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Interdisciplinary Doctorial Supervision –Lessons for Nurse Education and Practice.

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Abstract

Background: This paper concerns a reflection on one interdisciplinary doctorate supervision project. It outlines key elements for success within this supervisory context.

Aim: The aim of this paper is to present a reflection on interdisciplinary doctorate supervision project experience and examine these experiences in light of literature on the topic

Methods: Reflection was carried out using Rolfe et al (2010) framework for reflexivity.

Findings: The supervised engineering project aimed to develop, demonstrate and evaluate a new framework for the design of customisable assistive technology (AT) which involved professionals working with AT and users with disabilities. As this research occurs in between disciplines, it required an innovative and interdisciplinary approach, with an ultimate merger between health sciences and design engineering disciplines and external liaison with adults with disabilities and a disability service provider.

Conclusion: Interdisciplinary research is popular contemporarily and addresses societal needs. In the case outlined, clear understandings were developed, in addition to clear territorial boundaries that helped guide the novel research. Steps to success in interdisciplinary research supervision include selecting the appropriate interdisciplinary team; ensuring open communication; establishing and agreeing boundaries of the research and supervision; keeping an open mind; tolerance of lack of expertise in some areas; regular meetings and communication; keeping the student focused and agreeing publication plans in advance.

Key words: Nursing, engineering, doctorate, interdisciplinary, supervision.

Introduction

Internationally, graduate education programmes for nurses are the gold standard approach, with countries adopting this at various stages throughout the last century (Fealy and McNamara 2006). In addition to providing a standardised and accredited education for nurses, university status has rendered further education and research possible (Condell 2004, Treacy and Hyde 1999), and new graduates are equipped for purpose (Salvage 2013). One resultant benefit to the profession is the opportunity for nursing practice and research to grow and develop within the multidisciplinary environment of the university, which has the power to influence teaching, research and practice (Mac Lellan and Condell 2005). Research across the disciplines of nursing and with other health related disciplines is quite prevalent, and its importance has been recognised in recent national research excellence requirements in the UK (McKenna 2012). However research with *other* disciplines such as engineering is less well developed, and is an area that has been highlighted for future development (McKenna 2012).

However developing interdisciplinary research with disciplines outside of healthcare is not straightforward. Firstly nursing has experienced difficulty finding its feet in the university (Rolfe 2012 p.734): "it could be argued that, from the outset, nursing never really fitted into the academic structure of the university". Therefore engaging in interdisciplinary research as a novel academic community, potentially lacking confidence, is challenging. Furthermore each nursing discipline (mental health, general, intellectual disability and children's) has struggled to carve out their distinct identity within the university sector. As such while nursing disciplines may philosophically embrace the notion of interdisciplinarity, practically the initial work of

this has become associated with working across nursing and other health care disciplines as these are together as academic disciplines, under the umbrella of the University, for the first time (Rolfe 2012).

At the same time there are many elements of healthcare practice that are of concern to disciplines outside of healthcare. Indeed these concerns have yielded an increased focus on interdisciplinary research over last decade. The effectiveness of patient alarms (Korniewicz et al 2008), the hospital environment (Drahota 2012, Douglas and Douglas 2004, 2005) and electronic measurements of nursing work (BragadÓTtir et al 2013) are some examples of the small but growing body of work that reflects a hybrid between nursing and engineering.

However mergers between nursing and engineering are not without their challenges. There are perceived differences between the practice discipline of nursing and the “technical” discipline of engineering (Rolfe 2012 p.734)

“The fundamental distinction between technologies and practice as academic disciplines lies in the relationship between education, research and practice. Technological disciplines regard the three as separate and free-standing, and are premised on a straightforward one-way flow of information from research to practice. The knowledge-base of subjects such as engineering is largely propositional; it can be expressed in books and lecture notes, its application can be perfected in the laboratory or practicum, and then applied directly to real-world settings”

The need for and requirements of interdisciplinary research supervision between nursing and engineering disciplines has not been teased out. Possibly because while interdisciplinary research has been mooted in the literature for over 30 years, it is noted that disciplines struggle with its application (Repko 2012). Interestingly there is some evidence of innovative nurse/engineering collaborations such as the Hluchyj

Fellowship (University of Massachusetts 2013) in the USA. This innovation emerged from husband and wife engineer/nurse partnership, and supports two graduate students from the College of Engineering and the School of Nursing with annual stipends of \$25,000 to carry out research in the area of clinical healthcare. Similar cross disciplinary initiatives resulting from ad hoc partnerships are observed elsewhere (Douglas and Douglas 2004, 2005). However other than this, there is very little information available on interdisciplinary doctorate supervision between nursing and engineering disciplines.

Interdisciplinary research is popular contemporarily and addresses societal needs. However no consensus exists regarding definitions of interdisciplinary research. It is generally accepted as an integrated approach to research and supervision, between distinct disciplines. It differs from multidisciplinary research by virtue of its overt integration of approaches, understandings and methods. However the conceptual understanding of nursing, engineering, disability services (and other disciplines) as distinct disciplines is unclear and further complicates the blurred boundaries and confusion that is inherent within interdisciplinary research. Steps to success in these ventures includes selecting the appropriate interdisciplinary team, ensuring open communication, establishing and agreeing boundaries of the research and supervision, keeping an open mind, tolerance of lack of expertise in some areas, regular meetings and communication, keeping the student focused and agreeing publication plans in advance (Llyall and Meagher 2012, Repko 2012, Graybill et al. 2006, Arthur et al 2004)

The aim of this paper is to reflect on relevant aspects of one interdisciplinary doctorate supervision experience and compare this to the *literature on the topic* in order to explore effective ways of developing integrated interdisciplinary supervision in nursing education. Ultimately ways of working better to effectively navigate interdisciplinary supervision and working will be outlined.

The aims of this paper are as follows:

1. To reflect upon relevant aspects of one interdisciplinary doctorate project supervision experience.
2. To consider this aforementioned reflection in light of contemporary relevant literature on the topic.
3. To explore and develop effective ways of developing integrated interdisciplinary supervision.

Methods

The Conceptual Framework

Reflection may be considered as a component of a broader concept of critical thought (Barnett 1997). Critical thought requires that disciplines not only critically self-reflect but also critically analyze and take action on their practice (Barnett 1997). Rather than focusing on individual learning, Barnett (1997) emphasises the importance, within disciplines, of broadening out the narrow lens of critical thinking or reflection, to a more inclusive, collaborative model of critical thought. Ultimately, He describes three classifications of 'criticality' which together outline the 'scope of critical being' (Barnett 1997:69) (emphasis authors own). These are critical reason, critical self-reflection and critical action (Table 1).

Insert table 1 about here

These operate within what Barnett (Barnett 1997) describes as the domains of criticality- knowledge, self and the world (Table 1). Critical reasoning involves the questioning of established doctrine, policies, procedures and knowledge using critical thinking skills. Critical self-reflection encompasses reflection that is critically reflective and ultimately involves self-realisation. Critical self-reflection occurs wholly in the domain of self. Critical action occurs in the world, that is, in the practice environment often the most crucial and neglected area of reflection (Barnett 1997).

These three aspects of criticality echo the aims of this paper:

1. To reflect upon relevant aspects of one interdisciplinary doctorate project supervision experience (critical analysis).
2. To consider this aforementioned reflection in light of contemporary relevant literature on the topic (critical reason).
3. To explore and develop effective ways of developing integrated interdisciplinary supervision (critical action).

Critical frameworks in action also require a conceptual framework. Developing practice theory needs consideration of the use of *appropriate* frameworks with the development of suitable estimations of rigour (Rolfe *et al* 2010). Just as there are differences in opinion regarding definitions, there are divergent views regarding model use (Rolfe *et al* 2010). Indeed, there is sparse direction regarding how to select an appropriate model. Rolfe *et al* (2010) suggest selection depends on the personal requirements of the situation.

In this project, Rolfe *et al* (2010) framework for reflective practice was utilised as a conceptual framework. The Rolfe *et al* (2010) guiding questions (based upon Borton's 1970 developmental model) were:

- What?
- So what?
- Now what?

This framework provides for critical analysis (what), critical reason (so what) and critical action (now what) in this context.

Although traditionally reflection and reflective practice do not aim to estimate validity of either the process or the results, it is useful to ascertain how useful the framework may be for the purpose. Credibility, logical congruence and theory generation are considerations when selecting appropriate models for use in practice (Fawcett 2005). In terms of credibility, many prominent academics and universities recommend this model for use in development of practice theory (Rolfe 2005). This support for its

use, together with the level of conceptual development lends credibility and validity to this model, thus rendering it suitable for inclusion as a conceptual framework. The framework is directed at professionals working in disciplines and from this perspective is ultimately congruent with this project aims. Generation of theory is potentially possible as the work is certainly comprehensive, logical, congruent and credible.

Findings

What ...

In the Republic of Ireland (ROI) one national technological college has pioneered an innovative teaching programme, a key component of which is the development of an Applied Medical Design module; within which there is a particular focus on educating engineering design students about assistive technology (AT). AT is an umbrella term that describes a range of products and technological supports that are used by people with disability to improve their independence and overall quality of life.

Arising from these initiatives, engineering academic staffs began to supervise one doctoral project aimed at developing, demonstrating and evaluating a new framework for customisable AT design. The research involved one post graduate engineering student surveying experts who work with AT in a professional capacity, such as occupational therapists and training providers, and facilitating participatory design workshops with AT users with disabilities. The approach required research skills in areas such as focus group methods, observation and Delphi techniques as well as experience in working with vulnerable groups, and analysing qualitative data. As these research skills fall outside of those usually required by an engineering

doctoral student, and given the human subject involvement, interdisciplinary supervision collaboration with one university based discipline of nursing was arranged in order to adequately support and guide the student/project.

The engineering doctoral student aimed to develop an innovative AT design idea using a participative approach involving service users with physical disability and professionals in practice. The engagement of both the professional practice community and individual users in this project required an innovative interdisciplinary approach to both the project design and supervision, which ultimately merged both health science and engineering disciplines, a template for which was not readily available.

A team of five supervisors from three different sites supervised the student, three from engineering, one from nursing and one from a community advocacy group. The approach taken was a merging of methodologies and ideas, guiding and advising the student to adopt research approaches from both engineering and health science disciplines as suited the research question. None of the disciplines took a tokenistic, multidisciplinary approach (Repko 2012) (as consultants/advisors for example) rather the research methodology was steered in equal measure and emerged as a hybrid of all three disciplines.

The result was the formation of a new approach to engineering research, with novel methodology. Elements of the project such as ethical approval requirements, requirement for Police clearance and other considerations when dealing with client based research were new to the engineering supervisors and principally managed by the nursing supervisor. Similarly literature review skills and skills of writing synthesis

and critical analysis were guided by the nurse academic. Other elements of the project such as design and engineering materials were managed by the engineering team. The advocacy representative provided valuable advice and assistance regarding specific contextual aspects of accessing with the sample population, and needs of this client group. Research supervision occurred over a three year time period with the research team meeting with the student on a regular basis, supported by more frequent meetings of the main engineering supervisors. Although all participants, including the student, were navigating uncharted territory, the process was successful insofar as correct methods and boundaries/ scope of research were established and developed, publication processes were agreed and specific elements of the project were adequately supervised. All of the team (including the student) displayed a comfort with ambiguity (Repko 2012) that permitted the supervision to proceed when at times the end outcome, nor the way of achieving this, were entirely clear.

As this was new territory for the nurse academic (NA), there were undoubtedly challenges. Ensuring student confidence in the potential contribution of a non-engineer to the project was the first hurdle. This was due to the novelty of this approach within the mother engineering school, and inconsistency of this interdisciplinary approach with usual supervision methods. Compared with other doctoral students, most of whom would conduct laboratory research supervised by a small close knit engineering team, the interdisciplinary team approach was unusual. However it soon became evident that the NA's experience of human research was a valuable contribution to the team. There were also concerns that the NA's expectations (in terms of the literature review for example) might create an additional

burden to that normally required in engineering disciplines. This was a real concern that is reflected in the literature. Owen et al (2011:1001) describe the “intellectual odyssey” often required in social science theses. While nursing often has a similar requirement this differs significantly from engineering trends. There was also great freedom of choice (in terms of methods, design, approaches) which was somewhat unexpected for the doctoral student, many of whose peers were on pre-determined, highly structured engineering research pathways, resonant of the typical sciences approach (Owen et al 2011). These concerns were not unfounded, as there was a risk that the doctorate could become unmanageable, and indeed risk failure as a result (Llyall and Meagher 2012). However open communication about concerns, and agreeing boundaries of research investigation between the team and the student as the doctorate progressed prevented this.

Of interest to note is the suggestion in the literature that particular skills are required of those involved in this type of research in order for it to be successful (Repko 2012). There is a requirement for an open, flexible not-knowing approach to navigating previously uncharted territory, thus the researchers required skills of reflection, humility, enterprise, love of learning and a “tolerance of ambiguity and paradox in the midst of complexity” (Repko 2012). Supervisors also required receptivity to other disciplines, a willingness to collaborate and openness to the divergent perspectives of other disciplines (Repko 2012). There needed to be a willingness to achieve “adequacy” in the understanding of other disciplines (rather than high standards of knowledge/awareness that one would have in one’s own discipline) and an appreciation of diversity (Repko 2012), all of which the team displayed. Open communication to deal with emerging issues was paramount.

Additionally boundaries of supervision arrangements were clearly outlined and considerable effort was taken to ensure that the student stayed focused and did not attempt to take on too much, which is a risk (Repko 2012).

So what ...

The risks and benefits identified within the literature emerged as real concerns in this case. The challenges are summarised as follows (Llyall and Meagher 2012):

- Lack of focus/clarity, danger of losing focus -mission drift.
- Absence of common goal (chance of some being 'outsiders').
- Lack of theoretical rigour and a discipline base.
- Lack of integration.
- Fewer outputs (e.g. fewer high quality interdisciplinary journal outlets).
- Disagreements over ownership of intellectual property.
- High risk of failure.
- Bottlenecks due to interdependencies among team members (complexity of some playing key roles at different stages, with others dependent upon them).
- Wasting time on management and administration rather than doing one's own work.

Steps that lead to success towards "bridging the two cultures" (Owen et al 2011) were open communication and developing clear boundaries. It was also identified that the two most important aspects of gaining success in the work of interdisciplinary studies are to recognise two distinct aspects of interdisciplinary research that co-exist (Repko 2012):

- The work of integrating knowledge
- The work of recognising and confronting differences.

Other factors that contributed to success for this student and supervisory team included building a sense of confidence, good collaboration between the disciplines, developing publication strategies and good student focus.

Now what ...

Interdisciplinary research is popular contemporarily and addresses societal needs. However no consensus exists regarding definitions of interdisciplinary research (Repko 2012). It is generally accepted as an integrated approach to research and supervision, between distinct disciplines (Repko 2012). Emergent definitions (from a systematic review) describe Interdisciplinary research “as any study or group of studies undertaken by scholars from two or more distinct scientific disciplines” (Aboelela et al 2007:341).

It differs from multidisciplinary research by virtue of its overt integration of approaches, understandings and methods, rather than just consultation. The literature reveals that this research is often a lonely venture, as both students and supervisors navigate unfamiliar territory (Repko 2012). Identified risks include difficulty defining a focus, isolation and concerns about intellectual property rights. These are outweighed by the benefits such as increased satisfaction and practical relevance of the research.

There are a range of exciting benefits to working in this across and between disciplines (Lyall and Meagher 2012). It can be interesting and satisfying work, for example the natural scientist leaving the laboratory to perform field work in the social science. There is also a great possibility of developing diverse methodological tools

and new perspectives (Lyall and Meagher 2012). It can improve people's understanding of complex phenomena, result in novel, exciting breakthroughs and facilitate interdisciplinary communication (Lyall and Meagher 2012). Both challenges and benefits are reflected in the case study in question. In the preparatory phase in particular it was difficult to see the research path clearly, and the lack of certainty associated with interdisciplinary research (as a new approach was developed) was a cause of concern. Engineers, used to more certainty within their own discipline could have found this approach very challenging. However the benefits, such as learning new skills, generating new tools and developing engineering research in the real world of the community yielded obvious benefits.

Discussion

Ultimately this research occurs in between disciplines; therefore it required an innovative and interdisciplinary approach, provided by an ultimate merger between nursing and engineering disciplines. Exploring this challenge is timely, as there are increasing numbers and diversity of students (Baptista 2011). Additionally, internationally there are increasing expectations that doctorate students receive supervision from multiple supervisors rather than the traditional single supervision arrangement (Baptista 2011). There is also increasing emphasis on research that addresses complex societal problems and thus increased national and international emphasis on interdisciplinary research (Lyall and Meagher 2012). There is also more emphasis now on interdisciplinary practice, particularly in fields such as health care (Maccallin 2001, Drinka and Clarke 2000) and disability (Rentsch et al 2003).

While the merger of nursing and engineering may not conceptually represent two distinct disciplines, but rather a blend of natural and social sciences. Overall the fusion may be termed truly interdisciplinary, perhaps more so than research among health professionals (nurse and occupational therapist for example), which is in effect occurring within the one discipline (intradisciplinary) (Repko 2012).

There is an inherent challenge in integrating knowledge across disciplines and it is important to develop and encourage students' sense of ownership of the research (Repko 2012). Differences need to be addressed early, acknowledged and spoken about in an open atmosphere of mutual respect (Repko 2012). It is important to also to seek to understand and appreciate different worldviews and to gain institutional support (Repko 2012). In order to address any issues that may emerge in relation to intellectual property rights, developing publication strategies is an essential component of the preparatory work (Repko 2012). It is important for the student or novice researcher to network to become part of a community, as there not be a natural fit within their primary discipline. This community may be an online or virtual one that is developed for the purposes of the research, to support and nourish the emerging new knowledge. The researcher may also need to explore options for marketing themselves for future jobs in the field while at the same time maintaining one's interdisciplinary approach. Careful planning is also required every step of the way to ensure success:

"Students must for their survival (and successful completion) stay focused, knowing what part of which disciplines they will use to answer which research questions. ... more planning is likely to be needed for interdisciplinary projects than for disciplinary projects" (Lyall and Meagher 2012 p.614).

Overall the supervision team and the student need to recognize and acknowledge the uncharted and un-navigated territory that they are embarking on. The team need to seek to build networks; keep open communication and an open mind; set boundaries and agree and keep the project focused; Integrate their knowledge and experiences and confront and accept differences.

Conclusion

Interdisciplinary research in AT design has real potential to contribute actively to the disability community internationally thus interdisciplinary links ought to be strengthened. However, these must be augmented by a willingness to initiate and participate in collaborative research initiatives in the absence of clearly-defined pathways. Openness to evolving the methodology to meet the needs of all stakeholders is also central to the success of these initiatives, as is the development of trust across all participants. This work provides a template for nurse academics working across disciplines, outside of healthcare.

It is likely for the future that more emphasis will be placed on problem focused research rather than within a single discipline. It is important therefore that nurse educators prepare for this possibility. It is also important that nurse educators when developing research projects with nursing students consider the need for collaboration with disciplines outside of the traditional health care arena. Many pertinent clinical issues, such as medication management, pressure ulcers and pain management could benefit from such involvement. It is also possible as part of research teaching, undergraduate nursing students could partner with undergraduate

engineering students to develop research solutions to basic client problems. Examples of these are older people's difficulty opening medication containers or challenges with reading medication information. Similarly Masters nursing students could attempt to address some of the emerging research problems with engineering solutions. Nursing practice is replete with examples of physical frustrations in the environment (difficulties wheeling infusion pump stands for example), the solutions for which could benefit from engineering input. This case study demonstrates that while nurses do not possess engineering skill and engineers cannot profess to be nurses there is an awareness that human/client problems do not exist in these silos. Human problems require a merger of intellectual and academic skill, and to find real solutions to real problems of the future increasing transfer of knowledge between disciplines is required. This paper demonstrates that this leap into the dark is possible and can be successful, and steps to success include a comfort with one's own lack of knowledge in a new field, good communication and clear boundaries that helped guide the novel research.

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	<i>Domains</i>	<i>Forms of Criticality</i>
1.	Knowledge	Critical Reason
2.	Self	Critical Self-Reflection
3.	World	Critical Action

Table 1 The three domains of the critical being and their associated forms of criticality (Barnett 1997)

Research Highlights

Interdisciplinary research is popular contemporarily and addresses societal needs. In the case outlined barriers existed in terms of potential for unrealistic expectations of the research. However clear understandings were developed that helped focus and guide the novel research. Successful steps to success in interdisciplinary research supervision include selecting the appropriate interdisciplinary team; ensuring open communication; establishing and agreeing boundaries of the research and supervision; keeping an open mind; tolerance of lack of expertise in some areas; regular meetings and communication; keeping the student focused and agreeing publication plans in advance.