

# NAVIGATING THE IN-BETWEEN SPACES - GROWING DESIGNERS OF THE FUTURE USING AN INTERDISCIPLINARY APPROACH

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## ABSTRACT

**Background:** This paper concerns a case study of the supervision of one research project aimed to develop, demonstrate and evaluate a new framework for customisable assistive technology (AT) which involved experts 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 nursing and engineering disciplines.

**Aim:** To describe the current understandings of this interdisciplinary approach to PhD supervision, outlining the risks and benefits of such initiatives.

**Methods:** A literature search of CINAHL, ERIC and Google using the key term “interdisciplinary research” revealed seven relevant sources.

**Findings:** Findings revealed that 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 health sciences, 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. The literature reveals that this research is often a lonely venture, as both students and supervisors navigate uncharted territory. 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.

## 1 INTRODUCTION

Although interdisciplinary research has been described in the literature for over 30 years, disciplines struggle with its application. However exploring this challenge is timely, as there are increasing numbers and diversity of students [1] increasing expectations of multiple rather than single supervision [1] and increasing need for research that addresses complex societal problems and increased national and international emphasis on interdisciplinary research [2].

As a result of engineering teaching initiatives at one third level institute linked with an assistive technology (AT) training service, which supports service users with physical disability, one PhD research project arose 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.

In order to fully inform both the supervisory approach a literature review was undertaken. The aim of this paper is thus to use the literature and experience to explore effective ways of developing integrated interdisciplinary supervision. It also aims to demonstrate practical solutions to ways of

working efficiently in this context and explore ways of working better to effectively navigate interdisciplinary supervision and working.

## 2 LITERATURE REVIEW

A literature search of CINAHL, ERIC and Google using the key term “interdisciplinary research” revealed seven relevant sources. Four of these were deemed relevant to the subject under discussion [1, 2, 3, 5] and were thus used to explore the evidence base, in conjunction with seminal texts on the topic, to provide a basis for the supervisory approach to the current interdisciplinary research project. Of interest to note, little empirical evidence emerges within this domain. With the exception of one systematic literature review [5] the remainder of the papers were describing general approaches to the subject. The emergent themes were definitions of interdisciplinary research; interdisciplinary research challenges and associated risks and “bridging the two cultures”- pathways to success [3]. These arising themes will now be discussed in order to highlight and support best practice recommendations for interdisciplinary research supervision.

When considering interdisciplinary research it became apparent that each discipline has its own “intellectual history” [4 p. 4] and group of scholars concerned with that field. Academic disciplines are described as “scholarly communities that specify which phenomena to study, advance certain central concepts and organizing theories, embrace certain methods of investigation, provide forums for sharing research and insights, and offer career paths for scholars” [4 p. 4]. Interestingly, Repko [4 p. 5] identified “three clusters” of *traditional* disciplines, the natural/life science, social science and humanities and described “interdisciplinary” as occurring in the overlap “between two fields” of study. What is not clear however is whether or not research between two fields *within* these broad definitions of academic disciplines (for example health sciences and engineering) is also considered interdisciplinary. The arising lack of conceptual clarity is addressed in part by the multiple definitions of interdisciplinary research emerging within the literature.

### 2.1 Definitions of interdisciplinary research

While there was little reference in the published literature to interdisciplinary research supervision per se, a distinct difference emerged between descriptions of interdisciplinary and multidisciplinary research. Interdisciplinary research is described as an integrated approach whereas multidisciplinary means involvement of multiple disciplines as distinct entities [4 p.7]. Quite simply multidisciplinary research might involve consultation by multiple disciplines concerned with a specific research question or project, whereas interdisciplinary involves a true merger of approaches and ideas to form a new approach to studying a topic. Interdisciplinarity manifests itself through research involving two or more knowledge domains [4]. Whereas established disciplines may lay claim to a body of knowledge this interdisciplinary approach creates new knowledge [4]. Similarly these established disciplines might have standard approaches to research, however when merging with other disciplines, in order to answer research questions or solve problems in practice, novel approaches or novel application of previously established research methods may be required [4]. Repko [4 p.7] considers this an exploration of the “in-between” space, between disciplines, which often focuses on “contested terrain”, or problems/issues that are of concern to several disciplines. The interdisciplinary approach to research is guided by the research problem, thus even choice of disciplines suitable for enquiry is equally defined by the problem:

*“disciplines are not the focus of the interdisciplinarian’s attention; the focus is the problem or issue or intellectual question that each discipline is addressing.* The disciplines are simply a means to that end. [4 p. 7. emphasis authors own].

While there is an emergent lack of consensus regarding the understanding and use of the term interdisciplinary research within the literature, Repko [4 p.14] cites several “authoritative versions” concerned with: “a process of answering a question, solving a problem, or addressing a topic that is too broad or complex to be dealt with adequately by a single discipline or profession” and integrating “Information, data, techniques, tools, perspectives, concepts, and/or theories from two or more disciplines” to solve problems and find solutions. These findings are greatly substantiated by one systematic literature review [5 p.341] which describes interdisciplinary research as:

“any study or group of studies undertaken by scholars from two or more distinct scientific disciplines. The research is based upon a conceptual model that links or integrates theoretical frameworks from those disciplines, uses study design and methodology that is not limited to any one field, and requires

the use of perspectives and skills of the involved disciplines throughout multiple phases of the research process”

Repko [4] draws particular attention to prefix “inter”, which he suggest highlights that there is a “contested space” between disciplines; that action taken by the interdisciplinary approach to research is called “integration” and novel insights add to human understanding and knowledge. Of interest to note is the suggestion that particular skills are required of those personnel involved in inter disciplinary research [4]. Due to the requirement for an open, flexible not-knowing approach to charting previously uncharted territory, the researchers require skills of reflection, humility, enterprise, love of Learning and a “tolerance of ambiguity and paradox in the midst of complexity” [4]. Staffs also require receptivity to other disciplines, a willingness to collaborate and openness to the divergent perspectives of other disciplines [4]. There needs 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 [4].

These definitions of interdisciplinary research underpinned the approach used in the case study in question. A team of five supervisors from three different sites supervised the student, three from engineering, one from health sciences 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 discipline as suited the research question. None of the disciplines took a tokenistic, multidisciplinary approach (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. Although it wasn’t initially planned as such, it became apparent that all the team had the required attributes: openness, flexibility, comfort with unknown territory and willingness to collaborate that are essential to success in the field.

## **2.2 Interdisciplinary research challenges and associated risks**

There is some reference within the literature to the challenges inherent in the research journey within interdisciplinary research [2]. Firstly as the student often has to forge a way through hitherto unexplored territory, “early career researchers are often somewhat alone in their interdisciplinary pursuits” [2 p.610]. This type of research often involves a greater than usual personal and intellectual commitment, and the incumbent fieldwork can be challenging and time consuming

It involves an “intellectual and personal commitment” and fieldwork and obtaining access can be novel time-consuming ventures [2 p.610]. “Students are presented with the challenge of drawing on, and integrating, two or more bodies of literature and methodologies and indeed research paradigms [2 p.611] unless embedded in a specialist interdisciplinary research team or department. A natural science student for example, usually preoccupied with collecting pre-prescribed quantitative data under highly controlled conditions, often as part of a large team with a lead supervisor finds it quite the challenge when exposed to additional requirements of the social science approach which is much more individualized, involves more freedom with topics and approaches and may produce a unique individualized manuscript-style “intellectual odyssey” requiring a lot of material [3p.1001).

It is the merging of the discipline styles that often causes challenges to students. Ethical approval not required perhaps in one discipline, or secured by the team lead, may now become a requirement for the student to procure, with additional incumbent burden. There is a risk therefore, in this merger, that the novice researcher may lose their way in this in between space, due to the lack of obvious focus of the research, particularly in the early stages [2]. As several disciplines may be involved it not be immediately clear what the common goal is for the research, and the confusion may be compounded by a lack of theoretical rigour and a discipline base [2]. There is also a risk that the hoped for interdisciplinary approach does not occur, and there is lack of integration [2]. Given the possible integration of two or more disciplines in the research, there is a possibility that publication outputs will not have a natural fit within any of the single disciplines thus fewer outputs emerge. Llyall and Meagher [2] suggest that there are few “high quality interdisciplinary journal outlets”. There can also be disagreement about intellectual property rights, which ought to be clearly agreed at the outset [2]. The lack of clarity that seems to emerge with regard to the research journey can place successful outcome at risk, and result in “bottlenecks” where researchers cannot move forward as they are reliant on other elements of the interdisciplinary team which are not perhaps ready or involved with other commitments at the same time [2].

There are also of course a range of exciting benefits to working in this across and between disciplines [2]. 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 [2]. It can improve people's understanding of complex phenomena, result in novel, exciting breakthroughs and facilitate interdisciplinary communication [2]. Both challenge and benefits are reflected in the case study in question. In the preparatory phase of this case study 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 yield obvious benefits. Steps that led to success towards "bridging the two cultures" described by Owen et al [3] were open communication and developing clear boundaries both of which were reflected in the literature and will now be discussed.

### **2.3 "Bridging the two cultures" -pathways to success**

It was 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 [4]:

1. The Work of Integrating Knowledge.
2. The Work of Recognizing and Confronting Differences.

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 [4]. Differences need to be addressed early, acknowledged and spoken about in an open atmosphere of mutual respect [4]. It is important to also to seek to understand and appreciate different worldviews and to gain institutional support [4]. 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 [4]. 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, 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" [2 p.614].

In the case study in question all of these above factors were taken into account and led to increased success. The research project aimed to develop an innovative AT design idea using a participative approach involving service users with physical disability and professionals in practice. Firstly knowledge needed to be integrated from the health sciences with regard to fieldwork, as some of the planned approaches (such as focus groups with services users and Delphi study of health professionals and the required ethical review procedures) are non-standard within the engineering sciences concerned. Additionally the requirement for an in depth, robust literature review to precede the engineering design was also non standard. The negotiation and development of the latter required both a sharing of knowledge and open communication to both negotiate the correct approach, but also set limits on what was feasible/acceptable within the confines of the PhD requirements and to find the most suitable approach to address the research problem. While it is important to note that there was common ground between the engineering and health sciences [in terms of PhD requirements and usual approaches], the aforementioned issues did require additional attention. Ethical components of the study in particular required a great deal of learning among the team, as those outside of health sciences were less familiar with the ethical requirements of contemporary health care practice. Simple issues like the use of photography and/or video equipment during data collection needed careful management. In the same way the health sciences staff were less familiar with the design element of the project and needed to learn how best this would fit with the developing literature review and project design.

Within this interdisciplinary case study research and open communication to deal with emerging issues was paramount. Additionally boundaries of supervision arrangements were clearly outlined from the start 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 when researching within these in between spaces. 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.

### **3 CONCLUSION**

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 health sciences, 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. However, in the case study outlined, clear understandings were developed, in addition to clear territorial boundaries that helped guide the novel research. The literature reveals that this research is often a lonely venture, as both students and supervisors navigate uncharted territory. 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. Both benefits and risks were encouraged in the case study, and general advice to students and supervisors, from this experience is to recognise that you are chartering un-navigated territory; seek to build networks; keep open communication and an open mind; set boundaries and keep the project focused; agree boundaries and integrate, confront and accept differences.

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