



University of **HUDDERSFIELD**

University of Huddersfield Repository

Williams, Dina, Smith, Kelly, Yasin, Naveed and Pitchford, Ian

Evaluating the state of enterprise training for post-graduate researchers in the UK

Original Citation

Williams, Dina, Smith, Kelly, Yasin, Naveed and Pitchford, Ian (2013) Evaluating the state of enterprise training for post-graduate researchers in the UK. *Education + Training*, 55 (8/9). ISSN 0040-0912

This version is available at <http://eprints.hud.ac.uk/id/eprint/18459/>

The University Repository is a digital collection of the research output of the University, available on Open Access. Copyright and Moral Rights for the items on this site are retained by the individual author and/or other copyright owners. Users may access full items free of charge; copies of full text items generally can be reproduced, displayed or performed and given to third parties in any format or medium for personal research or study, educational or not-for-profit purposes without prior permission or charge, provided:

- The authors, title and full bibliographic details is credited in any copy;
- A hyperlink and/or URL is included for the original metadata page; and
- The content is not changed in any way.

For more information, including our policy and submission procedure, please contact the Repository Team at: E.mailbox@hud.ac.uk.

<http://eprints.hud.ac.uk/>

Evaluating the state of enterprise training for post-graduate researchers in the UK

Dina Williams, Senior Lecturer, the University of Huddersfield
Queensgate, Huddersfield, HD1 3DH
44(0)1484 473277; d.williams@hud.ac.uk

Kelly Smith, Head of Enterprise, the University of Huddersfield

Naveed Yasin, Research Assistant, the University of Huddersfield

Ian Pitchford, Research Excellence Framework & PGR Manager, the University of Huddersfield

Keywords: Enterprise Education, Postgraduate Researchers, Higher Education Institution

Abstract

Purpose - This paper seeks to provide insight into the state of enterprise education and skills training at post-graduate level at UK higher education institutions (HEIs).

Design/Methodology/Approach – Case study

Approach. A case-study research strategy was used to address the lack of existing research on enterprise training for PGRs. The initial task was to identify those UK universities which provide enterprise and entrepreneurship training for their PGRs. Based on this desk exercise, 5 universities were selected according to the nature and structure of their training programmes and geographical spread such that one university was included from Wales, Scotland, South of England, Midlands and North of England. The next stage of the research focused on gaining in-depth understanding of the enterprise training available to PRGs at selected universities through face-to-face semi-structured interviews with key personnel responsible for the design and management of PGR enterprise education programmes. The data collected was analysed using the Rugby Team Impact Framework to explore the training and development provision and structure, internal and external profile raising and awareness, staff and skills required, research-based practices, the reaction of participants, behaviour and outcomes, stakeholder engagement, and ongoing strategy

Results. The study highlights the current best practices in enterprise education for PGRs. It identified key factors contributing to the success of selected programmes including the development of objectives, the modes and pedagogy of delivery, and the involvement of stakeholders.

Implications. The results of the research enable universities across the UK to drive the development of a suite of learning opportunities tailored to the needs of the PGR population in order to overcome barriers to engagement and best promote entrepreneurial activity - both within employment and as new venture creation - as appropriate career options.

Originality/Value. This paper contributes to the limited literature concerning the state of enterprise training for PGRs which provides a detail analysis of current provisions useful for benchmarking and planning purposes and which can be useful to researchers and enterprise education providers.

Evaluating the state of enterprise training for post-graduate researchers

Introduction

Despite significant growth in policy calls and initiatives concerned with fostering entrepreneurial universities and enterprising graduates (BERR, 2008; BIS, 2010a, 2010b, 2011; Wilson, 2012), the main attention so far has been given to encouragement of entrepreneurship within undergraduate and master's courses with very little focus on the development of enterprising skills for those undertaking research degrees (McKeown et al., 2006). There is currently little published information on the state of enterprise education provision and the needs of postgraduate researcher students (PGRs) in relation to enterprise and entrepreneurship education, and few accessible examples of good practice (Phillips, 2010; Zalevski and Swiszczowski, 2009).

In the current economic climate there is an increased need for researchers to develop management and commercial awareness and provide training programmes for the new generation of young researchers (Gilbert, 2004; Gilbert et al., 2004; Nerad and Heggelund, 2008; Nerad, 2004; Thune, 2010). This reflects socio-economic trends over last 20-30 years including the closer integration of science and industry, the greater societal expectation for academia to contribute to economic development, and a need to respond to changes in the labour market for research students, including support for non-linear, flexible, and multiple career paths.

Enterprise training for PGRs is recognised as key to addressing challenges of economic recovery and long-term prosperity and is recognised in the development of doctoral training with enterprise skills, behaviours and attitudes explicitly identified by VITAE's Researcher Development Framework (RDF) and the Enterprise Lens on the RDF (VITAE, 2011a, 2011b). To address the needs of the wider society, the UK Research Councils set the assessment of social and economic impact of excellent research as a formal component of research evaluation within the national Research Excellence Framework¹, with an overall weighting of 20%, and yet researchers often receive little guidance on the economic exploitation of their research at the earliest stage of their careers as PGR. Recently introduced practices of UK and European universities reflects the shift from traditional apprenticeship models of doctoral training to the new realities of diverse career choices the needs of the knowledge economy (Enders, 2004) and demands of research councils as will be explored here.

Enterprise training for PGRs is becoming highly desirable to address the demands of economy and society described in more detail below. However until recently there has been no or limited formal training available to enable this to happen. For example, the "SET for Success" report indicated that postgraduate programmes do not "prepare people adequately for careers in business or academia" (Roberts, 2002, p. 111). Regardless of career choice (academia or industry), PGRs need a variety of enterprise skills in order to recognise and take advantage of opportunities developing from their work. The expectation is that a new generation of entrepreneurs will come from current university graduates and a new generation of innovation will stem from research undertaken by current PGRs. In addition, for those not intending to continue with a research career, development of enterprise and entrepreneurship skills through advanced postgraduate studies should provide transferable skills sought by employers.

This paper will explore the importance of enterprise education for PGR students from career and policy perspectives. It will introduce the Rugby Team Impact Framework (Bromley, Metcalfe, and Park, 2008) used to evaluate five case studies of PGR specific enterprise-related training programmes. Summaries of each case study is presented, exploring their structure and design, staff and resourcing, internal awareness raising, and how they were funded. Mechanisms for evaluating the programmes are explored along with potential or actual impact if known. Key learning points are also provided for each case study and general conclusions are drawn out in the final section.

Background

In the traditional model of higher education, academia reproduces itself through doctoral students (Enders, 2004). Success here depends on adequate socialisation: a process of social and intellectual integration into the structure of opportunities offered to graduate students through funding, work space, and helpful faculty members and peers. These resources, when they are available to the student, contribute to his or her integration in the field and, consequently, to the development of corresponding professional perspectives that give meaning to the pursuit of the PhD. The effectiveness of academic socialisation explains the relative stability of many features of the academic world, however, change is also an intrinsic feature of the university environment. Internal dynamics are not the only factor of transformation with external forces also contributing to change in the academic world. Recent developments in the doctoral training reflect complex social and economic changes such as 1. changing role of research in knowledge economy; 2. massification of student

¹ <http://www.ref.ac.uk/>

(including PGR) population; 3. changes in the labour market and a need for preparation for employment; and 4. internationalisation of doctoral training (Enders, 2004; Haynes and Metcalfe, 2007; Park, 2007).

The needs of knowledge economy

The modern stage of economic development is often referred as “knowledge economy”, in which science-based knowledge is central to promote innovation. Increasingly, universities are integrating a new entrepreneurial role into traditional mission of research and education (Etzkowitz, 1998, 2004) which in turn affects their traditional functions. Education policies are, or it is argued should be, shifting more onto employability, entrepreneurship and collaboration with industry (Gibb, 2005). Changes in university-industry-government relationships (the Triple Helix model) impacts on PGR training through an increasing emphasis on entrepreneurial values and competencies, commercialisation of knowledge, and collaboration with industry and/or government (Thune, 2010)

The UK's long-term performance and competitive advantage depend on its ability to generate new ideas and “the ability to create and then commercialize new products and processes, shifting the technology frontier as fast as their rivals can catch up” (Porter and Stern, 2002, p. 102). A ESRC report on the UK competitiveness (Porter and Ketels, 2003) concluded that although the UK has a strong science base, it lags in commercialisation of research and development results. Moreover the report highlights that the current level of UK innovation is insufficient to drive UK growth and close the productivity gap with key competitors. The need for enhancing the innovation base cannot be overestimated, particularly in times when the UK economy is recovering from financial crisis. In this respect there are substantial and growing expectations for the UK universities to play a significant role in engaging with business communities to stimulate innovation (BIS, 2010a; Smith and Beasley, 2011). Unquestionably the research function of universities remains a key to innovation, however more emphasis should be given to the importance of knowledge and human capital in the innovation process and subsequent competitiveness. It can be argued that universities increasingly need to become partners with knowledge-intensive firms, especially in an environment where public subsidies for core university activities are declining, and where subsidies for innovation and research are rising. Public-private partnerships, networks and alliances are already being established but more is needed (Wilson, 2012).

Disappointingly, a relatively recent view of Research Councils was that “the PhD provides neither a rigorous enough methodology training for those who go into academia, nor an appropriate initial and continuing professional development for those who go outside” (Park, 2007, p. 30). As a response to the Robert's review (Roberts, 2002) UK universities began embedding a range of skills within doctoral training programmes, culminating in the development of the Research Development Framework (VITAE, 2011a), and more importantly here, the ‘Enterprise Lens’ on the Framework (VITAE, 2011b). Thus, the practices of UK universities reflect a shift from the traditional apprenticeship model of doctoral training to the new realities of diversity of career choices and the needs of the knowledge economy (Enders, 2004).

Massification of Doctoral training and the PGR labour market

The massification of higher education, after transforming undergraduate education during the second half of the twentieth-century, is now becoming more visible at the doctoral level. In the UK, higher education has passed the critical demarcation line between elite and mass higher education. Some countries, like Finland, Italy and Portugal, made explicit attempts to strengthen their home-grown PhD output, which doubled in just one decade; PhD output in the UK also doubled in the same period with France and Germany experiencing a 30% increase following the expansion of undergraduate education (Enders, 2004). By 2009, the number of registered PGRs in the UK reached nearly 31,000, a 14% increase compared to 2003 (BIS, 2010b). The increase is not restricted to home students with the reputation of UK universities attracting a large number of overseas PGRs mainly in STEM subjects (Haynes and Metcalfe, 2007).

Graduates at all levels are expecting and expected to be trained for what is increasingly seen to be a dynamic market for ‘knowledge workers’. However, the career trajectories and expectations of PhD holders are still relatively limited, with a career in HE reported as the preferred career choice of 49% of those with a firm idea (Hodges et al., 2011) (Mellor-Broune et al., 2012). Some large-scale surveys reveal that although many PhD holders are employed in the higher education and research sectors, a surprisingly high proportion found further employment in other sectors and occupations (Enders, 2004). In the UK the employment rate among PhD graduates remains stable at 80%, with around 50% employed in the broadly defined education sector. Research is a primary occupation for PhD graduates with 22% working as postdoctoral researchers in higher education institutions, 14% employed in research roles outside academia. Teaching roles accounted for 22% of PhD occupation with the large majority in higher education (Haynes and Metcalfe, 2007).

Evidence indicates sectorial composition has shifted as public and non-profit employers as well as those in industry have employed proportionally more PhD holders compared with academia (Stephan, 1996). A recent VITAE report (Hodges et al., 2011) on employment trajectories of Doctoral graduates reveal that employment in higher education diminishes over time, with a particularly noticeable decline two years after doctoral

graduation. The Wilson Review (Wilson, 2012) draws upon the result of VITAE survey emphasising only 23% of PhD graduates were employed as academic staff 3.5 years after graduation. It stated that “*there is a distinct disconnect between the aspirations of research students and the reality of their future career pathways*” (Wilson, 2012, p. 62)

It can be argued from the literature presented above that there is a clear need to develop broader employability skills of doctoral degree holders beyond those traditionally required for academia. The traditional model of the doctoral training was designed to prepare PGRs exclusively for an academic career, however the practical reality and growing need to anticipate the needs of the labour market outside academe calls for such training to be decoupled from its strong association with the academic labour market (Enders, 2004).

Government concern and policies

Prior to last two decades, doctoral training was rarely an explicit concern of policymakers or university leaders. However, recent attempts to initiate explicit policies for doctoral training in the UK show that the landscape has changed (BERR, 2008; BIS, 2010a, 2010b, 2011, 2012; Wilson, 2012).

Roberts (2002) was the first to draw attention to the need for addressing skills development for PGRs in his “SET for Success” report (SET here standing for Science, Engineering, and Technology). The report stated that postgraduate programmes do not “prepare people adequately for careers in business or academia” (Roberts, 2002, p. 111), particularly highlighting issues around lack of management and commercial awareness. Regardless of career choice (academia or industry) PGRs in SET subjects are more likely to be working on novel technologies that may result in commercial products. A variety of enterprise skills are needed in order to recognise and take advantage of opportunities developing from their work. As a result of Roberts’ report a number of initiatives were implemented in Government-led drives such as Research Council UK academic fellowships, and EPSRC funding for Enterprise and Entrepreneurship transferable skills training for researchers. The Wilson Review (Wilson, 2012) accepted that advances have been made in improving provision of skills training for PGRs since publication of the Roberts’ Review, however, the results are patchy and the career path for researchers in business or in academia needs further definition. Wilson (2012) also noted that PGRs are perceived to lack ‘work wisdom’, commercial awareness, understanding of the market, and work experience as well as being seen to be overspecialised with unrealistic expectations of the world of work; this create barriers to employers looking to recruiting PhD graduates.

Looking beyond the UK, the policy focus in doctoral level training in Europe is on increasing the relevance of doctoral level training for careers outside academia, particularly highlighting issues around graduate employability and the development of transferable skills with an objective to equip PGRs to work in a wide range of employment sectors (Borrell-Damian, 2009; European Commission, 2003; Thune, 2010). Many of the EU initiatives reframing the content and structure of doctoral training draw on the experience of the UK.

In the United States there is a rising concern on the content, structure and process of preparing PGRs and young researchers for present and future societal needs (Nerad, 2004). A report commissioned by Council of Graduate Schools (Wendler et al., 2010) stresses that the US is losing its position in graduate education and calls for the nature of US PhD education to respond to needs of employers outside academia to counteract this trend. This has led to a number of initiatives launched by charitable foundations such as the National Science Foundation, Council of Graduate Schools, The Carnegie Foundation, and The Woodrow Wilson Foundation. Whereas the situation in the USA is de-centralised, highly diverse and varies from institution to institution, The Path Forward report (Wendler et al., 2010) again recognises the advances made by the UK in doctoral training since 2002 after the publication of Roberts’ review.

Despite strong policy calls and arguments for enterprise skills training to be provided for PGRs internationally, there is a lack of case studies and evidence base to help UK universities develop and deliver good quality skills training programmes for their PGR community. This paper aims to fill a gap in the literature, describing five case studies of PGR-specific enterprise skills programmes currently being offered by UK universities. The following sections describe the frameworks used to develop the case studies, give an overview of the programmes provided, and draw out learning points to assist those looking to develop and offer similar schemes.

Methodology

The Framework for Evaluating Impact Training of Developing Researcher Skills

The methodological foundation of this research is VITAE’s Researcher Development Framework (VITAE, 2011a) outlining a new approach to researcher development to enhance universities’ capacity to build the high-skilled workforce and develop world-class researchers.. The RDF urges researchers, as part of their life-long personal and career development from PGR level onwards, to demonstrate “high motivation and

commitment to taking forward enterprising ideas,” and to “appreciate the significance of the research-enterprise relationship.” A more detailed look at enterprise-related skills, behaviours and attributes related to PRG development can be found in the VITAE’s Enterprise Lens on the RDF(VITAE, 2011b).

The Rugby Team Impact Framework recognised by VITAE (Bromley et al., 2008) is an applied evaluation model for customised training and the development of researchers in Higher Education. The framework was developed to provide users with a structure to demonstrate the appropriateness of skills development of researchers, to provide feedback to funding bodies, to inform the enhancement of quality of the experience for PGRs, research staff and individuals in HEIs, and to assess the impact of initiatives.

Figure 1 illustrates the Rugby Team Impact Framework. According to the framework the programme of training and development should focus on four levels of outcomes. It is intended to enable researchers to continue CPD throughout their career, be able to pursue and continue research career activities in the form of attracting research funding, managing people and projects. It is intended to improve the status and recognition of researchers in higher education and beyond, to make UK trained researchers globally more attractive, and to aid recognition of the value and purpose of the PhD qualification.

Rugby Team Impact Framework:

Logic Diagram - IMPACT levels (levels 0 - 4)

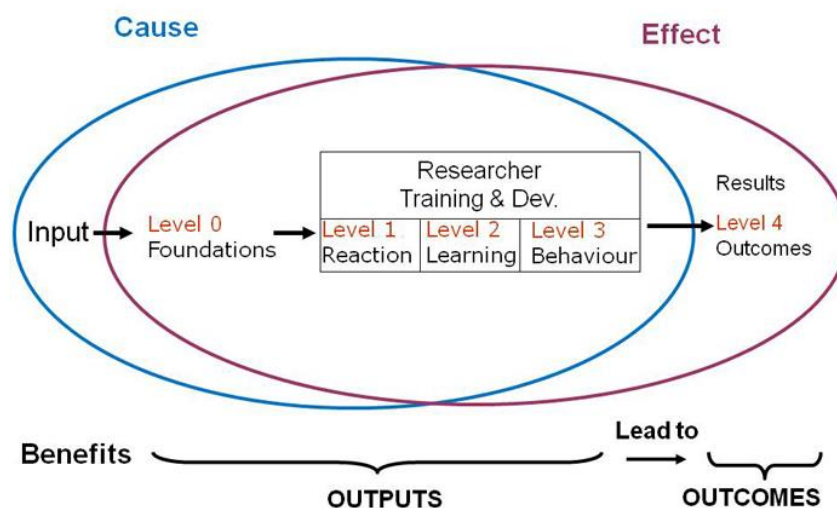


Figure 1 Rugby Team Impact Framework (Bromley et al., 2008)

The first Level 0 (Foundation) is an important part of developing best practices from the start-up stage of the programme. Levels 1-4 (Reaction, Learning, Behaviour and Outcomes respectively) are focussed around the student experience and can only be shared if the lead educators have some form of analysis or evaluation of the programme.

Desk Study – Identification of Case Study Candidates

A desk study was conducted to identify candidate programmes for case study research. A list of around 300 British HEIs was compiled using the UCAS recognition list. Further education colleges offering higher education degrees were subsequently excluded from analysis as they do not offer postgraduate research programmes.

A three-way manual search of publicly available web-based information was conducted as described below for each of the remaining HEIs to identify current postgraduate enterprise training programmes.

1. A web search was conducted entering the title of each HEI with keywords such as “PGR Enterprise”, “Postgraduate entrepreneurship”, “Enterprising skills”, “Doctoral Enterpriser”, “Academic Enterprise”, or “Postgraduate skills” etc.

2. A search and manual browse was conducted across internal newsletters and various areas of each HEI's website such as enterprise, business and skills development, the graduate centre, research degree information, and support for postgraduate students/researchers, etc.
3. A search was conducted using the internal University search engine to confirm if programmes were available.

Intermediary websites such as VITAE were also used to help identify additional PGR training programmes that may not have been publicised through, or made publically accessible via an HEI's own website. Programmes that were not specifically targeted to PGRs were excluded from further analysis.

The desk study identified 14 universities running independent enterprise training programmes specifically aimed at PGRs, and 4 regional programmes run as joint initiatives by collections of HEIs. 5 programmes were selected for further research in the case study phase based on the nature and structure of their training programmes as well as geographical spread. The case study institutions are introduced in Table 1.

INSERT TABLE 1 ABOUT HERE

Interview Guide for Case Study Research

Case studies were constructed following an in-depth semi-structured interview and collection of supporting literature. The interview guide was designed to reflect the levels described in the Rugby Team Impact Framework and gain an insight into the programmes, activities and techniques used by the lead educators. Issues to be covered included:

Foundations:

1. Structure and design of the programme, including whether a needs analysis was conducted
2. Staff resources required, including professional development
3. How awareness of the programme was raised internally, including terminology and definition considerations
4. How design and delivery of the programme was funded

Level One – Reaction:

5. How many students attended
6. Did the programme attract students that wouldn't typically consider a career in enterprise and entrepreneurship
7. What is the initial reaction by staff and students

Levels Two and Three – Learning and Behaviour:

8. How have PGRs been able to apply and/or transfer the skills learned through the programme

Level Four – Outcomes:

9. Did the course stimulate any new product or ventures? If yes, can you please provide further details?
10. How many researchers considered entrepreneurship as a legitimate career option prior and post to the activity?
11. Did their attitude change towards evaluating commercial feasibility of their research?

The completed case study reviews were approved by the lead interviewee.

Analysis and discussion

Five case studies were developed through the use of interviews from the lead educators responsible for Postgraduate Enterprise training programmes as described above. Table 2 presents a summary of each

programme broken down into each of the Rugby Team Impact Framework levels. A description of each programme is provided below.

INSERT TABLE 2 ABOUT HERE

University A

Arguably, the training offer of University A is the most long-standing and established among all the reviewed cases. At present there are over 10 optional module topics and specific programmes available for PhD researchers and Research staff throughout the year. The development of the Enterprise training started 5 years ago within the University's Enterprise Centre - now an integral part of their Business School. The development and delivery of the 'Research to Enterprise' project was funded by EPSRC with an annual budget of £150,000. Over the last 3-4 years more than 2,200 people have attended workshops; more than 1,700 people have attended the annual summits and more than 130 people have attended the Enterprise School. According to the University, these figures represent only 60% of actual interest as many events are oversubscribed and the University has to turn down large number of people.

Each training programme has a generic element applicable across different discipline and a tailored component to address the needs of a particular school/faculty. The enterprise training offered largely addresses recommendations from the Roberts "SET for Success" report as well as demands from research councils. According to the academic director, the main benefit of the training provided comes from the mixing of students with different backgrounds:

"When you get business people mixing with scientists and various parts of the University, it works out quite well. I suppose if we are looking at skills of individuals we are adding a layer of skills to take advantage of opportunities and entrepreneurship helps them with that and in anything that they do."

The programmes proved to be a success. Participants have been involved in the setting up of various types of business ventures but, most importantly, there is a gradual shift in perception of entrepreneurship as a legitimate career option and many now see the commercial potential of their research projects:

"on average, in the Enterprise School there were approximately 10% who have been able to clarify their ideas and been able to take it forward. With the mentoring approximately 20% of participants have a business idea. ... "Some researchers hadn't seen it [commercial potential] before but could now see the commercial application ... and started recognising opportunities everywhere. Some students have engaged with industry following the completion of their PhDs and might start businesses at a later stage. The signs are quite positive from what we have been doing here."

The University collected immediate feedback from participants; however, there is no formal evaluation of the mid- and long-term impact of the training programmes.

Learning points

- Engineering and live sciences were key schools
- Include social enterprise course content
- Use a website to channel communication and use Google analytics to analyse the effectiveness
- Use internal publications to create awareness and provide exposure across the University
- Keep subject areas broad and use broad terminology for it to appeal to all students
- Use the Enterprise Centre within the University
- Use industry faculty and private trainers with industrial experience so that the training is practitioner led.
- Collect evaluation feedback at the end of the programme

University B

University B offers two distinctive training programmes to Doctoral or/and Post-Doctoral researchers: the Talent Pool and the Postgraduate Enterprise Summer School. Enterprise skills development is organised and coordinated by the Entrepreneurship and Innovation unit within the University's Academic Services division.

The Talent Pool is a unique programme developed by University B to support Researchers in developing knowledge transfer relationships with businesses. Through an intensive training programme, researchers are

challenged to deal with common business issues. The Talent Pool was created with a specific focus around consultancy aspects and this was supplemented through the use of interviews, focus groups, and workshops that were used to develop the programme content and mode of delivery. In addition to a 'thin' 6-week Talent Pool, University B offers a Postgraduate Enterprise Summer School (PESS): an intensive week-long programme developed specifically for PGRs, tailored more towards developing enterprise skills.

The content of both programmes was developed based on an internal training needs analysis and suggestions from the Roberts' Report:

"The training forms part of the Roberts recommended training programme as it supports the transferability of skills and prepares researchers with careers in and outside of academia".

Whilst the Talent Pool focuses mainly on developing general transferable skills for consultancy, the PESS emphasis is on enterprise skills such as business strategy, marketing, and finance. At the end of the training programme, the team collects an immediate evaluation feedback on the course content and to reflect on the future direction of the participants' career path. Again, there is no formal evaluation of mid- and long-term impact of the training.

Learning Points

- Involve supervisors they have more contact with PhD students and can encourage them to participate
- Speak to the research community to identify their needs and ensure the programme is designed according to researchers' demands
- Delivery should be flexible and participants' preferences should be considered (e.g. weekends, residential, one day a week, etc.)
- "To get good people doing the delivery is important"
- Invite guest speakers to events
- Do not invite undergraduate entrepreneurs to speak to PhD students as they will not be able to relate to them. A current or alumni PhD in the area of entrepreneurship is far more appealing and engaging for fellow PhD researchers. *"Richard Branson wouldn't be able to relate to them, it might be interesting- but there is a difference."*

University C

University C has delivered an extracurricular enterprise and commercialisation skills programme since 2009 aimed specifically at Postgraduate researchers. It is designed to develop transferable enterprise and entrepreneurship skills with a central focus on intellectual property. The programme is organised and coordinated by the Student Enterprise team and accommodates approximately forty participants in each cohort, delivered three times a year. The programme is non-residential and is boosted by funding from the Welsh Government and EPSRC.

The 9-10 week programme offers Postgraduate Researchers and Postgraduate taught students an opportunity to develop commercial awareness and commercial skills by focussing on the Universities internal intellectual property policies:

"We want our graduates to possess commercial awareness and knowledge of the commercial environment. They should also have the skills in terms of enterprise and innovation. The ...programme is aligned with our innovation and engagement strategy and also with our employability and enterprise strategy."

The training programme content reflects the results of an initial training needs analysis and is adapted to particular IP projects, mainly in medical, life sciences, pharmaceutical and science areas.

Although there is no formal evaluation of mid- and long-term impact of the training, the informal evidence suggest that the programme has been effective in developing the transferable skills stated in its aims and objectives. Feedback received from the participants indicated that attending the programme helped them professionally and with their career development plans.

Learning Points

- Gain involvement from industry
- Create activity which is beneficial to the participant
- The programme must be creative, exciting and professional
- The projects need to be live, good quality, appealing and engaging

- Allow participants to discover learning opportunities and consider an innovative approach as this will develop their skills

University D

University D delivers a large range of transferable skills development activities and programmes which are compulsory for PhD students to progress throughout their research. These include presentation skills, networking, business orientated finance and entrepreneurial activities.

The University's Graduate School offers short practitioner led activities and workshops in the area of intellectual property, guest entrepreneur events, workshops on writing a business plan, networking, commentary feedback which are based on the needs of their current PhD cohort. Many workshops are designed to offer PGRs an understanding of the concepts and language used in the business environment and to provide a framework to start-up a business.

As a part of broader network of European research universities in summer 2011, University D hosted its second Doctoral Summer School. Each of the group's summer schools is focused on a specific theme. The summer school held at University D aimed to provide PhD researchers with an opportunity for their personal and professional development through an interdisciplinary, intercultural and a truly international programme to stimulate the learning experience and future career opportunities. The programme focussed on developing knowledge and attributes on commercialising research and business ideas in an academic and business environment. The next Summer School will take part at the University of Barcelona and will address issues of open access (open education, open data and open knowledge).

The programme design not only takes the needs of students into consideration, but also addresses demands from funding councils and key organisational objectives:

"A research student may do a number of things, he may use his PhD to become an academic researcher in which he/she will have to work with businesses due to funding councils requiring translation of activities into specific outcomes or, they may work in a business for which enterprise and entrepreneurship skills would enhance the quality of their work, or alternatively they may choose to commercialise their research which will help them to understand different routes. PhD researchers need to have a reasonable amount of understanding at least at a conceptual level and at the level of motivation and understanding of the commercial environment."

The Graduate School recognises that it is too early to evaluate the full impact of the Doctoral Summer School, however anecdotal evidence suggest that it has had similar impact on PGRs as the broader entrepreneurship education offer which has the highest number of graduates starting a business in the UK and a large profile of businesses creating employment. There is a growing segment of students taking entrepreneurship as an alternative to seeking employment in academia at the University.

Learning Points

- Programmes should be practitioner led
- Deliver in a non-lecture format.
- Provide appropriate information and support
- Offer good solutions in a broad range of areas

University E

University E offers a range of enterprise and entrepreneurship programmes through a centre for entrepreneurship, situated in an award winning Business School. The centre for entrepreneurship offers approximately 20 unique programmes delivered at different levels ranging from undergraduate, postgraduate taught, PGRs, and research active staff. The offer includes a series of programmes in social entrepreneurship, technology road mapping, special events, internship programmes, enterprise workshops, and seminars. In October/November the University launched a new EPSRC funded initiative, an Enterprise Academy, addressing the needs of 900 Postgraduate Researchers in developing transferable skills in enterprise and entrepreneurship:

"The Enterprise Academy started as a pilot in October, 2011 consisted of thirty-eight researchers joined a team of leading academics and entrepreneurs to work an interdisciplinary idea to develop a business idea, business plan and business pitch with the ultimate goal of success in the Enterprise Challenge. Alongside with

mastering the theory behind business planning, participants have the opportunity to explore, develop and practice career enhancing skills in entrepreneurship."

The Enterprise Academy is an extension of the entrepreneurial spirit and ethos of the university.

"It is our aim to instil entrepreneurial confidence and behaviour within our research community which is embedded in all of our communities ranging from undergraduate to academic and professional services."

The design of the training programme reflected the results of a training needs analysis and was mapped against the vision and values of the University, incorporating key features of the Researcher Development Framework to equip researchers with relevant entrepreneurial attributes.

Despite its early age, the team at the Enterprise Academy believes that

"The impact has been immense! Not only on the participant but also on the organisational culture. The programme will be a flagship to go forward. We hope to get all of our programmes up to such excellent standards. We understand the tough financial climate ahead but will hopefully continue this programme next year with an improved format."

Learning Points

- The Project Team must allow a greater lead time
- Budgets must not be underestimated
- Consider different models to residential and non residential settings
- Consider flexible knowledge exchange (i.e. splitting the programme over a period of time)
- Trial and error
- Hire specialist academics in the teaching and administrative aspects of Entrepreneurship
- Undertake regular assessments (Level 2 and Level 3 evaluation)

Conclusions

Despite the limited experience of some of the initiatives presented in this paper, the case studies allow us to draw some valuable lessons which could be taken forward in the future enterprise training programmes for PGRs.

Universities are increasingly considering or offering enterprise and innovation-based postgraduate courses or commercialisation and technology transfer courses. McKeown *et al* (2006) note that most programmes aimed at taught postgraduate students were based in business schools; however, many of the most successful courses are based around practical commercialisation of a product and are located in faculties such as science, engineering or creative subjects. In the selected sample of five cases enterprise training offered to PGRs were developed and delivered at the pan-university level albeit with strong Business School input in at least two cases.

All cases presented here based the content of the training programme on an initial training needs analysis, recommendations from the Robert's report (2002), and in the case of research-intensive universities, on the demands of research councils. The breadth and theme of the content however, varies from programme to programme depending on institutional priorities and context. The evidence suggests that general practice is to have a broad, generic content that will work in different areas with a diverse audience. However, whilst the enterprise training has to work with a diverse audience, it might be appropriate - and indeed recommended - to provide tailored content according to attendees specific needs and subject contexts if this is known in advance. Although some of the cases presented above had a relatively narrow focus (e.g. commercialisation of IPR, or consultancy), all emphasised the development of transferable employability skills and of commercial awareness.

When it comes to enterprise skills training, there is still a large emphasis on business skills such as business and financial planning. These are often best suited to PGRs looking to start up their own business, become intrapreneurs for industry employers, or arguably to work in technology transfer at a university. However, those looking towards such career options are unlikely to remain in pure research and may be from a technical or business studies background. In some cases, although a broader approach to enterprise was used taking into account the needs of those who are likely to remain in an academic setting. Here there is a recognition that enterprise skills can be applied to academic activity - such as research grant bidding for

example, or where academics might discover commercial potential out of their research where a license or spin-out company can be created. Noticeably, although all universities recognised a need to address industry demand within PGRs skills and competencies set, none involved potential employers in developing and shaping the programmes. This suggests there is a need to engage a broader range of internal and external stakeholders in the planning and/or delivery of training programmes in order to meet their rapidly changing needs of industry employers.

The results of this study suggest that success in attracting PGRs to the enterprise training programmes is largely dependant on managing the interests of internal stakeholders – primarily research supervisors. All interviewees agreed that it's vitally important to "sell" the benefits of the programme to supervisors and reassure them that their students' participation in enterprise training will not jeopardise their academic progress. From an organisational perspective it is important to re-evaluate the role of the research supervisor in the modern context, recognising and rewarding good doctoral supervision and the support of appropriate career development of research staff,.

The study also suggests that there is a great diversity in way enterprise training programmes are delivered. Delivery varies considerably from a "thin" 6-10 week long course to intensive residential summer schools. The decisive factor here is how well the format of the delivery accommodates the preferences of PGRs and their commitment to their research work. The practice of the universities selected here indicates that intensive residential programmes with generic content are one of the most popular options. However it is suggest that PGRs will benefit most when the generic content of a summer school is coupled with more tailored thin courses where they can explore enterprise skills relevant to their area of research. Taking into consideration reduced central funding of the PRG's training it would be reasonable to assume that in the near future we will witness a shift from resource-consuming residential retreats to individual sessions or thinner courses that could be delivered more economically and relying more on the internal university resource and competencies base. However, as mentioned earlier, for successful programme it's vitally important to engage with industry both at stage of development and delivery. Although external stakeholders are not necessarily involved in the delivery of the programmes, most of reviewed programmes have industry experts at the heart of the delivery process; this may be at risk as funding contracts. We argue here that it is important to work with companies and experts who are engaged with technologies and research relevant to the PGRs. Examples of the selected universities demonstrate that even if a university has sufficient academic resources to deliver a programme, it should invite guest speakers and industry expert to enrich programme with practical application.

Although every case study university undertook programme evaluation to assess the immediate effect of the training, there was no evidence of built-in formal or informal evaluation of it's mid- and long-term impact. To a certain extent this is understandable as enterprise training for PGRs is new phenomenon and there is no a shared understanding of the expected outcomes. This area deserves further investigation. Understanding of mid- and long-term impact of the enterprise training would also assist with resolving the previously identified issue of financial sustainability particularly if it could be shown to improve success factors such as grant bidding conversion, university-business collaboration with resultant knowledge exchange activity, or PGR employability rates and perceptions of industry-related PhD graduate skills.

This study confirmed that the vast majority of enterprise skills development programmes are funded by EPSRC "Roberts' money" for enterprise and entrepreneurship transferable skills training for researchers. The role of externally provided funding in driving behaviour with culture change potential can not be underestimated. Disappointingly there are voices in the HE community arguing that without governmental support institutions will not be able to develop new or carry on with existing training programmes. In a situation when the resource base is diminishing, it's appropriate to assess the effectiveness of various approaches and share the best practices and benefits to wider audience. It is vital to continue the development of such programmes and to embed them into strategy and practice of the universities with adequately allocated resource base in order for UK universities to continue to set a global direction for skills development in doctoral training, maintaining their leadership position and ensuring future sustainability of enterprise training programmes.

In recent years, UK universities have made progress in addressing the needs for enterprise skills training for PGRs (Roberts, 2002; Wilson, 2012) (Roberts, 2002; Wilson, 2012) and responding to policy calls highlighting the needs of industry and the wider economy (BERR, 2008; BIS, 2010a, 2010b, 2011, 2012). Yet this is just a beginning of a process of full-scale integration of enterprise training in post-graduate education. It is hoped this paper will provide a useful contribution to further roll out by providing examples of practice and summarising the lessons learned by deliverers through the utilisation of a recognised framework by which training programmes can be evaluated. Research questions however remain. Further research is required to assess the mid- and long-term impact of enterprise skills training on career intentions; changes in attendees' attitudes towards research exploitation and entrepreneurship; employer/employee perceptions; institutional culture change and engagement with university-business collaborative activity.

Acknowledgements

The research reported here was funded by an Enterprise Educators UK (EEUK) Research and Education Grant.

References:

- BERR. (2008), *Enterprise: unlocking the UK's talent*, London: HM Treasury. Retrieved from
<http://www.berr.gov.uk/files/file44992.pdf>
- BIS. (2010a), *A strategy for sustainable growth*, Department for Business, Innovation & Skills. Retrieved from
<https://www.gov.uk/government/publications/a-strategy-for-sustainable-growth>
- BIS. (2010b), *One Step Beyond: Making the most of postgraduate education*, Department for Business, Innovation & Skills. Retrieved from
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/32409/11-944-higher-education-students-at-heart-of-system.pdf
- BIS. (2011), *Higher education: students at the heart of the system*, London: Department for Business, Innovation & Skills. Retrieved from
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/32409/11-944-higher-education-students-at-heart-of-system.pdf
- BIS. (2012), *Business-university collaboration: government response to the Wilson review*, Department for Business, Innovation & Skills. Retrieved from
<https://www.gov.uk/government/publications/business-university-collaboration-government-response-to-the-wilson-review>
- Borrell-Damian, L. (2009), *Collaborative doctoral education : university-industry partnerships for enhancing knowledge exchange ; doc-careers project*, EUA, Brussels.
- Bromley, T., Metcalfe, J. and Park, C. (2008), *The Rugby Team Impact Framework*, VITAE.
- Enders, J. (2004), "Research training and careers in transition: a European perspective on the many faces of the Ph.D", *Studies in Continuing Education*, Vol. 26 No. 3, pp. 419–429.

- Etzkowitz, H. (1998), "The norms of entrepreneurial science: cognitive effects of the new university–industry linkages", *Research Policy*, Vol. 27, pp. 823 – 833.
- Etzkowitz, H. (2004), "The evolution of the entrepreneurial university", *International Journal of Technology and Globalisation*, Vol. 1, pp. 64–77.
- European Commission. (2003), *Researchers in the European Research Area: One profession, multiple careers.*, Brussels: European Commission. Retrieved from http://ec.europa.eu/research/fp6/mariecurie-actions/pdf/careercommunication_en.pdf
- Gibb, A. (2005), *Towards the Entrepreneurial University: Entrepreneurship Education as a lever for change.* Retrieved from <http://www.irpds.com/FileEssay/karafarin-c-1386-10-30-m21.pdf>
- Gilbert, R. (2004), "A framework for evaluating the doctoral curriculum", *Assessment & Evaluation in Higher Education*, Vol. 29 No. 3, pp. 299–309.
- Gilbert, R., Balatti, J., Turner, P. and Whitehouse, H. (2004), "The generic skills debate in research higher degrees", *Higher Education Research & Development*, Vol. 23 No. 3, pp. 375–388.
- Haynes, K. and Metcalfe, J. (2007), *What do PhDs do? - Trends*, What Do PhDs Do? series by the UK GRAD Programme®, UK GRAD Programme, p. 44.
- Hodges, V., Metcalfe, J. and Pollard, E. (2011), *What do researchers do? Career paths of doctoral graduates*, VITAE.
- McKeown, J., Millman, C., Sursani, S.R., Smith, K. and Martin, L.M. (2006), "Graduate entrepreneurship education in the United Kingdom", *Education + Training*, Vol. 48 No. 8/9, pp. 597–613.
- Mellor-Broune, R., Jackson, C. and Hodges, V. (2012), *What do researchers want to do? The career intentions of doctoral researchers*, VITAE. Retrieved from <http://www.vitae.ac.uk/CMS/files/upload/WDRWTD-The-career-intentions-of-doctoral-graduates-Feb12.pdf>
- Nerad, M. (2004), "The PhD in the US: Criticisms, Facts, and Remedies", *Higher Education Policy*, Vol. 17 No. 2, pp. 183–199.
- Nerad, M. and Heggelund, M. (2008), *Toward a global PhD?: forces and forms in doctoral education worldwide*, University of Washington Press.
- Park, C. (2007), *Redefining the Doctorate*, The Higher Education Academy, p. 56.

- Phillips, R. (2010), "Encouraging a more enterprising researcher: the implementation of an integrated training programme of enterprise for Ph.D. and postdoctoral researchers", *Research in Post-Compulsory Education*, Vol. 15 No. 3, pp. 289–299.
- Porter, M.E. and Ketels, C.H.M. (2003), *UK Competitiveness: Moving to the next step* (No. DTI Economic Paper No 3), ESRC, p. 60.
- Porter, M.E. and Stern, S. (2002), *National Innovative Capacity*, The Global Competitiveness Report, World Economic Forum, pp. 102–119.
- Roberts, G. (2002), *SET for Success*, HM Treasury, p. 217.
- Smith, K. and Beasley, M. (2011), "Graduate entrepreneurs: intentions, barriers and solutions", *Education + Training*, Vol. 53 No. 8/9, pp. 722–740.
- Stephan, P.E. (1996), "The Economics of Science", *Journal of Economic Literature*, Vol. 34 No. 3, pp. 1199–1235.
- Thune, T. (2010), "The Training of 'Triple Helix Workers'? Doctoral Students in University–Industry–Government Collaborations", *Minerva*, Vol. 48 No. 4, pp. 463–483.
- VITAE. (2011b), *Enterprise lens on the Vitae Researcher Development Framework*, Research Councils UK.
- VITAE. (2011a), *Researcher Development Framework*, VITAE. Retrieved from <http://www.vitae.ac.uk/CMS/files/upload/Vitae-Researcher-Development-Framework.pdf>
- Wendler, C., Bridgeman, B., Cline, F., Millett, C., Rock, J., Bell, N. and McAllister, P. (2010), *The Path Forward :The Future of Graduate Education in the United States*, Princeton, NJ: Educational Testing Service. Retrieved from http://www.fgereport.org/rsc/pdf/CFGE_report.pdf
- Wilson, T. (2012), *A Review of Business-University Collaboration*, Department for Business, Innovation & Skills.
- Zalevski, A. and Swiszcowski, L. (2009), "Gender and attitudes to enterprise: Survey of UK doctorate students in science, engineering and technology", *Equal Opportunities International*, Vol. 28 No. 1, pp. 65–79.

Table 1 Case Study Universities

University Label	Location	Training Description	Programme	Start Date
University A	North West, England	Various		2007
University B	Midlands, England	Summer School		2005
		Talent Pool		2010
University C	Wales	Commercialisation Training		2009
University D	London, England	Summer School		2011
University E	Scotland	Enterprise Academy		2011

Table 2 Brief Description of Enterprise Training Provision at case-study Universities

[illegible]

Programme	Foundations				Impact Level 1 Reaction	Impact Level 2-3 Learning & Behaviour	Impact Level 4 Outcomes
	Structure/Design	Staff Resources	Internal Awareness	Funding			
Commercialisation Training	Focus on commercialisation of IP. Programme design is based on initial training needs assessment and adapted to the nature of IP projects	Administered and coordinated by Student Enterprise, delivered by external mentors	Postgraduate information pack, online notice boards, website, blogs, email, VLE.	EPSRC	30-50 participants in each cohort. There are 2-3 cohorts per year.	Data were not available	No formal framework to assess short- mid- and long-term impact of the programme. Anecdotal evidence of improved employability.
University D							
Essential Enterprise Skills for Early Career Researchers Summer School,	The programme design is based on a training need analysis (qualitative and quantitative). The programme is generic	Combination of internal and external experts	Emails; posters, leaflets, website advertisements, and staff awareness.	By the participants £375	Students are motivated by interest within their own area and future professional development	The impact tends to be focussed around the feasibility and reality of the commercialisation aspects	No formal framework to assess short- mid- and long-term impact of the programme. Anecdotal evidence of seeking employment outside of academia and start-ups.
University E							
Enterprise Academy	Mapped according to the Researcher Development Framework; based on training needs assessment; benchmarked against leading institutions. Generic in nature	Resources of the, Business School + external coaches and facilitators	Newsletters, websites, internal publications, posters, engagement with the Students Union and Career Services. Road Show	EPSRC	Initial feedback is positive	Too early	Culture change. No formal framework to assess short- mid- and long-term impact of the programme