Doctoral Learning Journeys *Final Report*

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1. Executive summary

This project set out to investigate how doctoral students (PhD and Professional Doctorates) across the disciplines of Humanities, Social Sciences, Health, Education and Arts can be best supported to make 'learning leaps' - to recognise and cross conceptual and skills thresholds in their research. The project responds to current national and international concerns about the nature of the doctorate and its purpose and value for different stakeholders. The research aimed to (a) explore and conceptualise the nature of doctoral students' learning during research and skill development; and (b) examine and enhance the practices of supervisors and examiners in order to support and assess students' learning. Quantitative and qualitative approaches were combined in three research stages: Stage A comprised a survey of doctoral students, investigating their learning processes, experiences and development; Stage B mapped the individual learning journeys of over 20 doctoral students through in-depth interviews and journaling; and Stage C involved research interviews with doctoral supervisors and examiners. Now that the research is complete, the final stage of the project involves the ongoing creation, development and dissemination of resources to ensure that the work is of maximum benefit to the sector. Current activities include the development of theoretical models and resource materials relating to supervisory strategies, alongside the creation of e-learning environments and written texts to support doctoral students' learning and scholarly progression. These outcomes accompany academic presentations and publications aimed at advancing conceptual understanding of doctoral processes and student learning. At the time of this final report both the resource production and conference delivery and publications are well underway and will be continued beyond the funded stages of the project.

Research Questions

- *How do doctoral students signify their awareness of working conceptually?*
- *How do students' comments and writing display conceptual grasp, indicating their crossing of subject-specific and generic doctoral thresholds?*
- *How do supervisors recognise students' conceptual grasp in their research and research learning behaviours?*
- *What strategies and activities do supervisors use to encourage conceptual grasp by doctoral students?*
- *How do examiners identify and assess conceptually-robust research outcomes and skills developments?*

2. Background

The project has responded to current concerns about the nature of the doctorate, its purpose and value for stakeholders. For example, the project built upon the Higher Education Academy's audit and development of research programmes in the Postgraduate Research Experience Survey (2006), Park's paper on the nature of the doctorate (2007) and the QAA Special Review of Research Degree Programmes (2006). The project also recognised the new doctoral skills and quality agenda and contemporary emphases on employability that reflect the Lisbon Agenda and the Bologna Process. The team concurred with the UKGRAD 2005 Policy Forum call to gather evidence on the value and impact of skills development initiatives for doctoral students, and their belief that this initiative should be sector-led and emphasise enhancement rather than measurement.

Our work indicates that research at the doctoral level has critical points when students cross conceptual thresholds and make 'learning leaps', moving their work to conceptual levels of understanding. These 'aha' moments represent 'leaps of faith' beyond their comfort zones when students acquire new ways of seeing their research. Thus, they experience conceptual paradigm shifts regarding their research and themselves. Meyer and Land's (2003) notion of 'threshold concepts' encapsulates such 'new ways of seeing'. However, this work is largely focused on learning in the disciplines, and at undergraduate level. They identify threshold concepts as essential learning outcomes, with examples from pure maths (complex numbers; limits); literary studies (signification); and economics (opportunity cost). Their evidence shows that a threshold concept will be:

- *'transformative'* – leading to significant, and probably irreversible, shifts in perception;
- *'integrative'* – exposing previously hidden interrelatedness of something;
- *'bounded'* – bordering into new conceptual areas;
- *'troublesome'* – conceptually difficult, counter-intuitive or alien.

Students passing through the 'portal' opened by a threshold concept experience change in their use of symbolic language, understanding of their discipline and conceptual appreciation of research issues. Threshold crossing also involves a state of liminality, whereby students 'strip away' the old and pass into the new. However, they may be stuck in this liminal state between older understandings and new appreciation of concepts (Land et al, 2005). Here, 'mimicry' may be

employed as if they have elevated status within their discipline community (Meyer & Land, 2005). The mimicry displayed when passing through a conceptual threshold is distinguishable from ritualised 'parrot fashion' learning. Thus, liminality can be defined as when students are on the threshold of deeper conceptual understandings, often becoming frustrated, losing confidence or dropping out (Land et al, 2005; Trafford, 2007).

Like Meyer and Land we believe that "Gaining clearer insights into why some students find it troublesome both to understand and to express particular threshold concepts, and into why certain students undergo a transformational or even creative experience in what we have termed the liminal space of learning, whilst others clearly get 'stuck', is…a quest well worth pursuing" (Meyer & Land, 2005). Investigations into discipline-based epistemological and pedagogical aspects of 'threshold concepts' occur within economics: Reimann and Jackson (2003), Shanahan et al (2006); within accounting: Davies and Mangan (2005), Lucas and Mladenovic (2006); within health professions: Clouder (2005); within geography: GEES colleagues (2006) and within English: Wisker et al (2008). However, these studies focus on undergraduate learning rather than doctoral study. The project offers a contribution to this developing field in two ways. We focus on the learning of research students at doctoral level, and rather than focusing on discipline specific threshold concepts, we explore the perception and evidence of research learning achievement which emerges through those stages of learning which we recognise as conceptual threshold crossing. (Kiley & Wisker, 2009, 2010; Wisker, 2010; Wisker & Robinson, 2009).

Conceptual threshold crossing has been developed by the project team taking threshold concept theory into a new dimension focusing on doctoral level study, and identifying generic stages at which students make such 'learning leaps' and cross conceptual thresholds. At the doctoral level we have identified and explored students', supervisors' and examiners' awareness of the achievement of both discipline-specific threshold concepts (which do not appear to differ from those achieved at undergraduate level) and generic conceptual thresholds. We conclude that doctoral conceptual threshold crossing includes:

- *ontological shifts* – security of self is challenged and researcher identities affected;
- *epistemological shifts* – knowledge is problematised and deepened.

Research and theorising which examines transition points in learning processes and learners' identity includes that of Vygotsky (1978) on liminality and 'not knowing' in learning; Schön's (1983; 1987) theories of reflective learning; Mezirow et al's (1990) fostering transformative and emancipatory learning amongst adults; Tripp's (1993) identification of teachers' critical incidents in professional development; and Becher and Trowler (1989) on the nature of academic disciplines and communities ('tribes and territories'). Our thinking has been informed by research into linkages between teaching and learning (Gibbs, 1981, 1992; Brew and Boud, 1995; Trigwell, Prosser, Ramsden & Martin, 1998; Trigwell, Prosser & Waterhouse, 1999; Prosser & Trigwell, 1999; Lindsay et al, 2002) and developing supportive academic communities of practice (Lave & Wenger, 1991). We also draw upon meta-learning (Flavell, 1977) and the threshold concepts research of Meyer and Land (2003; 2005) and Land, Cousin, Meyer and Davies (2005, 2006).

The team has engaged with this earlier work and built on wider developments in research on doctoral students' learning and academic identities, on supervision strategies, and on threshold concept research. Kiley and Wisker (2006) explored supervisory strategies that empower doctoral students to cross conceptual thresholds at various stages in research. Trafford (2007) examined difficulties doctoral students encounter in acquiring and using conceptualisation. Since confidence in handling conceptualisation is central to doctoral-level work it is argued that this represents a 'threshold concept' (Leshem & Trafford, 2007). Explaining how doctoral students understand this threshold, and how supervisors and examiners support them in this endeavour, illuminates significant determinants of scholarly success and failure. More recently Wisker (2010) has explored the notion of the 'Good enough PhD' where a determining factor of quality and transformation is such conceptual threshold crossing. Kiley and Wisker (2010) have latterly built on earlier work defining the processes undertaken by examiners of doctoral theses and their definitions of quality. This explores examiner definitions of conceptual threshold crossings as they are evident in doctoral theses and, where appropriate, vivas. This latter work on examiner processes builds on work by Holbrook et al (2004), Trafford and Leshem (2008, 2009), Kiley and Mullins (2004, 2006), among others.

'Doctoral Learning Journeys' has built on and augmented this theorising, contributing enhanced understanding of the process of and value of doctoral learning. The project also tuned into the HE sector issues of the importance of research capacity-building amongst undergraduate and postgraduates; an emphasis on linking research and teaching and encouraging students as

researchers; the increase in student numbers and learner diversity; and the enhancement of research development programmes and student experiences to build robust research and researchers, providing postgraduates with research and related skills useful for future employment, and creating sustainable academic communities of practice.

3. Aims and objectives

The project aimed to produce information and develop new knowledge. To achieve this it aimed provide a broad survey overview and in-depth understanding of the learning experiences and trajectories of doctoral students in order to inform and enable the students themselves. It aimed to gain an insight into strategies used by doctoral supervisors through research development programmes or individually to support their students' 'learning leaps' their conceptual threshold crossings and subsequent achievements. It considered how understanding the characteristics of such paradigm shifts in student learning achievement can be positively exploited and ultimately lead to the development of materials and strategies to support doctoral students in their progression, including printed texts, and e-learning resources.

The research investigated the crossing of conceptual thresholds in five disciplinary-related areas - Humanities, Social Sciences, Education, Arts and Health. These areas share similarities in teaching, research methods and processes. The team decided not to include the natural sciences, since the design and trajectory of a science PhD is sufficiently different to require a separate research study. Research and development activities encompassed traditional PhDs and Professional Doctorates, since both display generic features of conceptualisation and doctorateness (Scott, Brown, Lunt & Thorne, 2004).

To summarise, the project initially aimed to:

- gather large-scale data on the learning processes and conceptual threshold crossings of approximately 600 doctoral students, through survey methodologies;
- map the learning and development of 16-20 doctoral students in arts, humanities, health and social sciences over 2.5 years, through narrative interviews and journaling;

- examine how 20 doctoral supervisors and research programme contributors and leaders, and 10 examiners recognise and support the crossing of conceptual and skills thresholds by their students, through semi-structured interviews;
- utilise the research findings as a resource to plan and develop materials and strategies to support doctoral students in making 'learning leaps' and completing high quality research.

Some of these original aims were revised as the project developed. Following the piloting stage, the decision was taken to produce a more qualitative survey with a smaller number of respondents (200 – 300) in order to best answer the research questions. Over 30 students were initially interviewed and over 20 stayed with the project for two years. This was not as long as originally anticipated as recruitment of participants was challenging and time needed to be allowed for this. The next phase of the research focussed on supervisors' and examiners' perspectives of doctoral students' learning as this group were best placed to observe firsthand students' learning moments and trajectories. As A separate groups, Programme leaders were not specifically included in the main because several of the supervisors interviewed also either lead programmes or contribute to them.

4. Research methodology

A mixed method approach was utilised in order to consolidate and extend the team's own research into the nature of doctoral threshold concepts and conceptual threshold crossing. This approach sought to capture generic and discipline-specific experiences of threshold crossing and to demonstrate how supervisors, peers and research programmes can support students in their learning processes.

The research involved three overlapping stages:

Stage A: Establishing theoretical perspectives and surveying doctoral students in the UK

A comprehensive, internationally based, literature and data review of doctoral learning generated theoretical perspectives and conceptual approaches for a survey into the learning experiences of UK doctoral students in Humanities, Social Sciences, Education, Arts and Health. The survey was distributed via doctoral student mailing lists, student media and websites, university intranets and

Vitae (http://www.vitae.ac.uk/) using 'SurveyMonkey', an online service which allows data to be collected electronically, enabling the creation of a database and providing direct access to SPSS and NVIVO spreadsheets for data analysis.

Stage B: Mapping the learning trajectories of doctoral students through narrative interviews and journaling

Students self-selected from a range of participating Universities and constituted a cross-section from the relevant disciplinary areas. Thirty-three students were initially interviewed (7 Humanities, 7 Social Sciences, 7 Education, 7 Arts and 5 Health) and 22 students stayed with the project until Spring Term, 2010. The sample included 10 international students, 11 students with a taught component (Professional Doctorate/EdD), 13 were part-time and 14 were male. The majority of doctoral students were interviewed at least three times over two years during the project. Interviews were conducted face-to-face, by telephone and by email. Initial interviews were highly structured and subsequent interviews employed narrative techniques to draw out experiences and identify transitions, turning points and key learning moments. As well as the interviews students were invited to document their experiences through journaling and some chose to share their experiences through blogs and emails to the researcher.

To determine threshold crossing, qualitative evidence was sought from students on:

- personal awareness of how their learning is changing;
- interpretive and conceptual understandings of research as a complex process;
- intellectual engagement with appropriate literature, scholarly traditions and conceptualisation;
- utilising supervisors and others through mediation and self-initiated cognitive action;
- engagement with relevant research development programmes.

Data from student interviews and journaling extracts identified key learning moments of the journey, producing case studies of learning trajectories; data analysis attended to the ways in which students talked about their research and the interviews were also analysed thematically.

Stage C: Supervisor and examiner interviews

Twenty-three semi-structured interviews were carried out with doctoral supervisors from three different universities in England. These supervisors were chose from the disciplines on which this project is based - Humanities, Social Sciences, Education, Arts and Health. The interviews explored supervisors' understandings and perceptions of 'learning leaps ' and conceptual threshold crossings and whether they thought these took place in students' research and writing, and whether these were perceived as related to students' individual projects, to the discipline, or to the stages and processes of undertaking a doctorate itself. During the interviews, there were discussions on critical points in doctoral level studies where students made 'learning leaps' to achieve a conceptual understanding of their projects, when these leaps were likely to happen, the characteristics of these 'learning leaps', the evidence for them, and the 'nudging' strategies used by supervisors to encourage students to work at this level and articulate their achievements.

Sixteen semi-structured interviews were carried out with doctoral examiners across the disciplines of Humanities, Social Sciences, Education, Arts and Health. The interviews explored examiners' understanding, awareness and perception of if, how and where students could be seen to make 'learning leaps' or achieve conceptual threshold crossings in their theses and vivas. During the interviews there were discussions on critical points in the doctoral thesis and the thesis examining process where examiners became aware that students had made and articulated 'learning leaps' to achieve a conceptual understanding of their projects, when these leaps were likely to happen, and their characteristics.

5. Implementation

Planning

Project planning commenced immediately and involved both face-to-face and online meetings and communication between the project members in two university departments, and the consultants to the project. Different modes of communication were explored and it was decided that alternating termly whole team meetings at each university with online meetings utilising videoconferencing facilities worked well, alongside keeping in close contact to report on progress and share ideas and challenges via email.

The team worked very closely together to discuss the relevant literature; design, pilot and distribute the survey; share key contacts and reading resources; and refine interview schedules and recruit participants, and latterly to co deliver at conferences. It was recognised early on that more time should be allowed for some of the rich discussions around the literature, research process and theory building and so plenty of time was subsequently allowed for this in face-to-face meetings. Yearly evaluation meetings enabled consultants to have an overview of project progress and to advise on theoretical developments.

Internal events – symposia, workshops and forums, alongside a comprehensive programme of presentation at relevant national and international conferences, in particular the European Association for Research in Learning and Instruction Conference in Amsterdam, 2009, the 9th Quality in Postgraduate Research Conference in Adelaide, 2010, the 3rd Biennial Threshold Concepts Symposium in Sydney, 2010 added another dimension to the project, enabling work to be shared and discussed with doctoral students and academic staff as the research progressed.

Overall, the project progressed well. However, it was recognised that both the processes of recruitment of interview subjects and of data analysis were not allocated sufficient time in the original research design and both universities contributed additional resources in terms of staff time to mitigate this. The team also experienced slight setbacks around staffing; the University of Brighton needed to recruit a Research Fellow, Research Officer and a Research Administrator early on in the process as the original team moved on to other positions. Recruitment, especially for a Research Fellow, took time and the new members of the team needed time to be inducted to the project. This meant that data collection and analysis were slightly behind schedule and additional time was allowed for this in the final stages of the project. The additional time needed was also due in part to the vast amount of data collected longitudinally and its complexity and richness which required intensive analysis.

Stage A: Student Survey

We found through piloting the survey that the questions needed to be more qualitative in order to capture the experience of learning at this level. The survey needed to be significantly revised as doctoral students in the pilot demonstrated that issues around conceptualisation were extremely

difficult to grasp and to articulate, especially in the early stages of the process. Their research training had not provided students with a language in which to discuss their learning experiences and this applied to students at very different stages of research. Students were often not aware if they were thinking at a conceptual level and were uncertain about the role of conceptual and critical skills in their research. The team therefore worked together to develop more accessible language and open questions to allow for more flexibility of response.

It was found that because the answers to the survey were more qualitative than originally anticipated, with qualitative responses more relevant to answering our research questions, the number of survey responses to be collected needed to be revised to 200. Timing of survey distribution was an issue as it was initially distributed early in the summer term when first year doctoral students are likely to be extremely busy with research outlines, proposals and others have deadlines for submission of chapters or presentations at the end of the academic year. We therefore made the decision to extend the survey until the autumn term.

Stage B: Mapping doctoral student learning journeys

Thirty students were originally recruited to the project as it was recognised that there might be a high drop-out rate due to heavy study and other commitments and also that some would intermit, or not complete. Four interviewees who came forth were final year students despite our advertising for first- or second-year students. However, their narratives of their experience proved highly valuable. Two students made the decision not to complete their studies, a number also intermitted and two lost contact with the project. A wide variety of students were recruited including 4 part-time, 7 men and the rest women, and 10 international students. Six participants were on Professional Doctorate courses and four were on EdD courses; one was recruited during the first year of a new route DPhil which began at Masters level training and proposal preparation. This diversity of backgrounds, contexts and programmes made the data collection and analysis complex although, interestingly, many similar issues and learning experiences emerged.

Originally it was anticipated that we might interview students at proposal stage, upgrade stage and upon completion. However, while some full-time students' journeys were tracked from the first year to the third year, none of the participants have to date completed, although seven of the full-time PhD students hope to have completed in terms of handing in their thesis by the beginning of

next academic year. While 20 students remained with the project over a period of two years, we were only able to capture partial journeys. Nevertheless, the data produced has enabled us to answer our research questions - to identify key moments and leaps in the students' learning journeys and to explore the dimensions of these journeys and the threshold crossing necessary to enable students to achieve 'doctorateness' and work and think like researchers. The process generated over 80 in-depth, high quality interviews and a rich resource of data. Interviews took place face-to-face where possible and if not, telephone and email interviews took place. Telephone interviews proved a good data collection technique, although interviews tended to be slightly shorter, possibly due to less interaction with the interviewer. Email interviews provided extremely detailed, reflective accounts of learning experiences and could be useful as an elicitation technique for further exploration in the future, especially when researching at a distance with a highly scattered population.

The original interview schedules were highly structured and asked about the minutiae of student learning and progress in the early stages of preparing research outlines/proposals, for example, how they were developing research questions and engaging with theoretical and methodological frameworks. Subsequent interviews were less structured with open questions to enable students to reflect on progress so far and their experiences of learning. Final interviews were largely unstructured and elicited students' narratives of their overall experience up till that point. Interviews tended to become richer and more reflective over the course of the study – in part due to the interview design but also perhaps due to both an increasing awareness of the self as a doctoral learner and to the increasing familiarity and trust built with the researcher.

Journaling was included in the original project design and this component of the research was adapted in line with student needs. Students reported that they found it hard to make time to keep a journal. While two were already keeping journals, they did not feel comfortable sharing this very personal activity. The decision was therefore taken to invite students to blog or email about the learning experiences, moments, challenges and breakthroughs as they occurred. Three students engaged in keeping blogs, although this was sporadic. The most successful means of gaining written responses was when students simply emailed the researcher when prompted, in between interviews. This allowed an ongoing exchange to take place. Students in their third year intensified this activity as this was a period of time when they began to be more reflective about their work and their development, having often experienced a range of breakthroughs, and they

began to write in a more self-aware way. These online techniques very much complemented the interviewing process and enabled more rapport and trust to be built between researcher and participants over time.

6. Outputs and findings

Research Findings: Student Survey

Students identified that they made the following types of breakthrough in their thinking:

- **Discovery** – the identification of a new theory, theorist or concept that encapsulates thinking
- **Synthesis** – the bringing together of two or more concepts to create a new concept
- **Verbal** – the discovery of new ways of thinking as a result of discussion or the recognition of knowledge sufficient to defend a position
- **Mechanical** – almost superficial adoption of conceptual position to satisfy requirements of discipline
- **Innate** – *'I always thought this way'*

Respondents recognised they had made a breakthrough in the following ways:

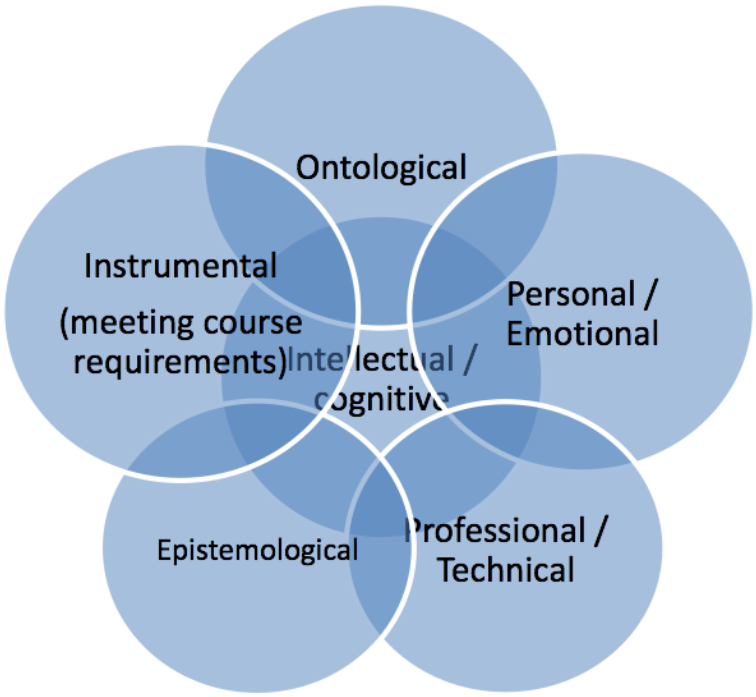
- **Visual** – respondents' descriptions of change were described using visual references: *'jigsaw coming together', 'lightbulb moment', 'seeing connections', 'the fog cleared'*
- **Kinaesthetic** – *'things just seemed to click'*

These breakthroughs affected students' ways of thinking as a researcher in the following ways:

- **Confidence** – almost a permission to think at doctoral level
- **'Troublesome Knowledge'** – new questions and knowledge initially produces discomfort, fear, critical thinking
- **Kinaesthetic** – respondents described how they felt differently about themselves as learners, and about construction and ownership of knowledge

Mapping student learning trajectories - 'The Learning Journey'

The learning journey for doctoral students is experienced as multi-dimensional, involving ontological, epistemological, emotional and professional development, as well as cognitive shifts in understanding, which are closely interlinked. Students highlighted shifting ontological, professional and personal positions and awareness, as well as staged and phased intellectual and instrumental developments. These dynamic, often overlapping shifts and developments are illustrated through identity construction, rites of passage, tensions and resolutions (Figure 1 below).



The learning process differs between individuals and for many students progress is a gradual, iterative process. The intellectual and instrumental development aspects of the journey were described by one student as 'putting little bits into the pot each of the time' and 'developing a portfolio': a process of putting together constituent parts and developing competencies. At certain stages, notably at the transfer of status/upgrade stage and in the final stages of writing, students become more aware of dramatic shifts in their self-understanding, understanding of their topic and its underpinning concepts, the language of their discipline and of the research process. Personal attributes, such as developing confidence, were considered particularly important as indicating developments in all dimensions of the learning journey. A significant rite of passage for many students, apart from the official fulfilment of requirements, was the acquisition of sufficient

confidence in their subject knowledge, arguments and language to contribute to and feel part of a wider academic community. This was often manifested as taking ownership of the thesis and through displaying competency in presenting, writing and justifying their decisions and findings.

Analysis of interviews over the course of students' learning trajectories identified changes in interview participants' articulation of their learning, especially between the first and second years of study, and indicated developing meta-learning skills at this level. While previous and ongoing studies identify subject-specific threshold concept achievement in undergraduate students (Meyer & Land, 2003, 2005, 2006) the project found little evidence of awareness of any distinctly postgraduate (as opposed to undergraduate) subject-specific threshold concept achievement. There were, however, some instances of specific project-related threshold concepts, when threshold concepts were applied in a new way to illuminate the work or when two or more concepts were integrated. This latter discovery of integration should form the basis for further study, particularly in relation to projects which are multidisciplinary and combine across disciplines, or are truly interdisciplinary in nature.

There was ample and rich evidence of conceptual threshold crossings, of moving from 'stuck' places through liminal spaces into new, more conceptual understandings. Students described experiences of profound ontological change, which is transformative and leads to their seeing the self and the world differently. Epistemological understanding also develops considerably as students understand and engage in the research process, thinking and working like researchers and preparing to make an original contribution to knowledge.

Learning moments, where students indicate conceptual threshold crossing, are not limited to a single generic moment or stage in the learning and research, but may occur at any point in the learning journey or indeed at several points and stages. These have to date been discovered as most likely to be when they identify research questions from broad topics and interests; determine relationships between existing theories and their own work; devise methodology, engage with methods and defend their choices; carry out field work; analyse data and interpret findings; articulate i.e. write, discuss and present their work and when they reach conceptual conclusions. These sometimes take the form of dramatic leaps in learning, moments where students identify a theory or concept which illuminates their research, or when the direction of their research becomes clearer, as illustrated in the comments below:

'Crikey, I think the biggest would have been the realisation I think that I was on the right track when I wanted to do a comparative study and that something like this is going to be worthwhile to do. It's going to be better than just doing qualitative or quantitative - that I have to do both, even though it's harder.'

'...so I was feeling before we got to the research outline stage and when I was at the beginning of trying to manage this big soup of ideas, I was really feeling that I was coming up against a brick a wall and as well because I had to step away from it a few times and go back to it I was feeling quite low and that I hadn't really achieved much in that time. But I think the work that I have done just in the last couple of times has kind of helped to define what I am doing and I am really feeling clearer about it.'

'I came across this one theory that didn't specifically address my topic... but then the penny dropped and I realised how I could integrate all the other approaches within that particular approach, sort of as skeleton where I could fit other theories onto. And that was quite a satisfying moment really.'

In-depth interviews have identified learning leaps which are *transformative* and *irreversible* in line with the threshold concepts literature (Meyer & Land, 2003, 2005, 2006; Cousin, 2003). While moving through the process of designing and conducting research which will make a contribution to knowledge, doctoral learners begin to "think like a researcher" (Trafford & Leshem, 2008, 2009), developing conceptually and creatively in terms of thinking processes. They may deepen their understanding of the research process itself, develop confidence in academic language and the language of their discipline, understand their contribution to knowledge and how their work fits in with that of other researchers, and ultimately develop an identity as researchers, academics and/or professionals and feel able and confident in defending their research. The transformative quality of these processes is encapsulated here:

'As time goes on and you start to, you almost develop this skin that is academic and this persona within yourself and as you… get the feedback that comes back and you're thinking about you're doing this the right way and so you begin to start, it's like watching a butterfly I suppose emerge from chrysalis pupa or pupa chrysalis and so on like that and so you begin to develop and I think as that goes on then you gain a certain amount of confidence.'

Conceptual development tends to be experienced as a gradual, accumulative process, with various learning moments occurring as the students move through difference phases of research. Conceptual threshold crossing may also take the form of a sudden learning leap, often described as

a ‘lightbulb moment’ or ‘Eureka moment’, a breakthrough moment where things ‘click into place’. The interviews with doctoral learners identify that the moments in the learning journey when these more dramatic leaps occur tend to come towards the end when the student is writing up, though students also often make significant breakthroughs during the transfer of status process.

Interview data has revealed that in the early stages of the journey, the majority of participants struggled to find a language in which to discuss their work, both in terms of grasping or being comfortable with academic language and articulating their learning. However, for full-time students, there were significant developments in interview participants’ articulation between the first, second and third years of study. Many students experienced a shift in their identities, beginning to see themselves as researchers or practitioners within their disciplines, rather than ‘students’.

Intellectual developments were reported through the various phases of doing PhD research. One student commented that the process of refining and producing the proposal and ethics application enabled grounding and clarified what needed to be done. Addressing structural issues associated with the challenges of adhering to guidelines e.g. conducting action research and wanting to get participants involved in preparing the ethics dimensions was another stage of the learning process. Others noted gradual intellectual developments through skimming over ideas and concepts then revisiting them, thinking through ontological and epistemological positions and reading round them, and engaging with the literature review more critically and exploring data within a theoretical context.

The developmental journey is marked by instrumental, personal and cognitive tensions/challenges and identifying what is appropriate and enough at different stages. One student noted:

> *‘I think there is a tension isn’t there between you can… you know, you can sit and sort of analyse things and kind of go deeper into some aspect of it but it doesn’t necessarily give you the outcome you need. The outcome I needed was to have my research proposal and I’ve got it but I think the kind of roots of it are spindly and I feel like the roots need thickening up’.*

Another described the multi-faceted aspects of his learning journey as:

> *‘I always describe it as it’s kind of like the man in the circus who has the plates on the poles and he’s always trying to spin them so they don’t fall off and that's kind of what it’s like ‘cause I’m constantly running from one project to the next. But I*

think I like it because every time I finish one I add another two or three to the, to the assemblage so… It's multitasking I think at its wors[e]'.

Many students saw the doctorate as an "apprenticeship" (or rite of passage) for becoming an academic, although for some this created tensions in competing professional and personal identities. This identity development was experienced as *transformative* and *irreversible.* Developing an academic identity was considered a key shift during the learning journey with the ongoing process of reflection a significant factor in making it happen. For some this confidence in an academic identity developed gradually and for others it was a dramatic learning curve which took place at the beginning of the journey:

'Well I certainly say that I feel much more like a researcher now than when I started. I think that it's been a massive learning curve, I think I have learnt so much about different aspects of research and I have learnt a lot about defending my corner and a lot about the kind of debates that are going on, you know you will go in one day with one lecturer and they will be giving one kind of perspective on qualitative research and then someone else will come along and so you realise you are just caught up in an ongoing debate really about how you do research and I think in terms of being a research student it's important to understand exactly who you are, you know what your place is in the world, how you understand research and why you position yourself and I think I've worked through a lot of kind of problems in order to kind of work out exactly where I'm positioned and I think that's going to be really important, it's been really important to work through those sorts of problems first before I start.'

Professional and academic identity development is repeatedly mentioned by students interviewed, although the uncertain status of doctoral students can constitute a tension, with one student commenting:

'I forget that I am a student and I don't think of myself as a student…I guess I tend to introduce myself as a PhD researcher anyway, which is what we are encouraged to do in the department, it's not just me being pretentious, but there was an incidence where I was at this social... for other tutors…and one of the young lecturers in the department…also a tutor…introduced me to her friends as one of my PhD students… and it seemed so pointed that she had used this word student… cos it's like she is not the supervisor, in what way am I her student, you know?'.

As the previous quote implies, PhD researchers confront power-inflected expressions of their role within the academic community and although some are confident in their new self or academic

identity, others are not. There appears to be differentiated status of the PhD student or researcher across institutions.

Learning moments

Learning moments were identified as largely gradual and continuous, small and medium, but also sudden, lightbulb-like moments in some cases. They were often associated with articulation of the research - preparing and presenting papers at a conference, writing a paper and collaborating on a project; exploration and discovery - 'finding out or discovering new things', and gradual development of understanding - 'plugging away and keeping on doing it until you realise the significance of your data'. Learning moments were also described as learning to learn better, exposure to new ideas at conferences 'that get you closer to shaping theory' and breakthroughs in the momentum of the project, such as picking up the phone to arrange interviews. Outcomes of learning moments were often described in terms of a clearer understanding of 'how it fits together' and so could be described as *integrative*. Key learning moments tend to be stimulated when students have the opportunity to articulate and defend their research, for example presenting to peers as part of the research outline approval process, or at conferences. Supervisors can play an important role in introducing students to the wider research community through networking and providing a safe space to challenge them to defend their research decisions.

Conceptual threshold crossing

We explored the metaphorical language often used to describe conceptual threshold crossing taking place. Students evoked auditory, kinaesthetic and visual imagery to describe this, including moments where '*ding goes the bell'; 'it clicked into place'; 'a light went on'; 'the fog cleared'; 'a jigsaw piece coming together'; 'a good feeling, like an adrenaline rush creating feelings of pride that you are going to write a good PhD'; 'a peeling away of layers of arrogance'; 'getting through a mountain'; 'ideas coming together and learning to think more realistically'; and 'a narrative weaving a pattern'*. Moments where students feel they are stuck are described as *'I hit a brick wall'; 'I stopped moving';* or *'I reached a plateau'.*

A range of internal and external triggers to conceptual threshold crossing were identified. Students described key learning moments and leaps as occurring: when reflecting; developing confidence; in

the process of writing; through teaching practice; broadening reading; grasping the philosophical underpinnings of their topic; undertaking fieldwork; conferences and network building; as well as fulfilling formal programme requirements, such as completing an upgrade paper. They described becoming part of the academic culture - 'immersion into the culture and atmosphere of successful people', 'osmosis' and 'absorbing all that you go through'. Mimicry can form part of this process, enabling students to become confident with their disciplinary language and academic writing, as demonstrated in this student journal extract:

> *'I read my friend's PhD after my upgrade and then wrote my own ideas in a similar format, for an introductory chapter, just to feel like I had something concrete.'*

Related skills doctoral students developed included teaching and networking, writing, presentation and public speaking, communications skills, technical proficiency and research techniques. Some commented that generic research skills were of limited value at this level and appreciated opportunities for more specialised or advanced development in their chosen methodologies, as well as in writing and project management – this more specialised input tended to come from supervisors. Those who completed Masters level training in research methodologies prior to starting their doctorate found this extremely beneficial for proposal development and implementation. For those undertaking Professional Doctorates, engaging in epistemologies at an early stage of their journey was helpful in laying the foundation for their research, enabling them to make informed choices.

Troublesome knowledge, liminality, stuckness

Prior to learning leaps, students often report experiencing 'stuck places' where they feel unable to move, which can involve, for example, a sense of feeling overwhelmed with the amount of data or reading. These moments may indicate a state of *liminality*, they may oscillate between different positions and, while they can trigger a crisis in confidence and even dropping out of the course, are normal parts of the learning process, enabling students to step back from the research, reflect on its progress and if necessary develop more focus:

> *'At this point I feel like I've reached a plateau… It seems the more I read, the more I need to read, because I can now pinpoint what exactly I don't know and need to learn more about, but I have begun to worry that the time constraints may limit*

just how much I need to do. I have spoken with several of my colleagues and they say they feel the same way. It's a bit of a mid-course panic.'

'Well yes, I think a couple of weeks ago I found that things have stopped. Partly because they actually had physically stopped and I haven't been able to get back to my PhD for a while, but also mentally I found myself up against a brick wall and felt that, I think I was worried that I didn't have my conceptual framework or my analytical framework ready. I felt that I should have been there by the end of my first two years, prior to doing the research that I should know exactly what to do but I don't think that it all happens like that and so I just felt that I was kind of stuck and it wasn't moving and it was all bitty, I'd done all these chunks of work but I couldn't really see how they fitted together and yeah so I reached quite a crisis point. Especially when I got negative feedback I just felt quite downhearted about it…'

This student, in a journal extract, described the experience of moving from an experience of stuckness and liminality to conceptual threshold crossing, through engagement with the theories and a sense of returning to the research questions and objectives, taking control and ownership of their work. The extract highlights the physical, emotional, creative and intuitive, as well as cognitive dimensions of their learning experience as the student becomes aware of, and comfortable with the process of knowledge construction. It also encapsulates the heightened physical and cognitive state which conceptual threshold crossing can engender:

'I had a moment a few weeks ago, well a rather long moment that lasted perhaps a week and a half or two, where it seemed that nothing made sense for days on end. By that I mean I couldn't reconcile the empirical data with my theoretical ideas, it seemed there was such a big gap and I was running the danger of falling back on existing frameworks to explain what I was observing, although it is my intention to critique these. But I couldn't abstract beyond what I was seeing...whenever I sat down to actually do it, it seemed that I couldn't or wouldn't - like a child who doesn't want to do homework.

Then I remind myself that it's not about 'discovering' the link and the argument, it is about me making it, constructing it, literally 'making sense' in the sense of bringing into being links and associations between concepts, theories and concepts…. for me it often is a matter of thinking very hard about what story I want to tell, what argument to make.

And then there are these wonderful moments where things just slot into place, but only after a long engagement and in-depth knowledge …then suddenly all relates to each other, like my argument is revealing itself to me. Of course this isn't the case… I can't really explain what happens, but it does feel like the pieces of my puzzle physically move towards each other.

Physically, I experience these moments as 'blurs' in time. Time doesn't matter anymore, I lose feeling for it, it can take minutes or hours, however long my concentration holds, my brain is in overdrive, nothing distracts me (not even roadworks!), it's incredibly fun, a feeling of elation of the mind – and eventually I emerge again, like stepping back into real time/space. And then I have hopefully written down all these thoughts and can come back to them, draw on them whenever I need to.'

Strategies to enable successful completion

Students highlighted supervisory, regulatory, scholarly, practical and affective strategies for achieving doctorateness that provide insights into the 'push' and 'pull' factors, those which enable them to move on with their learning. Such identification of factors can inform all parties involved in this process. Examples of practical strategies may include encouraging doctoral students to write; reflect; read widely; think outside the box; engage in visualisation, mind or concept mapping; keep a journal; network; present; engage with the wider academic community; enter into dialogues and debates; reflect on and articulate their learning; develop meta-learning; and gain generic and advanced research skills. Opportunities to enable student development, for example through presenting and writing, are often built into programmes:

'I think from the whole process of doing it [research outline presentation to department] I think it just helped me to formulate my research in a much more simple, easier to understand way than if I hadn't done it and I think that it was quite successful in that and that I've suddenly found a way of presenting it that made it easier and it has also made it a lot easier for me because I identified from another study that there was these particular discourses I thought that would make it really easy to present it.'

There are also strategies and processes students themselves initiate and engage in to advance their learning. Reading and writing are seen as key to enabling development:

'So I'm kind of looking at those theories that underpin my question. The essence of the professional doctorate has to be related to practice so I'm hoping that using those underpinning theories I'll be able to bring up a theory of my own of self management.'

Students emphasised the role of supervisors and how good practice in this area was a key enabler. Supervisors were regarded as mentors and advisers with whom students discussed issues and who provided support with managing the PhD and meeting deadlines, challenging students

intellectually, and providing guidance as to reading and networking. It was seen as important that supervisors had the professorial, doctoral, supervisory and editorial experience to help 'meld things into more of a tighter sequence'. Regular meetings with all supervisors together frequently helped students and difficulties arose when regular meetings were not achieved. Particularly important was the questioning, challenging role of supervisors, which as an ongoing process can eventually help students to prepare for the final viva stage of their doctorate:

> *'...the supervisor I have been with from the beginning kind of took everything apart and critiqued everything and kind of pushed me and questioned me and I actually feel that I came out and I felt that had been absolutely constructive, even though it was very difficult at first to get the negative feedback which I had partly been expecting because I knew it was hotch potch, I did feel that it was really important to kind of go through that process and have everything critiqued. And practise defending myself because that prepared me for the presentation and focused me into thinking about the sorts of questions I might be asked, getting ready to defend every decision.'*

The relationship with supervisors was identified as one which often changed over time. One student described how her supervisors gave very structured guidance in the early stages of her doctorate and then gradually 'let go' and enabled her to take ownership of her work, taking up a more facilitative role and providing contacts for wider networking. Another described the changing balance of power as the relationship became one more of equals. These shifts could be seen as an indicator of a threshold crossing in the way they see themselves, increasing autonomy and taking ownership of and responsibility for their work:

> *'I think last year they were quite prescriptive and they were quite strict and they structured my year quite heavily in terms of giving me certain things to read and then reporting back, writing essays, making me do all these posters and conferences and so on, which is quite hands on, but since I've finished my first year they've actually taken a step back and I think they trust me a bit more now and I have sort of proven that I can do things on my own. So they seem to, yeah, take a step back and just let me get on with my research and now they're kind of…they're more…I guess they still guide me and put me in touch with useful people that they know... so that's been really useful. So I think at the moment they act more as sort of facilitators or networkers almost for me, which is good'.*
> *'The balance in the relationship between us is tilting slightly as well because where I was prepared to be guided, going back to assignment one where you are at the beginning stage, the actual balance itself is quite, it's more of an equal partnership in the discussions now.'*

Another international student appreciated the freedom her supervisor allowed her to explore different ideas, broaden her knowledge, explore different writing styles and challenge the constraints of academic conventions:

> *'And I have, I have this supervisor that he's wonderful person, he really er gives me freedom to think... I told him I was doing this, this course on academic writing and he said oh, okay, it's okay for you; you know I understand that you need that, but you don't have to be so... you have to write more in a free, free, freedom. With freedom... you have to learn this; I understand that it's important for you to, to, acquire this, to be more secure, but on the other hand you have to express yourself with freedom.*
>
> *I have to be so concerned to be in, in rules that some English teachers told you that no you have to… to avoid writing in personal, like say I, I, or my, my and you have to avoid this and my supervisor said the opposite. He said, no, you have to put your voice in the study, yeah, because if you don't it will be a very impersonal thing, so he said, okay you have to, you need to learn, but you can write er with freedom.'*

However, different individual students had very different support needs – some preferred structured support throughout, while others preferred to work as independently as possible. They appreciated the opportunity to discuss and negotiate this with supervisors at intervals as support needs changed over time.

Good qualities in supervisors as identified by students and which may be useful benchmarks for good supervisory practice, include: being encouraging, open and accommodating; having enthusiasm and engagement with the topic area, as well as relevant expertise; listening skills; providing positive feedback; confidence building; assisting with practicalities and skills such as time management; having a good mix of supervisors presenting alternative perspectives; conducting regular meetings and maintaining contact; supporting well through discussions and questioning; maintaining an equal balance of power with the student; providing networking and dissemination opportunities; and having a second supervisor – someone to be more critical and to take a second look. As well, working with milestones features as a useful supervisory strategy for some students. Supervisors were reported to understand students' need for milestones in their research journey, significant moments when they could reflect on their achievements and learning leaps. Other enabling actions or characteristics include flexibility, empowering students to negotiate, and good communication such as providing opportunities for emailing extracts from research journals for

discussion. These comments illustrate the 'nudging' function of supervisors which ideally strikes a balance between guidance and encouraging openness and freedom in learning in their students:

> *'So, he just kind of nudges me in directions where I, that I might want to follow, but he doesn't constrain me in any way; he doesn't say you don't want to follow this, you want to follow this. He'll just sort of listen to what I have to say and then say, okay then, but have you thought about this, which is really, really helpful. He's had loads of experience at it, so…'*

> *'…flagging up things, making me think outside the box, making sure I don't set my mind on things and stay a bit more dynamic in my research process I think.'*

> *'…Yeah definitely a confidence thing. It becomes very enlarged when you do a PhD I think, because it's all down to you and I think I'm probably the sort of person who needed a bit of external validation and you're always used to being a good student. I still am but I really had to convince some people that I was and I wasn't used to that, I think one of the most important things with doing a PhD will be your supervisors and your relationship to them.'*

There were instances when the supervisory relationship did not work well, for instance when students felt they were not receiving enough emotional or personal support; when they felt their supervisor(s) lacked sufficient expertise in their topic area or methodology; when there were conflicting theoretical or methodological positions they were unable to resolve; and – most frequently – when meetings were irregular, or the supervisor(s) lost contact, or did not respond to communications. When the supervisory relationship was not working effectively, this often had a negative impact on students and their work. Some students expressed frustration with the lack of or quality of supervision, indicating the need for regulative and accountable measures:

> *'Things like people not showing up to meetings or like sudden like last minute changes to plan or people just not really listening and I expected to encounter a lot of that on my fieldwork like I really prepared myself like I say for people dropping and, you know, I wasn't going to be upset by this. Well this never happened. Didn't happen at all. I was fine. I was great, like I enjoyed it, but my supervisors do that all the time and you know they'll say yeah I'll look at that next week and they don't and I've psyched myself up and perhaps, you know, been up and dressed since four in the morning thinking oh god will they like it? And then they're like yeah, yeah, I don't really have time to see you today. So that's, I think that's frustrating.'*

Barriers

In addition to some negative experiences of supervision, students face a wide range of internal and external barriers to successful learning experiences. These include practical factors (time, financial); work-life balance; and conflicting demands of teaching and other paid work, and family commitments; personal and emotional factors (confidence, self-esteem, expectations, motivation, personal circumstances, support network); institutional factors such as administration, or access to resources; academic factors such as learning to write in an academic style; language and cultural factors, especially for international students. There are often several factors at play and students can reach crisis point:

> *'Yeah, I'm doing this reading, basically reading a lot and trying to recognise my ideas, to really reach the main question that I want to, to put in my project, my outline project. And I think some, another thing that occurs to me that I, I am a person that er I require so much of myself. It is a, it's a defeat I think, because sometimes I, I, find myself, found myself complaining to my friends in [my country] that I, oh, I'm here for almost six months and I didn't do anything at all; I just did this, that, I don't have anything in write yet and the answer that they give to me is, are you crazy? It's not a long time, six months; you did a lot of things. You, you, you are in a different country, learning a different culture; you have a child with you. In six months, you made a big effort.'*

> *'Time is a real problem. It's a full time job and I never realised it, but there's so many other things get in the way; there's not a thing as a perfect research day is there? It just never works out like that. You've to get it in when you can. With the paid work and the wardening and the Latin; I'm a college tutor as well, which is great. I love doing it, but as I say it's all about time. I think I just need to mature into the PhD a bit more.'*

While for many of the students the project followed into the third year, the external factors such as personal circumstances, financial challenges, and family and work commitments were ongoing, they often found that taking ownership of their work; making research decisions; taking the initiative to develop skills; and learning to manage their research projects helped to overcome some of the practical and academic constraints. However, a small number of students experienced mental health problems such as anxiety and depression and needed to seek support such as counselling or take time out from their studies. One such student decided not to continue with their studies. Supervisory and peer support were crucial in helping students in crisis overcome their difficulties.

Research student wellbeing

As indicated, anxiety in learning was a recurring theme throughout the research process and research student wellbeing was often a concern, especially as some students were dealing with multiple factors which created barriers in their learning, such as work and caring responsibilities, disabilities (including some long-term mental health difficulties), adapting to life in a different country and its language. The experience of doing a doctorate was not always what students expected and some found the challenges of discovering personal and academic limitations, as well as strengths, daunting. Encounters with troublesome knowledge, experiences of liminality, renegotiation of identities and conceptual threshold crossing involve emotional and ontological, as well as cognitive dimensions. Students often described these experiences in affective terms and spoke of accompanying anxieties, uncertainty and fear, which at times posed a threat to their self-confidence and wellbeing. There was also a sense in which the experience of undertaking doctoral research could be overwhelming, in some instances overtaking students' lives:

> *'Personally the really difficult thing, the worst thing is it's melted into my whole life and my whole life has melted into it… like I've become stressed out, not sleeping anymore…'*
> *'When it all comes at me and I feel like this sponge and there's just so much, I don't know but I'm sort of aware of that I just need to keep an eye on it, but that's when it will feel a bit more uncomfortable'*

> *'I realise that knowing something in depth is different to knowing something on the surface and I think I know a lot of things on the surface and not many things in depth.'*

Doctoral students face a variety of personal as well as academic challenges throughout their studies, often investing much time, finances and commitment to their studies, and maintaining a work/life/study balance was particularly difficult for part-time students, professionals and those with caring responsibilities. The uncertain status of doctoral students, uncertainty about the value of doctoral research and future prospects in terms of employment contributed to a sense of unease for some students, particularly those in the final stages of completion:

> *'I don't know if everybody feels this way but there are times that I just thought why am I doing this, it's pointless, I just want to give up…there are days when I just think this is of no value to the world and that feels horrible'.*

The team discussed whether the development of emotional resilience is a key factor in doctoral learning as students find ways to deal with some of these challenges and cope with an element of

uncertainty and unpredictability, both in their learning processes and in wider society. However, there are also likely to be strategies that supervisors, programmes and institutions can develop to help foster wellbeing and emotional resilience in their learning communities. This is an area for further research, which members of the team are currently pursuing. A further key factor relating to the wellbeing and learning of doctoral students was the isolation faced by many students. The value of peer support and the sense of a supportive academic community are discussed further in the next section.

Academic Community

Peer support, from those exactly in the same position, was regarded as highly valuable and for many Professional Doctorate students is a structured component of their programme. Other students have initiated their own study groups, which have proved highly beneficial. Through these groups students benefit from the opportunity to discuss what is going well and wrong, helping them to evolve as people. By having a cohort that meets regularly, once a month or two, students can report back to each other about their progress, and stay motivated, coming together and debating, and overall to help keep them in study mode. Involvement in a community of practice, and being able to access training materials and papers and opportunities to engage and discuss offered opportunities to support learning.

Becoming part of the wider academic community, defending their work and engaging in debate, can be seen as both a trigger to and an indicator of transformative threshold crossing for students. This can take place through presenting to peers and at conferences, attending conferences, networking and producing papers. It has also been a factor in stimulating ongoing conceptual, emotional and academic identity development:

> *'A big learning experience for me has been that doing a doctorate is not a search for the truth but is really just taking part in a conversation. I suppose that is also a learning experience in that when I sit with the 'learned' in a conference I feel confident in challenging them as I now see myself as a peer.'*

Conclusions from Mapping of Student Learning Journeys

According to students, there are a wide range of factors which help to trigger successful learning in the form of conceptual threshold crossing, including opportunities to articulate their ideas and

findings through networking and presenting; discussion, questioning and critiquing from supervisors and peers; a good supervisory relationship, based on flexibility and trust, which enables confidence to develop; visualisation techniques; taking a step back from the research; having the freedom to explore ideas and take risks; opportunities to link learning with experience; the process of writing; goal setting; life and study skills, e.g. work/life balance, time management; familiarisation with appropriate academic language; and the development of meta-learning (awareness of the self as a learner). All of these factors can enable doctoral learners to move forward, to work at the levels necessary to achieve their doctorate and can stimulate transformative conceptual threshold crossing. They require the motivation and openness to learning of the individual student, a supportive supervisory relationship, and an enabling academic environment with opportunities to engage with a wider academic community. To summarise, key threshold crossings for students include new ways of seeing, understanding and of being in the world when they:

- Understand exactly what their contribution to knowledge/understanding is;
- Deeply understand the research process;
- See their thesis as an integrated whole;
- See themselves as a researcher/academic contributing to their professional field;
- Own their research;
- Understand who they are as a researcher;
- Develop confidence with academic language and that of their discipline.

Research findings: Supervisor and examiner interviews

Findings which have emerged from the supervisor and examiner interviews confirm those of the research with students. They also add other insights into ways in which supervisors can support and enable students to move towards developing conceptual and critical levels of working, and the evidence both supervisors and examiners use to identify such levels of achievement.

Supervisor interviews

It was identified that a key goal of doctoral supervision was to enable students to become independent and to encourage them to gain ownership of their project. Some supervisors noted

that students' conceptual development tends to be project related while others mirrored findings from the student interviews - that development is very often ontological, as students move through the process, becoming more independent, confident and developing identities as researchers in their own right.

> *'You talked, you mentioned at the beginning there about the idea of the thresholds or breakthrough moments and I think that there might be kind of points where somehow that's experienced by the student, that they feel that sense of, not complete independence, but a sense of ownership and some elements of independence in terms of their abilities as a researcher and in terms of driving their project, because I think, you know, often we get a lot of students that come in and are used to being in programmes where they are very much structured in term…everything's structured for them in terms of their expectations and what they should do and so it's about kind of trying to enable them I think somehow to become…or to have a good sense of independence in terms of their research aims and to, you know, to really feel that sense of ownership with the project and not always feeling that they have to kind of, you know, look to their supervisor or other people actually to tell them what they should or shouldn't be doing, but to sort of be able to take lots of different perspectives on their work and be able to use that in a constructive way but essentially to begin to drive that themselves is important.'*

Supervisors therefore identified conceptual threshold crossings as specific to individual student's progress in their learning, and as stages where students gradually develop ownership of their projects. As with the student interview results, there was a suggestion that learning leaps or conceptual threshold crossing could take the form of either a gradual process or a Eureka moment. Supervisors emphasised that the main way for students to cross conceptual thresholds is to empower students to take the initiative in their learning, such as engaging in ongoing reading and writing. Supervisors were aware that there were different kinds of student breakthroughs. Most of them could be detected from students' articulation through writing and conversation, their better understanding of subjects, their taking an active part in the academic community, for example through conference presentations, as well as some physical indicators of enhanced confidence. Another example of conceptual threshold crossing, in line with student experiences, is where students gain a sense of perspective on their contribution to knowledge.

> *'Well the breakthrough happens in different ways, you know, you may have a theoretical breakthrough or you may have a breakthrough in you design or, you know, sometimes the breakthrough may be when you feel a student hasn't got overall command of what they're doing, you know, sometimes, you know, if a breakthrough like is a new finding or a new nugget of information, you know,*

sometimes that may happen, you know, probably not many PhDs are gonna change the world, you know, they can still find out important things, but, you know, they're likely to a be a small cog in a much bigger wheel rather than to come up with something that alters the course of history. So, you know, a breakthrough can happen in different ways.'

There was no consensus among supervisors on when conceptual threshold crossings happen, as they could happen at any stage of the study and vary with students and projects, though, in line with findings from the student interviews, the upgrade and writing stages are mentioned as key times. Learning leaps/conceptual threshold crossings are more likely to happen when students show interest in their project and become more confident, but supervisors have observed that a clear introduction about the learning expectation and constructive discussion with students during their study will help the learning leaps to happen. This quotation highlights a combination of those factors which contribute to successful threshold crossing:

'Well I mean I would certainly, I mean I would stand by my first comment which is to read deeply and widely on a particular like say if it's a particular theorist you're interested in like Bourdieu or Foucault or whoever then it's not enough to read a couple of texts, you do need to immerse yourself, but then I think there could be ways, the next step to that would then be about trying to apply those ideas and then maybe doing that in discussion with the supervisor, you know, so not writing a whole chapter but maybe 2 or 3 pages to where you can attempt to apply the ideas and then you can use that as a discussion forum...
So yeah I don't think it's enough, I think it would be important, the first step would be to ensure lots of reading but I think that would just be the first step and then it's about using the ideas and that's often the hard part. So again it's about finding ways to scaffold that so there could be sort of different ways of trialling those ideas which you then use as discussion documents to try and take those ideas forwards.'

Conversely, difficulty in the reading process is described as one significant barrier to learning leaps taking place and this supervisor drew on their own experience of undertaking doctoral research as an example:

'You know yourself from doing a PhD it's a really hard process and there are bits where you just think I simply do not understand it. Erm, I didn't really have…my supervisor kind of abandoned me very early on during my PhD for a variety of reasons but I did a Masters by research, er, before that, all you did was write a 30,000 word thesis. I remember going to my MA supervisor, who was a very smart guy, and he told me to read all these books and I said look, I've read this again and again and again and I simply do not understand it, you are going to have to tell me what it is that I'm looking for here and he said I don't understand

it either and I thought, well, you know, now I understand why you wanted me to do this thesis because it's going to help you out, erm, and I just had to read it again and again and again and it's not a nice process. It's pretty much what it comes down to.'

When asked about other related skills students expected to develop, some supervisors argued for the importance of research methods, described as analytical skills, data collection, field work, organisational, communication and networking skills. These methods are described as both generic and project related.

'...sometimes doctoral students need generic skills of, not necessarily communication because I think mostly I'm dealing with health practitioners who have good practitioner communication skills, but in fact interviewing skills are quite core and are different, erm, because of course you know you have to learn how to be quiet, don't you, and listen and they find that quite difficult so they don't necessarily come with those but they do have to learn how to do that so sometimes we do that in house or sometimes they can go off on qualitative modules to learn how to do that properly or they can sit in with some other interviews that are going on.'

'They need to be good at organising lots of material, because the one thing you're gonna get in a PHD is masses and masses of material and if you kind, were the kind of person that found it really hard even to write an essay when you've done with the reading then you're probably not gonna make a very good PHD student because you just you'll never you'll just get lost in all the you know and in all the reading or each time you read something you think the last thing you read is really good and you can't remember what you read. So I mean ideally someone who can sift material can kind of draw out important points from complex material, is kind of comfortable with using theoretical concepts. I mean this is the ideal, I mean most students don't necessarily conform to all those things.'

Liberating breakthroughs were also identified at points of confusion which gave students a 'whole set of new problems' and the realisation that it is difficult to generalise. Other transformative moments for supervisors included a realisation that specific cases were different and specific cases of student development and learning leaps can display many variables, because of cultural contextualisation and framing.

Departmental strategies to enhance doctoral students' learning might helpfully focus on seminars, conferences, and workshops, as these activities would help to encourage students to get involved with academic culture, which as a result would enable students to become independent learners

and lead to successful doctoral completion. Supervisors highlighted the importance of providing opportunities for interaction of doctoral students, both formal and informal. They also recognised the importance of both student led groups and of integrating staff and students (who often overlap), seeing them as part of the same community. Supportive communities were conceived as important both for students' emotional wellbeing, to prevent isolation, but also to boost their skill set and begin to prepare them for the challenges of an academic career:

> *'Well, people are working on their own topics, you know, normally a PhD has one name on it, doesn't it? So people are working on their own topic but they... it's within the context of a research centre ... So, we're interested in similar things and there is another research group here as well working on the whole variety of gender issues and they have a number of post graduate students who've come from all over the world particularly to study that. So they have regular meetings as a group with members of staff where there may be outside speakers.*
> *So I think much of the time is often on your own, you know, reading a book, looking at the computer screen writing something. But I think social interaction is very important, you know, just to sort of reinforce the more sort of collegiate nature of academic work and to make sure that it doesn't become isolated. You know, there used to be problems that a research students was neither a member of staff nor a student, you know, when I did it a long time ago, you never knew where you fitted, you're neither one or the other. You didn't know which coffee room to go in.'*

It was also stressed that mechanisms should be in place to safeguard the support of doctoral students, for example providing supervisory teams and systems for monitoring progress and supervision, acknowledging that the dyadic supervisor-student relationship can potentially break down:

> *'Well, hopefully. I mean we have various means of support here and I suppose most institutions now, because of these difficulties and the increasing politicization of graduate work, have put in place various mechanisms in order to try and, you know, safeguard... it's a probably like secondary supervisors for example is one thing that a number of institutions have, you've probably come across.*
> *Or having other people that student can go and speak to in the department if they're they have concerns with respect to their own supervision, those sorts of things, and I do try and make that clear to my students that you know "if you're having difficulties or you want to talk to someone about this and you don't want to talk to me then, you know, you should be aware that you've got other avenues you can use" and I do think that's important. I mean there are some cases where, for various reasons, the relationship between the supervisor and student breaks*

down and that's difficult. I mean it's precisely because of those things happening that you have to have these safeguards in place.'

Supervisors identified a range of positive supervisory strategies to enable conceptual threshold crossing and related development. They reported that they aim to intellectually challenge students to become independent thinkers and learners, through regular meetings; discussion with students; providing students with direction in reading; encouraging them to engage with theory and concepts and guiding students in conducting their projects. Supervisors ultimately aimed to encourage students to develop their authorship of the research, tailoring their support to meet individual students' learning needs:

'I think to challenge students in a constructive way, not just agree with everything they do; but if you think what a thesis will have to look like, what a viva eventually will be like and get used, you know, in a way to putting students on the spot, you know, in a positive, not an unpleasant way, but, you know, intellectually challenging students about their work and getting them to defend why they're taking a particular approach.

I think finding out a student's pattern of studying, you know, different students work in different ways and I think a good supervisor understands that and doing a PhD or an MPhil isn't easy and although students have usually done dissertations, those are more modest in scale. So to take something on that's quite broad over a long period of time can be quite daunting.'

Examiner interviews

In terms of the research literature underpinning this project, the least researched area is that of the work of examiners. We asked examiners to discuss both the ways in which they conducted their examination of students' theses, and the evidence they identified as indicating quality of work which merited a doctorate, in particular evidence that the student had made learning leaps and crossed conceptual thresholds to produce doctoral level work. In these instances, the examiners could not know what the moments were at which such developments took places, but could we hoped identify evidence in the work that doctoral quality had been produced. Examiners tended to comment not merely on the evidence of student achievement from the theses and the vivas they examined, but to extrapolate into commenting on this as evidence of supervisory practices and interactions, and evidence of the student learning journey. Both of these latter would be unknown to them in relation to the work of the student under examination, but provides evidence

of the examiner thinking as a supervisor and contributing to our growing knowledge about the supervisory interaction process and the student learning process.

Both supervisors and examiners emphasised the intellectual, cognitive and the ontological dimensions of students' learning journeys as evidenced in the quality of their work produced in the thesis and viva. Such evidence of intellectual and cognitive achievement includes that produced when the student's work demonstrates an extension of knowledge, comprehension of where the student's subject is situated (its theoretical underpinnings and margins of theory), philosophical awareness, conceptual clarity, confidence to challenge existing perspectives, reflection on the learning and how it contributes to knowledge. The achievement is evidenced in the thesis often in terms of ownership, managing information to present it differently to different audiences, and clarity in expression of ideas. Content analysis of the examiner interviews also revealed that they recognised that 'doctorateness' involved personal and emotional dimensions (making emotional and psychological leaps). In this respect, examiners note that there are instances in the theses of evidence of reflection about life view and worldview in relation to academic identity.

Supervisors and examiners reflecting from their supervisory roles are aware of the difficulties students face in trying to achieve conceptual and critical levels of work while hampered by a range of personal issues. However, students, supervisors and examiners are also aware of the existence of moments of learning leaps or learning achievements and conceptual threshold crossings which are evident in the student's articulation, in their written work and, for the supervisors, and the examiners reflecting on their own supervision practices, in the student's dialoguing with supervisors. The data suggests that learning moments are linked to regulatory, functional and scholarly aspects of doctorateness demonstrated through research process and techniques. Learning takes place through conforming to the institutional framework, writing and reflection and shaping of the research, at specific stages (e.g. data analysis). Transformation, illumination and revelation are key signifiers of threshold crossing.

One examiner implied that making the interconnection between different areas of the field was a key learning leap, signifying movement into new understanding and displaying a specific threshold crossing. Writing that showed 'deeper understanding of the issues' at a conceptual level and 'a step up in theoretical work' were also considered evidence that students had crossed thresholds. The shift from treating research less in terms of techniques and methodology and more in terms of

the particularity of the epistemological questions raised and 'what is possible' were also considered indicative of learning.

Generally, key learning moments were evidenced through generic technical and conceptual processes of the PhD research, for example, 'a building on seminal work; selling, explaining and developing a concept.' Working out what to do with the data was also identified by one examiner as a key learning moment evidenced in the thesis:

> *'I found myself saying to them right near the end there's a kind of dip, and that quite often happens in my experience when students are doing empirical research which most of them do, have their data, there's something about, I think it's often to do with qualitative data as well, it's not knowing what do with it, it's almost being overwhelmed by the complexity of it and I think that's a breakthrough… if they get out of it.'*

It was recognised that the uniqueness of the student, their disciplinary area and personal circumstances make each individual's learning journey different. Learning is also seen as contingent upon the forms of prior knowledge and the openness people bring to a situation. Examiners, however, tend to agree that conceptual threshold crossing is evidenced in the writing (thesis) and through dialogue (viva). Reflexivity, self-awareness and meta-awareness and analysis are examples of evidence of conceptual crossing process within the thesis. Reflection encourages the leap enabling the students to reach a higher level of conceptualisation. In dialogue in the vivas, when students were less defensive about penetrating questions this was considered to represent a kind of maturity and learning leap. Students going beyond the troublesome point were confident enough to confess to confusions and difficulties. Displaying confidence also in owning the research material and having a clear view of the importance of their research contribution were other clues to conceptual crossing having taken place.

The examiner interviews also highlighted revelatory moments where patterns emerge from the data as indicative of conceptual crossing. Asking the right questions and obtaining the right outcomes were considered important for achieving conceptual depth. Another conceptual threshold crossing moment was being able to see the thesis as a whole and that it actually did what it said it was going to do, with the appropriate kind of rationale and justification.

Conceptual threshold crossing was described in several ways by examiners using terms which related to its existence conceptually, procedurally and metaphorically. Coherence of concepts was

mentioned by most examiners. One examiner indicated that achievement of conceptual and critical levels of the research evidenced in the thesis often had to do with the theoretical framework applied, the coherence of the concepts applied, how language was used and evidence of methodology in action. Evidence that the student understood their area, how their research works, subtleties, and engaging sufficiently with ideas in a big way were signs of conceptual threshold crossing. 'Getting beyond the myth of perceived wisdom' was one interpretation, representing a moving on from understanding and learning to arguing against established positions and developing a way to challenge that position.

One examiner described the achievement of doctorateness as a 'conceptual elegance of research design' with 'an interesting story attached' and provided an example of one such PhD where the researcher had been able to formulate a hypothesis and isolate testable questions from a multivariate complex situation. The 'elegant conceptualising coupled with an analysis driven by the question and not what SPSS can do for you' and the process of standing back and reflecting on the question of data:

> *'…and that process of standing back and spending long periods of time of just walking in and out of the data through different kind of doorways, looking at it from different points of view, without any preconceived ideas… See what it looks like from, and then you get the elegance of the precision of the analysis or analytical thought that in my view makes for a good piece of research'.*

Threshold crossing was described as a 'revelatory moment' for which there is a lack of a formal repertoire of language and metaphors to describe or express it', a 'jolting of the comfort zone', an unclicking of the troublesome and grappling with counterintuitive ideas. Another examiner, extrapolating from their experience as a supervisor, described it as transformational, an awakening:

> *'I do... the very beginning it seems like a huge path ahead of you, and you know, that is a daunting thought, and then to get to the end, once I've got to the end of this the student's got to think well then... the next way of thinking and it's the beginning of how you are as a person... comes through that journey and the individual then sees you know... about themselves... that's an awakening I think...'*

Examiner comments notably mirror students' depictions of their learning processes in the use of metaphorical language and the way in which they highlight its transformational quality:

'I want to see lights come on in what the person is saying and what they've achieved… see illuminated thinking coming through in the sections'

Examiners identified strategic points in writing up as important phases for evidence of conceptual threshold crossing. One examiner indicated that this learning moment or shift was incremental and most probably happened during the process of writing successive drafts:

'in the writing, marked shift in successive drafts where the writing becomes more authoritative, more bolder and what accompanies this is a reconfiguration of the self, the realisation that actually for a brief moment in time, I am actually the expert – this is the hallmark of advanced scholarship, it is a letting go of the supervisor and previous sense of self – a confidence, maturity'.

Knowing that the material presented might one day be published, was one examiner's own personal marker that significant conceptual crossing had taken place. One examiner suggested that a breakthrough could occur through constructing a section, after doing something mechanical, and an 'aha' moment happens:

'...it doesn't happen straight away and you can almost begin you know collecting data then suddenly have an 'aha' about something explored or read or been you know confronted by or your supervisor said'

Examiners reported that scholarly activities (e.g. publishing), nudges from supervisors and affective processes enable conceptual crossing. Placing research material in the right journal for proper scrutiny to get the learning leap that is required was one helpful strategy mentioned by an examiner. Another indicated that dialogue encouraged breakthrough moments, asking the right questions particularly. Support from supervisors enables the transformation, moving from troublesome knowledge towards conceptual threshold crossing. As one examiner indicated in discussing a student they had supervised:

'…her moment, her click moment if you like, was when she kind of, we had regular kind of phone conversations, and one conversation she …she's done all the right things but she said, I just don't know where this is going, so myself and the other supervisor sat down at my suggestion and we drew up a concept map of how we saw the thesis'.

According to examiners, students encounter troublesome knowledge at different stages and moments. One examiner described how a student encountered troublesome knowledge relating to specificity of case studies and 'generalising' and moved on:

'And it's when they start struggling that this ain't that easy…as a step up…there is a student of mine doing a really interesting , I think, PhD…and she suddenly realised it's a real, you could say threshold development, she's suddenly realised that it's very difficult to generalise, yet the whole thesis is about generality'.

Examiner interviews pointed to good practice and the duty of care supervisors had and the importance of them helping students understand what is required for a 'good enough' PhD, develop researchable questions, craft their theses, extend their language and discourse.

According to the views of examiners reflecting on the roles of supervisors, supervisors in their developmental role therefore needed to read drafts, point out work that needs to be redone/recommend changes, dialogue and use prompt questions. Examples of practical support provided by some supervisors included developing modules, for example how to develop researchable questions, and facilitating get-togethers where students can talk and offer each other mutual support. One examiner said that as a supervisor, they encouraged students to prepare a conceptual map to produce a transferable model of how things should be done, based on evidence. Another examiner in a supervisory role encouraged students to express their research problem and background reading in few words, in the form of a mini-proposal.

One of the questions we asked examiners concerned the processes they undertook in reading and examining a thesis. Examiners revealed specific examiner thresholds and how they proceeded through theses. Such processes offer insights for students, supervisors and other examiners and confirm those processes suggested in the research literature. Attention to the architecture, structural considerations are important since examiners indicated differing approaches to reading through the PhD (for example, back and forth, straight through, specific chapters first then others). Where corrections were necessary, one examiner suggested that 'it's beholden on the examiners to clearly explain why corrections were required'. The necessity for the role of a chair was singled out as key to providing clarity and help for the piece of work requiring corrections. This good practice in guiding students required to make corrections was emphasised by one examiner who noted:

'I think there should be a chair who is really very clear about what these students…and what's going to be helpful for this piece of work and the student to get to this, the end point so that it's a really good piece of work that can go out and be used as a resource by others in future'.

Examiners explored how they proceed through a thesis to evaluate its doctoral quality and evidence the extent to which the thesis was conceptually, critically and creatively adequate for doctoral level. In other words, the student demonstrates that they had learned or acquired the conceptual, critical and creative skills and research behaviours a PhD demands. One examiner highlighted abstracts, clear relationships, correlation and alignment, the significance and advancements made, the openings, what makes it interesting, structure (e.g. introduction), and evidence of peer reviewed publications as markers of this learning and doctoral achievement:

> *'Ok, um, I guess, first thing I do is look at the abstract or that sort of abstract chapter, abstract section and I look for a clear relationship between what they set out to do and the way in which the work unfolds and at the end of the abstract I look to make sure, to see that it's wrapped up and then I look for the so what, so what what's what's important this, what does it show, how can we apply it, how does it advance or make anyone's life more interesting, or what does it open up for us, so that's probably where I start, and then in a series of, circles I guess, psychic process, I look at the introduction to see where they're coming from to try and see how they flesh out the abstract and then I'll probably go to the conclusion... and again look for the correlation and the alignment and the sense that this is a well rounded piece of work where a doesn't have to lead to b but I do have to see the relationships drawn out for me. I then probably look at the publications that have arisen from it, to some extent knowing that somebody else has already peer reviewed it gives me a sense ok well there's already some quality about this work, so that makes me usually feel a bit easier about it, if there are no publications I usually find it to be a hard grind, and then I look at the references, look for seminal references in the area, look for current references in the area and look for key people working in the area.'*

Students aiming for a good PhD need to demonstrate the following: 'clarity, coherence, evidence…the chain of argument has to be there…the big and small to align', as mentioned by one examiner.

> *'...it's clarity, consistency, coherence, evidence of, cos I work in the sciences so, the chain of argument has to be there... quality... so I want the big picture and the small picture to align. If I'm looking at something in a chapter in the thesis I want to know at the beginning of the chapter why they're doing it. I would ideally like some indication about linking back to the methodology chapter to remind me of how they're doing it.'*

Keeping the reader with you, understanding your reader and displaying data correctly are also noted:

'To keep the reader with you. And then in the discussion section I'd like to have or the result section sorry the data displayed clearly, I'd like the graphs and typical sort of stuff, the graphs to stand alone as a story without having to refer backwards and forwards all over the text to find out what the purpose of this graph is. I like the data to be there, I like the graph the data to be modified, if they're doing that, so I want to see the original data as well as the data that make it easy to understand what they're talking about.
'I mean it really is about understanding your reader, not necessarily an examiner, but your reader, that is I'm trying to let you know that I know exactly what I'm doing and I know this deeply and thoroughly and I can explain it even to a person who may not be an expert in the field so that they feel that they're there'.

Evidence of doctorateness included working at a higher level with more originality:

'Um well they are not that different from lower level they're just at each point they have to do it kind of better and with more originality, more kind of lasting impact I suppose'.

Inhabiting the work is a further illustration of doctorateness, as one examiner noted:

'I see, someone who understands their PhD, they should inhabit the work... you should know it so well that you should inhabit it, you should be able to think and be flexible on the run and reshape it according to the dialogue you are having and who you're having it with so I expect them to know their work well enough to say I know this this, this, this and have it planned out so the reader is led along not that the reader has to work out where they're going'.

Further Outputs

The production of the outputs continues beyond the end of the report. The CD-ROM 'Interviewer Viva' which takes postgraduate students through a mock PhD viva was developed in very draft form as the project started and piloted successfully with a number of UK and international doctoral students both in its very early developmental stages and in its pilot stage. As a result of their responses, and the technical complexities and technical updating, it has been rewritten and much of it will be re-shot. This is taking place in Summer 2010 at the University of Bradford. The CD-ROM should then be usable by postgraduates, supervisors and programme leaders through any PC and webcam.

In addition to this, meetings are in progress to develop theoretical models and to develop further resources for supervisors and students. Talks with Vitae are underway to investigate how these

resources can best be shared in the wider research community. Plans are underway to hold a dissemination event at the University of Brighton with the intention that the project team can then offer symposia and workshops nationally. Further to this, project team members are developing workshops and resources which focus on research student wellbeing and are building on this aspect of the research findings. The research has already been and is being widely disseminated and this is an ongoing process as summarised below.

Events:

Symposium, University of Brighton, with Professor Erik Meyer, December 2008
Symposium, University of Brighton, on Threshold Concepts and Creativity, with Professor Ray Land, May 2009
Symposium, University of Brighton, forthcoming 2010

Conference presentations:

'"Now you see it, now you don't": Identifying and supporting the achievement of doctoral work which embraces threshold concepts and crosses conceptual thresholds' by Margaret Kiley and Gina Wisker, Threshold Concepts Conference: From theory to practice, Queen's University, Kingston, Ontario, Canada, June 2008

'The Good Enough PhD' Keynote by Gina Wisker, Postgraduate Learning Conference, University of Stellenbosch, South Africa, May 2009

'Doctoral learning journeys' by Gina Wisker, Charlotte Morris, Ming Cheng, Annual Learning and Teaching Conference, University of Brighton, July 2009

'"Nudging": exploring effective strategies to enable postgraduate research students to cross conceptual thresholds in their doctoral work.' By Gina Wisker, 3rd Threshold Concepts Symposium, Sydney, Australia, July 2009

'Nurturing and sustaining postgraduate learning: conceptual thresholds, creativity and communities of practice.' By Mark Warnes, Jaki Lilly, Gillian Robinson, Vernon Trafford, Ming

Cheng, Gina Wisker, Charlotte Morris, European Association for Research on Learning and Instruction (EARLI), Amsterdam, August 2009

'Doctoral examining: evidence of research learning' by Gina Wisker and Margaret Kiley, Quality in Postgraduate Research conference, and post conference proceedings, 2008

'The Good Enough PhD' Keynote by Gina Wisker, Postgraduate Conference, Thames Valley University, February 2010

Journal articles:

'Threshold concepts in research education and evidence of threshold crossing' by Margaret Kiley and Gina Wisker, Higher Education Research Development journal, 2010

Special edition of Innovations in Education and Teaching International, August 2009
Edited by Gina Wisker (Brighton) and Lynn McAlpine (Oxford) and focusing on doctoral education and supervision, with entries from colleagues from New Zealand, Canada, Australia, Israel and UK. Research team contributions include essays from Wisker and Robinson, Trafford and Leshem, and Kiley (consultants to the project).

'Doctoral learning journeys' by Gina Wisker, Charlotte Morris, Mark Warnes, Jaki Lilly, Assessment Learning and Teaching journal, Leeds Metropolitan University, 2009

'Crossing liminal spaces: Encouraging postgraduate students to cross conceptual thresholds and achieve threshold concepts in their research' by Gina Wisker, Gill Robinson, and Margaret Kiley. In M. Kiley & G. Mullins (Eds.), Quality in Postgraduate Research: Research education in the new global environment - Part 2: Conference Proceedings. Canberra: CEDAM, ANU, 2008

Book chapters:

'Learning to be a researcher: The concepts and crossings' by Margaret Kiley and Gina Wisker. In J. H. F. Meyer, R. Land & C. Baillie (Eds.), Threshold Concepts: Theory to Practice, 2010

7. Outcomes

The project addresses significant gaps in professional and scholarly knowledge regarding doctoral experiences, the nature of doctorateness and supervisors' and examiners' understandings of doctoral students' learning processes. It provides evidence on how appropriate conceptual understanding can be achieved by students to raise their levels of scholarship, alongside a holistic journey personal and professional development, which can be enabled by good institutional and supervisory practices. Based on this research, the project team are developing evidence-based models of good doctoral education that are sustainable and practice-orientated. These have the potential to enhance research development programmes, supervisory strategies, examining processes and communities of practice to support doctoral students in achieving conceptually robust research outcomes and skill developments and in the longer term to improve retention and completion among doctoral students and enhance postdoctoral researchers' capabilities and skills. Positive benefits for participants in the piloting phase have already been reported.

For development

The project will complete both a new version of the CD-ROM 'Interviewer Viva' and draft online course materials and processes for supervisors. The CD-ROM specifically focuses on development for the viva stage. Research conducted with students who piloted the CD-ROM produced these comments:

> *'The points and the tips that were given and those were very, very helpful… I have seen some 'Preparation for Viva' notes beforehand off other people and other resources but this is unique.'*
>
> *'The uniqueness of the Interviewer is that it really gives you the examiner's point of view and it gives you a few tips of what might the examiners look for in answering the questions. How to satisfy, how to understand the questions, what perspectives you can take the questions to and, and then, you know, hopefully your answers are much better. So, in that respect it was really helpful.'*
>
> *'It is not so much the questions as the situation, you see, it really gets you into the situation, the setting, the atmosphere, the context of the viva and it really gives you a sense of realness about the viva.'*
>
> *'Going through the Interviewer CD-ROM made me think hard about particular generic questions that might turn up… and I was able to formulate a… well thought-out answer to each one.'*

'What was most useful to me is the opportunity to speak. I have a problem with my level of speaking English.'

'First of all, I tried to answer exactly and even I wrote m, my answers. I tried to remember them by heart. And after one or two days I felt that there is no chance that I can remember it and I started to speak with the computer fluently with mistakes, with the gap between, you know, sentences. And that, was the main, you know, helpful points in this CD-ROM.'

'So some of the tips are so, know like a distance from the questions. Many small questions prepared you to answer not only one question but four or five according to the number of the tips and also the remarks.'

And the ultimate accolade:

'I don't think that I could answer these questions without this experience.'

The project has had a positive benefit within the participating institutions as it has progressed, enabling discussion and reflection among students, supervisors, examiners, programme leaders ad managers. For research participants and the students in particular, it has enabled an ongoing opportunity for reflection on progress. Positive benefits have been reported in terms of maintaining motivation and enabling the development of self-awareness as learners, contributing to the learning process by providing additional opportunities for articulating the research in process, through both verbalisation and writing. For supervisors and examiners, participation provided an opportunity to reflect on both personal experiences and practices, identifying positive strategies to facilitate doctoral learning. At the University of Brighton the benefits of the research process were augmented through ongoing discussion through Supervisor forums and doctoral learning and supervision enquiry groups, which facilitated further sharing and embedding of good practice at the institution. Nationally and internationally ongoing dissemination and workshops have had a positive impact for participants.

Consultancy by Professor Wisker has been affected and informed by the research programme and has included:

- Supervisor workshops for the University of Gothenburg in October 2009; and for the University of the West Indies in August 2009, as well as in January 2010;

- Keynote sessions for the Southern Consortium of Professional Doctorates in July 2009, and Professional Doctorate workshops for the University of Brighton in 2009 and 2010.

Note: see Coda, p. 61.

Contribution to knowledge about 'research as learning' and support from supervisors

Ultimately the project has contributed to and enhanced depth of understanding of the process of research student learning. This enables theory building which, in demonstrating the depth, complexity and transformative potential of doctoral learning alongside significant transferable skills development, contributes positively to wider debates regarding the value of the doctorate. Issues of quality of the doctorate, student conceptual and critical levels, skills development, supervisory practices and the recognition by both examiners and supervisors of learning leaps and evidence of quality in the PhD have been elements of key debates internationally. Since the beginning of the project, the work of the Doctoral Learning Journeys team has been invited, consulted and disseminated at conferences, through keynotes, in supervisor and postgraduate development programmes, in a range of publications, and in relation to the work of Vitae, NUS, QAA and significant opinion leaders on doctoral education in the UK and internationally. We intend to continue to publish and present at conferences beyond the end of the funded part of the project to enable the findings and good practice, which the research has surfaced, to be appropriately disseminated throughout the research community.

8. Conclusions and implications

Since the beginning of this project, the significance of doctoral education to the building and sustaining of a successful knowledge economy has become more evident and as a result the notion of *doctorateness* is exercising the minds of significant opinion leaders on doctoral education in the UK and internationally. The work of the project offers research evidence based insights into and guidance on the effective development of research as learning which is crucial for the sector, doctoral and postdoctoral researchers, supervisors, examiners, employers and those seeking regeneration and transformation of knowledge in times of rapid and unprecedented change.

The project evidences the dynamic, multi-faceted nature of doctoral learning and the range of qualities and skills doctoral students develop through their cognitive, ontological, epistemological, emotional, instrumental and professional/technical developments. Doctoral students demonstrate the development of a wide range of transferable skills of value both within academia and the wider society, including the development of considerable resilience to cope with change and uncertainty. However, ironically doctoral development is threatened by the continuing uncertainty as to the status and value of doctoral learning. The research findings can therefore contribute a renewed affirmation of the value of doctoral learning and the need to re-evaluate the level of required support for this learning, which is crucial in order to build a sustainable research community for the future.

The Doctoral Learning Journeys project reveals significant commonalities between candidates' research perceptions and approaches, doctoral experiences, actual or attributed meanings and uses of 'doctorateness', and, comparability between doctoral awards and has to potential to invigorate attitudes towards doctoral education. Our work has been usefully informed by theories of conceptual threshold crossing by Wisker, Kiley, and Robinson (2008) building on threshold concepts of Meyer and Land (2005, 2006).

The project has demonstrated conceptual threshold crossing (moving from stuck places through liminal spaces into new, more conceptual understandings) at this level, and provided evidence of the process of becoming an independent researcher, of ontological change – seeing the self and the world differently (transformative) and epistemological contribution – developing understanding of research process, contributing to knowledge and meaning, interlinked with instrumental, professional, cognitive and emotional development. These are vehicled through a positive engagement with troublesome knowledge, developmental response to the enabling practices of supervisors, research development programmes and the wider academic community.

Based on these research findings, we are beginning to develop a model which enables identification of breakthrough moments, learning leaps or conceptual threshold crossings in doctoral research as learning, and strategies which 'nudge' or enable such breakthroughs and achievements. This is informed by doctoral candidates, supervisors and examiners and will be invaluable to the sector and the knowledge economy. It will need further work beyond the project to achieve its potential.

Since the start of this project doctoral education has become a key national and international issue in Higher Education. This research into doctoral learning, informed by doctoral candidates, their supervisors and examiners, contributes significantly towards recognition and definition of the quality of doctoral work, learning and attributes, and suggests concrete strategies and practices which can be deployed by supervisors and doctoral programmes to enable breakthroughs, leaps and crossings, to enable the conceptual, critical and creative work which merits a doctorate. It can provide most useful insights into and examples of perceived good practice to inform research programme development, supervision and the examination of doctorates, as well as informing students themselves about the actualising of doctoral level learning behaviours, qualities and evidence in their work. Ultimately these strategies and practices engender sustainable research practices and communities, which contribute to the effective, long-term building of buoyant knowledge economies.

9. Recommendations

Our findings about the learning journeys of doctoral students and the nature of the learning journey could be incorporated in a useful manner into development work for postgraduates (programmes) and into supervisory practices (supervisor interactions) and supervisor training.

Ongoing dissemination through presentations, symposia and workshops with support from the sector will enable this as will the continued development of online resources for doctoral students and their supervisors.

- The sector should consider developmental support for examiners who are often working in isolation even more so than supervisors.
- There is a need for re-invigorated debate as to the nature and value of the doctorate in the sector and the ongoing dissemination of this work has the potential to provide a springboard for this.
- Further work should be carried out into emergent areas of wellbeing, international students/cross-culturally contextualised research and supervision, taught doctoral programmes, science doctorates, supervisory and examining practices and success strategies.

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APPENDICES

Appendix 1

DLJ Questions for Student Interviews (1st / 2nd year)

1. So you're on x programme, which started in x year and ends x… can you tell me what made you want to study at doctoral level?

2. Tell me about your experience of doing a doctorate so far.

3. What is your research topic?

4. What work have you done on your doctorate up until now?

5. In what ways have you developed as a research student so far?

6. How do you feel about being a research student?

7. How clear is your research question at this point? *(How did you develop that? How important is it to be clear at this stage?)*

8. Are there any key concepts or ideas within your discipline which have informed your work?

9. What are the main theories informing your research?

10. What methodology are you using? *(By methodology I mean how you understand knowledge, how you see the world and your place within it)*

11. What methods are you using?

12. Have you encountered any barriers or difficulties in the research process so far? *(learning/thinking/ skills / personal – confidence)*

13. How did you overcome these? *(What strategies did you employ? have you had any support?)*

14. Have you experienced what we call “learning leaps” or “aha!” moments when your thinking moved forwards? *(Can you describe this experience?)*

15. What helped you achieve this breakthrough?

16. What role has your supervisor played in your progress so far?

17. What research training have you undertaken? *(How has this helped you to progress?)*

18. Do you feel there are any specific research skills you need to develop? *(e.g. thinking skills, technical skills, organisational skills?)*

19. What are you currently working on?

20. Are there any problems that need addressing in your work? *(Do you envisage any problems arising?)*

21. If so, how might you go about overcoming these?

22. What is the next stage for you?

23. In what ways could your supervisor support you as you continue to move forwards?

24. What does “working at doctoral level” mean to you?

25. Is there anything else you would like to say in relation to your doctoral studies?

Appendix 2

DLJ Questions for Student Interviews (1st / 2nd year) - 2nd Round

Background to the Study – what / why / how

1. Perhaps we could begin with you telling me about your research topic…

- What is it?
- What made you choose that particular topic?
- Do you have a research question?
- What methodological approach have you adopted?
- Can you tell me more about this approach?

Development – personal / professional / conceptual

2. What are you currently working on?

3. How has your work in this area developed over the course of your studies?

4. In what ways do you feel you have developed as a researcher?

5. What are the main theories / ideas informing your research?

- Are these ideas specific to your discipline?
- How did you first come across these ideas?
- What made you decide to apply these ideas to your research?

Learning Moments

6. What sorts of barriers / problems have you encountered so far in the research process so far?

- Learning / thinking skills
- Other skills
- Personal / practical / emotional barriers

- Have you been able to resolve these?
- Describe how you have worked through these problems

7. Describe any moments you've experienced in which your learning has moved forwards

- What triggered this learning?
- What factors contributed to this breakthrough?
- What did it feel like to achieve this breakthrough?

Supervision and Research Training

8. Can you say a bit more about / tell me about the role your supervisor(s) have played in your progress so far?

9. Have you undertaken any research training?

- How has this supported your development?

10. In what ways do you feel you need to develop as a researcher?

- Thinking / skills – technical / practical / personal / professional

11. What will you be working on next?

- What are the next challenges for you in your studies?

12. What factors will help you to continue to move forwards?

13. Overall, how have you found the experience of doing a doctorate so far?

14. What does the term "working at doctoral level" mean for you in your field?

- Do you feel you are currently working at doctoral level?

15. Is there anything else you would like to say in relation to your doctoral studies?

Coda

The online doctoral supervision course is now available http://www.brighton.ac.uk/clt/clt-courses/

A CD-ROM for doctoral students and case studies will be available shortly and links will be provided in due course.