REFORMING DOCTORAL EDUCATON:
There is a Better Way

August 2018

Rachel Spronken-Smith[*]
University of Otago

ABSTRACT

The traditional apprenticeship model for PhD education involves supervisors mentoring students through a substantive research project and ultimately into academia. Although about half of PhD graduates enter careers beyond academia, this apprenticeship model, with a narrow focus on thesis research has continued to dominate in many countries. While there are variations in terms of coursework requirements, the main assessment continues to be on the PhD thesis, and, in most countries, an oral defense of this thesis. The aims of this working paper are firstly to critique the dominant models of PhD education by using the lens of 'success', and secondly to consider an alternative model of PhD education. A PhD program may be deemed successful if it leads to high employment rates, high satisfaction with types of employment, and graduates who are well equipped for *being* in the world – in work and in society. Through examining these indicators of success, I argue that the North American and British PhD models may be failing, and suggest an alternative model based on 'constructive alignment', in which the graduate outcomes are well aligned with teaching and learning methods, and the assessment regime. This alternative model is still based on an apprenticeship approach but requires PhD programs to be tailored to the individual and their desired career pathway, so that alongside and through their research, they can develop a holistic set of graduate attributes – for 'doctorateness', for possible careers, and for global citizenship. This model has implications not only for the learning opportunities available to PhD students, but also for how we assess PhDs. Universities may need to develop programs to better support the career planning and professional development of PhD students. A portfolio or digital badge assessment approach, whether summative or formative, would allow PhD graduates to demonstrate the depth and breadth of knowledge and skills they have acquired through doctoral study, and better equip them for their chosen career pathway.

Keywords: PhD programs, doctoral education, graduate outcomes, graduate attributes, employability, digital badges

The education of PhD students has traditionally been associated with an apprenticeship type model in which supervisors mentor students into academia. Over the last decade in particular, there has been a growth in the number of PhD graduates, coupled with a decrease in the availability of mainstream faculty jobs. These factors, together with a growing awareness of the value of PhD graduates to positions outside academia, has meant that now about half of PhD graduates find careers beyond academia (e.g., ACOLA, 2016; Guthrie & Bryant, 2015; King et al., 2008; McAlpine, 2016; Mellors-Bourne et al., 2013; Nerad, 2007; Neumann & Tan, 2011). Despite this change in the career destination for many PhD graduates, PhD programs have tended to remain somewhat unchanged, at least in many countries. Consequently, many researchers have been questioning whether the PhD is still fit for purpose (e.g., ACOLA, 2016; Gould, 2006; Roberts Report, 2002; Sutherland & Corballis, 2006). Therefore, there are two main aims of this paper: first to critique two dominant models of educating PhD students; and second to consider an alternative approach for PhD education that may provide better outcomes for graduates.

---

[*]Rachel Spronken-Smith (https://www.otago.ac.nz/hedc/people/otago615546.html) is a Professor in Higher Education and Geography and Dean of the Graduate Research School at the University of Otago, New Zealand (https://www.otago.ac.nz/). She is a past Head of the Higher Education Development Centre, where she worked as an academic staff developer. In 2018, she was a CSHE Visiting Scholar under a Fulbright grant.

Before discussing and critiquing two dominant models of PhD education, it is important to provide some definitions. In this paper I use the term 'supervisor' rather than advisor, for the academic mentoring of the PhD student through the research process, and the terms PhD and doctoral are used interchangeably. Importantly, this paper focuses on the Doctor of Philosophy (PhD) degree, rather than professional doctorates. Finally, the term 'assessment' is used in the British sense, to refer to how PhD students are examined.

A.   TWO DOMINANT MODELS IN DOCTORAL EDUCATION

The PhD degree is awarded mainly on the ability to undertake research, demonstrated through a thesis, and, in some countries, an oral defense of the thesis. The criteria for assessing the thesis are universal and typically involve an original and significant contribution to knowledge, critical engagement with the literature, mastery of methodological and analytical methods, and communication of research findings to an international standard (e.g., Bernstein et al., 2014; Bourke et al., 2005; Johnston, 1997; Mullins & Kiley, 2002). Although there is a range of models of doctoral education around the globe (see Nerad & Heggelund, 2008), there are two dominant models, which are the focus of this paper:

- The North American model, which prevails in the United States of America and Canada. In this model, students normally enter a PhD program after a Bachelor's degree, and they may change field. Consequently, in the PhD program, students first undertake one or two years of coursework, followed by three or more years of supervised research. In this model, the coursework is typically discipline-based, ensuring students learn the breadth and depth of disciplinary knowledge, and courses usually include research methods. At the end of their coursework, students usually have a comprehensive examination, to test their acquisition of this disciplinary knowledge and their suitability for continuing with research in the field.
- The British model, which is widespread throughout the United Kingdom, Australia, South Africa, and New Zealand. In this model, students enter a PhD program after a Bachelor with Honours degree or a Master's degree involving thesis research. Because students have normally had education in research methods and engagement in a substantive research project, they enter directly into a program involving supervised research; coursework is not usually required.

Once into the research phase, the typical teaching mode for PhD students is supervision or mentoring by one or more academics in an apprenticeship model. PhD students may also have the opportunity to teach through employment as teaching assistants, and/or may work as research assistants. In both models, the quality of the PhD programs is usually overseen by graduate schools, and graduate councils or boards. Because of concerns regarding preparedness of PhD students for careers beyond academia, most universities now have graduate schools working with career services and other appropriate providers to offer ad hoc, or sometimes structured, programs, to support the career planning and professional development of students. In some countries however, more structured and integrated approaches to doctoral education are occurring. For example, in the U.S., a recent initiative is the promotion of Integrated Graduate Education Research Training, which involves interdisciplinary, problem-oriented, theme-based doctoral education. In these programs students work in interdisciplinary teams and learning communities, and develop professional skills (Nerad, 2009a, 2012). Australia has taken a slightly different approach for more structured and integrated doctoral education, promoting Cooperative Research Centers, which are industry-led collaborations usually involving a university partner (Manathunga et al., 2009). In Britain, with reforms in research funding leading to the advent of Doctoral Training Centers in 2003 and 2004, PhD students who study through these Centers have opportunities to develop a broad set of research and professional skills, with possible careers in mind (Lunt et al., 2014). Moreover, as Cressey (2012, p. 1) explains, in the Doctoral Training Centers, PhD students are "increasingly coming out from under the wing — and the shadow — of a PhD supervisor", since they are being taught in cohorts, usually involving interdisciplinary groups. When referring to the North American and British models in this paper, I am meaning the more traditional models based on an apprenticeship approach, rather than the more recent structured approaches that typically involve learning communities.

B.   ARE THE DOMINANT MODELS OF DOCTORAL EDUCATION SUCCESSFUL?

The answer to this question depends on how we define success. Wood and Breyer (2017, p3) say that success in higher education exists at different levels and depends on the stakeholder – whether it is the student, the institution, the nation or the globe. They propose a model of student success based on personal and professional transitions, involving transitions into the university, within the university, and from the university into the workplace. Although referring to undergraduate education, at the student level, success usually entails completing a qualification (Moore & Shulock, 2009) and obtaining a job (Kuh et al., 2007). However, as Wood and Breyer (2017) caution, a focus on degree completion may overlook other important desirable outcomes and aspects of the educational experience, while a focus on employment outcomes may limit educational experiences.

Past research has examined degree completions for PhD students, and found that while there has been significant growth in the number of PhD graduates (e.g., Cyranoski et al., 2011; Pedersen, 2014), PhD completion rates vary considerably by discipline area, and institutional statistics reveal high rates of attrition (e.g., Spronken-Smith et al., 2018c). For example, in a seminal report for U.S. universities, the U.S. Council of Graduate Schools (2008) found institutional PhD completion rates of 46% after 7 years and 57% after 10 years. However, it is important to realize that these data are now very dated, and, moreover, because students in the U.S. enter the PhD with only a Bachelor's degree, many will opt out of the PhD program with a Master's degree after 2-3 years, thus contributing to these high attrition rates. In the U.K., Australia and New Zealand, where students typically enter the PhD with either a Bachelor with Honours or a Master's degree, completion rates are better at 62-87% (see Fuller (2015) for the U.K.; Palmer (2015) for Australia; and Spronken-Smith et al. (2018c) for New Zealand), but there is still plenty of room for improvement. However, it is not just the high attrition rates that are cause for concern, but also the long completion times. In North America, where doctoral education typically involves 1-2 years of coursework followed by supervised research, completion times range from 4-5 years in Canada (Elgar, 2003) to about 7-10 years in the U.S. (U.S. Council of Graduate Schools, 2008). In the research-only PhD degrees of the U.K., Australia and New Zealand, completion times are much faster – typically about 4 years (Spronken-Smith et al., 2018c).

In terms of deciding whether the North American and British PhD education models are successful, I am guided by Wood and Breyer's (2017) suggestion to consider personal transitions and focus on transitions out of the university. In particular, I consider employment outcomes and whether we are fostering PhD graduates with a holistic set of graduate attributes – for employment, life, and as global citizens.

Employment outcomes
For employment outcomes, the measures of success could include employment rates, the types of employment PhD graduates enter, and their satisfaction with their employment. Regarding employment rates, the PhD system does seem to be successful, as very high rates are reported (Figure 1). For example, data reported by the OECD/UNESCO Institute for Statistics/Eurostat (2013) for the 'Careers of Doctorate Holders (CDH) Project' shows employment rates of 86-98% for doctoral graduates (but note these data include professional doctorates). The highest rates were in countries such as Poland and Portugal (98%), with rates from 86-90% in the US, Lativa, Finland and Israel.
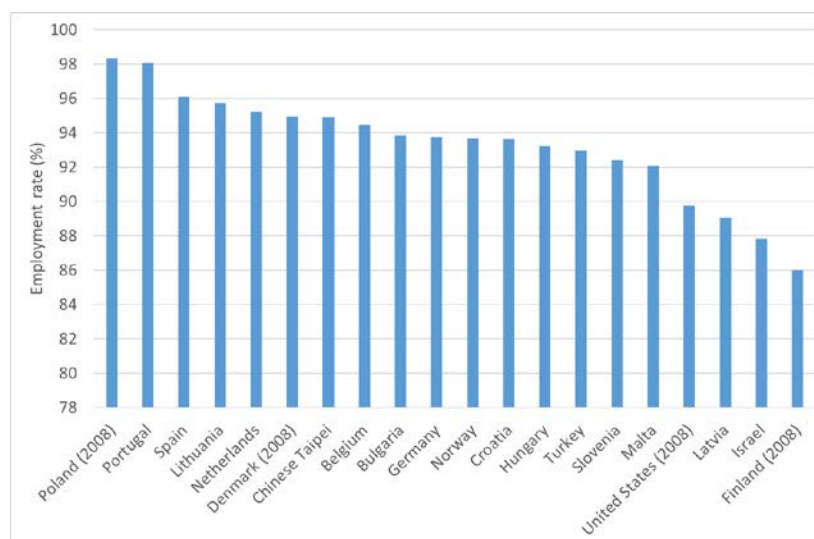

Figure 1: Doctoral employment rates as a percentage of doctorate holders in OECD countries for 2009 (unless otherwise specified). (Source of data: OECD/UNESCO Institute for Statistics/Eurostat, 2013)

Regarding types of employment, the success of the PhD education system is debatable. As Nerad (2008) discusses, a common assumption is that all people who study for a PhD want to become an academic. Yet two national career path studies in the US showed that only about half of PhD recipients wanted to enter academia, and the desire to enter academia varied widely by discipline area (Nerad, 2009b). Importantly, of those who wanted to be an academic, only about 60% achieved that goal. Similarly, in a case study at a New Zealand university, Spronken-Smith et al. (2018a) reported that approximately 55% of about 130 PhD graduates in 2015 hoped to obtain a career in academia, but only 29% managed to do so. So, if PhD students have expectations of employment in academia, then the system may well be letting them down.

Only about half of PhD graduates now enter academia, and indeed many of these graduates will not be in tenured positions. This statistic though, does not necessarily mean the system is not producing PhD graduates capable of working in academia, but rather reflects the situation of a tightened job market for tenured academic positions. In a novel study applying a reproductive analysis to tenured academic positions in engineering in the US, Larson et al. (2014) found that in a steady state US higher education system, less than 13% of PhD graduates would be successful in gaining a tenured job. Given the employment prospects in academia, there is likely a group of disheartened PhD graduates who have not managed to attain an academic job, while for others, this was never their intention.

Quite worryingly, there is a discourse of shame or failure that PhD students and graduates respectively may report, either if they have no intention of getting an academic position, or if they fail to get an academic position (e.g., Whelan, 2016). As Whelan (2016, p. 1) comments, "Undertaking a PhD does not automatically mean that you will be a professor or researcher, nor that you want to be. That traditional train of thought needs to be broken." Indeed, Nerad (2015), in her search for taboos between doctoral students and their supervisors, noted a recurring taboo regarding students not informing their supervisors if they did not want to pursue an academic career. The reasons they gave included that they feared they might be perceived by their professors as not being smart enough, less worthy, or a failure, if they admitted they did not want to become professors.

Similarly, Thiry et al. (2007), in a study of graduate students involved in science outreach at a research university in the U.S., found that those students opting into teaching as a career path, felt their supervisors were disappointed in this career track as they had been training them for researchers – they felt they were not being seen as "real" scientists (p. 403). Other writers have likened being in academia to being in a cult, as both "instill in their members a sense of shame about leaving" (Merberg, 2015). A similar discourse of shame and failure was also found by Barcan (2018) in her research with over 30 academics from a range of disciplines, university types, and countries, who had left the academy early or who had given up seeking academic work. This stemmed from academics on casual contracts who failed to progress because of a lack of prospects, agonizing by academics over whether to leave or stay in the academy, or the feeling academics were trapped because they could not work anywhere else. She relayed a powerful quote from a participant when he realized he could not continue in academia, which he saw as his calling: "Investment of hope. That's what crushes you. I mean more than anything. Investment of time is nothing. Investment of effort is nothing. Investment of hope is an intangible. It's a death of a thousand cuts" (Barcan, 2018, p. 116).

Burford (2018) explored why PhD students remained optimistic about achieving an academic good life, despite the precarious nature of academic employment. He used queer theory and drew on Berlant's (2011) work on 'cruel optimism' to explain the situation. Burford commented that "the doctorate appears to operate as an 'organising fantasy' for students' imaginings of a particular kind of 'good life'. This 'good life' hangs, at least in part, upon normative desires for upward mobility, secure employment, and/or the possibility of retreat from more stressful forms of labour" (Burford, 2018, p. 12-13). He argued that this was evidence of cruel optimism, involving an affective framework with a double bind, in which even if academia was recognized as being problematic or toxic, the proximity of the student to the desired object (the PhD), meant this enabled them to continue in their pursuit. Some early career academics who have decided not to pursue academia or who could not get a job in academia, have been very public in their views about not continuing in what has become known as the 'quit lit' (Dunn, 2013). The reasons these academics comment publicly includes the need to counter claims that going into a career other than academia is somehow a failure – whether through choice or because of a lack of jobs in academia.

Alongside the discourse of failure discussed above, is one about the failure, or even dishonesty, of universities to prepare PhD students for the realities of the job market. For example, Acker and Haque (2017) found this discourse through interviews with 13 PhD graduates from a Canadian university about 10 years after graduation, discussing career pathways and structural and personal factors shaping their employment. Of the 13 graduates, only two had tenured positions, three were in tenure track positions, six were in contingent positions, and two were in stable non-university careers. Some of the graduates were critical of the lack of preparation for careers, as well as the lack of preparation for the job market. One commented "There're a million things I think they could have done. They could have given us some preparation of what to expect with the job market. We really were set adrift" (Acker & Haque, 2017, p. 108). Another questioned the morality of the University in offering a degree that had uncertain consequences in terms of the reality of the job market. Those participants in contingent positions were particularly critical of their situation, which was described variously as "sessional hell, sessional purgatory", "bitter, resentful, strained", and "a life of hardship and poverty" (Acker & Haque, 2017, p. 111). Such narratives are not illustrating outcomes from a successful PhD education system.
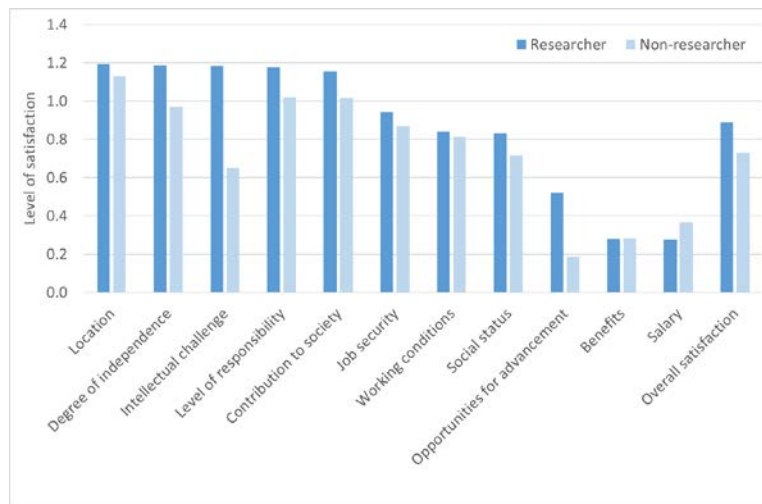
Figure 2: Average satisfaction with employment by doctoral graduates in OECD countries 2009. Note: The average satisfaction levels of doctorate holders were calculated by assigning values of "+2","+1","-1" and "-2" to four satisfaction levels of "very satisfied", "somewhat satisfied", "somewhat dissatisfied" and "very dissatisfied", respectively. (Source of data: OECD/UNESCO Institute for Statistics/Eurostat, 2013)

The potential mismatch of expected career with actual career may lead to lower rates of satisfaction with employment. However, there is a paucity of data to test this assertion. The *Careers of Doctorate Holders* project (OECD/UNESCO Institute for Statistics/Eurostat, 2013) generated data on satisfaction with aspects of employment, and, as Figure 2 shows, those graduates who ended up in research roles were overall more satisfied than those in non-research roles, in nearly all aspects measured except for benefits and salary. It is encouraging however, to see that most indicators are positively rated, meaning graduates are overall satisfied with their employment situation. In a study of social science PhD students who graduated in the years 1995-1999 from 65 U.S. institutions, about 3025 responded to a survey sent in 2005-2006 i.e. five years plus after completing their PhD (Nerad et al., 2007). About two thirds of these respondents were professors, with a fifth in business, government and non-profit sectors, and the remainder in non-faculty jobs in higher education institutions. Nerad et al. (2007) reported that most of the graduates rated themselves as "very satisfied" or "somewhat satisfied" with aspects of their current job.

Graduates with a holistic set of attributes
Bearing in mind Wood and Breyer's (2017) argument for success includes transitioning into a career, then again there may be cause for concern. Much of the literature questioning whether the PhD is fit for purpose assumes universities are at least preparing students well for academia. Yet some recent studies contest this assumption. For example, in studies of early career academics in New Zealand (Sutherland, 2018), Canada (Barcan, 2018), South Africa and Sweden (Frick et al., 2016), and across 17 countries worldwide (Bennion & Locke, 2010), researchers have found that doctoral education has not necessarily prepared students well for academia. If PhD education models were preparing students well for academic careers, learning opportunities would involve for example, learning how to teach and design courses, practicing teaching, learning how to write research grants, publishing and communication of research in a range of genres, and learning how to be an effective member of university committees.

Sutherland (2018), in a study involving 538 early career academics in New Zealand, found that about 65% had some experience of tutoring or teaching assistance during their doctoral study, 63% had published some of their research, 43% had worked on writing grant applications, 42% had gained experience lecturing and/or course coordinating, and 17% had served on university committees. However, she noted considerable variation in preparation for academia depending on where these early career academics had done their PhDs. Only 44% of the sample were NZ born, reflecting the high number of international staff in NZ universities. For the 403 academics with doctorates, 51% had achieved them in NZ, while 49% gained them overseas.

In countries adopting the British model of PhD education, the opportunities to teach are more limited, with systematic teaching opportunities more embedded in the North American model. Yet even in the U.S. PhD system, research has found a "lack of systematic professional development opportunities" (Austin, 2002, p. 104; see also U.S. Council of Graduate Schools, 2017). Drawing on the *Changing Academic Profession* (CAP) survey of over 25,000 early career academics across 17 countries (Teichler et al., 2013), Bennion and Locke (2010) noted that only 34% of the 1109 U.S. respondents reported having been taught instructional

skills or learned about teaching methods. However, despite being only 34%, this was the second highest level of involvement across the countries – only surpassed by Mexico (36%). Of the early career academics who responded from Germany (n=1218) and Norway (n=986), only 8% reported having such opportunities. So, it appears, even in a PhD education system designed to generate academics, there are some deficiencies.

If, however, we believe that the aim of educating PhD students is not just for academia, but for preparing graduates for a range of career choices, then the education of PhD students' needs to foster a wide range of attributes. The two dominant PhD education models were not designed to foster such a set of attributes. Rather, the models narrowly focus on educating PhD students to be able to design, conduct and communicate research. Certainly, many students will develop a wider range of attributes, beyond research skills, but often these are acquired in an ad hoc and unplanned way. Of great concern, is the fact that some supervisors actively discourage engagement in teaching and/or outreach activities, telling students that such activities will distract them from research (e.g., Laursen et al., 2012; Spronken-Smith et al., 2018b). Perhaps it is not surprising then, that in a seminal report on the state of research training in the U.K., Roberts (2002) found that employers perceived a lack of preparedness of PhD graduates for careers in industry. Similarly, the ACOLA (2016) report on research training in Australia, identified a lack of training in transferable skills for PhD students, and an inability of graduates to adapt to non-academic work.

So what sorts of attributes do PhD graduates have? Unfortunately, there is a paucity of research to draw on. Manathunga et al. (2009), in a study of PhD graduates from either university or Cooperative Research Centers in Australia for the period 2000-2003, found a high level of graduates who felt that their doctoral study had not prepared them well for employment – even those students in the Cooperative Research Centers, which aimed to produce 'industry-ready' graduates. Durette, Fournier and Lafon (2016) identified core competencies of 2794 PhD graduates across a range of disciplines in France: knowledge and technical skills; formal transferable competencies such as communication and project management; informal transferable competencies such as cognitive abilities and teamwork; dispositions such as creativity, rigour and autonomy; behaviors such as perseverance; and meta-competencies such as capacity for adaptation.

Recent research by Spronken-Smith et al. (2018a) revealed that the attainment of a broad set of graduate attributes was, at best, patchy. In their survey of PhD alumni who graduated from a New Zealand university in 2015, they asked alumni for their perceptions of the development and application post-university of a range of graduate attributes. They found that while attributes relating to research and written communication were highly developed, attributes such as teamwork, self-confidence, willingness to learn, and the skills to implement change were less well developed (Figure 3). They also noted strong disciplinary differences in the development graduate attributes, with science and health science graduates perceiving better development of a more holistic set of graduate attributes, while humanities, and particularly commerce graduates reporting significant gaps in some attributes (teamwork, the skills to implement change, and flexibility and adaptability).
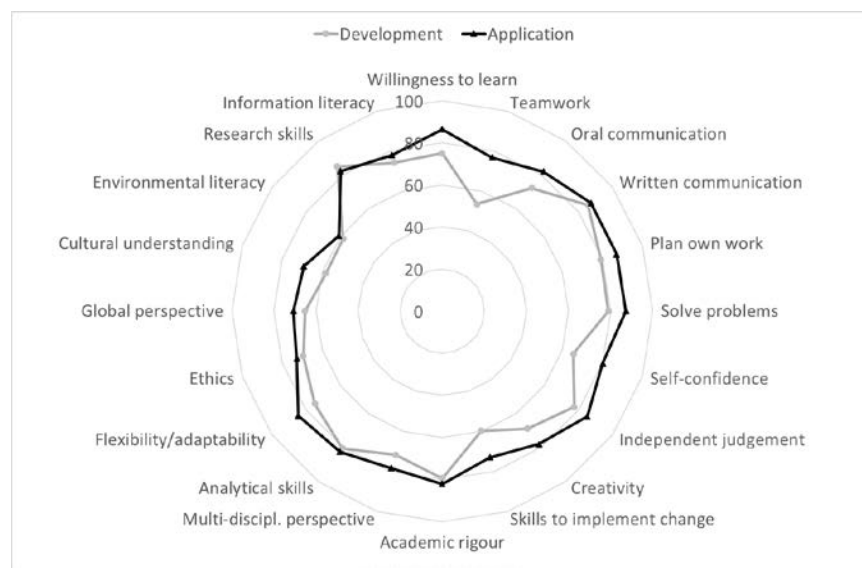

Figure 3. Development and application of graduate attributes in PhD graduates from a research-intensive university in New Zealand (n=108 to 133; the number varies because of differing response rates to the questions). (Source: Spronken-Smith et al., 2018a).

With the widespread neoliberal, managerial agenda, and the increasing focus by governments on higher education for employment, it is perhaps not surprising that academics have argued that higher education is not just about preparation for employment. In a criticism of instrumentalist managerial approaches to graduate attributes, Mowbray and Halse (2010) called for a reframing of the purpose of the PhD as "the acquisition of an interrelated suite of intellectual virtues" (p. 662). The intellectual virtues included personal resourcefulness or growth in practical knowledge, cognitive development – especially critical thinking, and development of research and other skills. Referring to the work of Aristotle and Nussbaum, Mowbray and Halse said that it is through the development of intellectual virtues that individuals can flourish in life and work and contribute to society. Similarly, Ron Barnett, a prominent U.K. higher education researcher, argued that graduates of the 21st Century need to be able to cope with change and uncertainty, saying that "the fundamental educational problem of a changing world is neither one of knowledge nor of skills but is one of *being*" (Barnett, 2006, p. 51).

The attribute of global citizenship addresses core aspects of 'being' in the world. Nussbaum (2002), in a call for more liberal, Socratic higher education, argued that graduates should be educated as global citizens with the capacity to be critically aware of oneself and one's traditions, to be able to think as a citizen of the whole world, not just part of it, and have empathy for others' positions. Haigh and Clifford (2011) also argued that we should be educating undergraduate students for global citizenship so they "care about and for their world" (p. 573). They proposed fostering attributes such as being responsible, capable, compassionate, self-aware, ecoliterate and cosmopolitan so that graduates have values such as social justice, equity, and social responsibility (Haigh & Clifford 2011, p. 579-80).

Surely such values should be fostered in our PhD graduates as well? Indeed, Maresi Nerad, one of the leaders in doctoral education research in the U.S., argued that we need "to prepare our PhD students not just to be expert scholars, but also to become world-citizens, world-citizens who are aware of the negative effects of globalization and who are equipped to operate as informed leaders and responsible citizens on the world stage" (Nerad, 2008, p. 2). The graduate attributes illustrated in Figure 3 contain a mixture of employability attributes (e.g., teamwork, problem-solving, oral and written communication), as well as more affective attributes such as global understanding, cultural understanding and environmental literacy. These affective attributes, together with others, contribute to the development of PhDs as global citizens. Yet, to date, few studies have reported on their development (intentional or otherwise) in doctoral students. The research by Spronken-Smith et al. (2018a), suggests that some of these affective attributes may not be well developed in PhD students, particularly in some disciplinary areas.

In summary, if a PhD education model is successful, for transitions out of the university we would expect to see high levels of employment, graduates placed in jobs they desire, high levels of job satisfaction, and graduates with a holistic set of graduate attributes. Considering both the North American and British models of PhD education, it is apparent that, if using these indicators, neither system is entirely succeeding. Surely, we can do better for our most highly educated university students? Is there a better model?

To rethink *how* we should educate PhD students, I use the concept of success and consider how we could design a system that will be more successful for our PhD students. Whilst one could argue this lens is promoting a neoliberal or managerial agenda, my interest is not in accountability of the system, but rather in a deeply-rooted desire to improve the PhD outcomes for students. Clearly, I cannot change the employment market, but I can suggest ways to better prepare PhD students for the realities of this market, and for the realities of the jobs within this market. Universities, including graduate schools, departments and supervisors, need to be transparent about career pathways following a PhD. While certainly alerting PhD students to the competitive market for mainstream academic jobs, we should be offering other possibilities and these should be framed in a positive way, not as some second-rate career decision. We need to espouse the terrific attributes that PhD graduates develop, that should stand them in great stead for a range of careers and prepare them as not just global citizens, but as potential global leaders.

Given the range of careers that PhD students now have in mind upon entering and exiting doctoral study, it is important to inform and support these decisions, no matter where they intend to work (or not work) and provide learning opportunities that will develop graduate attributes desirable for those careers. Moreover, if we want PhD graduates to be global citizens, we need to ensure our programs are providing opportunities to foster the necessary attributes. Doctoral students should be purposively planning their professional development – for completing their research, for developing as global citizens, and for possible future careers. A 'one size fits all' approach will not work – programs must be tailored to the individual. The existing apprenticeship model of PhD supervision lends itself to personalization of learning plans and graduate outcomes, providing the supervisor is open to a range of career possibilities – not just academia!

C.   TOWARDS A NEW MODEL

In proposing a new model of PhD education, three core tenets underpin my approach. First, PhD programs should better prepare graduates for the careers they enter, and second, the PhD experience should be richer in order to develop a holistic set of attributes in graduates. Third, I propose continuing with an apprenticeship model, but recognizing the apprenticeship is about mastery of research, not necessarily as an apprenticeship in becoming an academic. The model does not discount the possibility of Doctoral Training Centers or similar, and indeed such centers can assist in achieving the first two aims. All tenets require a personalized approach to doctoral study, and in order to develop such bespoke programs, I draw on the concept of 'constructive alignment' (Biggs, 1996), as a design principle for the doctoral curriculum. The concept of alignment is not new for doctoral education. For example, Wuff and Nerad (2006) proposed aligning five key doctoral education components: program activities, students, faculty and staff, desired outcomes, and the context. However, in this paper, I hone in on the key elements identified by Biggs (1996) and consider learning outcomes, teaching and learning opportunities, and assessment

Constructively aligning PhD programs
The notion of constructive alignment was promoted by Biggs (1996, p. 360) and involves a marriage of a constructivist approach with alignment in teaching. As discussed by Sharmini (2016), a constructivist approach is implicit in current doctoral education models whereby the student is working closely with the supervisor in constructing new knowledge. However, she noted a lack of alignment in doctoral education. By alignment, Biggs (1996) meant that the teaching and learning methods and the assessment regime should be well aligned with the intended learning outcomes. Sharmini (2016) and Sharmini and Spronken-Smith (2018) argued that the PhD is currently out of alignment as the assessment regime focuses narrowly on a written thesis (and sometimes on an oral defense), while the expected outcomes are much broader and may include for example, ability to teach, ability to write research grants and publish research.

While some doctoral education systems do provide opportunities to develop these broader skills, they are not usually assessed as part of the degree. In order to become aligned, because of varied career pathways for PhD graduates, there should be personalised learning outcomes. So, alongside a core set of outcomes related to advanced research skills, there should be a set of desired outcomes that will vary according to the planned career pathway. And, if we believe that PhD students should be global citizens embracing values of caring for the planet, then these also need to be considered. Having identified the desired learning outcomes, the learning activities should then be considered, as well as assessment to provide evidence of meeting these outcomes.

To help align the PhD degree, and ensure a personalized and relevant educational experience, PhD students need to develop a personal development plan. This plan should identify intended learning outcomes and learning opportunities to develop the necessary skills sets – for conducting doctoral research, for preparing them for future careers (if indeed they need this; some will already be in employment while others may be doing a PhD solely as an intellectual pursuit), and for developing them as global citizens. It is important to note that many research grant agencies are now requiring professional development plans to be in place for researchers (including graduate students), so this will be a useful skill in itself! Several tools are available to assist in this process, such as the myIDP (http://myidp.sciencecareers.org/), which is an interactive web-based career planning tool (Hobin et al., 2012). Although such tools are helpful, even a low-tech option such as a simple table, is sufficient to get students to map out their outcomes, and how they might develop these attributes.

While the skills needed for doctoral research and the attributes for development as global citizens can be relatively easily articulated, the skills for particular careers are more difficult to determine. Ideally PhD students should be tasked with researching possible careers and determining the skills sets required. Job placement data (not just for academic positions) should be available to PhD students through departmental websites. Research on career pathways by PhD students could involve searching the literature, but also contacting alumni working in the relevant area, and discussion with staff in career services, as it is unlikely that supervisors will either have the necessary knowledge of the range of career opportunities or know what key skills are needed for such careers. Also, as McAlpine et al. (2013) reported, there have been several initiatives to support the career planning and professional development of doctoral researchers, including Vitae in the U.K., the Concordat to Support the Career Development of Researchers, and national associations of postdoctoral researchers, and these are valuable resources for PhD students. The key ingredients of a personal development plan include:

- a planned career pathway (or pathways);
- identification of strengths and weaknesses;
- a set of goals or intended learning outcomes covering particular attributes to be developed;
- identification of ways to help develop these goals or outcomes (i.e. learning opportunities and mentoring support); and
- how to demonstrate acquisition of these goals or outcomes (i.e. assessment).

Three of these core components (outcomes, learning opportunities, and assessment) are considered below.

Bespoke set of intended learning outcomes
If there is agreement that we should be educating PhDs to have a more holistic set of graduate attributes, and recognition that PhD graduates will enter a variety of careers, then, in order to provide an aligned system of doctoral education, we need to offer bespoke programs of study. Thus, in the transition into doctoral study, students should be identifying possible career pathways, so that a set of intended learning outcomes can be generated. The holistic set of learning outcomes should include:

- research attributes required to demonstrate 'doctorateness';
- transferable skills, including career management skills;
- professional skills, specific to the particular career pathway or pathways; and
- global citizenship attributes.

These outcomes are similar to those proposed by Nerad (2012): traditional academic research competencies for successfully undertaking and publishing research; professional competencies in order to effectively disseminate research findings; and cultural competencies, which she defined as working with and functioning in multinational teams and settings (p. 58). However, here I distinguish between transferable skills and professional skills, and encompass cultural competencies in a broader suite of global citizenship attributes. It is likely that many PhD students will have fostered many of these attributes in prior study, work and life experiences. At the doctoral level, we would expect a high level of attainment of these attributes, so some of these attributes may require further enhancement during doctoral study.

Some of the research attributes will be common to all doctoral graduates, such as the ability to conduct original and significant research, and present this to an international standard. Other research attributes may be more discipline specific – particularly regarding methodological and technical skills.

The transferrable skills may include a host of skills such as communication, problem-solving, flexibility and adaptability, teamwork, time management, creativity, ethical understanding and information literacy. Some of these skills may be necessary to contextualize for the particular discipline. For example, in relation to geographers, Whalley et al. (2011) combined the attributes of ethics and sustainability, arguing that developing ethical thinking in geographers should include not just knowing about sustainability, but acting in a sustainable way. Alongside these transferrable skills, it is important that graduates have a set of career management skills. Bridgstock (2009) argued for the need to ensure graduates have career management skills including self-management skills such as attitudes, interests, work-life balance, and career-building skills such as finding and using information about labor markets, locating and applying for work, and creating professional relationships.

The set of professional skills will vary depending on the desired career pathway, and indeed students might have a couple of alternative career pathways in mind. So, for example, if the intention is to go into business, skills such as entrepreneurship, project management and financial management are likely to be important. If a student wants to pursue an academic career, then their program should include learning how to teach and design courses, developing a research profile, writing research grants, publishing research, and working on committees etc.

The final set is global citizenship attributes, including, as noted above, affective attributes such as being responsible, capable, compassionate, self-aware, ecoliterate and cosmopolitan (Haigh & Clifford, 2011). O'Brien (2011, p. 42) provided a useful 'literacy' framing of global citizenship attributes including:

- digital literacy - how to communicate across media and communication technologies;
- cultural literacy - how to approach and understand others with greater sensitivity, empathy, and openness in a way that recognises and values diverse experiences and perspectives, particularly those emerging from divergent world-views or subject-positions, or variations emerging from culturally-situated knowledge; and
- socio-communicative literacy - how to negotiate across multiple perspectives from various cultural stand-points, to work through differences in approach and values in order to produce collaborative products (texts, images, project designs) that accomplish a shared goal.

These literacies combine some quite concrete skills (e.g. ability to use web-conferencing platforms), with more affective attributes such as empathy and sensitivity, but they are missing environmental literacy, which is arguably very important for our graduates. As reported by Buissink-Smith et al. (2011), some teachers use Krathwohl et al.'s (1964) taxonomy of the affective domain to design affective learning outcomes. Krathwohl's hierarchy involves five stages:

1. *Receiving*, which means being aware of or sensitive to ideas or phenomena, and being willing to tolerate them;
2. *Responding*, through interactions with others;
3. *Valuing*, involving attitudes or values appropriate to particular situations;
4. *Organization*, in which values are organized into an internally consistent philosophy; and
5. *Characterization*, involving internalization of values and displaying a commitment to principled practice on a day-to-day basis (Krathwohl et al., 1964).

In this hierarchy, we would hope that PhD graduates would be operating at the highest level. Careful thought is needed in order to design learning outcomes that help foster the attributes of global citizenship at this highest level.

Bespoke learning opportunities beyond thesis research
In my proposed approach to PhD education, the apprenticeship model will continue to be core to the PhD experience. However, as noted above, the supervisor or supervisory team, need to see their students as apprentices in research, not necessarily as apprentice academics. As supervisors, they should take an active interest in supporting the professional development of their students, no matter which career pathway is proposed. Supervisors should have oversight of the personal development plans of their students and ensure regular check-ups on progress. Ideally though, alongside supervisors, students should be immersed in learning communities to realize the range of benefits from working with peers (e.g., Flores & Nerad, 2012; Nerad, 2012).

It is likely that many transferable skills and attributes will be developed during the course of doctoral study, and indeed an embedded approach to skill development is preferable to a bolt-on model. For example, doing a PhD project implicitly involves skills such as project management, time management, ethical considerations (depending on the topic), analytical skills, and communication of research. However, in research I am currently undertaking eliciting PhD alumni's perceptions of skills acquired during doctoral study and preparedness for the workplace, while there is a recognition that such skills are developed during study, there is also a desire by some for explicit instruction in, for example, how to manage a project, how to give a great presentation, how to work in teams, and how to manage conflict (Spronken-Smith et al., 2018b).

Thus, universities need to consider professional development – and career planning – opportunities beyond the thesis research. Of course, most universities do provide such opportunities, but most of these are unstructured and optional. The main exceptions are universities in the U.K. who provide mandatory structured career planning and professional development through programs offered in Doctoral Training Centers, the Integrated Graduate Education Research Training programs in the U.S, or the Collaborative Research Centers in Australia.

So, in a successful PhD program, what might the teaching and learning opportunities look like? It is likely that to assure the development of holistic PhD graduates, the program will need to include both mandatory and optional elements. It is important to emphasize that I am advocating for tailored learning experiences, depending on the existing skills set of students and their planned career pathways. The recognition of prior skills is very important as most PhD students have worked full-time prior to embarking on doctoral study, so they will already have a range of transferable skills (Spronken-Smith et al., 2018b).

It is possible that the framework for supporting the career planning and professional development of students may be a qualification, such as a postgraduate certificate. For example, the University of Strathclyde in Glasgow introduced a Postgraduate Certificate in Researcher Professional Development that is mandatory for PhD students to complete alongside their doctoral study (Nimmo, 2014). In this program, students participate in learning activities to meet a series of learning outcomes aligned with papers based on the Vitae Researcher Development Framework. Their choice of learning activities will vary according to their planned career pathway. Importantly though, the development of transferable and global citizenship attributes should be embedded in the research program, so that they are not seem as bolt-on aspects of research education (Manathunga et al., 2007; Pearson & Brew, 2002). As Cryer (1998, p. 212) commented, the attributes should be embedded in students' research degree programs to ensure they are "part of the students' everyday thinking, help develop proficiency, facilitate transferability, and develop the habit of lifelong learning".

When entering the PhD program, students need to reflect on why they are embarking on this difficult journey, and on what skill sets they will need. If they are planning to find a job on graduation, they need to be thinking ahead to possible careers, and the skills required. Thus, during induction, it is important that students generate a personal development plan – for research, for developing as global citizens, and, if applicable, for a career pathway or pathways. If the institution has a graduate profile, with a defined set of graduate attributes, these attributes should also be included in the personal development plan.

For those students who are planning a career (some will already be taking time out from a position to upskill), there should be a mandatory module that gets students to research their planned career pathway to determine the job market and skills needed for such a profession. McAlpine and Emmioğlu (2015) noticed that while prospective PhD students researched which doctoral program

to apply for, once in the program, they showed a remarkable lack of rigor in researching possible careers. Resources for students should include job placements of recent PhD graduates, literature regarding careers for that discipline area, and alumni and/or employers of PhD graduates who are happy to be approached for advice regarding that career pathway. Instruction for this module may come from careers centers and/or graduate schools, as well as appropriately equipped faculty.

During coursework (if the program contains this element) and/or thesis candidature, the PhD program should include opportunities for explicit instruction in enhancing particular skills – whether for research, transferable skills, or a profession – as well as an opportunity to practice these skills. This latter element – of learning by doing – should underpin PhD education, ensuring the constructivist approach is maintained. For example, there should be explicit instruction of research skills such as research methods, project management, how to give oral presentations, academic writing and publishing research, ethical considerations and processes in research. Such instruction may come from disciplinary experts, possibly with input from staff in central services, such as student learning centers and ethics boards. There should also be explicit instruction to enhance transferable skills such as: working in (and leading) teams, managing conflict, networking, with instruction in such skills probably coming from staff in central services, and again the opportunity to practice these skills is important. For example, regarding networking, while it is common for universities to provide networking events for graduate students to meet potential employers, how many universities explicitly teach how to network prior to these events? The teaching of career management skills and practice in writing curriculum vitaes, job application letters and job interviews are also an essential element of a PhD program (and also of course at lower educational levels). Again, this element needs to be tailored according the planned career pathway. Such career management skills should be taught by the university's career services, but there should also be input from the department, particularly to help identify alumni who can return to the university to discuss their career pathways and how they achieved their positions. PhD students want to hear from panels about hiring processes in a range of careers – including academia (Spronken-Smith et al., 2018b).

As well as these mandatory elements, there should be optional learning activities. Such activities will help foster a more holistic range of attributes and allow more targeted skills to be developed that will help students achieve positions in desired workplaces. Examples of these optional learning activities include projects or committee work requiring a collaborative approach, undertaking outreach activities, communication of research to a variety of audiences, and incorporation of learning activities relevant to planned professional pathways (e.g., teaching, internships, writing policy). Although some of the activities may be available within the department and ideally embedded in the PhD degree program, others may occur in different parts of the university, or indeed externally. Fostering attributes for global citizenship will occur through many of the activities above, but may require additional learning opportunities, some of which may also occur external to the PhD program, such as interdisciplinary projects, volunteering, or community-based work.

Nerad (2012, p. 65-66) proposed a "global village" approach to doctoral education, combining five levels of learning communities:
- Grassroots – through the apprenticeship model with development of research skills by supervisors;
- Departmental – through communities of practice within the department, developing professional competencies of the discipline;
- Peers – in both formal and informal activities;
- Central graduate school – through provision of professional development support for research, teaching and careers;
- Global village – involving national academic meetings, conferences and international collaborations etc.

While many learning opportunities for fostering a wider set of graduate attributes will arise throughout the research journey, and through these various levels identified by Nerad (2012), it is likely that universities may have to rethink career planning and professional development opportunities available to doctoral students. Indeed, in recent years many universities have bolstered their professional development programs for graduate students, recognizing that students need support for career and professional development. My recent conversations with PhD alumni has revealed that although all had access to career services, rarely did they take any advice (Spronken-Smith et al., 2018b). Yet, in hindsight, they wished they had been forced to think about careers, pointing to the need to embed career planning and professional development into a PhD program. Alongside providing more structure and opportunities for PhD students, it is important to also educate supervisors, to ensure they are supportive of PhD students spending time on activities beyond thesis research, and to be supportive of their career pathways, no matter what they are! While some countries have a well-embedded culture of professional development for supervisors, in others such programs are scarce.

Assessment in a PhD program
The final piece of the doctoral education system to bring into alignment is the assessment regime. If the curriculum is well aligned, then the assessment regime should target the intended learning outcomes. In the British PhD education model, the assessment focuses narrowly on research skills, and even then, really only covers written and sometimes oral communication skills i.e. aspects that can be assessed by reading the thesis and conducting an oral examination (if this is held). In the North American model, a

broader range of learning outcomes are assessed because of the incorporation of coursework and comprehensive examinations which occur after completion of this coursework. However, the comprehensive examination tends to focus on disciplinary knowledge, and may include some research skills. The assessment of the thesis in the North American system is similar to that in the British system, involving an examination of the written thesis and possibly an oral defence. In both models, the assessment regime is mainly targeting research skills and disciplinary knowledge, which are certainly important for a graduate entering a career in academia. But even if academia is the desired pathway, what about their teaching and publishing skills? Regarding the former, only in some countries are PhD students required to teach, but their teaching ability is not assessed as part of the doctorate. Some national models of PhD education require publishing prior to graduation, but this requirement is not widespread. And what about a PhD graduate who wants a job in government – how can they demonstrate their readiness to work there? The assessment regime for PhD students needs a complete overhaul, without losing track of the universal criteria which assess 'doctorateness'.

If seeking constructive alignment in the PhD curriculum, then really the full set of intended learning outcomes should be assessed. Given my argument for a bespoke set of intended learning outcomes, this then means a personalized assessment regime. However, as noted above, we need to be careful to ensure the criteria for assessing doctorateness are still at the core of this assessment regime. It becomes a matter of deciding how to demonstrate the holistic set of attributes that have been acquired through the doctoral journey. A portfolio assessment approach is an obvious way to achieve alignment, relevance and authenticity in the PhD curriculum. Indeed, professional doctorates have adopted the portfolio approach to assessment (e.g., Cyr & Muth, 2006; Huba et al., 2006). Some of the arguments put forward to support a portfolio approach in doctoral assessment include: students being fully included in their own learning; portfolios supporting the apprenticeship model of teaching; the promotion of collegiality between the supervisors and their students; engagement of the students and supervisors in establishing criteria for successful completion of a program; and the opportunity for frequent and effective feedback to students (Cyr & Muth, 2006). In a professional doctorate, the portfolio provides evidence of competency and capability in the particular professional field, as well as research ability. However, if a portfolio is used to assess a PhD, aside from demonstrating the research ability, the elements would not be as prescriptive, but rather allow a range of items according to possible career pathways.

So, while the core element of a portfolio for a PhD would involve demonstrating research ability – likely through a thesis, the other elements would depend on the intended learning outcomes, thus providing relevance. For a PhD student seeking an academic career, their portfolio would likely include: a thesis; a career and professional development plan; publications (which may be within the thesis); a statement of their teaching philosophy; teaching evaluations; evidence of ability to communicate their research in different modes and to a variety of audiences; evidence of their ability to work on committees; evidence of participation (and skills acquired) in community outreach or service work; and an academic CV. For a PhD student wanting a government position, their portfolio could include: a thesis; a career and professional development plan; coursework in policy; evidence of ability to translate research into policy; an internship in a government position; evidence of ability to communicate research to a lay audience; and a professional CV. For students who do not know what they want to do post-PhD, a portfolio approach would allow them to consider a range of possibilities, to try various avenues, and develop a host of professional and transferrable skills.

Should such a portfolio should be formative or summative? The University of Strathclyde's Postgraduate Certificate in Researcher and Professional Development discussed previously, combines both formative and summative elements, with students producing a portfolio to demonstrate their acquisition of a broader set of attributes. The portfolio development is overseen by both their primary supervisor and a program coordinator, and it is assessed by the examiners during the oral examination. So, for a portfolio involving a summative element, that assessment approach is one possibility. But how well positioned are academics to comment on portfolios that are oriented towards business or government? If trying to ensure certain attributes or competencies are being demonstrated, relying solely on academics to make this judgement is problematic, particularly for a credit-bearing qualification. Perhaps this is why some universities have adopted a formative approach, requiring the development of portfolios alongside the PhD to demonstrate broader skills sets, but these portfolios are not formally assessed for a qualification. For example, at the University of Queensland, Australia, a formative Research Student [Virtual] Portfolio (RSVP) was implemented (Manathunga et al., 2007). The core elements of the approach comprised a:

- set of graduate attributes for research students;
- reflective review tool that translated these attributes into the local disciplinary/ interdisciplinary dialect and listed ways in which students could demonstrate each graduate attribute;
- portfolio based on evidence of the achievement of the graduate attributes;
- resource package for students and supervisors;
- training program for supervisors (Manathunga et al., 2007, p. 24).

Thus, the RSVP provided a framework for students to organize their professional development to demonstrate attainment of a range of graduate attributes. The approach was found to be a useful tool to get students (and supervisors) to move beyond a sole

focus on thesis research. There was a resistance by supervisors and students for the RSVP to be summatively assessed, with concerns that this would be another hurdle for students, as well as the difficulty of assessing more affective attributes (Manathunga et al., 2007). However, ongoing research (admittedly 10 years later in a more competitive job environment) is showing that some PhD students do want credit for their participation in activities beyond the thesis research (Spronken-Smith et al., 2018b).

A further possibility for assessment is to offer micro-credentials, nanodegrees or digital badges to recognize and reward achievement of learning outcomes related to career planning and professional development. In recent years, led mainly by industry and education reformers rather than universities (Young, 2012), there has been increasing interest in these "compact, flexible and job-focused credentials that are stackable throughout your career" (Shen, 2014, p. 1). They have come into popularity through the open education movement, which has involved the rise of massive open online courses (MOOCs), and the associated demand for alternative certifications such as digital badges (Sullivan, 2013). Digital badges are now finding favor with universities because they allow students to demonstrate a range of skills (Raths, 2013). Indeed, in David Rath's blog, he cites Sheryl Grant (who led a Digital Media and Learning Competition, as well as being a doctoral student at the University of North Carolina), who commented if there were two top PhD programs in her field, one that allowed her to work toward badges in defined competencies through a combination of coursework and field experience and another that didn't, "there's no question which one I would choose" (Raths, 2013, p. 3).

These smaller sized chunks of professional development may be more attractive for PhD students, and could be offered as more informal digital badges, or possibly be stacked to lead to a formal qualification such as a postgraduate certificate. Ideally the digital badges should be embedded in the disciplinary context and research program, rather than bolt-on, but as suggested earlier, some elements could be taught centrally (i.e. outside the discipline), as long as they practiced within the disciplinary context.

Digital badges have been trialed in doctoral education. Inger Mewburn and colleagues at the Australian National University led a pilot study on implementing digital badges to support PhD students in developing key transferable skills in the area of digital literacy and research integrity (Mewburn et al., 2014; Mewburn et al., 2016). Although students were definitely interested in recognition for professional development, they wanted the badges to look official and credible, reflecting university branding (Mewburn et al., 2016, p. 11). Mewburn et al.'s work highlighted significant difficulties trying to implement digital badges in a conservative university setting. These difficulties included: assuring quality for such badges; overcoming technological, legal and administrative issues that are geared towards a paper-credentialing model; a tension between the desire within the university for open access and public engagement versus a closed, private system; and a lack of professional development support to implement a badging system (Mewburn et al., 2016, p. 6). In any pilot using 'disruptive technology', there is bound to be difficulty and resistance, but there is certainly increased interest in the use of digital badges for micro-credentialing in higher education (see Ifenthaler et al., 2016).

It is clear that we need to reshape the assessment of PhD students if we want a system that produces holistic graduates capable of conceiving, designing, implementing and communicating research alongside other skills that will equip them for *being* in the world. Continuing to focus narrowly on a thesis as the key output of a doctoral education is not preparing our students well for life beyond the PhD. We need to think creatively about alternative approaches such as portfolios, postgraduate certificates or digital badges as ways to assess the broader skills sets that PhD students may develop.

D.   CONCLUSIONS

In this paper I aimed to firstly critique two dominant models of PhD education – the North American and the British systems, using the lens of success, and secondly propose an alternative model. Using several indicators, it is apparent that these two models may be failing students. Although employment rates are high, there is a lack of academic positions for about half our PhD graduates, meaning that for many students, their motivation for doing a PhD is not being realized. Worse, many are suffering from feelings of shame or failure either if they do not want to go into academia, or if they cannot obtain an academic position.

Recent research is showing that PhD students may be graduating with a fairly narrow skill set, meaning they are not necessarily well prepared for careers within and beyond academia. While British universities have responded by introducing Doctoral Training Centers, some American universities have introduced Integrated Graduate Education Research Training, and some Australian universities partner with industry in Cooperative Research Centers, these integrated programs are not available to all PhD students. To try and address the rather dire situation, I propose an alternative model of PhD education – one based on John Bigg's notion of constructive alignment. It is clear that we need to think more broadly about the learning outcomes for our PhD students, and expand these beyond thesis research to prepare them for the workplace (whatever that might be), and as global citizens. In a constructively aligned system, this means rethinking how we teach and assess PhD students, to ensure they develop these holistic graduate attributes. The apprenticeship model can still be core to the PhD experience providing supervisors are developing their

students as research apprentices, not necessarily as academic apprentices. Alongside the apprenticeship model, students should have the opportunity to be immersed in learning communities, benefiting from interactions and support from peers and colleagues.

Supervisors would be required to oversee the holistic development of their students – as many already do. Importantly, supervisors (and departments) need to be supportive of their students, no matter what their planned career pathway entails. We need to be offering learning opportunities to purposefully develop and implement career and professional development plans, such that students are acquiring and/or enhancing research, transferable, professional and global citizenship skills for life beyond the PhD.

We need to be creative in thinking about ways to recognize and reward PhD students for the incredible skills sets they acquire during and alongside doctoral study. A continuing focus on the thesis for assessment (even with comprehensive and oral examinations), is not going to help our students. Portfolio approaches may offer a solution, or digital badges could capture the broad set of attributes that PhD students develop. However, I am not naïve. The academy is very conservative, and the PhD degree, as the institution's highest award, holds a place of reverence. Any changes to the nature of this degree will be extremely hard to implement. But the time is right to at least try – we owe that to our brightest students!

ACKNOWLEDGEMENTS

_____

REFERENCES

Acker, S. & Haque, E. (2017). Left out in the academic field: doctoral graduates deal with a decade of disappearing jobs. Canadian Journal of Higher Education, 47(3), 101-119.

Austin, A. (2002). Preparing the next generation of faculty: graduate school as socialization to the academic career. The Journal of Higher Education, 73(1), 94-122.

Australian Council of Learned Academies (ACOLA) (2016). Review of Australia's Research Training System. Melbourne: ACOLA.

Barcan, R. (2018). Paying dearly for privilege: conceptions, experiences and temporalities of vocation in academic life, Pedagogy, Culture & Society, 26(1), 105-121.

Barnett R. (2006). Graduate attributes in an age of uncertainty. In: Hager P., Holland S. (eds) Graduate attributes, learning and employability. Lifelong Learning Book Series, 6. Springer: Dordrecht.

Bennion, A. & Locke, W. (2010). The early career paths and employment conditions of the academic profession in 17 Countries. European Review, 18 (1), S7-S33.

Berlant, L. (2011). Cruel optimism. Duke University Press: Durham, NC.

Bernstein, B., Evans, B., Fyffe, J., Halai, N., Hall, F., Jensen, H., Marsh, H. & Ortege, S. (2014). The continuing evolution of the research doctorate. In: Globalization and its impacts on the quality of PhD education. Global Perspectives on Higher Education. SensePublishers, Rotterdam, pp. 5-30.

Biggs, J. (1996). Enhancing teaching through constructive alignment. Higher Education, 32(3), 347-364.

Bourke, S., Holbrook, A., & Lovat, T. (2005). Using examiner reports to identify quality in PhD theses. Paper presented at the AARE Special Notice Focus Conference: Quality in Educational Research, 4-5 July, Cairns, Australia (2005).

Bridgstock, R. (2009). The graduate attributes we've overlooked: enhancing graduate employability through career management skills, Higher Education Research and Development, 28(1), 31-44.

Buissink-Smith, N., Mann, S. & Shephard, K. (2011). How do we measure affective learning in higher education? Journal of Education for Sustainable Development, 5(1), 101-114.

Burford, J. (2018). The trouble with doctoral aspiration now, International Journal of Qualitative Studies in Education, DOI: 10.1080/09518398.2017.1422287.

Cressey, D. (2012). PhDs leave the ivory tower: UK doctoral training centres prepare students to run a lab — or work outside academia, Nature, 484 (20; 5 April 2012). Available at: https://www.nature.com/news/phds-leave-the-ivory-tower-1.10383 (accessed May 2018).

Cryer P. (1998). Transferable skills, marketability and lifelong learning: the particular case of postgraduate research students, Studies in Higher Education, 23(2), 207-216.

Cyr, T. & Muth, R. (2006). Portfolios in doctoral education. In Maki, P. & Borkowski, N. (Eds) The assessment of doctoral education. Stylus: Sterling, VA, 215-238.

Cyranoski, D., Gilbert, N., Ledford, H., Nayar, A. & Yahia, M. (2011). Education: The PhD factory, Nature 472 (20 April, 2011), 276-279.

Dunn, S. (2013). Why so many academics quit and tell, The Chronicle of Higher Education. Available at: https://chroniclevitae.com/news/216-why-so-many-academics-quit-and-tell (accessed May 2018).

Durette B, Fournier M & Lafon M. (2016). The core competencies of PhDs, Studies in Higher Education, 41(8), 1355-1370.

Elgar, F.J. (2003). PhD degree completion in Canadian universities: Final report. Graduate Students Association of Canada: Dalhousie, Ca.

Flores, E. & Nerad, M. (2012). Peers in doctoral education: Unrecognized partners. New Directions for Higher Education, 157 (Spring), 73-83.

Frick, B.L., Albertyn, R.M., Brodin, E.M., Claesson, S. & McKenna, S. (2016). The role of doctoral education in early career academic development. In M. Fourie-Malherbe, E.M. Bitzer, R.M. Albertyn & C. Aitchison (Eds). The future of postgraduate supervision in the knowledge society. African SunMedia: Stellenbosch.

Fuller, M. (2015). Doctoral education in the UK: ideal models and the stark reality. Presentation at the Australian DDOGS meeting, Sydney, April 19-20. Available at: https://www.ukcge.ac.uk/documents/DDoGS%202015%20-%20Fuller.pdf (accessed May 2015).

Gould, J. (2006). What's the point of a PhD thesis? Nature 535 (7610, 6 July, 2006). Available at: https://www.nature.com/news/what-s-the-point-of-the-phd-thesis-1.20203 (accessed May 2018).

Guthrie, B. & Bryant, G. (2015). Postgraduate destinations 2014: a report on the work and study outcomes of recent higher education postgraduates, Graduate Careers Australia: Melbourne, VIC.

Haigh, M. & Clifford, V.A. (2011). Integral vision: a multi-perspective approach to the recognition of graduate attributes, Higher Education Research & Development, 30(5), 573-584.

Hobin, J., Fuhrmann, C., Lindstaedt, B. & Clifford, P. (2012). You need a game plan, Science, Sep. 7, 2012. Available at: http://www.sciencemag.org/careers/2012/09/you-need-game-plan (accessed May 2018).

Huba, M., Schuh, J. & Shelley, M. (2006). Recasting doctoral education in an outcomes-based framework. In Maki, P. & Borkowski, N. (Eds) The Assessment of Doctoral Education. Stylus: Sterling, VA.

Ifenthaler, D., Bellin-Mularski, N. & Mah, D.K. (Eds) (2016). Foundation of digital badges and microcredentials demonstrating and recognizing knowledge and competencies. Springer: Cham, Switzerland.

Johnston, S. (1997). Examining the examiners: an analysis of examiners' reports on doctoral theses, Studies in Higher Education, 22, 333-347.

King, D., Eisl-Culkin, J. & Desjardins, L. (2008). Doctoral graduates in Canada: findings from the survey of earned doctorates, 2004/2005, Statistics Canada, Culture, Tourism and the Centre for Education Statistics Division: Ottawa, Ca.

Krathwohl, D., Bloom, B. & Masia, B. (1964). Taxonomy of educational objectives, Handbook II: The affective domain. David McKay Co.: New York, NY.

Kuh, G. D., Kinzie, J., Buckley, J. A., Bridges, B. K., & Hayek, J. C. E. (2007). Piecing together the student success puzzle: research, propositions, and recommendations, ASHE Higher Education Report, 32(5), 1-182.

Larson, R. C., Ghaffarzadegan, N. & Xue, Y. (2014). Too many PhD graduates or too few academic job openings: the basic reproductive number R0 in academia, Systems Research and Behavioral Science, 31, 745-750.

Laursen, S., Thiry, H. & Liston, C. (2012). The impact of a university-based school science outreach program on graduate students participants' career paths and professional socialization, Journal of Higher Education Outreach and Engagement, 16(2), 47-78.

Lunt, I., McAlpine, L. & Mills, D. (2014). Lively bureaucracy? The ESRC's Doctoral Training Centres and UK universities, Oxford Review of Education, 40(2), 151-169.

Manathunga, C., Lant, P. & Mellick, G. (2007). Developing professional researchers: research students' graduate attributes, Studies in Continuing Education, 29, 19-36.

Manathunga C., Pitt, R. & Critchley, C. (2009). Graduate attribute development and employment outcomes: tracking PhD graduates, Assessment & Evaluation in Higher Education, 34(1), 91-103.

McAlpine, L. (2016). Post-PhD non-academic careers: intentions during and after degree, International Journal for Researcher Development, 7(1), 2-14.

McAlpine, L., Amundsen, C. & Turner, G. (2013). Constructing post-PhD careers: negotiating opportunities and personal goals, International Journal for Researcher Development, 4 (1), 39-54.

McAlpine, L. & Emmioğlu, E. (2015). Navigating careers: perceptions of sciences doctoral students, post-PhD researchers and pre-tenure academics, Studies in Higher Education, 40(10), 1770-1785.

Mellors-Bourne, R., Metcalfe, J. & Pollard, E. (2013). What do researchers do? Early career progression of doctoral graduates, Vitae 2013. The Careers Research and Advisory Centre (CRAC): Cambridge, U.K.

Merberg, A. (2015). What are the similarities between academia and cults? Blog Post. Quora, January 31, 2015. Available at: https://www.quora.com/What-are-the-similarities-between-academia-and-cults (accessed May 2018).

Mewburn, I., Blackmore, K., Freund, K., Rutherford, E. & Jenks, H. (2016). INSIGNIA – digital badges for research education: final report. Australian Government Office for Learning and Teaching: Canberra.

Mewburn, I., Freund, K., & Rutherford, E. (2014). Badge trouble: piloting open badges at the Australian National University. In B. Hegarty, J. McDonald, & S.-K. Loke (Eds.), Rhetoric and Reality: Critical perspectives on educational technology. Proceedings ascilite Dunedin 2014 (pp. 643-648).

Moore, C. & Shulock, N. (2009). Student progress toward degree completion: lessons from the research literature. Institute for Higher Education Leadership and Policy: Sacramento, Ca.

Mowbray, S. & Halse, C. (2010). The purpose of the PhD: theorising the skills acquired by students, Higher Education Research & Development, 29(6), 653-664.

Mullins, G. & Kiley, M. (2202). It's a PhD, not a Nobel Prize: how experienced examiners assess research theses, Studies in Higher Education, 27, 369-386.

Nerad, M. (2015). Searching for taboos in doctoral education: an exploratory journey, Die Hochschule. German Journal for Science and Education, 24 (2/2015).

Nerad, M. (2014). Developing "fit for purpose" research doctoral graduates: increased standardization of quality measures in PhD education worldwide. In Nerad, M. & Evans, B. (Eds) Globalization and Its Impacts on the Quality of PhD Education Forces and Forms in Doctoral Education Worldwide, Global Perspectives on Higher Education, 28, 111-128.

Nerad, M. (2012). Conceptual approaches to doctoral education: A community of practice. Alternation, 19(2), 57-72.

Nerad, M. (2009a). Graduate education and its changes in the U.S. Daigakuin kyoiku no genjo to kadai [Graduate education, now and future], 291-305. Research Institute for Higher Education (RIHE), Hiroshima University, Japan.

Nerad, M. (2009b). Confronting common assumptions designing future-oriented doctoral education. In Ehrenberg, R. & Kuh, C. (Eds), Doctoral education and the future of the faculty, pp. 80-89. Ithaka, NY: Council University Press

Nerad. M. (2008). From doctoral citizen to world citizen: the chance for innovative doctoral education. Miegunyah Lecture, February 16, University of Melbourne-Australia. Available at: http://www.idea-phd.net/images/doc-pdf/Managing_Developing/from-doc-citizen-to-world-citizen-miegunyah.pdf (accessed May 2018).

Nerad M., Rudd, E., Morrison, E., & Picciano, J. (2007). Social science PhDs, five+ years out: a national survey of PhDs in six fields: highlights report. Seattle, Wa: University of Washington Press.

Nerad, M. & Heggelund, M. (2008). Towards a global PhD. University of Washington Press: Seattle, Wa.

Neumann, R. & Tan, K. K. (2011). From PhD to initial employment: the doctorate in a knowledge economy, Studies in Higher Education, 36(5), 601-614.

Nimmo, C. (2014). The Postgraduate Certificate in Researcher Professional Development: a revolutionary approach to supporting academic excellence with employee relevance. Paper presented at Quality Postgraduate Research Conference, April 9-14, 2014, Adelaide, Australia.

Nussbaum, M. (2002). Education for citizenship in an era of global connection, Studies in Philosophy and Education, 21(4-5), 289-303.

O'Brien, A. J. (2011). Global citizenship and the Stanford Cross-Cultural Rhetoric Project. Journal of the NUS Teaching Academy, 1(1), 32–43.

OECD/UNESCO Institute for Statistics/Eurostat (2018). Careers of Doctorate Holders (CDH) Project. Available at: http://www.oecd.org/innovation/inno/oecdunescoinstituteforstatisticseurostatcareersofdoctorateholderscdhproject.htm (accessed May 2018).

Palmer, N. (2015). Degree completion as an indication of quality. Unpublished report, Australian National University: Canberra, ACT.

Pearson, M. & Brew, A. (2002). Research training and supervision development, Studies in Higher Education, 27(2), 135-531e12w150.

Pedersen, H. S. (2014). New doctoral graduates in the knowledge economy: trends and key issues, Journal of Higher Education Policy and Management, 36(6), 632-645.

Raths, D. (2013). How badges really work in higher education. Campus Technology News, June 20, 2013. Available at: https://campustechnology.com/articles/2013/06/20/how-badges-really-work-in-higher-education.aspx (accessed May 2018).

Roberts, G. (2002). SET for success: the supply of people with science, technology, engineering and mathematics skills. HM Treasury, London, U.K. Available at: http://webarchive.nationalarchives.gov.uk/+tf_/http://www.hm-treasury.gov.uk/ent_res_roberts.htm (accessed May 2018).

Sharmini, S. (2016). Assessing publication-based theses. (Thesis, Doctor of Philosophy). University of Otago. Available at http://hdl.handle.net/10523/6344 (accessed May 2018).

Sharmini, S. & Spronken-Smith, R. (2018). The PhD – is it out of alignment? Paper submitted to Higher Education Research and Development.

Shen, C. (2014). Announcing nanodegrees: a new type of credential for a modern workforce [Blog post June 16, 2014]. Available at: https://blog.udacity.com/2014/06/announcing-nanodegrees-new-type-of.html (accessed May 2018).

Spronken-Smith, R., Brown, K. & Mirosa, R. (2018a). Employability and graduate attributes of PhD graduates. Chapter in Bitzer, E. (Ed) 'Spaces, journeys and new horizons for postgraduate supervision', African Sun Media: Stellenbosch, South Africa.

Spronken-Smith, R., Brown, K. & Mirosa, R. (2018b). Career pathways and preparedness for careers in PhD graduates: a comparative study between the United States and Aotearoa/New Zealand. Paper presented at the Higher Education Research and Development Society of Australasia Conference, Adelaide, Australia, July 3-5, 2018.

Spronken-Smith, R., Cameron, C. & Quigg, R. (2018c). Factors contributing to high PhD completion rates: a case study in a research-intensive university in New Zealand, Assessment & Evaluation in Higher Education 43(1), 94-109.

Sullivan, F. M. (2013). New and alternative assessments, digital badges, and civics: an overview of emerging themes and promising directions, CIRCLE Working Paper No. 77. Available at: http://www.civicyouth.org/wp-content/uploads/2013/03/WP_77_Sullivan_Final.pdf (accessed May 2018).

Sutherland, K. (2018). Early career academics in New Zealand: challenges and prospects in comparative perspective. Springer: Cham, Switzerland.

Sutherland, K. & Corballis, R. (2006). Reconceptualising the New Zealand PhD in English – fit for what and whose purpose? New Zealand Journal of Educational Studies, 41 (1), 85-111.

Teichler, U., Arimoto, A. & Cummings, W.K. (2013). The changing academic profession: major findings of a comparative survey. Springer: New York.

Thiry, H., Laursen, S.L. & Liston, C. (2007). (De)valuing teaching in the academy: why are underrepresented graduate students overrepresented in teaching and outreach? Journal of Women and Minorities in Science and Engineering, 13, 391-419.

U.S. Council of Graduate Schools (2017). Promising practices in humanities PhD professional development: Lessons learned from the 2016–2017 Next Generation Humanities PhD Consortium. Available at:
https://cgsnet.org/publication-pdf/5049/NEH_NextGen_LessonsLearned.pdf (accessed July 2018).

U.S. Council of Graduate Schools (2008). PhD completion and attrition: Analysis of baseline data. Presentation at NSF Workshop, March 31, 2008. Available at: http://www.phdcompletion.org/resources/cgsnsf2008_sowell.pdf (accessed April 2015).

Whalley, W.B., Saunders, A., Lewis, R. A., Buenemann, M. & Sutton, P.C. (2011). Curriculum development: producing geographers for the 21st Century, Journal of Geography in Higher Education, 35(3), 379-393.

Whelan, F. (2016). Here's what you need to know about 'failure' before you start your PhD. Times Higher Education, October 30, 2016. Available at: https://www.timeshighereducation.com/blog/heres-what-you-need-know-about-failure-you-start-your-phd (accessed May, 2018).

Wood, L.N. & Breyer, Y.A. (2017). Success in Higher Education. Chapter in Wood, L, N. & Breyer, A. (EDs): Success in Higher Education: transitions to, within and from University, 1-19. Springer Nature: Singapore.

Wuff, D. & Nerad, M. (2006). Using an alignment model as a framework in the assessment of doctoral programs. In Maki, P.L. & Borowski, N. (Eds.) Assessing learning at the doctoral level. Sterling, Virginia: Stylus.

Young, J. (2012). 'Badges' earned online pose challenge to traditional college diplomas. The Chronicle of Higher Education, January 8, 2012. Available at: https://www.chronicle.com/article/Badges-Earned-Online-Pose/130241 (accessed May 2018).