planning (PDP) for postgraduate researchers (PGRs).

Vitae 2008 <https://www.vitae.ac.uk/vitae-publications/rdf-related/researcher-development-statement-rds-vitae.pdf>

Walker, G. E., Golde, C. M., Jones, L., Bueschel, A. C., & Hutchings, P. (2008). *The formation of scholars: Rethinking doctoral education for the twenty-first century*. San Francisco: Jossey-Bass.

Ward, M.-H. (2013). *Living in Liminal Space: The PhD as accidental pedagogy*. Sydney: Unpublished Thesis.

Weisbuch, r. (2005). Woodrow Wilson National Fellowship Foundation. *The Responsive PhD: Innovations in U.S. Doctoral Education*. Princeton, NJ: Woodrow Wilson National Fellowship Foundation.

Western, M., Kubler, M., Western, J., Clague, D., Boreham, P., Laffan, W., Lawson, A. (2007). "PhD Graduates 5 to 7 Years Out: Employment Outcomes, Job Attributes and the Quality of Research Training." Brisbane, Australia: The University of Queensland Social Research Center.

NOTES

¹ In the following list, the terms "competencies" and "skills" are used interchangeably to keep consistent with the reviewed literature.

² I want to thank Ziyan Bai who contributed to the literature review section.

³ This article also uses the term "doctoral advisor" to refer to the main professor who works with a doctoral student. In European countries and in Australia and New Zealand, this person is known as a "supervisor." If references are made "doctoral advisor" or "supervisor" in respect to Australia and Europe, these terms are interchangeable.

⁴ The following section has been adopted from an earlier article in *Perspectives in Education* (Nerad, 2011).

⁵ The following section is based on the article in *Alternation* (Nerad, 2012).