

TOWARDS AN UNDERSTANDING OF INTERDISCIPLINARITY:

The Case of a British University¹

by

Corresponding Author

Jamila Razzaq, Research Associate, School of Education
University of Glasgow

Tony Townsend, Professor and Chair

Public Service, Educational Leadership and Management
School of Education, University of Glasgow

John Pisapia, Professor

Department of Educational Leadership and Research Methodology
Florida Atlantic University

Abstract: This study explores what academics in one major university in Great Britain (The Great Western University²) perceive interdisciplinary research (IDR) to be, and in doing so, differentiates it from associated concepts, such as multidisciplinary research and transdisciplinary research, found in the research literature. This study is important because the university in which the study is set has undertaken a complete restructuring of colleges and departments to support interdisciplinary research. The inquiry utilized a two-phased, mixed methods, descriptive case study to examine perceptions of the nature, significance, and benefits of multidisciplinary and interdisciplinary research. The methods of the data collection were semi-structured

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² Pseudonym.

interview (25 participants), survey (127 participants), and analysis of archival documents. The findings indicate that the restructuring of The Great Western University to support interdisciplinary research began on less than firm footing. While scholars seem to have clarified the definitions of interdisciplinary approaches, in practice there still is a lack of clarity in sectors which are less familiar with interdisciplinary approaches to solving major problems facing society. We identified issues of clarity of terminology and mission, flexibility of implementation, and alignment of faculty incentives as involving necessary but unmet conditions for fostering and promoting interdisciplinarity throughout the university.

Keywords: interdisciplinarity, interdisciplinary research, cross-disciplinary research, transdisciplinary research, multidisciplinary research, clarity, flexibility, alignment

“It is hardly possible to overrate the value . . . of placing human beings in contact with persons dissimilar to themselves, and with modes of thought and action unlike those with which they are familiar . . . Such communication has always been, and is particularly in the present age, one of the primary sources of progress”

John Stuart Mill (1848)

“Crossing boundaries is a defining characteristic of our age.”

Julie Thompson Klein (1996, p. 1)

Much has happened between 1848 when John Stuart Mill claimed that the primary source of progress was bringing diverse people together and 1996 when Julie Thompson Klein claimed that crossing boundaries was a defining characteristic of our age. Mill was prescient of what Klein observed. Collaboration and integration, they believed, are the keys to progress. What isn't clear is the focus of that collaboration, what its characteristics are, how it occurs, what results it achieves, and how it can be more productive. This article probes these issues through a consideration of concepts related to interdisciplinary research, what it is, why it is needed, and more importantly how it is perceived by the people who are expected to implement it.

The purpose of this paper is not to elevate the worth of interdisciplinary research above disciplinary research. Our aim is to explore what academics in one major university in Great Britain (referred to here as The Great Western University³) perceive interdisciplinary research (IDR) to be, and in doing so, to differentiate it from associated concepts, such as multidisciplinary research and transdisciplinary research, found in the research literature. One research question guided the study. What are the perceptions of administrators and academic staff of The Great Western University of the

³ Pseudonym.

nature, significance, and benefits of interdisciplinary research?

The study is particularly important because while some attention has been given to restructuring of the professions (Broadbent et al., 1997) few studies focus on restructuring of universities to support interdisciplinary research (National Academy of Science, 2004). The Great Western University is one of those universities that recently undertook a focused initiative and restructured its colleges and departments to promote and strengthen interdisciplinary research. This move was seen as necessary since interdisciplinary thinking is rapidly becoming an integral feature of research because of the inherent complexity and multi-faceted reality of natural and social phenomena, the need to solve societal problems in a holistic way, and the integrative power of new technologies. These conditions led funders of academic research and policymakers to support interdisciplinary research as a means of dealing with the complex problems facing society (Fayard, 2010). In turn, these funders and policymakers have increasingly called upon universities to produce collaborative, interdisciplinary research focused on larger societal needs (National Academy of Sciences, 2004; Rhoten, 2003).

Theoretical Considerations

Interdisciplinary research has surged, especially in the first decade of the 21st century, and this has provided impetus to the growing body of literature on the subject. It is pertinent to acknowledge from the outset that the concepts, descriptions, and practices associated with IDR have linkages with scholarship in interdisciplinary pedagogy, involving a number of different disciplines such as psychology, history, the arts, and the sciences (Haynes, 2002; Newell 1990; Newell & Green, 1982; Repko, 2008; Szostak, 2007) and in interdisciplinary curriculum, especially coursework that helps to translate the research into practical activity that cuts across different disciplinary areas (Augsburg & Henry, 2005/2009; Edwards, 1996; Klein, 2006). However, given the nature of our research, in the subsequent sections of this article we reflect this fact only implicitly, as we focus on the literature surrounding the nature of interdisciplinary research (National Academy of Science, 2004; Repko, 2008/2012).

There is a robust discussion of the notion of interdisciplinarity in the literature, especially related to the extent to which the demarcations between the disciplines can blur. Interdisciplinarians are usually academics involved in research that goes beyond the usual disciplinary boundaries; even if they remain focused on research within their respective disciplinary boundaries,

they use concepts and techniques from other disciplines as well. In either case, since they are working across disciplinary borders they are working in an interdisciplinary fashion (Pirrie et al., 1998). This work has benefits for the allied disciplines, the interdisciplinarians themselves, and society as a whole. When the field of application for their theories expands, they gain a more holistic view of the problem under investigation and complex problems come under scrutiny from multiple angles for both problem solving and innovation.

The philosopher Karl Popper (1963, p. 88) summarizes these claims when he suggests that people who engage in disciplinary work are “students of subject matter” whereas those who engage in interdisciplinary research focus on problems that cut across the borders of subject matter or disciplines. This crossing of the borders by individuals is described in many ways, for example, “multidisciplinary,” “interdisciplinary,” “transdisciplinary,” and “cross disciplinary.” As it stands, these terms, which describe the ways professionals work across disciplinary borders, are used ambiguously on many university campuses, among professionals, and by funders of research. In practice, the words have often been used interchangeably, and they have come to mean something and nothing to everybody (Perri et al., 1998). This confusion is widespread in Britain. As Griffin et al. (2006:74) have established, neither the UK research councils nor specific interdisciplinary research programs actually define interdisciplinary research or interdisciplinarity, and instead, “the term tends to be used in a declarative manner, often interchangeably with multi-disciplinarity.” Wilson and Pirrie (2000) concluded that many terms associated with interdisciplinarity are used interchangeably in the general literature, as well.

Clear definitions, however, are now to be found in the literature after many years of debate and analysis (see the 2001 and 2002 issues of *Issues in Integrative Studies*) even as the terms continue to be used interchangeably by many university administrators and other academics. As seen in Figure 1, expert interdisciplinarians agree “disciplinary research” is conducted from the confines of one discipline. “Multi” means “many” and “multidisciplinary research” implies that two or more disciplines work in conjunction on a common subject but from within the boundaries of their discipline in an isolated manner (Salter & Hearn, 1996; Stokols et al., 2008b; Wall & Shankar, 2008). There is “no actual integration across these disciplines” (Newell & Galliers, 2000, p. 1740). This lack of integration has been referred to as “mechanistic pooling” by Knights and Wilmott (1997, p.17).

Although academic boundaries are not crossed, multidisciplinary research

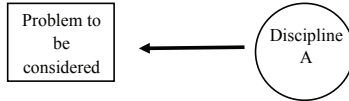
“features an additive approach towards the disciplines” (Holley, 2009, p. 333), with the “parallel existence of discrete bodies of knowledge in proximity of each other” (Griffin et al., 2006, p. 10). Friedman and Friedman (1985) describe it as investigators sharing facilities and research approaches but working separately on distinct aspects of a problem. The outcome is to offer different perspectives on the issues at hand (Dykes et al., 2009, p. 104).

Aboelela et al. (2006, p. 342) have warned, “the mere addition of researchers from various disciplines or with different academic and professional credentials is not sufficient to make a research effort interdisciplinary.” To develop, support, and strengthen truly interdisciplinary research, beyond simply bringing people from different disciplines together, it is fundamental to grasp the concept of interdisciplinarity and its associated terms. Based on a systematic review of the literature and using their own research, Aboelela et al. (2006) have identified the need for genuine linkage or integration throughout the research process, encompassing the development of a conceptual framework, research design, data collection and analysis, and drawing conclusions, if one is to make an endeavor truly interdisciplinary. Furthermore, The National Academy of Science (2004, p. 27) considers research truly interdisciplinary only “when it is not just pasting two disciplines together to create one product but rather is an integration and synthesis of ideas and methods.”

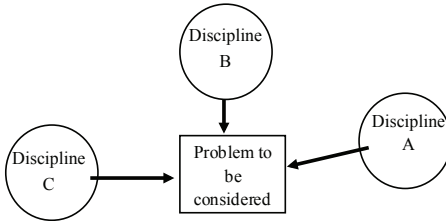
Interdisciplinary research means that scholars in multiple disciplines collaborate on the research (Carpenter, 1995; Dykes et al., 2009, p.105; Wall & Shankar, 2008, p. 552), there is an element of integration of knowledge for the purpose of creating new knowledge syntheses (Griffin et al., 2006, p. 11; Newell & Galliers, 2000, p. 1740), and it is “problem-oriented critical thinking focusing on *process* rather than *domain*” (Youngblood, 2007). These concepts of collaboration and integration are seen in the definition of interdisciplinary studies offered by Newell (2001): “Interdisciplinary study draws insights from relevant disciplines and integrates those insights into a more comprehensive understanding” (p. 2). They are also found in The National Academy for Sciences (2004) definition of interdisciplinary research.

Interdisciplinary research (IDR) is a mode of research by teams or individuals that integrates information, data, techniques, tools, perspectives, concepts, and/or theories from two or more disciplines or bodies of specialized knowledge to advance fundamental understanding or to solve problems whose solutions are beyond the scope of a single discipline or area of research practice. (p. 2)

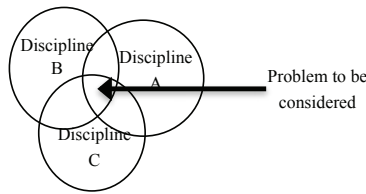
Figure 1: Defining the terminology used to describe types of research
 Disciplinary research looks at a problem from a single discipline's perspective.



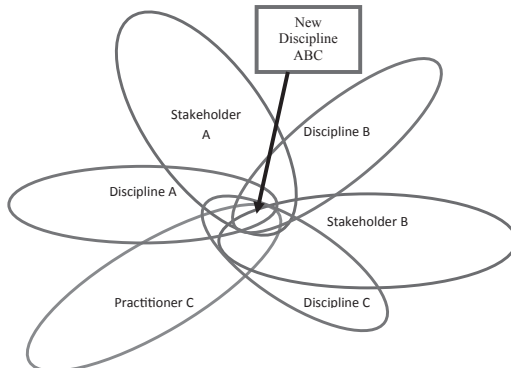
Multidisciplinary research looks at the same problem from more than one perspective.



Interdisciplinary research involves integration of perspectives yielding new ways of looking at the problem.



Transdisciplinary research combines the disciplines used to solve a problem resulting in a new discipline being created, such as nanotechnology or bioinformatics. It may also include other, non-academic stakeholders, such as politicians, public administrators, and practitioners, who may be involved in the development of policy or practices related to these new areas



Thus, in interdisciplinary research there is an assumption of interdependence in that the theories, perspectives, tools, and findings of one discipline cannot solve or illuminate the problem it is trying to solve, so there is a sharing of purpose and methods, and a development of an understanding of the core principles of the contributing disciplines (National Academy of Sciences, 2004; Aboelela et al., 2006; Boix Mansilla & Gardner, 2003; Clark, 1993; Dykes et al., 2009; Holley, 2009; Klein, 1990; Stokols, et al., 2008b; Hübenhal, 1994; Wall & Shankar, 2008). Interdisciplinary research is pluralistic in its methods and involves researchers working in tandem with each other in an integrated way to create new and unpredictable patterns, referred to as a “kaleidoscope” by Newell and Galliers (2000, p. 1740).

According to some expert interdisciplinarians, transdisciplinary research means that research team members have developed sufficient trust and mutual confidence to transcend disciplinary boundaries and adopt a holistic, blended, integrated approach so that the disciplinary distinctions become blurred, which may result in the creation of new disciplines, such as biochemistry, bioengineering, and cognitive neuroscience (Dykes et al., 2009; Stokols et al., 2008b). Pohl and Hirsch Hadorn (2007) argue that

transdisciplinary research deals with problem fields... in such a way that it can: a) grasp the complexity... of problems, b) take into account the diversity... of life-world... and scientific perceptions of problems, c) link abstract and case specific knowledge, and d) develop knowledge and practices that promote what is perceived to be the common good. (p. 9)

An extended view of transdisciplinarity suggests that it goes beyond an integration of academic disciplines so that “collaboration and mutual learning among people from practice and society are a salient and necessary part of transdisciplinarity” (Scholz & Stauffacher, 2010). This “trans-sector, problem-oriented research involving a wider range of stakeholders in society” has been characterized as the European version of transdisciplinarity by Klein (2008, p. S117). Transdisciplinary research is not a cumulative, but a transformative, approach. Griffin et al. (2006) describe it as being more critical and reflexive than disciplinary perspectives. While theoretically there is a difference between interdisciplinary and transdisciplinary practice, many argue they are really gradations of similar practice (Dykes et al., 2009; Huutoniemi et al., 2010; Aboelela et al., 2006).

For purposes of this research, we follow Stokols et al. (2008a) and use the

words “interdisciplinary research” and “transdisciplinary research” as synonyms, and we use the term “cross disciplinary research” as synonymous, as well. This position is further supported by other academics. “While the term *transdisciplinarity* at one time signified an insistence on integrating beyond the academy (an orientation also embraced by many interdisciplinarians), its meaning today is often very similar to that of the term *interdisciplinarity*” (Griffin et al., 2006; Wilson & Pirrie, 2000; Szostak, 2007).

The review discussed above suggests that there are levels of disciplinary interactions, collaboration, and integration that differentiate the terms “multidisciplinary” on the one hand, and “interdisciplinary” and its more or less synonymous gradations, “transdisciplinary” and “cross disciplinary,” on the other. Simply stated, multidisciplinary research is research that involves more than a single discipline but in which scholars from each discipline make a separate contribution. Interdisciplinary research is research that involves more than one discipline but in which scholars from each discipline attempt to integrate ideas and methods or even establish completely new ones.

As evident from Figure 1, the nature of the problem determines whether it is appropriate to use disciplinary, multidisciplinary, or interdisciplinary research methods. Based on the context and purpose of interdisciplinary research, the problem has been described as “instrumental” (Griffin et al., 2006; Klein, 1999), “critical” (Klein, 2010), complex (Newell, 2001), cognitive in dealing with issues of “fundamental understanding” (Griffin et al., 2006), and “comparative, exploratory, or contemplative” in purpose (Newell, 2007, p. 2). Klein and Newell, (1997) have described the criticality of the problem this way:

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 draws on disciplinary perspectives and integrates their insights through construction of a more comprehensive perspective. (pp. 393-394)

The focus of all research is on problems that need to be solved or on opportunities to be discovered. As portrayed in Figure 1, the more intricate and complex the problem, the more researchers tend towards crossing the borders of disciplines into interdisciplinary territory to gain a holistic understanding of the problem and to suggest a sustainable solution.

The Research Setting

The current study was conducted on the campus of Great Western University in the United Kingdom. The university is in the top 1% of the world's universities and is a research-intensive institution offering a broad range of courses in various disciplines. There are around 6,000 staff and 23,000 students from 120 countries who rate the university near the top in the UK for international student satisfaction. The university recently underwent a restructuring activity to keep its teaching and research structures abreast of changing social, political, and technological challenges, to attract the best staff possible, to improve the level of service to students, and to generate public and private funding to support "research that has impact" and solutions for "major social challenges." (Great Western University website)

Methodology

In keeping with the grounded nature of the research to explore the dispositions, processes, and practices in promoting, developing, managing, and executing interdisciplinary research, an interpretive approach was employed. The methodology used was a case study to gain in-depth understanding (Yin, 2003) of the phenomenon under study. To make the exploration of the case deep, representative, and valid, mixed methods were used. Triangulation (Fraenkel & Wallen, 2003, pp. 443-444) was employed to collect quantitative and qualitative data simultaneously and to validate the findings. The methods of data collection were document analysis, qualitative semi-structured interviews, and an 18-question survey with structured and open-ended narrative questions. The sampling was purposeful and based on the relevance to the research question (Miles & Huberman, 1994).

For document analysis, archival data were accessed from university websites, publications, and official documents. Qualitative interviews were conducted with 25 administrative and academic staff within the university, including four senior administrators at the university, three college heads (CH), five school heads (SH), two college-level research coordinators (CRC), two school-level research coordinators (SRC), six research team leaders (TL), and six research team members (TM). One-hour-long interviews were set up as an informal, conversational, "social interaction" (Cohen et al., 2007) free from the restrictions imposed "by the artificiality of a standard instrument" (Bush, 2007, p. 94). The interaction was focused around three themes related to interdisciplinary research teams: (a) how they

have been formed, (b) what makes them work or not work, and (c) what can be done to nurture and support them. All research active staff in three of the four colleges in the university were invited to participate, with promised confidentiality, and 127 responded. This research design enhanced the validity of the findings, in particular through the use of three methods and three sources of data, (a) academic staff, (b) work unit managers, and (c) organizational archival data, which strengthened the claim for internal validity of the research, and also reduced the likelihood of common method bias (Podsakoff, et al., 2003).

Data Analysis

The research question guided the data analysis process, which spanned “examining, categorizing, tabulating, testing, or otherwise recombining evidence, to draw empirically based conclusions” (Yin, 2003, p.126). Initially coding was based on the respondent groups for the survey (both quantitative and narrative data) and interview data. These coded data and the archival data were organized into chunks based on the research question from which evidence sheets were created. The data were re-coded through an inductive process as the research team became more familiar with the data through reviewing quantitative data and rereading interview summaries and field notes. At this stage, the categorization of data was done in two phases of “open coding” and “selective or focused coding” (Charmaz as cited by Bryman, 2008, p. 543), which involved “reassembling the data by searching for connections between the categories that have emerged out of the coding” (Bryman, 2008, p. 543). As the evidence from survey, interview, and narrative data extended beyond individual respondents, themes started to emerge. The emergent themes were triangulated. Then researchers delved into the data for patterns, contrasts, and paradoxes (Coffey et al., 1996) to identify evidence relevant to the research question, “What are the perceptions of administrators and academic staff of the nature, significance, and benefits of multidisciplinary and interdisciplinary research?” Finally, based on early comments on this article, we recoded a portion of the data that dealt with the reviews of the definitions of different forms of interdisciplinarity to ensure that appropriate definitional terminology was used by the researchers.

Perceptions of Interdisciplinary Research

In this section we describe the perceptions held by academic staff and administrators about the nature and benefits of multidisciplinary and inter-

disciplinary research at Great Western University. The need for increased interdisciplinarity had been identified by the university as one way to maximize research funding, and a comprehensive restructuring of the university was undertaken with one identified intention being to enable this to occur. The rationale provided for this focus on interdisciplinarity was as follows:

Government has made it clear that Universities are expected to contribute to increased economic growth by working in partnership with other agencies, industry, and policy makers to deliver economically valuable outcomes. A significant stream of funding has been re-directed at this objective. The effect of these changes is to increase funding to i) individuals of the highest calibre ii) initiatives which respond to funder priorities iii) interdisciplinary research teams, and iv) universities capable of setting strategic priorities in partnership with funders (including industry and Regional Development Agencies [RDAs]) on a broad front. (Great Western University, 2010:2-3)

The Sample

One hundred-twenty-seven research active academic staff responded to our survey. Of them, 33 did not provide demographic information, but their responses to our questions were used. Ninety-four people provided demographic information. The majority of them were male (67%). Different age groups were identified (26% were in the 30-40 category; 31% in the 40-50 age category; and 32% in the 50-60 age group). The respondents included 41% professors, 37% lecturers, 17% researchers, and 6% associate professors. Also, 33% indicated that they were a research team leader (TL), 34% indicated that they were a research team member (TM), and 87% indicated that they were a member of the academic staff (AS). None of the respondents indicated that they were an administrator, at any level of the university. This may mean that no administrators completed the survey or that they chose not to identify themselves as an administrator.

Most respondents (65%) reported that they were interested in interdisciplinary research, and most (84%) reported that they were actively involved in it, with 31% of the respondents indicating their research was primarily interdisciplinary and 60% indicating their research was partially interdisciplinary. In addition, 73% of the respondents said they had published in interdisciplinary journals, with 58% having published in the last five years more than three interdisciplinary articles and 30% more than five.

Understanding of Interdisciplinary Research by the University

It might be expected that such a comprehensive reorganization of a major university would be based on a clear understanding of what is expected given the term “interdisciplinary research,” yet a search of the university website finds many different terms used to refer to activity that crosses disciplinary boundaries. The university has a website that identifies the university’s “key interdisciplinary research areas.” However, if the links to some of these research areas are followed, we find statements as diverse in terminology as the following: “We specialise in multi-disciplinary research and development,” “Joined-up thinking,” “A number of units and centres both within the University and beyond provide a multi-scale approach,” and “strong interdisciplinary approach.”

Some of the research projects, in areas such as bioelectronics, cell signaling, nanotechnology, and optoelectronics, suggest that interdisciplinary research has now crossed over into what we have called transdisciplinary research. In each case, the implied assumption is that there will be collaboration between disciplines, schools, centers, or institutions, but no specific definition of what relevant terms mean is provided. This leads to the conclusion that the various terms, “transdisciplinary,” “cross disciplinary,” “interdisciplinary,” and “multidisciplinary” may have been used to describe similar research activities.

Further, in papers and presentations created by the university administration, these terms also appear to be used interchangeably. For instance, a single document proposing structural reforms at the university contains the following terminology within it: “interdisciplinary research teams,” “cross disciplinary teams,” “multi-disciplinary teams,” “cross-disciplinary investment,” “interdisciplinary research themes,” “inter- and multi-disciplinary activities,” “Enhanced collaboration & inter-disciplinarity,” “multi-disciplinarity,” “inter-disciplinarity,” “inter- and multi-disciplinary growth,” “interdisciplinary training,” “multi-disciplinary research,” “multidisciplinary research,” “inter-disciplinary research,” “cross-disciplinary research,” “Interdisciplinary work,” and “interdisciplinary portfolio” (Great Western University, 2010). This search suggests that there is not a clear understanding at the administrative level of what each of the various terms being used means. The various words used, sometimes hyphenated and sometimes not, have different meanings in the literature, but these meanings are not made clear in university documents.

Understanding of Interdisciplinary Research by Academic Staff

To establish whether university academic staff had a clear understanding of the terms being used, a specific question was included in the survey. It was an open-ended question asking respondents to articulate what they saw as being the difference between interdisciplinary and multidisciplinary research. This question was answered by 66 respondents. The responses were categorized into three levels of understanding: 0 = no understanding, 1 = some understanding, 2 = good understanding. Decisions were based on the closeness of the responses to the definitions provided in the literature, namely that multidisciplinary research looks at the same problem from more than one perspective with integration not attempted, whereas interdisciplinary research strives for integration of insights from various perspectives and involves looking at the problem in a new way.

As seen on Table 1, interdisciplinarity is understood better in the Arts College than in the Science College. Of the 64 college-identified respondents, 52% had no understanding of the difference between multidisciplinary and interdisciplinary research, 27% had some understanding of it, and 21% had a good understanding. This varied widely from college to college. In the College of Social Science (N=24), 50% of the staff had no understanding, 29% had some understanding, and 21% had a good understanding. In the College of Science and Engineering (N=26), 69% had no understanding, 23% had some understanding, and 8% had a good understanding. In the College of Arts (n=14) 28% had no understanding, 28% had some understanding, and 43% had a good understanding of the terms.

Respondent comments indicated that those whose responses were categorized as having no understanding believed that there was “no difference” or they had “no idea” or they completely misunderstood the terms, saying things such as “Multidisciplinary synthesizes multiple disciplines; interdisciplinary builds on those multiple disciplines but has a distinctive approach (which is almost a separate ‘discipline’ in itself).” A good understanding was reflected through statements such as “interdisciplinary seeks synthesis; multidisciplinary tends to be more parallel (sometimes ‘siloed’ work). In interdisciplinary, the sum should be greater than the parts” or “Interdisciplinary research can occur at the interface between two disciplines. Multidisciplinary research partakes of expertise in 2 or more subject areas.” The responses which were categorized as having some understanding were mostly those which explained one term only without focusing on the dif-

ferentiation between the two, as, for example, “Interdisciplinary research should create new knowledge/holistic approaches through synthesis of different disciplinary inputs.” This category also included responses, which alluded to some minor features of the terms without encompassing their real essence. They included statements such as, “interdisciplinary, I think, works together to perform a single goal taking the strengths from each approach. Multi-disciplinary allows multiple produces [sic] each meeting the strengths from each discipline but not necessarily borrowing strengths from the others” or “Interdisciplinary suggests both (all) parties engage somewhat in learning one another’s disciplines. It’s extremely difficult when crossing, for example, science and social science.”

College	2 (Good understanding)	1 (Some understanding)	0 (No understanding)	Total
College 1 (College of Social Sciences)	5 (21%)	7 (29%)	12 (50%)	24
College 2 (College of Science and Engineering)	2 (8%)	6 (23%)	18 (69%)	26
College 3 (College of Arts)	6 (43%)	4 (28%)	4 (28%)	14
No affiliation declared	1	1		2
	14 (21%)	18 (27%)	34 (52%)	66

More than half of the academic staff had no understanding of what the differences were, and many also indicated they didn’t care, saying, “I wouldn’t waste my time on such a non-issue,” and “these are just words you’ve made up, aren’t they?” and “I suspect they are different trendy phrases or buzz words.” Other respondents had difficulty in trying to understand how the differences might impact on their work: “I really struggle with this because the literature tells me one thing about this distinction, and then grant applications get bombed out for reasons that don’t fit with this distinction.”

The interviews also established that various perceptions are held about the distinctions between inter- and multi-disciplinary work, and some responses

suggested that respondents think the words are interchangeable. One research coordinator characterized the difference thus:

I use the term multi-disciplinary rather than interdisciplinary. Multi-disciplinary to me is where the tools of a discipline are used to focus on problem solution. It's the study of one topic by scholars from several different subject disciplines. Making use of several disciplines at once such as in teaching. To redefine problems outside of normal boundaries and reach solutions based on a new understanding of complex situations it is simply a fundamental expression of being guided by holism rather than reductionism. (RC 1)

Some interdisciplinary team leaders tried to respond to the question by looking at the bigger picture. One interdisciplinary team leader suggested that "Interdisciplinary research is research that is applied to societal problems and making change if necessary" (TL3). An academic staff member said, "I think interdisciplinary forces us to provide a synthesis that was not there" (AS 11). However, these respondents did express a concern about the lack of clarity as to what the terms mean and the tendency to use them as if they are interchangeable; this is confusing, even to those who lead research teams. "The jargon keeps shifting" (TL4).

The data suggest there is a lack of clarity among both the university administrators and the staff at Great Western University about what the terms "multidisciplinary" and "interdisciplinary" mean. The terms are used interchangeably at all levels, and nowhere is there any statement that helps to define either the level of analytical synthesis or the various levels of collaboration required to justify the use of each.

Perceptions of the Significance of Interdisciplinary Research

A number of questions on the survey asked for staff members' perception of the significance of interdisciplinary research and the practice of it at Great Western University. Table 2 lists the responses to questions that considered staff perceptions of various dimensions of interdisciplinary research.

Overall, 78% of staff said they believe that interdisciplinary research is as important as disciplinary research, although some expressed concern that it might be holding a privileged position within the university as reflected through interview data: "I notice a worrying recent trend towards fetishizing 'interdisciplinary' work - assuming that it is automatically better than 'disciplinary' work, automatically privileging it for funding" (AS5). Another mem-

ber of staff said, “it is a ludicrous assumption that interdisciplinary research ought to be promoted at the expense of single discipline research” (AS7).

	SA	A	U	D	SD	Total
Interdisciplinary knowledge is better than knowledge obtained from a single discipline.	21.4% (27)	23.0% (29)	28.6% (36)	16.7% (21)	10.3% (13)	126
Interdisciplinary research is just as important as single discipline research.	37.9% (47)	40.3% (50)	12.1% (15)	7.3% (9)	2.4% (3)	124
I recommend that staff get involved in interdisciplinary research early rather than later in their career.	26.4% (32)	29.8% (36)	26.4% (32)	11.6% (14)	5.8% (7)	121

Views were mixed as to whether interdisciplinary research is better than single discipline research, with 44.4% believing that it is, 29% being unsure, and 27% believing that it isn't. Comments indicated that interdisciplinary and single disciplinary research should be treated as equally important: “Interdisciplinary research is no more or less valuable, per se, than intradisciplinary” (AS11). A majority of academic staff (56%) agreed that it is better to become involved in interdisciplinary research early rather than later in one's career, possibly to overcome a concern that “traditional attitudes about the superiority and importance of certain disciplines over others hinders efforts to cross disciplinary domains” (AS3) that might build up over time. Yet some of the structures established by the university seem to privilege some forms of research over others. Townsend et al. (in preparation) report on issues related to the development of research institutes designed to support interdisciplinary research: A “major concern directed toward the Institutes was that they take resources away from the Schools”; “the shift away from departments to Institutes will further undermine departments through ‘asset stripping’ by ‘poaching the best researchers.’”

The Benefits of Being Involved in Interdisciplinary Research

Members of the academic staff are likely to get involved in a new form of research only if they see benefits for themselves in doing so. The data in Table 3 indicate that many of the respondents were able to identify positive outcomes from their involvement in interdisciplinary research. A ma-

majority of staff (72%) indicated that they had benefited from being involved in interdisciplinary research. A majority (54%) also indicated that this had helped them in their core field of study, and 62% indicated that they had accomplished more through interdisciplinary research than they could have working in their single discipline.

Table 3
Perception of the benefits of participating in interdisciplinary research.

	SA	A	U	D	SD	Total
I have benefited from being involved in interdisciplinary research.	34.1% (42)	37.4% (46)	16.3% (20)	8.9% (11)	3.3% (4)	123
The new knowledge I have acquired in my interdisciplinary research projects has given me an advantage in my core field.	18.9% (23)	35.2% (43)	28.7% (35)	14.8% (18)	2.5% (3)	122
The chance for high impact research is greater from interdisciplinary research efforts.	21.3% (26)	32.0% (39)	23.8% (29)	13.1% (16)	9.8% (12)	122
The results from my interdisciplinary research project have been greater than I could have accomplished alone.	29.4% (35)	32.8% (39)	26.9% (32)	10.1% (12)	0.8% (1)	119
The rewards available for interdisciplinary research don't match the effort required.	9.8% (12)	22.1% (27)	23.0% (28)	36.9% (45)	8.2% (10)	122
Being part of an interdisciplinary research team is a hindrance to getting published.	2.5% (3)	8.2% (10)	22.1% (27)	49.2% (60)	18.0% (22)	122
Interdisciplinary research improves my chances of promotion.	16.5% (21)	17.3% (22)	44.9% (57)	13.4% (17)	7.9% (10)	127

Furthermore, 53% felt there was a better chance of having an impact through this type of research. On the other hand, 11% of the sample felt that interdisciplinary research was a hindrance to getting published, and 31% felt that the rewards available didn't match the effort required. In fact, the majority of staff felt either negative (34%) or unsure (45%) about the impact interdisciplinary research might have on their chances of promotion.

Academic success is defined by success in a DISCIPLINE. One needs appropriate disciplinary publications for the REF.⁴ All my ex-

⁴ The Research Excellence Framework (REF) is a periodical review of the discipline-

perience in seeing people in my team trying to get interdisciplinary research published has been that if it falls between stools, reviewers from either side won't rate it highly. Funding income is weighted towards core disciplinary work. (AS21)

Such views have made it difficult to promote interdisciplinary research at the School level. "It is a struggle to get people motivated toward long term benefits which derive from interdisciplinary research when it's short term results which are demanded" (SH2). It is clear that even though interdisciplinary research was seen as being positive, both for the institution and the staff member, there are still a number of issues that need to be resolved. Key amongst these are how interdisciplinary research papers are seen both locally, for promotional purposes, and outside the university, for purposes such as the Research Excellence Framework (REF) activity and acceptance in high quality journals.

Discussion and Conclusions

The literature reveals that the concept of boundary crossing in research has evolved over a period of time into refined categories of multi, inter, cross, and trans disciplinary. There is enough theorization in the literature to differentiate among these categories especially with reference to the level of collaboration among the researchers and the integration of philosophies, methodologies, methods, analyses, and conclusions within the research. The data from the current study raise a number of issues relevant to The Great Western University, but these are likely to be issues for other universities engaged in restructuring to support IDR, as well.

The first issue is clarity. This relates to the desire of The Great Western University to promote interdisciplinarity without there being a clear understanding of what this means or how to approach it. There are strategies that might be adopted by this university as well as others to support the move from single discipline research to research at the varying levels of interdisciplinarity. Yet, the data reflect a low level of sensitivity towards the differentiated use of terms, especially "multidisciplinary research" and "interdisciplinary research," in the official documents of the case study university

based research undertaken by academics in British universities. It compares the quality and impact of research undertaken, and the publications that emanate from it, on a 4- point scale. In this way the British government identifies the level of funding support it will provide for research infrastructure in each university in the UK.

despite its desires to nurture interdisciplinary research. The interview and narrative data reveal the prevalence of this confusion of terms among the staff, as well. The data show many ways these terms have been interpreted and used by both administrators and academic staff. In fact, in one college 69% of the responding academic staff did not exhibit any understanding of the differences between the terms.

The university has declared the fostering of interdisciplinary research as the focal point of its restructuring strategy, but clarity of mission has not been demonstrated. The interchangeable use of terms that are not interchangeable (according to the literature in the field) raises the question of whether it is multidisciplinary or interdisciplinary research that has been declared necessary. It is crucial to give a clear message if the university intends to attract academics away from their silos and into congregations expected to do such research. A lack of clarity may be impeding people from taking the first step. If collaborative, integrative research (that is, truly interdisciplinary research) is the goal it should clearly be stated, and strategies for moving towards that goal, with stages along the way, need to be identified.

The good news is that 21% of the staff that responded to our survey demonstrated a good understanding of the difference between “multidisciplinary research” and “interdisciplinary research.” These staff might be used by the university as ambassadors to help other staff to come to terms with the changes. They might be used as models for how interdisciplinary research might be undertaken and even enhance the research profile that the individual staff member might develop. They might be used as team leaders to support others to move forward. However, the university will also need to identify ways of compensating these people for the work that they might do on the university’s behalf, to ensure that such activities are seen to be part of the work people do, not additional to it.

The second issue is flexibility. The university seems to be promoting interdisciplinary research as its approved preference for the future rather than as one of a number of equally valuable ways in which staff might contribute to the university research profile. As the data indicate, participants do not elevate the status of interdisciplinary research above that of single discipline research though overall most see it as important. They also see the value of being involved in it, and many said they have benefited from it. Many said that they have not considered IDR as a hindrance to getting published or an unrewarding exercise. It is interesting to note that despite the ambiguity of terminology, staff can still see the potential benefits, even for those who are not now involved. However, there is the concern that resources are gradual-

ly being redirected. As one school level research coordinator indicated when discussing institutes, “Academic staff members are invited to participate in the research. They can buy out of their teaching responsibilities and their employment status changes. Even when they are ‘bought out’ no money comes back to the school” (SRC2). Somewhere in the mix, there is the need to allow lone researchers, whether working in a single discipline or undertaking interdisciplinary work by themselves, to thrive within the university’s research structures. Many seem to feel that this option is no longer available.

The third issue is alignment. Some staff felt negative, and almost half were unsure about whether being involved in IDR would help or hurt their promotion prospects. This concern possibly stems from the fact that, in the British REF review of scholarly activity in late 2013, disciplinary research will count for more than interdisciplinary research in the judgment of research excellence. Staff also identified a problem associated with getting published in leading journals, which are overwhelmingly based on single disciplines. These two factors, more than anything else, are seen by staff to be associated with future promotion opportunities, and both seem to favor a disciplinary rather than an interdisciplinary approach. There needs to be a way in which interdisciplinary research is seen both internally, among those considering promotion within the university, and externally, by the REF and by high quality journals, as being equally as valuable as discipline-based research. At the moment, it is not.

Perhaps a first step for The Great Western University is to ensure that the redressing of the balance between disciplinary and interdisciplinary work happens internally, when promotion or review of staff performance is undertaken. It may then need to use its influence as a major university to address the current anomaly at the national level, where discipline-based papers seem to count for up to 70% of the REF judgements and only 10% to 15% focus on interdisciplinary work.

A further issue related to alignment is that this new form of research is seen as having to be accomplished on top of everything else that staff do. One team leader said, “It really would be nice if the University would recognize the work and let it count in my workload” (TL3). If interdisciplinary work is to be promoted, then it needs also to be recognized as legitimate work, not something extra. Realignment of workloads is necessary to ensure this new expectation does not push staff over the limit of their capabilities.

It is clear that interdisciplinary research will not go away. Government and funding agencies will see to that. So it is important for universities like the case study university to establish strategies and structures that will incor-

porate this new way of thinking about research into what they already do and to work through staff concerns to ensure that IDR will happen. Our study has identified some issues and made some tentative suggestions for ways forward. Clarity of meaning and message is critical, and clarification might be followed by the provision of supportive ways of moving from single discipline research through multidisciplinary research towards interdisciplinary research for those that see this as an opportunity for them in the future. Flexibility is needed to allow “a thousand roses to bloom,” for colleges, schools, teams, and individuals. Allowing for diversity, in approach and expectations, for both individuals and groups, is important. Finally, alignment, of resources, of workloads, of judgments about what academic work is important, is essential. Interdisciplinary research is valuable, but so is single discipline research that leads us to a deeper understanding of specific problems. Both need to be honored and supported. The individual researcher doing disciplinary research still has a place. But a key to helping staff move to a broader understanding of the types of research they might become involved in is to clarify and use the definitions of the various terms associated with interdisciplinary work as a means of supporting staff in moving beyond their disciplines, because it is beyond their own disciplines that interesting new challenges lie. IDR allows us to explore these challenges together. We return to Mill to outline the communications, between and across disciplines, that are now being explored. “Such communication has always been, and is particularly in the present age, one of the primary sources of progress.” John Stuart Mill (1848)

Biographical Note: Jamila Razzaq is associated with the University of Glasgow School of Education and is involved in a number of research and teaching initiatives there including interdisciplinary research, teacher professionalism, the impact of family and neighborhood on career aspirations of young people, and the impact of regeneration and games on health and well-being of people in the deprived areas of Glasgow. Previously, she taught in Pakistan for 17 years. She has a wide range of qualifications, skills, and experience and has developed expertise in Educational Leadership, Change Management, Pakistani Education (secondary and higher), and Gender Issues. She may be contacted at jamilarazzaq1@hotmail.com

Tony Townsend is Chair of Public Service, Educational Leadership, and Management at the University of Glasgow. Prior to this appointment he worked in universities in Australia and the U.S. He has authored or edited 10 books and numerous chapters and articles in the fields of leadership, school effectiveness, and educational reform. He teaches a master’s course in Oman and has worked with educators in more than 50 countries. He may be contacted at Tony.Townsend@glasgow.ac.uk

John Pisapia is a Professor of Leadership Studies at Florida Atlantic University (U.S.); he is also a recent Fulbright Scholar at the Chinese University of Hong Kong, a Scholar in Residence at the Chinese-American Center (Hong Kong), the Adam Smith Research Professor at the University of Glasgow, and the founder of the Strategic Leader Network (SLN), a global learning community focused on the principles of strategic leadership. He may be contacted at jpisapia@fau.edu

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