WHAT IS A PHD? PROCESS VERSUS PRODUCT IN PHD SUPERVISION

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Abstract. This paper uses concept mapping and interview techniques to track knowledge and understanding among students and their supervisors in the course of full-time research towards a PhD. The on-going work measures both cognitive change in the specific subjects that are the topic for research and in the understanding of the process of PhD level research and supervision. The data makes a unique contribution to our knowledge of research processes and an understanding of lab-based science research supervision. It also helps to provide documentary evidence of the ways in which supervisors can act to facilitate learning and discovery. The challenges of a PhD being both a process of learning (for the student and the supervisor) and a product of a research project are explored. The approach comprises detailed case study analysis rather than any broad inferential comparison. Case studies are used to highlight the unique nature of relationships and supervisory practices, contrasting with literature on generic PhD supervisory styles and practices. This paper works to develop a research-led pedagogy of supervision that places the process and product of a PhD at the centre of the supervisory relationship. Supervision and supervisory styles cannot be analysed independently of the work that is being done.

1   Introductión

This project attempts to lay the foundations for the development of a research-led pedagogy for dissertation supervision in the lab-based sciences, e.g. molecular biology and biochemistry. Hetrick and Trafford (1995) and Salmon (1992) provide detailed analysis of the processes involved in PhD supervision, however both neglect to document the process through time and report instead, individual expectations of the supervisory role. Further research details various roles and styles of PhD supervision (Burns et al., 1999; Lee, 2008; Mainhard et al., 2009). The results indicate the importance of supervision as a process, but do more to highlight the need for future research than to explain exactly what this 'process' might entail.

Nevertheless no extant literature provides empirical data for such a journey through time and no studies to date have attempted to do this simultaneously among supervisor and student. As a result any attempt to formulate pedagogy for dissertation supervision lacks an underpinning research base. This is despite Salmon's (1992) consistent emphasis on the importance of change and the support for change in the course of research. Documenting knowledge and understanding among PhD students and their supervisors through the course of a PhD is key to understanding what the joint processes of research and of supervision entail (Brew, 2003). Recent theoretical and methodological developments in the fields of concept mapping (Novak, 2010) allow for a research and development tool for longitudinal use in the study and practice of PhD supervision.

This study builds on previous work (Kandiko et al. 2008) and follows four pairs of students and supervisors over the duration of a PhD. Through detailed case studies using concept-mapping and interview techniques, changes (or lack thereof) are tracked over time. All of the case studies are in lab-based sciences, an area of large expansion in PhDs and one that differs in many ways from traditional one-on-one supervisory relationships; this is discussed further below.

2   Background

There has been a recent policy focus on employment outcomes, skills formation and quality, the latter judged by completion rates, student satisfaction, and supervisory effectiveness (Pearson & Brew, 2002). This shifts the PhD from a time of knowledge creation to one of research training. This is contrasted by Curzon-Hobson (2002), who develops and defends a notion of trust in higher learning, and examines the pedagogical challenges of its pursuit within the sphere of higher education. It is argued that the experience of trust between teachers and students is a necessary foundation for a critical, dialogical learning environment, yet it is an endeavour that can be endangered by many of the demands and restrictions placed upon teachers in higher education. There is a general neglect for the support and

development of research skills (Roberts Report, 2002) and an overall lack of a research-led pedagogy for dissertation supervision. Despite this, there is literature supporting the importance of communication and collaboration skills in PhD education (Phillips & Pugh, 2005) and also on feedback on written drafts as a form of communication, a form of learning and a process of discovery (Kumar & Stracke, 2007).

There is a need for research that blends both qualitative and quantitative elements in the study of doctoral education (Crossley & Watson, 2003). Unfortunately, much of the research on PhD supervision is decontextualised, and universalises the supervision process—across types of enquiry, disciplines, countries, and individual characteristics (e.g. Delamont et al, 1998; Phillips & Pugh, 2005; Whisker, 2004). This literature suggests an idea that supervision can be analysed separately from the context of the specific PhD. Rather, we see supervision as inherently part of the thesis development and completing a PhD, therefore supervision and the supervisory relationship is unique to each PhD. However, there is a developing literature around grouping and typifying supervisory styles, often set around personality types and matrix divisions, discussed below.

3   Supervision styles and roles

In a study of 250 postgraduate students, Kam (1997) found there was "no set prescription" (p. 101) for a supervision style, and supervision quality and style was significantly affected by the needs of the students. Furthermore there is a push for students to take a more proactive role in supervision (Gurr, 2001). Burns et al. (1999) identified three typical or preferred ways that supervisors and students conceptualise supervision: thesis orientation, professional orientation, and personal orientation. Murphy et al. (2007) furthered Burns et al. (1999) work and came up with four orientations, with two distinctions, that can be organised in a matrix format:

•   whether the supervisor should direct and take responsibility for the research (controlling beliefs) or should guide the process (guiding beliefs); and
•   whether the focus of supervision should be more upon the research tasks to be completed (task-focussed beliefs) or upon the development of the candidates (person-focussed beliefs). (p. 219)

Issues arise when there misalignment of student and supervisory styles or expectations. Mainhard et al. (2009) developed a questionnaire based on interpersonal supervisor behaviour, developed along two axes (Opposition—Cooperation) and (Dominance—Submission) and eight types of behaviour: leadership, helpful/friendly, understanding, giving students freedom and responsibility, uncertain, dissatisfied, admonishing and strict. They map out both influence and proximity. They find supervisors face the most challenge in combining oppositional behaviours, such as supporting a students' research and dealing with a student failing to meet requirements and deadlines. From literature reviews and interviews with supervisors Lee (2008) developed five approaches to supervision:
1. Functional: where the issue is one of project management.
2. Enculturation: where the student is encouraged to become a member of the disciplinary community.
3. Critical thinking: where the student is encouraged to question and analyse their work.
4. Emancipation: where the student is encouraged to question and develop themselves.
5. Developing a quality relationship: where the student is enthused, inspired and cared for. (p. 270-1)
However increasing regulation in universities to try and increase pass rates has led to a focus on the functional aspects of supervision, leading conversations about the other dimensions to be done within a policy framework of upgrades, progress reports and thesis deadlines. Scholars have recommended individual student-based supervision strategies "those centred on the needs and aspirations of students based on their role expectations of their supervisor and the degree of responsibility they assume for themselves" (Kam, 1997, p. 101). However in practice, these categorisations are of limited utility in the process of supervision; there is utility in ignoring lists of traits and characteristics and focussing on what supervisors do and why (Cullen et al. 1994)

4   Methodology

Concept mapping (sensu Novak, 2010) is a method of graphic organisation. Its considerable utility stems from its origins within the human constructivist epistemology and it is now widely reported in the literature for use in the sharing of individual knowledge and understanding (Nesbit & Adesope, 2006). The concept mapping work of Novak and others has been used in studies of learning (Kinchin, 2001b); measurement of learning quality (Hay, 2007); PhD supervision (Kandiko et al., 2009); assessment (Edmondson, 2000); cognitive typology (Hay & Kinchin, 2006; Kin-

chin et al, 2000); learning style (Kinchin et al, 2005; Kinchin, 2004); and expert identification (Hoffman & Lintern, 2006; Kinchin, 2001a; Novak & Gowin, 1984).

In 2000, Kinchin et al published an important modification to the concept mapping method that encouraged a radically different approach to analysis. In particular, this work proposed a qualitative approach to concept map analysis based on gross structural morphology and it proposed a classification of map structures in three categories: spokes, chains and networks (Kinchin et al, 2000). These three typologies develop from chain to spoke to network designs. Since the publication of this work, this broad classification of map types has proven remarkably robust, and has now been documented among school children and adult learners, health-care professionals, and academic teachers (see Kinchin et al, 2000; Hay and Kinchin, 2006; Kinchin & Hay, 2005; Kinchin et al, 2005 and Kinchin & Hay, 2007 respectively). Furthermore, it is indicative of varying roles within the learning process at university (Kinchin, Lygo-Baker & Hay, 2008). Concept mapping can therefore be seen as an integrated mixed methodology.

Subsequently, the work of Kinchin et al (2000) has had considerable impact on our understanding of 'novice' and 'expert' status (Kinchin, Cabot & Hay, 2008). This is because the three basic knowledge structures (chain, spoke and network) have been shown to be synonymous with rote learning, the emergence of 'learning readiness ' and expertise respectively (e.g. Hay & Kinchin, 2006). Furthermore, the spoke, chain and network structures provide a theoretical framework for the measurement of emerging student expertise and the assessment of teaching and learning. This classification scheme has recently been scrutinised by Gerstner and Bogner (2009) who concluded that it "may be a good indicator of students' learning success," particularly when applied in combination with other testing mechanisms.

4.1   Multiple Case Study Approach

The identification of mutual conceptual development requires a research design that enables the supervisory process to be explored over time. The method chosen is congruent with our epistemological position, which relates to the legitimacy of generating data about how PhD students and their supervisors work together by talking interactively with them. The approach most suited to this position is qualitative, utilising what Charmaz (2001) calls "multiple sequential interviews" (p. 682); this type of interviewing "charts a person's path through a process" and creates the opportunity for a "nuanced understanding of that process." This can be enhanced through the application of concept mapping to offer additional insights into the richness of an individual's understanding (Kinchin, Streatfield & Hay, 2010). Four pairs of students and supervisors were recruited through Heads of Graduate Studies at a research-intensive university in the UK. All pairs are in lab sciences, although from a variety of Schools and disciplines.

4.2   Interview Procedure

In this on-going research, interviews are conducted with four pairs of students and supervisors and interviews are conducted separately to minimise the interference in the supervisory relationship. In-depth, semi-structured interviews are done with the students and supervisors at four-monthly intervals. Interview transcripts are translated into concept map summaries that provide structure for the data, facilitating analysis within cases and across cases. This also helps to identify a route through the developing narrative. Data collection and analysis occur at each stage, and enable each interview to draw upon the experiences of the participants to inform theory generation relating to changes in content and processes over time. The interviews explore two complementary lines of enquiry:

1.   Topic – looking at the academic area under investigation within the PhD.
2.   Process – looking at the conceptions held of the research process and of the PhD as an entity.

Questioning during student and supervisor interviews takes the form of three interconnected phases for each of the two themes. These three phases reflect the three phases of questioning identified by Pedrosa de Jesus et al. (2006) as 1) acquisition, 2) specialization and 3) integration. These in turn facilitate the co-construction of concept maps (by interviewee supported by interviewer) by building upon spokes, elaborating chains and finally integrating these as networks. This was guided by careful use of relational language (sensu Loewenstein and Gentner, 2005), during the interview to encourage the interviewee to make links explicit.

Furthermore, the simultaneous assessment of students and supervisors is important for understanding how the cognitive changes of one affect the other and vice versa. What for example are the consequences of new discovery by the student researcher on the extant knowledge structures of the researcher? Do these constitute new thoughts and

new ways of seeing things for both parties? Furthermore, will the active demonstration of change (or the lack of it) through concept mapping impede or enhance the rate of cognitive alignment towards new understandings of the field of research and possible of the research/supervision process itself? These important issues are able to be addressed through using concept mapping in the longitudinal study of PhD supervision.

4.3 Using Concept Mapping to Track Cognitive Change in Time

The work of Hay, Wells and Kinchin (2008) illustrates the power that concept mapping has to reveal the changes in individual knowledge and understanding that might occur through time. Despite this, however, reports of long term studies to reveal cognitive change are conspicuous, only by their absence. There is now a well developed literature on change in the course of learning. The arguments of Meyer and Land for example, are now widely cited in the literature on higher education teaching and learning (e.g. Meyer and Land, 2003). This work suggests that learning proceeds through a series of 'watersheds' in which failure to grasp 'troublesome concepts' arrests further change, but that once attained, these 'thresholds' represent new vistas for knowledge and understanding. Whilst 'change' is seen as the goal of education, and as an indicator of learning (e.g. Jarvis, 2006), it is the lack of change that may characterise many of our observations through time. Long periods of 'conceptual stasis' (Kinchin, 2010) have been predicted to represent the 'dominant state,' punctuated from time to time with rapid bursts of change as students pass through various thresholds. Concept mapping, in the way it is described here, affords an opportunity to subject this theory to empirical measurement.

5 Findings

Pair A shows the supervisor and student maps for the first research questions, about the topic of the student's thesis. Pair A (see Figure 1 and 2) highlights the differentiation of scope between student and supervisor in the conception of a PhD project. The supervisor focuses on the process and the student on the outcomes. The supervisor notes the connected process and student a question that needs to be broken down and solved in pieces.

The set of maps for Pair B are in response to the second question about what is a PhD. Pair B (see Figures 3 and 4) shows a difference between the supervisor and student in terms of seeing a PhD being about process versus outcomes. The supervisor map (3) concentrates on acts of doing and being, whereas the student map (4) focuses on learning and acquiring traits and characteristics. The supervisor's map (3) details the scientific process of discovery (through hypothesis testing). In contrast, the student's map (4) centres on publishing, the eventual outcome, but does not indicate the exact path to get there. The supervisor sees traditional scientific process at work, whereas the student has a much more pragmatic approach. This unique approach to assessing PhD supervision may allow for analysis of the role of 'expert' and 'novice' status in cognitive change, and over time the role of expert and novice may change. The act of mapping appears to surface underlying thoughts about PhD process and supervision. Mapping and interview techniques surface the highly unique and personal nature of the student-supervisor relationship.
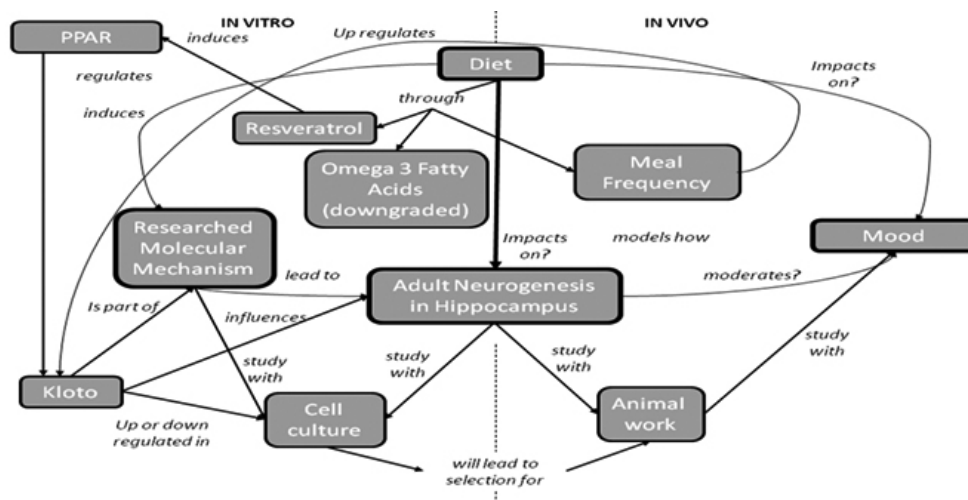

Figure 1. Pair A, Supervisor Map

6   Conclusions

There is more change in the relationship between the student and supervisor than change in understanding of the project, which seems to indicate long periods of conceptual stasis (Kinchin, 2010). This might be expected if a student's research project is seen only as development of a product to fit into someone else's life's work. In such a case, where a student is one of a large team and his/her thesis represents a contribution to a larger project one might question whether that "eureka" moment of critical insight is a required component of the thesis—or will be left to the supervisor after synthesising work from a number of theses to gain the big picture. Regarding the understanding of the topic, in all of the student maps there was a much stronger focus on the topic rather than the PhD process.

There was little change in the supervisor maps overall, with one supervisor asking, "why would these maps ever change." Perhaps for the supervisor, he or she has already passed the threshold of understanding and is not actively seeking additional thresholds to pass in the way the student is.

Figure 2. Pair A, Student Map
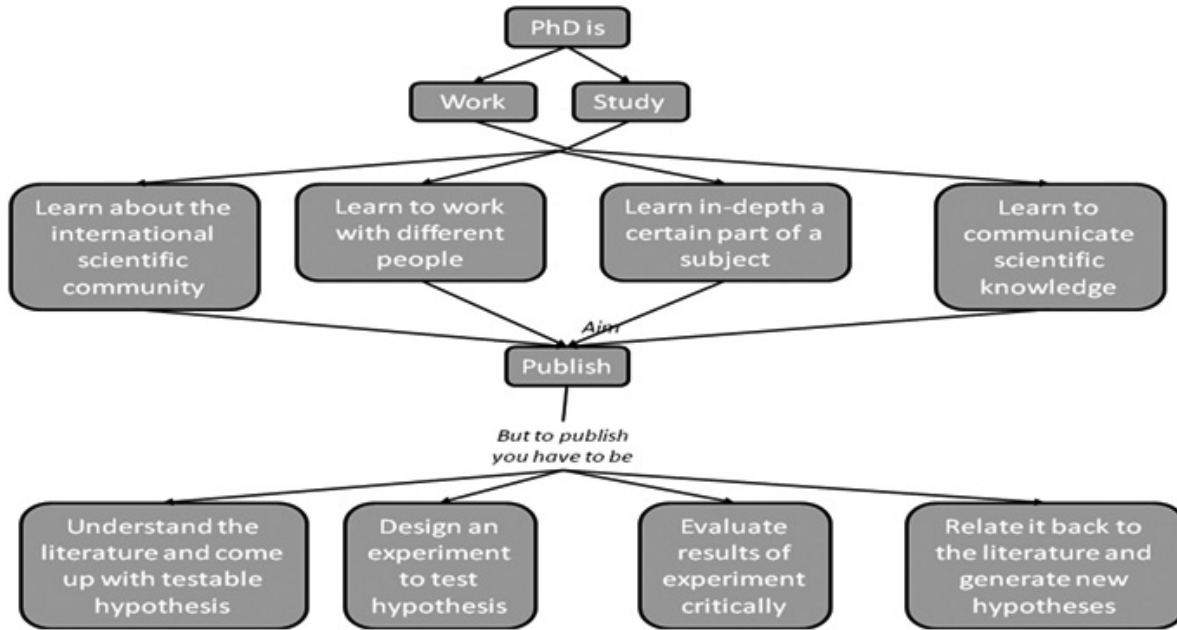

Figure 3. Pair B, Supervisor Map

Figure 4. Pair B, Student Map

In terms of understanding of process, the PhD process was more important for supervisors who were trying to get students thinking critically, which often led the student to go against suggestions or advice given by the supervisor. However, the degree that this was actually allowed is debatable. Supervisors indicate that they try to inculcate students into the larger disciplinary community and develop students as scholars, but students often just want to get their work,(i.e. their thesis) done. One student commented, "I don't know why my supervisor keeps asking me what I am doing socially and how I am feeling. It is like she wants to be my friend—I would like her to just tell me what to do and stop giving me extra work." For students, the thesis is central; this raises an issue of process versus product.

These maps show the essential role of the thesis in the supervisory relationship and the supervision process. There is an ideal of a Golden Age of PhD education of students entering a lab full of busy scientists and after three years of learning on their own the students leave with thesis and all the skills they need. Now, as part of the accountability regime that has surrounded the thesis, to the extent that ironically the thesis seems to get in the way of the development of understanding and "the ability to become a scientist." This raises a question of how the thesis can be positioned, or repositioned, as on object of learning, development and understanding in the relationship between the student and supervisor.

In contrast to a Platonic empty vessel theory of learning, PhD supervision involves a mutual intellectual engagement that has been previously described as an "intellectual courtship" (Kandiko & Kinchin, 2009). However, the degree of involvement and sharing varies dramatically across case studies and disciplines. The case studies are used as examples of how the thesis is central in the supervision process, along with emergent issues of trust, learning and working styles, and the changing nature and purpose of the PhD. Product (thesis) needs to be part of the process (supervision). There is a need to make the thesis a central part of a research-led pedagogy for PhD supervision, rather than concentrate on supervisory styles and roles.

It is important for this research that the data illustrate particular cases of cognitive change and show patterns of stasis and change. Furthermore, the simultaneous assessment of students and supervisors is important for understanding how the cognitive changes of one might affect the other and visa versa. What for example are the consequences of new discovery by the student researcher on the extant knowledge structures of the researcher? Do these constitute new thoughts and new ways of seeing things for both parties? Furthermore, will the active demonstration of change

(or the lack of it) through concept mapping impede or enhance the rate of cognitive alignment towards new understandings of the field of research and possible of the research/supervision process itself?   These are important issues that are able to be addressed through the teaching of conceptual change using concept mapping in the course of research.

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