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Creativity Within Limits: Does the South African PhD Facilitate Creativity in Research?

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Abstract

One view of the PhD student is that of the independent scholar, with the thesis being an original work that contributes to the body of knowledge. National plans make much of the notion that graduating doctoral students will increase the degree of innovation in the country and make new ideas available for economic benefit. At the same time, the process of completing a PhD takes place within frameworks of institutional and disciplinary tradition; student and supervisor expectations, practical resource limitations and, increasingly, national and international quality standards – all of which place boundaries on what can be studied and how it can be studied.

Based on interviews with doctoral students at South African universities, this paper explores the extent to which they experience themselves as independent scholars and the role of creativity in their PhD studies. It explores the boundaries that limit creativity in doctoral programmes and whether PhD candidates experience these boundaries as restrictive or not. It asks whether innovation can realistically be expected to result from doctoral programmes.

Résumé

Une des opinions sur l'étudiant en doctorat est celle du chercheur indépendant dont la thèse est une œuvre originale qui contribue à la connaissance dans son ensemble. Les plans nationaux soutiennent l'idée que les étudiants diplômés de doctorat vont augmenter le degré d'innovation dans le pays et rendre de nouvelles idées disponibles pour un avantage économique. En même temps, le processus d'achèvement d'un doctorat se déroule dans des cadres de tradition institutionnelle et disciplinaire, d'attentes de l'étudiant et de son encadreur, des limites en matière de ressources pratiques et, de plus en plus, des normes de qualité nationale et internationale – ce qui place des limites à ce qui peut être étudié et la manière dont cela peut être étudiée.

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Sur la base d'entretiens avec les doctorants des universités Sud africaines, cet article étudie la mesure dans laquelle ces doctorants s'expérimentent en tant que chercheurs indépendants ainsi que le rôle de la créativité dans leurs études de doctorat. Il étudie également les frontières qui limitent la créativité dans les programmes de doctorat et si les candidats au doctorat ressentent ces limites comme étant restrictives ou non. Par ailleurs, il pose la question de savoir si l'innovation pourrait en réalité résulter des programmes de doctorat.

Introduction

This paper arose out of my own experiences of being a PhD student in two different disciplines at two different South African universities. Common to my experiences at both was a feeling that I was being constrained in what and how I was allowed to research. This experience was in stark contrast to my years of working in the IT industry where I felt that ideas were valued and the directions I chose to pursue were significantly less constrained. I wondered to what extent my experiences were unique and to what extent they were shared by other doctoral students.

Understandings of the nature and purpose of the PhD degree have varied over time and geographical location, but generally include the conduct of original research that contributes to the body of knowledge (Bakradze et al. 2005; Golde & Dore 2001; Leonard 2001; Mouton 2001). Knowledge has been held up as the key to economic growth and wealth creation (Davenport & Prusak 1998; Gibbons et al. 1994) – goals that are espoused in national policy and widely accepted as worth pursuing (Department of Education 1997; Department of Science and Technology 2002). Thus one might assume that the PhD degree, where one practises and perfects the processes of generating knowledge, might be important for meeting these national goals. The goals of economic growth and wealth creation depend on what is broadly termed innovation of which creativity is considered to be a key element (Schweizer 2006), and promoting creativity in higher education is viewed as a desirable (Wits 2005).

The PhD has certain inherent constraints. It has to represent research of a significant size and weight. It has to conform to distinct disciplinary rules of what constitutes original research and contributes to the body of knowledge. It has to be reported in a written thesis or dissertation, which is expected to conform to specific conventions for how research is reported. It has to build on and show a familiarity with prior research in the area. All these things constrain a PhD, but there are also less obvious constraints. Each institution has rules about the procedures for applying and being accepted into PhD studies, for monitoring progress and for assessment and acceptance; and these rules are increasingly expected to fit into quality assurance frameworks. These procedures may

constrain what can be done. There is pressure on institutions to ensure students complete within specified timeframes, which makes it difficult to justify undertaking ambitious long-term research projects. Each PhD student works under the guidance of a supervisor or promoter, and these individuals have their own research interests, biases and preferences for particular areas and methods of research as well as their own understandings of what a PhD is and what a thesis should be. And PhD students embark on the degree with their own unique financial, work and family situations, which affect how much time, energy and other resources they have to bring to the PhD and their own skills, motives and expectations of the degree, which affect what they are willing and able to do. Any of these constraints may impede creativity – the question to be explored is in what ways and to what extent?

In an investigation into PhD programmes at South African universities, I conducted semi-structured interviews with PhD students in four academic units at three South African universities about their expectations, experiences, learning and career aspirations. The study was conducted using multiple qualitative cases in order to be able to investigate the PhD experience in depth, while gaining some perspective of disciplinary differences. The cases were selected to represent the four combinations of hard/soft and pure/applied disciplines (Becher & Trowler 2001: 36), from academic units that were running successful doctoral programmes. However, the final choice of cases was in part dictated by access. This paper draws on twenty of those interviews, from only two of the academic units,[1] and focuses specifically on issues pertaining to the role of creativity in the PhD. The two academic units were a department of Mathematics and Applied Mathematics and a school of Civil and Environmental Engineering, both in formerly advantaged[2] universities, which rank among the top research institutions in the country.

Quotations from interviews are referenced by the letter M (for mathematics and applied mathematics) and C (for civil and environmental engineering), an interview number and a paragraph number. Thus M02: 70 refers to paragraph 70 of the second interview in the department of Mathematics and Applied Mathematics. In the case of more controversial statements or where a respondent might be identified by association with their research, the references are to an alternative set of codes, designated T.

PhD Programmes in South Africa

In many African universities, doctoral programmes face significant challenges. Higher education institutions lack infrastructure, including research facilities, library holdings and technology infrastructure (Belay 2004; Benneh 2002; Szanton & Manyika 2002). Research work is poorly funded (Benneh 2002:

255) and compromised by heavy teaching workloads so that few staff are actively publishing and universities lack a 'critical mass of well-motivated researchers' (Benneh 2002: 250). South Africa is fortunate to have many well-established doctoral programmes and produces a steady supply of PhD graduates. The institutions that run these programmes have a substantial number of staff trained to PhD level, active in research and able to supervise; and are well equipped in terms of libraries, laboratories, research equipment and computing facilities (Szanton & Manyika 2002: 24). Although South Africa also has institutions that are ill-equipped to run doctoral programmes, this study focused on the well-established doctoral programmes in order to understand what works in the South African context, and how and why it works.

Despite having strong doctoral programmes, South Africa produces relatively few doctorates. This is of concern as there is an urgent need to replace ageing researchers and to correct the racial imbalance in academic staff. Few black South Africans have doctorates or enrol in doctoral studies. In the higher education sector overall, the proportion of black African students increased from 40 per cent in 1993 to 61 per cent by 2006,[3] but of the 9,828 people enrolled for doctoral studies in 2006, only 36 per cent were black African, and it is not known how many of these were South African.[4] In South Africa, research continues to be an elitist activity in which powerful myths 'limit who feel they can participate in research activities, who take on post-graduate studies and who succeed in these programs' (Christiansen & Slammert 2005: 1058).

Doctoral education in South Africa is carried out in 'the classic British model of supervision' (Dietz et al. 2006: 9) in which a doctoral student works independently, under the supervision of an established researcher. While there have been some programmes that approach doctoral training differently (Dietz et al. 2006; Samuel 2000; Szanton & Manyika 2002), and claims that such changes are beneficial for developing researchers in formerly disadvantaged universities,[5] there appears to be resistance to experimenting with new modes of postgraduate learning and to the introduction of different doctoral degrees (Samuel 2000). While universities in Britain have embraced diverse forms of doctorates, including professional doctorates and structured doctoral programmes (Park 2005; Sadlak 2004), and the addition of explicit training elements (Huisman & Bartelse 2001; Sadlak 2004) attempts at similar innovations in South Africa are opposed as being of inferior quality (Samuel 2000) and the Higher Education Qualifications Framework introduced in 2008 only allows for doctoral qualifications that are research and thesis-based (DoE 2007).

Research into Creativity

Research into creativity goes back to 1950 when Guilford, in his inaugural speech as the president of the American Psychological Association, proposed an agenda to investigate how to identify and cultivate creativity (Miettinen 2006; Sternberg 2006). Early attempts to identify creativity were influenced by work in measuring intelligence and took a largely positivistic and individualistic approach to the subject. Later research began to draw on other traditions, including sociology and economics, and has taken a more systemic or socio-cultural perspective (Miettinen 2006; Csikszentmihalyi 1999; Ambrose 2006). Studies in cultivating creativity have similarly shifted from those that focus on the cognitive processes, skills and aptitudes of the individual to those that examine practices, social environments and artifacts used in creation (Cropley 2006; Csikszentmihalyi 1999; Miettinen 2006; Nyström 2000).

One of the challenges in discussing creativity is agreeing on what it is. The term creativity has been used by researchers to describe an extremely wide range of behaviours, while some reserve it for those radically novel situations in which 'a completely new idea or product has been created, and that the creation in question is of a particularly high magnitude' (Kaufmann 2004: 155–6). Different types of creativity have been distinguished including *adaptive* creativity, which leads to improvement within existing frameworks and boundaries, and *innovative* creativity, which leads to the restructuring of problems and boundaries (Kaufmann 2004: 154); and Sternberg's eight types of creativity – four that 'accept current paradigms and attempt to extend them', three that 'reject current paradigms and attempt to replace them' and one that 'synthesizes current paradigms' (Sternberg 2006: 96). The existence of types of creativity that appear distinctly uncreative, for example, Sternberg's *replication* creativity type, which attempts to 'show that the field is in the right place' and 'keeps the field where it is rather than moving it forward' (Sternberg 2006: 96), makes some of the broader notions of creativity indistinguishable from notions of intelligence (Kaufmann 2004: 156–8).

Others have proposed that in order to distinguish creativity from simply intelligent behaviour, there should be elements of both novelty and unconventionality. Creativity requires 'a *modification* or *rejection* of previously accepted ideas in *addition* to novelty' (Kaufmann 2004: 158) or a transforming (rather than exploring) of the conceptual spaces (Boden 1995: 3). And a further requirement from some authors is that the creative act needs to be valued or externally sanctioned in some way. Since this valuing is a social process and depends on existing values, worldviews and power structures, creativity is contextual and time-dependent (Boden 1995; Cropley 2006: 126; Sternberg 2006: 95). What might be considered creative in one setting might be considered banal or in poor taste in another, and rediscovering a theorem or a genre of art is generally not considered creative.

While early research viewed creativity as an inherent aspect of personality and associated different personalities with different types of creativity (Kirton 1987), later research acknowledges that creativity is not a special gift – it involves ordinary capabilities like noticing and remembering (Boden 1994) – and is a function of a combination of inherent abilities, learned skills and environmental factors (Sternberg 2006: 88). Increasingly, creativity has come to be seen as a social phenomenon in terms of how it is understood, valued and encouraged (Cropley 2006: 125). This has led to research aimed at understanding what skill sets and environments might best foster creativity and how they can be developed. In an effort to explore the optimal conditions for creativity, the creative process has been explored and modelled. For example, Hadamard proposed four phases in creativity – preparation, incubation, inspiration, and verification (Boden 1994) – each of which requires a different set of factors to function optimally. In the remainder of this section, we explore some of the factors that support creativity.

The literature on motivation and creativity has examined the effects of extrinsic and intrinsic motivation on creativity. Extrinsic motivation involves the getting of external rewards such as money or praise for desired behaviour, and has been shown to reduce creativity as individuals focus on the reward and approach the task with a view to completing it quickly and with minimal effort. Intrinsic motivation, on the other hand, involves completing a task because the task is of itself interesting and has been shown to increase creativity as individuals are more likely to explore the task and invest time and energy in completing it (Amabile 1996; Cooper & Jayatilaka 2006: 153–4; Haring-Smith 2006: 25).

Much research has focused on the need for divergent thinking, associative memory and analogic thinking (Boden 1994), particularly in the early stages of generating ideas, although more recent research has indicated that there is also a need for convergent thinking in the later stages (Nyström 2000: 111). The process of generating ideas depends on the intellectual abilities, knowledge and styles of thinking of the individual (Sternberg 2006: 88); on skills in pattern recognition, the use of schema for problem solving and the creation of analogies and mental models; and benefits from an environment in which there are opportunities for casual interactions that encourage cross-pollination of ideas and access to different knowledge domains (Haring-Smith 2006).

Boden (1995) discusses the centrality of conceptual constraints in the creative process. She argues that the most interesting creative novelties are those that *could not* have arisen before. Ideas arise within a particular conceptual space – such as Impressionist art or Euclidean geometry. These conceptual spaces contain inherent constraints that delineate a range of possibilities, and explora-

tion of the spaces usually takes place within that range of possibilities. However, the most creative novelties are those that step outside of this range of possibilities, and they very often arise from the removal of a conceptual constraint – for example, the development of non-Euclidean geometry by dropping the requirement that parallel lines do not meet (Boden 1995: 2–3). It is this process of asking 'impossible' questions that gives rise to entirely new domains. However, research into creativity has largely focused on the creativity of responses to some stimulus and has left relatively unexplored the processes of identifying problems or posing interesting questions (Kaufmann 2004: 160). Research that emphasizes the role of open-mindedness in creativity suggests that interesting problems can only be posed if the questions are allowed to develop and grow in the process of exploring solutions (Haring-Smith 2006).

Boden argues that creativity can only be understood with reference to a particular conceptual space – thus one requires an understanding of musical expression in order to be able to recognize a pianist whose style is 'original' – and, in order to be able to challenge the constraints of a conceptual space, one needs to develop exceptionally rich and deep cognitive maps of the space (Boden 1995). There are 'norms about breaking the norms' (Cropley 2006: 126), and these need to be understood in order to ask questions that will be viewed as creative rather than simply disruptive. So we must expect that notions of creativity differ across academic disciplines. The disciplines that have weak boundaries and internally contested conceptual frameworks are likely to be more open to different methods of inquiry and diverse ideas, while those with firm boundaries and uncontested conceptual foundations tend to use specific methods and have less scope for challenging existing constraints (Ambrose 2006: 77).

Sternberg and Lubart have proposed that creativity is a strategic decision and can be likened to an investment decision. Creative people pursue 'ideas that are unknown or out of favor' and turn them into popular ideas, often in the face of opposition (Sternberg & Lubart 1991). In this view (and experiments with students confirm this), creativity can be encouraged simply by making it clear that creativity will be rewarded (Sternberg 2006: 90). For students to decide to act creatively, they need to feel confident that the rewards are likely to outweigh the costs (Sternberg 2006: 93); they need to choose non-conformity in the face of possible social censure and resist the social pressures towards intellectual conformity (Cropley 2006: 125), and they need to be willing to take risks. Creativity can be encouraged by creating a social climate in which 'variability is welcome and that people who generate it are respected' (Cropley 2006: 129).

It has been suggested that there is no one ideal environment that is best suited to creativity, but that different individuals will thrive in different environments, depending on their preferences (Cropley 2006: 128). However, there

are certainly common elements that will encourage creativity, for example, that individuals who are focused continually on their survival needs have less space for creativity. (Haring-Smith 2006: 24–5).

The elements of research into creativity discussed suggest that, within the context of PhD studies, conditions conducive to creativity might include the following combination of individual and environmental factors: On a personal level, we seek (or seek to cultivate) PhD students who are motivated by an intrinsic interest in research; who have displayed the cognitive abilities and had the opportunities to acquire a deep conceptual map of their field, while at the same time have enough breadth of understanding across other fields to remain open-minded; who are willing to take risks and who have developed skills in identifying interesting problems to solve. And we seek to place these students in an environment where their survival needs are catered for; where opportunities are provided for interactions with experts in their fields and with people in other fields that stimulate different conversations; where risk-taking is encouraged and in which the need for open-endedness, the space for problems to develop alongside their solutions is acknowledged and supported.

Of course, these attributes are not neatly divided between personal and environmental. There are factors in the environment that influence student motivation and the willingness of students to take risks influences and is influenced by the degree of risk-taking tolerated in the environment. Consequently in what follows, some of the attributes will be discussed across the personal and environmental level simultaneously. The remainder of this paper draws on the interviews with students to explore the extent to which their experience reflects this ideal situation. References are to student interviews and the paragraph(s) within each interview.

Student Motivation

PhD students display high levels of self-motivation. Many have 'always known' that they would one day get a PhD. Students say, 'It was kind of always like an ambition – "I'll be a doctor one day."'[6] And, 'I always had this idea that I'd like to do a PhD… that was always a dream.'[7] For others, the aspiration developed during their undergraduate studies like this student, 'When I went to the university I started seeing that I can be a Mathematician.'[8] They study for their own personal satisfaction or because the work is intrinsically interesting, saying, 'I found it interesting, I liked to study, I didn't actually go for the qualification'[9] or 'I just like research'.[10] Some students, notably those in academic careers, were completing a PhD for promotion and career opportunities,[11] but even they displayed a strong interest in their work. While conducting the interviews, I was struck by how the students 'lit up' when asked to talk about their research.

They sat up straighter, leaned forward, spoke more animatedly and gesticulated more during this portion of the interviews, and in the audio tapes one can hear the excitement in their voices as they describe their research.

PhD students experience a loss of the external motivators that were prevalent in their undergraduate years. They speak of how their supervisors do not set targets for completing work, how they have to do this for themselves and how exciting they find it to be directing their own work.[12] One said, 'I like that kind of feeling that I am not learning for an exam. I am learning to understand, and that is very, very important for me.'[13] However, students also speak rather wistfully of the value of extrinsic motivators, for example, 'I wish they were like a teacher going: "Where's your homework book?" But unfortunately that's not what they do. … Knowing that I'm going to get my punishment for not handing in my assignment for this week's research might just push me a little bit more.'[14]

In discussing the desirability of course work in the PhD, several students mentioned that they found self-directed studies preferable: 'I mean, I really have to search for information on my own rather than being taught … the process of reading and understanding, not necessarily being taught I think, to me is very important.'[15] The only exception was in certain mathematical specialisms where students had a lot of material to cover when they went into the PhD and felt that coursework would have been a quicker way to cover the ground.[16]

Students do speak of the difficulties of staying motivated over what is a long process. Students who work part-time find that their work helps to keep them motivated. When they can see the need for the application of their studies and when they can apply what they are learning to problems within their environment, they find it helps them to keep going.[17] Students make use of their peers and family to keep motivated – particularly in addressing the emotional ups and downs of the process.[18] Students also expect a certain amount of motivation to come from the supervisor in the form of encouragement and direction[19] or simply reassurance like, 'Don't panic, don't panic, everything will be fine.'[20] And students learn in the process how to motivate themselves.

While most of the research into creativity and motivation has considered the effects of intrinsic and extrinsic motivation, recent research suggests the existence of a third, distinct type of motivation – obligation motivation. Obligation motivation stems from a strong and pervasive 'rule of reciprocation' in human society that makes people behave in ways consistent with expectations of others (Cooper & Jayatilaka 2006: 56–7). While obligation motivation has some of the characteristics of extrinsic motivation – in that one's action are constrained by the wish to avoid feelings of self-reproach and the censure of the social group – research shows that the effects of obligation motivators on

creativity are more in line with those of intrinsic motivators (Cooper & Jayatilaka 2006: 166). This was reflected in some of the student interviews. A student who was part of a journal club spoke of how the regular meetings 'gives me a duty to always make sure … that I read the paper.'[21]

It seems that most PhD students are highly self-motivated, and this could be because few would undertake the volume of work and the commitment that the PhD represents without an intrinsic interest in the research. Students were supportive of the research model of the PhD in South Africa as one that allowed them to work in a self-directed way and experienced a great freedom in this kind of study. It is important for supervisors to provide encouragement and for students to have peers or family to draw on for emotional support, and commitments to other students can assist in motivation. On the whole, the PhD as it is currently run in South Africa would appear to develop graduates who are able to motivate themselves through a long and emotionally varied process. Thus, graduates are likely to be well prepared to take on the work of long-term creative endeavours.

Developing Deep and Broad Understandings

Because of their interest in knowledge, and because of the unstructured nature of the PhD, students do have opportunities to develop broad interests. A student says, 'I have read things that are absolutely incredible. In fact one book … my supervisor said to me I must just read the one paper – it was a compilation of papers – and I ended up reading the entire book … completely off the topic but, you know, it was really interesting.'[22] Another says, 'I had to learn things like string theory as well, just for interest sake, just to get a broader perspective of how things relate.'[23] And a third, 'There's books that I've read that I'd never have read if I hadn't [done a PhD]. I think my understanding of architecture is vastly enriched – you know, its gone way outside of what the actual PhD problem is.'[24] Students say that this explorative knowledge-gathering gives them different perspectives, enriches their understanding, provides intellectual stability (like 'adventitious roots'[25]) and provides ideas to add to 'the file of wonderful things to do once you've finished the PhD'.[26]

I was struck by the number of PhD students who found that they had to investigate other areas for their research to be meaningful – for example, 'I'm touching on the chemistry, the physics, the hydrology, the biology all of that kind of stuff as well as policy and management and public participation.'[27] And another says, 'I am doing a PhD in mathematics, and it's financial maths, so you will find that I will need ideas from economics, I will need ideas from finance, I will have to look at what is being used in the banking sector.'[28] Many also interact

with industry and government bodies.[29] This kind of boundary crossing was common, and even students who ostensibly researched within one subject area found that their research intersected with a wide range of other areas. So, it seems that the current configuration of the PhD does allow for (or perhaps demand) considerable breadth in the knowledge base that students develop and draw on.

However, for students who are working within traditional boundaries of disciplines or specialisms, it can be difficult to cross knowledge boundaries. Here, a student talks about trying to communicate with pure mathematicians: 'Even if I ask them questions about Hilbert spaces that we apply in physics, the approach to the maths is just from an entirely different perspective. We think about physics – how do you apply the maths to physics. They think about some complex … I don't know what they think about.'[30] And while it is common to draw on other areas of knowledge, it is very difficult to complete a PhD that straddles different disciplines. This student's experience appears to indicate that a PhD student is better off having one intellectual home:

> I had a supervisor in Science and a supervisor in Humanities. They … neither of them had a very high opinion of the other. Well, not as academics as such, but of one another's disciplines, and of what the other would be doing to the thesis. And I just felt torn between the two. I just felt that sort of pulling between, 'Oh, the other supervisor clearly doesn't know [what] this thesis is supposed to be about.' And I didn't like that, that tearing. (M21: 90)

It cannot be assumed that students completing a PhD have accumulated depth in their subject through studying it in their undergraduate years. Few of the students interviewed had selected a subject to major in during their undergraduate years, completed honours and master's and proceeded to doctoral studies in the same subject. Students come to PhD studies via a wide variety of paths. One had begun with a clear passion for one subject, but had later lost interest and moved in another direction.[31] Another had not been able to major in her chosen subject owing to the undergraduate degree structure, but moved into the area at master's level.[32] And a student in one discipline deliberately sought to complete her PhD in another related discipline because she felt that the focus could be different.[33] Despite this, students are very aware of the need to develop depth in their subject area and generally agree that they cannot make progress without it. They make use of their time as PhD students to take courses, attend seminars and read in order to develop knowledge in their chosen fields, and there is a sense of their own expertise developing over time.[34]

Part-time students, who have less pressure to complete in a fixed time frame, have more scope for exploration both in terms of the depth and breadth of their work. A lecturer who took a sabbatical to work on the PhD ended up doing 'some other massively exciting tangential projects',[35] and while these delayed graduation, they were part of the journey of discovery. Another was able to complete a larger, longer and more ambitious project than she would have been able to do as a full-time student.[36] This experience highlights an essential tension between the push to graduate students efficiently and the view of the PhD as a process that cultivates scholars.

It appears, then, that the unstructured, open-ended nature of the PhD encourages and makes it possible for students to explore and draw on a wide range of knowledge at the same time as they deepen their knowledge in their specific subject area. Depending on their area of research, and the route that they took in arriving at the PhD, students develop more depth in a single subject or breadth across related subjects (or work at some point along a continuum between these positions). This space for the extensive exploration of knowledge is likely to develop the kind of rich, deep and detailed cognitive maps that are necessary for creativity (Boden 1995). However, the degree to which students are under pressure to complete appears to affect the scope of this process, with part-time students having more freedom to explore.

Providing Opportunities for Interaction

Students appreciate the value of interactions with others in generating and developing ideas. One student presented this ideal of how the creative process can work in the right environment:

> I was at Stanford and one of my clearest memories was – you walk down the passage, and you would see the same two people standing at the doorway talking about something and every day you'd walk past – they'd just talk for fifteen minutes in the morning – and every day when you walk past you'd hear, you'd catch a little of the conversation. Literally four days later, they'd posted that article on the archive and I was like: 'Wow, now that's how it should be done.' And it seemed like there was just such a wealth of ideas, and there was such experience. (M05: 12)

Students clearly appreciate the value of discussions with other people as a source of ideas.[37] Mostly, they rely on their supervisors for these conversations,[38] but while there are a few supervisors who are prepared to devote an inordinate amount of time to their PhD students,[39] many are not able to provide a constant source of interaction.[40] After supervisors, students speak highly of the value of postdoctoral students who are an important source of ideas, support and collaboration for

students in particular specialisms. One student said, 'We had two to three postdocs at all times, and I learnt the most I've learnt in my whole career from them, just because they were willing to help and they had, you know, done everything before.'[41]

While students sometimes find that discussing their work with other PhD students gives them different perspectives or ideas,[42] generally they find that other students are not working closely enough to their own area of research. A student explained, 'What you need to have is certain discussions with people – it's the type involving more technical details – and then people can't really help you because they don't really know the exact work of, you know, what you are doing.'[43] Students do interact on a social level with other PhD students and draw on them for general support – sharing information about software or administrative issues – but generally, do not discuss their work in any great detail.

PhD students attend seminars within their research groups or departments and interact with people in other departments within their own universities[44] and in other institutions, both local and international.[45] Technology makes it increasingly possible for students to collaborate across geographical distance, and this does help to bring students into contact with others in their specific fields of study. International travel is an important source of new ideas, and several of the PhD students had had opportunities to travel to conferences or to spend time at other universities,[46] although for some this was clearly considered to be unattainable.[47] Funding for these opportunities is limited and can be inflexible. For example, one student spoke of the importance of summer schools as a way to meet other young researchers as well as 'big names in your field' and of the difficulty of finding funding for this kind of travel.[48]

While the emphasis on independent research might make it appear that the PhD does not encourage collaborative work, a significant number of students did work collaboratively on papers or projects in the course of their PhD, even where their own PhD work was done alone. Students in general were ambivalent about collaboration – they acknowledged the value of sharing ideas and work, but found it difficult to do. Reservations included 'I've never really been a work-in-a-group type person'[49]; working with people who don't 'seem to listen to anyone in the group'[50] and working with large groups who just wanted 'their names on a paper'.[51] Others recognized that collaboration was a skill that had to be learned, and felt that they were developing these skills in the process of their studies.[52] Students also recognize the benefits of collaboration across different knowledge areas. As this student explains, 'If you only work by yourself, you're limited to some extent, because you're limited to a certain range of research topics, where if you collaborate, you can always get somebody else that comes from a different field that contributes to the paper and you get a much better paper in the end.'[53]

Just setting up opportunities to interact is not enough. The importance of the social climate (Cropley 2006) in interactions was illustrated by a student who compared seminars attended as a visitor to a well-known American university with interactions with faculty at the local university. At these seminars, despite the presence of significant figures in the field, 'everyone gets considered an equal at the table', and this challenges students to ensure that what they say is 'respect-worthy'. By contrast, at the local institution, one encountered a distant and patronizing attitude, 'We are the Professors, we know a lot. You are the students, you do not know a lot. We *like* you, we are going to *teach* you.' Student ideas and contributions were effectively stifled with, 'Hmmm, *but*, this is actually how it is.'[54]

Casual interactions between students and staff are difficult to encourage. Students often felt that they were treated as colleagues, rather than students, by the academic staff.[55] But students who had been undergraduates in a department found it difficult to view their former lecturers as colleagues: 'They're on a pedestal, no matter what.'[56] And while departments have staff tea-rooms, postgraduate students may not feel welcome there as this student describes: 'I've never found it a welcoming environment. … Nobody's ever said "you're not welcome here" or anything like that – it's just the vibe.'[57] Women in particular felt excluded.[58] The international student office arranges for foreign students to get together, but one student expressed doubt at how effective these arrangements are.[59] On the other hand, several students who tutored commented on the value of tutoring as a means of getting to know other students and staff members. While these interactions did not directly feed into their research, they did help to make the students feel more at ease in the department and created a sense of belonging.[60]

Interactions with others in and outside of the field are an important source of ideas and inspiration for PhD students. While departments do try to encourage interaction, it can be difficult for students to locate individuals within their specific area of interest. Postdoctoral researchers and supervisors play an important role, and students also seek out and work with researchers at other institutions. PhD students are exposed to a surprising amount of collaboration and learn valuable skills in the process. Interactions need to take place in a social climate of openness, tolerance and support that gives social status to those that introduce novelty (Cropley 2006) if they are to encourage creativity, and the data suggests that this is sometimes not the case.

Research Questions and Risk-taking

Creativity relies on being able to ask meaningful and useful questions, and the more creative questions are those that challenge the constraints of the conceptual space. Arriving at a research topic is a significant part of the PhD process. For some students, the choice is simple: 'Your supervisor has got a set of things that you can choose from and I chose one.'[61] A research topic should be 'well defined'[62] and reasonably likely to result in publishable results,[63] and supervisors are expected to be able to make judgements about what a 'good topic' is while students are expected to have a better sense of this towards the end of their studies. A student who is in the first year of her PhD says, 'I'm not quite sure, at this point in time, exactly what is a good topic to work on and what isn't. In a couple of years' time, I will be expected to have ideas of my own [about what to research].'[64]

What one studies can be a matter of what research the supervisor, research group or department is involved in: 'Very often a supervisor will be quite selfish and say, "I'm interested in these problems, are you?"'[65] For one student, arriving at his research topic was 'a two-way process' between his interests and the interests of the research group.[66] But another student feels that they have far less say in what they research, 'And the thing that really has always interested me is _____, and that's not done here. So, I was kind of forced to do what this department does, and it was awful, it was really, really awful and I hated it.'[67] The choice of research projects is also influenced by issues that are topical: 'There are models that have been built … but these do not explicitly incorporate climate change, and climate change has recently emerged as one of the most threatening episodes within developing countries'[68]; or fashionable: 'I mean my Master's project, the latest craze at that stage was _____ and so I went into that. But by the end of that, I quickly realized that its days were numbered and that was not the way to go.'[69]

For some students, the process of 'getting a problem' is complex and consumes years of their time:

> You see the problem is we are still actually trying to find a very good problem that is … that can be published. In the sense that we can find a problem today and think, 'No, this is a problem that is, you know, worth a PhD.' Later on you discover that maybe it's nothing actually, or it has been dealt with already. So, coming up with something that you can actually say *this is it*, I think it's the most difficult thing. And I was talking to my supervisor the other day and he was saying, sometimes getting a problem can be worth a PhD. (M02: 36)

That this process needs to be open-ended, with the opportunity to explore, to get side-tracked, to develop deeper understandings and to revise the problem along the way is reflected in what other students say. For example, 'You set yourself a research problem and then you just see that problem. … It's like a slippery eel – you keep having to come back to that research question and say, "Well is the question still valid?"'[70] Such comments might indicate that students are being encouraged to ask interesting questions that challenge the constraints of the conceptual space. However, this is not reflected in the administrative procedures, and one student wondered why the university required a proposal at the start of the process rather than later on when 'it makes more sense'.[71] Mathematicians in particular were quick to point out that it is often not possible to say in advance what problems will be solved.[72]

While some students experienced great freedom in their research, there was evidence of the control of ideas by those established in the discipline. One student's idealism about science had been replaced by cynicism on encountering this. After starting out 'wide-eyed and so excited' about knowledge as an undergraduate, 'I really did think that everyone was working towards the bigger body of knowledge and … as long as your science was good, it would be accepted.' This student later found out that 'There are some very powerful people who've got long careers and proven themselves and they obviously carry a lot more weight. So if they throw out your idea right in the beginning, there's little chance that anyone's even gonna look at it.'[73] In response, the student had chosen to be 'strategic' in selecting problems that 'I know will be publish-worthy in a short span of time'.[74] Another student thought that the pressure to publish (for both students and experienced researchers) meant a proliferation of papers announcing incremental results and little incentive to fully develop a general case: 'Essentially the same tools are being applied; it's just the model that changes slightly.'[75] This student felt that, far from contributing to knowledge, their study was 'contributing to the clutter of information'.[76]

In general, risk-taking is not encouraged. Students are encouraged to be pragmatic in selecting research topics that can be completed in the required time frame and that can be investigated using well-known research methods. Full-time students tend to want to finish so that they can move into employment while employed students who study part time in an area related to their employment have more scope for taking on ambitious projects because they have access to research sites and equipment. A student who is doing a country-wide study of invertebrates says that, 'If I had to do it full-time, I probably would have stuck to one order, I wouldn't have attempted to do four, and I would have done a little bit, maybe just the northern part of the country.'[77]

It seems that the PhD does encourage students to develop skills in asking questions. Whether students experience the process of arriving at a research question as an exciting creative journey or a series of cynical strategic choices differs by student, supervisor and discipline. It appears unlikely however, that many PhD students will transform the conceptual spaces in which they work, since those that are inclined to ask 'impossible' questions encounter boundaries past which they may not step. Constraints of time and resources push students increasingly towards modest and safe projects, 'rather than research for pleasure, significance and originality' (Leonard 2001: 41–2). There is a danger that these pressures might reduce the PhD to research training where students apply known methods to predictable problems in much the same way as undergraduate students are set problems with known solutions. In the process, students will be denied the opportunity to encounter the messy world of real research and to develop the tacit understandings of how experienced researchers deal with it.

Freeing Students from a Focus on Survival Needs

PhD students are quick to complain and joke about their lack of money, but perceptions of poverty are relative. Survival needs in this section refer to basic needs for shelter, food, safety and transport. The PhD students interviewed fell into three broad groups as far as their financial position went.

Most of the part-time students were well established in secure jobs. Some of them enjoyed financial support from their employers to cover their study costs, but even those who did not, were well able to afford the tuition fees. These students also drew on their work environments for computers, internet access and other resources that they used for their studies. One says, 'Well, basically we've got our basic equipment – sampling equipment and preservatives to preserve the samples. We've got microscopes here, we've got cameras here, we've got the meters – everything. All the equipment needs and software needs and computer needs that I have, I'm lucky enough to have it at my work. I've got my vehicle and I've got field assistants.'[78] For these students there were no concerns about their financial position.

The second group is characterized by the comment, 'I've got an NRF[79] bursary so I'm fine for this year. I do a bit of tutoring also, but I would be fine with just the NRF actually. I do the tutoring more for a little bit of extra cash and experience.'[80] These students are typically young, without family commitments, studying full time and funded through some combination of study grants, tutoring work and family support. They were able to maintain a comfortable standard of living and generally did not raise any concerns with their funding. Towards the end of their studies, as they saw their contemporaries 'married

and buying houses'[81] they experienced some frustration that their financial position had not kept pace, but apart from some impact on their time when they took on tutoring work, they did not have any concerns that kept them from their studies.

The third group of students was those with serious financial difficulties. These students were typically foreign, older students with families to support. South Africa draws many students from the rest of Africa, and of the twenty students interviewed for this paper, eight were from other African countries. These students are funded in a variety of ways, including funding from academic institutions at which they are employed, funding from their governments, grant funding from various international donors, funding through South African universities or research funding linked to specific supervisors. Some begin their search for funding years before they are able to secure it[82] and only realize the opportunity for PhD study later in life when they have established families and face living without them for three to four years.[83]

Some students had run into serious difficulties with their funding that had interfered with their studies. One whose funding had been provided through his supervisor lost it when the supervisor left unexpectedly in the middle of his studies,[84] and another said, 'When I came here, I was sponsored by [a donor organization] and they made us believe that the funding was for three years. And this year in February – like during the time that we are supposed to be registering – they then sent us an e-mail and said no, we are not going to fund this year.'[85] Students have had to take time out to work in between their studies, and this has added to the duration of their degrees. When these difficulties arise, students find it difficult to concentrate on their work, like this student who says, 'We have some problems that we are trying to solve concerning my funding so I wasn't working as hard as last year.'[86] Those who have left families behind have the added worry about their families that detracts from their work.

Of course, not all students fall neatly into these categories. There are young, single foreign students some of whom are well-funded and some of whom struggle for funding. And there are South African students with family commitments and young, single South African students for whom finding funding is difficult.

On the whole, the PhD students interviewed appear to be comfortably funded. Those who study while they are young and without commitments and those that study part time are most likely to be free of concerns about their survival needs. The existence of a range of funding options makes it more likely that students can access funding through one or other avenue. The system of employing PhD students as tutors provides a valuable source of funds for some students (and cheap but highly skilled labour for the universities).[87] The one serious gap in funding is for foreign students who often cannot ac-

cess the same range of funding sources that South Africans can. They tend to spend more time focused on their survival needs to the detriment of their research work. Of course, this study includes only students who have succeeded in gaining access to funding for doctoral study. In addition, access to funds is probably easier at these more prestigious universities. It may not reflect the situation at other universities.

Conclusion

This paper has examined the question of creativity in PhD studies, working from the assumption that creativity is valued and that encouraging creativity at the PhD level is desirable. Accepting creativity as something that can be cultivated and not an inherent aspect of personality, and taking a systems view of how creative processes work and are encouraged, I identified those attributes of individuals and the environment that might be expected to foster and support creativity. These included aspects of student motivation, developing both deep and broad understandings of the field, providing opportunities for interaction, support for risk-taking in identifying and developing interesting problems, and freeing students from a focus on survival needs.

The interviews reveal that students and their experiences of the PhD vary widely and are individual and idiosyncratic. PhD students are highly self-motivated but there are ways in which supervisors can and do encourage and support students through the long process. Obligation motivators can be effective in this regard. A surprising number of PhD students work across knowledge domains and have to develop skills in other areas. There is valuable flexibility in the PhD that allows students to develop breadth of knowledge in these cases. And despite the different routes that students take to the PhD, they do have the opportunity to develop depth in their chosen field through an individually selected combination of reading, seminars, courses and collaborations. PhD students value opportunities to interact with others in their field and, to a lesser extent, in other fields. While departments make some (not always successful) efforts to encourage this they are hampered by the lack of funding for travel, although technology has made it easier to collaborate internationally.

The extent to which students are encouraged to identify interesting problems differs. Some spend a lot of time crafting their research questions over time, and the administrative need to submit a proposal may work against the need for questions to grow and develop. The current concern in higher education for efficiency, the trend towards viewing the PhD as training in research (rather than research), together with resource limitations, is pushing students towards 'safe' PhD projects, and this poses a serious threat to creativity. Most PhD students interviewed have few concerns with survival needs, but a sig-

nificant number find their studies hampered by a lack of money. In particular, better funding strategies would enable South Africa to make more of the opportunity of attracting PhD students from the rest of Africa.

On the whole I found that the experience of PhD students did not reflect my own experience of feeling constrained. With a few exceptions, PhD students are enthusiastic about their work and find that there are elements of the current system that are flexible and allow for creativity in developing and solving research problems. However, there are areas in which creativity in the PhD could be better supported.

This study took place in two well-resourced South African research universities where students had access to a range of funding sources and opportunities for collaboration and interaction. However, because the conditions that support creativity are likely to be similar, there are several aspects of the findings that apply more generally to universities in Africa. Given the many obstacles they face, students who pursue doctoral studies in Africa are likely to be highly self-motivated. The flexibility afforded by the traditional model of individual supervision continues to be valuable for breadth and depth of learning. The need for interaction can be supported by paying attention to the social climate in departments and with travel or technology where possible. And concerns with efficiency are widely felt and pose a similar threat to creativity across most universities. In particular, the finding that part-time students are less restricted by financial and time constraints poses the intriguing possibility that better support for part-time doctoral study might facilitate more creative doctoral research.

Notes

1 At the time the paper was written, the interviews at the other sites had not been completed.
2 In South Africa, universities that were in the past reserved for whites are known as formerly advantaged.
3 HEMIS, Department of Education, http://www.education.gov.za/dir_docs/Update/2006/2006.asp [accessed 25 October 2008].
4 From the profile of PhD people on campuses and in this study, it is likely that a significant majority of black people enrolled for PhD studies are not South African.
5 In South Africa, formerly disadvantaged universities are those that were reserved for people not classified as white during the apartheid years.
6 C04: 10.
7 C02: 2, also M05: 8.
8 M02: 16.
9 M08: 6.
10 M02: 16.
11 M01: 18; M02: 16; M07: 6; C02: 39–42; C10: 16.
12 M01: 18, 89, 91; M21: 122; M02: 78; C02: 56; C04: 108, 120.

13 M01: 91.
14 C04: 74.
15 M01: 24, also M02: 28; C02: 68–70.
16 M07: 22; M13: 36.
17 M04: 68; C10: 72; C04: 118.
18 M02: 132; M05: 80; C04: 103–5.
19 M13: 84; M14: 120; M21: 24.
20 M14: 108.
21 M01: 57, also C02: 78.
22 C04: 118.
23 M07: 80.
24 C02: 84.
25 C04: 110.
26 C02: 56.
27 C04: 110.
28 M02: 118, also M07: 80.
29 Interviews M02; M04; M09; M22; C02; C03; C04; C05; C07; C10.
30 M08: 60.
31 M21: 6–8.
32 M14: 10–12.
33 C02: 96.
34 Interviews M11; M21; C02; C04.
35 C02: 48.
36 C10: 48.
37 M07: 66; M08: 92; M13: 122–4; M14: 118–20; M21: 68.
38 M02: 59–60; M04: 76; M08: 54; M13: 68; C04: 72.
39 M13: 90.
40 M03: 68; M19: 44.
41 M05: 16, also M08: 54, 108; M14: 98.
42 M07: 66; M14: 100.
43 M14: 100. Also M08: 60; M13: 70, 74.
44 M04: 50; M21: 20; C04: 102.
45 M02: 48; M07: 74; M13: 72; C04: 50.
46 M05: 12; M14: 66–8; M21: 40; C02: 75.
47 M02: 70. This kind of opportunity appears to depend on the supervisor's access to funding.
48 M14: 62–4.
49 M13: 76.
50 M05: 48.
51 M08: 92.
52 M05: 50–2; M08: 92.
53 M08: 92.
54 T01: 68.
55 M04: 102; M07: 124; M13: 118.
56 M13: 118.
57 T01: 72.
58 T01: 70, also M19; M22.
59 M07: 106.
60 M02: 140; M08: 102; M14: 128–32.
61 M08: 14.
62 M08: 62.
63 M02: 36; M05: 32; M14: 70.

64 M13: 52, also M07: 70; M08: 10; M13: 52; M14: 80.
65 M05: 68.
66 M01: 77.
67 M21: 8.
68 M01: 79.
69 M08: 14, also M14: 72.
70 C02: 56, also M07: 42; C04: 108.
71 M14: 72–80.
72 M02: 40; M13: 107; M14: 159–63; M17: 164.
73 T02: 44.
74 T02: 32.
75 M08: 78–80.
76 M08: 80.
77 C10: 48.
78 C10: 126. Also C04: 128, 133–4.
79 National Research Foundation, a body that distributes national funding for research.
80 M13: 142.
81 M08: 10, 84.
82 M01: 2.
83 M01: 113–17; M07: 94; M16; C06.
84 C07: 109–11.
85 M02: 96–8.
86 M02: 48.
87 One student referred to the system of postgraduate assistantships at the University of South Africa (UNISA), where students receive a salary, including medical aid, but carried a reduced teaching workload, as a less exploitative alternative (M08: 86–90).

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