

No academic borders?

Transdisciplinarity in university teaching and research

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Transdisciplinarity has been a veritable mantra, especially in the humanities and social sciences, for twenty years or more. Yet academic structures and research application requirements still struggle to come to grips with cross-boundary research and teaching. Making universities more trans-discipline-friendly is a tricky task, however. As Wendy Russell explains, trans-disciplines require disciplines, and disciplinary boundaries, too.

Transdisciplinarity

Academic disciplines provide a ‘social order of knowledge’ (Weingart & Stehr 2000, p. xi), a framework to organise knowledge and knowledge production, both instrumentally and conceptually. Just as disciplines and disciplinary boundaries have shifted and changed, the popularity of disciplinarity as a way of ordering knowledge has ebbed and flowed, both influenced by trends within academia, political and economic imperatives and social movements (Turner 2000).

Recent trends appear to herald a post-disciplinary stage (Weingart & Stehr 2000, p. ix), with a new mode of knowledge production, characterised by problem-based, industry-driven, collaborative research (Gibbons et al. 1994). A look at the structure of almost any modern university, however, indicates that disciplines continue to be central to the organisation of university teaching and research.

This article focuses on areas of study or research that fail to fit within existing disciplinary boundaries. Such areas have been described as multidisciplinary, interdisciplinary or transdisciplinary (CERI 1972, p 25). Multidisciplinary tends to refer to research that simply brings two or more disciplines together, in teams or over particular applications or

problems. Interdisciplinary generally refers to activity that goes on in the space between disciplines, and particularly the interaction between disciplines. This generally involves integration of disciplines and may give rise to new disciplines, such as environmental toxicology, human ecology and biogeochemistry.

Transdisciplinary refers to activity that transgresses disciplinary boundaries (Nowotny 2003) and transcends these boundaries in the integration and synthesis of content, theory and methodology from a number of disciplines in new knowledge production. There is considerable debate and contention about these terms, and they can be further distinguished by bodies of theory and groups of proponents.

I use transdisciplinarity because of its sense of transcendence but also because multidisciplinary suggests being all things to all people (as when the research is assessed), and interdisciplinary suggests falling between disciplinary cracks (so often the case when research funding and resources are distributed). My purpose in this article is to argue for the importance of transdisciplinarity in universities, to outline some of the obstacles to this type of work and to make some suggestions as to how these could be overcome.

Why transdisciplinarity?

The emergence of transdisciplinarity from a large range of disciplinary contexts has not simply resulted because of the intrinsic value of research that transcends discipline. Its emergence is partly in response to the imperatives of communication and application. An expansion in transdisciplinarity has coincided with the broader social distribution of knowledge in increasingly educated societies (Gibbons et al. 1994). Specialised knowledge is no longer the restricted domain of academic elites, but is in demand from the public, and also from government, non-government organisations and industry (Turpin & Garrett-Jones 2000). This has occurred in response to two rather disparate trends.

On the one hand, there has been a tendency for knowledge to become commodified, to represent part of the capital of companies and nations and to be traded in the form of intellectual property. At the same time, particularly with advances in information technology, groups and individuals in the community have become better informed on a range of issues, which has tended to lead to greater participation, both in individual decisions, for instance in healthcare, and in local, and to some extent national, decision-making. Knowledge that is expressed in ways which restrict its use to elite, specialised groups, rather than being broadly communicable and accessible, has less value in either of these contexts.

A second imperative acting on research organisations is the need for knowledge-based solutions to an increasing range of material and social problems. This requires not only that the research outcomes are designed and communicated with implementation in mind, but that the research design process is responsive to and inclusive of the various parties involved. In research leading to new products or services, again, responsiveness to both need and end use are essential, and call for a broad, integrative research process. Moreover, an increasing number of areas that academics are choosing to, or being called to, engage in are topics that simply cannot be adequately addressed by single disciplines. Sustainable development, science and technology policy, public health and climate change are all examples of areas which, by their nature, cut across several disciplines. These areas, and the problems that arise in them, can only be adequately understood and addressed by adopting a transdisciplinary approach.

It should be noted that calls for transdisciplinarity or mode 2 type research (Gibbons et al 1994) are also coincident with a push for partnerships between public and private research. While such partnerships, on the one hand, may boost the ability of public research organisations including universities to generate knowledge and provide practical applications and solutions, they also carry the danger that knowledge production in these institutions will become subservient to commercial values and to maintaining the competitive 'performance'

of universities, in lieu of fulfilling public interest goals (Krimsky 2003; Turpin & Garrett-Jones 2000). This has created some skepticism about the transdisciplinary push, particularly by those who uphold 'pure', curiosity-driven research. Yet, should curiosity-driven or public interest research stop at disciplinary boundaries? Would transgressing them further their goals? It seems to me that the problem lies with the purpose and politics, rather than the mode, of research and that transdisciplinarity, and particularly metadisciplinarity (see below), have considerable potential to contribute to public interest research (Krimsky 2003, chapters 11 & 13).

Much of the literature on trans- (or inter-) disciplinarity focuses on scientific research, using a very broad definition of science that often extends to humanities. A discussion of what does and what does not constitute science is well beyond the scope of this paper, however assumptions about the nature of science and scientific method in this literature suggests the need for another level of transdisciplinarity, namely metadisciplinarity. While meta-analyses of science and technology are already located in the relatively new discipline of Science and Technology Studies, there are important and growing areas of transdisciplinary research that revolve around issues that arise from the application of scientific, technological and other research activity.

Importantly, some of these emerge from within the disciplines they investigate (internal metadisciplinary enquiry, see e.g. Matsuda et al 2003). In the new environment of socially distributed knowledge and blurred boundaries between knowledge producers, knowledge users, and society at large, metadisciplinary activity – research that investigates the practice and implications of a particular area of research, and actively engages with the practitioners of that research – may become increasingly important, particularly in areas that lack a culture of reflexivity.

Institutional Obstacles

In response to calls for research that is accessible, relevant and innovative, the idea of transdisciplinarity has been extremely popular in universities, particularly in relation to research. Centres and institutes bring researchers together from neighbouring or distant disciplines around topics such as materials science, environmental policy and functional foods. Schemes and themes are established around subjects such as environment, sustainable development, and public health. Research links between researchers and with industry are applauded and institutionalised in structures like the Cooperative Research Centres (Turpin & Garrett-Jones 2000). Yet, while such schemes and linkages may benefit researchers whose disciplinary research fits into such themes and projects, researchers whose positions are grounded in disciplinary departments who seek to transcend disciplinary boundaries, particularly in

areas outside those prioritised by their institution, may still meet a variety of institutional obstacles and dead ends. These obstacles exist in four main overlapping areas:

- Assessment of grant applications.
- Assessment of output/ research quality.
- Access to infrastructure.
- Difficulty in attracting and catering for postgraduate students in terms of:
 - assessment,
 - administrative difficulties (enrolment, qualifications),
 - scholarship applications,
 - space, facilities, resources.

Assessment

Assessment of transdisciplinary projects by traditional means and structures seems to fall short in two ways. Firstly, research across disciplines rarely satisfies the criteria and standards of all of the disciplines involved. This may be because the researcher or assessor has insufficient time and focus to be fully versed and proficient in each discipline. It is difficult to be an expert in more than one field. Alternatively, the particular methodological or theoretical frameworks of the discipline may not fit with the broader, integrative perspective of the transdisciplinary project. A new framework of understanding may be created, based on elements from the different disciplines. Despite being valid and effective, such frameworks may appear poorly grounded to assessors steeped in the traditions of either discipline. This is unfortunate, as it is precisely the creation of new, integrative, synthetic frameworks, which draw upon more than one discipline, that makes research truly transdisciplinary.

This brings us to the other disadvantage of assessing this type of work in traditional ways, and by disciplinary peers. Transdisciplinary research has unique, emergent qualities. These include the integration of different bodies and types of knowledge, the synthesis of new approaches and techniques of inquiry and the communication of specialised knowledge across disciplinary boundaries and beyond. Transdisciplinarity also requires new modes of collaboration and interaction between researchers. Beyond a simple 'add disciplines and stir' approach, successful transdisciplinarity involves interdependence and synergy between researchers contributing different expertise and knowledge. This requires the creation of new languages and approaches, which may then be more broadly applicable and have greater exploratory or explanatory power. While these qualities and skills of communication, synthesis and teamwork give unique value to transdisciplinarity, they are not explicitly taken into account in current assessment processes. Rather than encouraging these important characteristics, individual researchers may effectively be penalised for them.

The difficulties of assessing transdisciplinary research, particularly in relation to grant applications, have recently been identified in an Australian Research Council (ARC) report (Grigg 1999). Proposals arising from the report include the establishment of either a cross-disciplinary (use of this term is similar to my use of transdisciplinary) panel, or internal advocates for cross-disciplinary research on each disciplinary panel of the ARC. There is also a suggestion that the cross-disciplinary nature of an application be explicitly addressed, either in the application, or by the assessors. An interesting alternative was a suggested change to the review process, for example to allow interaction between reviewers and with the candidate. All proposals reflect the need to identify and take account of the emergent qualities, as well as the challenges, of transdisciplinary research. These add to and overlay the quality of the research as judged by usual criteria.

The problems described here apply as much to the assessment of postgraduate student work as to the assessment of grant applications and project proposals (ARC Postgraduate Workshop 1999; see below). For students, they will be particularly acute if the brave student initiates the transdisciplinary research under the supervision of two or more discipline-bound academics. While this may be an important introduction to transdisciplinarity for the supervisors, the student must do much of the navigation into new territory. Without at least one co-supervisor or external advocate with an appreciation of the qualities of transdisciplinarity mentioned above, the student will struggle to satisfy disciplinary criteria, and not necessarily be rewarded for integration they achieve between the disciplinary areas. Of course, these considerations are particularly relevant in the choice of examiners.

Research output

The news for transdisciplinary researchers in terms of research output is good and bad. The virtue of working in several disciplines is that the potential audience is larger and, in principle, there should exist more opportunities for the publication of results presented to several disciplinary groups. The novelty of the work is likely to be a mixed blessing. In some cases, as suggested above, the work may be rejected because it does not meet the criteria of the particular disciplines to which it is aimed. In other cases, the criteria applied to the new work may be less stringent, the niche less crowded and therefore less competitive.

More broadly, the criteria used to assess academic work, either of students or academics, are generally based on acceptability of the research by a research community. Standards are maintained by this community and its discourse. When transdisciplinary research is carried out in response to particular problems, or external interests and needs, the standard of the research is judged on the basis of whether it solves the

problem or meets the interests or needs, i.e. in what it directly contributes. This is not to say that disciplinary work does not make contributions outside the discipline, but the output is mediated by the disciplinary community. This means that there may be external standards applied to transdisciplinary work, by the various interested parties, be they industry sectors, policy agencies, community groups or whatever.

This could potentially lead to several problems. There may be divergence between the judgement of the work by the academe, and by the external parties. If the work is applauded outside, but not rewarded inside, the researcher may either discontinue the research, leave the institution for greener pastures outside, or consolidate links outside, weakening links inside the institution, and relying on external funding or consultancies. In any case, the academic contribution of the work may be lost to the academic institution.

In addition, a traditional role of the academy, and the peer-review system in particular, is in quality control. Here quality is related to the rigour of methodology, logic of the interpretations, consistency with previous research, and (hopefully) broader ethical considerations. When links between the researcher and the research community of the institution are weakened, as above, this quality control process may not be brought to bear on the work. While the quality control process in academia is not flawless, it is nonetheless important in maintaining standards. In order to maintain a place for such academic standards in new modes of knowledge production, the quality control process must adapt to the changes. It must come to terms with the dual purpose of this type of research, in contributing knowledge, but also in providing practical solutions, services or advice outside the university. If academic standards remain conservative, elitist and narrow, they will not cater to the broadening role that universities are adopting, and being forced to adopt, within the wider community.

Infrastructural and administrative barriers

Because universities are structured around disciplines, the distribution of funds and resources and the administration of both research and teaching tend to operate within a disciplinary framework. Despite the obvious disadvantages for transdisciplinary research, there are many sensible reasons for this structure. It is difficult to conceive of universities structured explicitly around transdisciplinary approaches. Particular transdisciplinary areas may gain enough critical mass to form new disciplines, with new names and new approaches which are formalised and codified by an academic community that gathers and works in that area. There are numerous examples of this (cognitive science, science and technology studies, marine science) and they represent the constantly shifting map of disciplinarity. Some areas, particularly areas of research strength, may be formalised in centres and institutes.

While providing a home, and physical and human resources, for researchers, these are less rigid, less stable and often shorter lived than disciplines or departments, and may not contribute to teaching. Paradoxically, attempts to create structures to facilitate transdisciplinarity may work against one of its key ingredients, flexibility. This is particularly true for new areas and responsive to new problems. Each new problem may require new groupings and new interactions that will then be transient in nature (Gibbons et al. 1994). While the identification and support of transdisciplinary areas of strength within a university are important, universities may also be well served by flexible approaches that facilitate free-floating transdisciplinary work and encourage transdisciplinary approaches within and between existing disciplines.

For this kind of free-floating transdisciplinarity to thrive within the disciplinary structure of the university, allowance must be made for it. This requires flexibility, special consideration and discretionary negotiation in a number of areas of decision making. These include:

- The allocation of internal research money.
- The allocation of competitive grants.
- The allocation of funds and student load associated with postgraduate students.
- The location of students within departments.
- Access to resources for students and staff between departments.
- The credentials of students entering transdisciplinary projects.
- The designation of specialisations associated with degrees.

Suggestions of changes to current decision making processes in these areas that could facilitate transdisciplinarity are offered in the next section.

Facilitating transdisciplinarity in research

The allocation of internal research money and competitive grants generally involves discipline-based filters, in the form of peer reviewers, faculty committees and disciplinary committees. As suggested by the ARC report, accommodation and facilitation of quality transdisciplinary work requires transdisciplinary filters that operate either through increased awareness of this type of research and its unique attributes among the existing actors and committees, or introduction of additional committees or reviewers who explicitly evaluate transdisciplinary projects separately. I support the latter approach, as there are political dangers in competition between disciplinary and transdisciplinary work for the same pot of money. Moreover, transdisciplinary projects require different levels of appraisal that consider their transdisciplinary qualities as well as their intrinsic merits based on more traditional academic standards. Because of the nature of such projects, a review

team that assesses the application collaboratively is probably more appropriate than attempts to combine the judgements of separate reviewers.

This kind of initiative requires commitments from universities and funding bodies; of funding, either specifically allocated to transdisciplinary projects or available from discretionary funding, of policy and of resources, for example, in the setting up of new committees. Such commitments, particularly in times of fiscal challenge, require recognition of the value of transdisciplinarity, both in generating new cutting-edge areas of research and in promoting research into complex and multidimensional issues and problems. Paradoxically, in a time of consolidation of research funding and 'big science', maintenance of the kind of free-floating, flexible transdisciplinary work described above may be key to the sustainability of vibrant knowledge production systems and may be an important part of strategic planning.

Facilitating transdisciplinarity in teaching

Research training

A recent ARC funded workshop brought together postgraduate students involved in interdisciplinary research in ecologically sustainable development (ARC Postgraduate Workshop, 1999). They identified the rewarding aspects of such research, which included intellectual challenge, making a contribution, being pioneers, building links and employability. These rewards came with obstacles, such as a lack of equity in relation to scholarship applications and access to space and other resources; administrative difficulties in enrolment and graduation; difficulties in finding appropriate supervisors, mentors and examiners; and additional challenges of fitting such ambitious projects into existing timeframes.

In addition, they recognised that transdisciplinary projects are generally more challenging intellectually, with less clear paths to success, less recognition, and more isolation. Ironically, although this type of research training seems to be desirable outside academia, there appear to be few opportunities for jobs within academic departments for students from transdisciplinary backgrounds, particularly those who want to continue such research.

The fact that students persist with this type of project despite these difficulties is impressive, and reflects the breadth, inquisitiveness and commitment of the students. Obviously, these impediments mirror difficulties for established academic researchers, and, of more concern, are reflected in recruitment into academia. Ecologically sustainable development, which now encompasses environmental, social, economic and cultural development, is a crucial issue in society. It is an excellent example of an area of study which would not only benefit from transdisciplinarity, but to which a transdisciplinary approach is arguably essential.

The research training path could be made smoother for transdisciplinary postgraduate students through a number of initiatives, which once again rest on recognition of the value of transdisciplinary approaches. In general, the establishment of a supervisory committee, the composition of which reflects the relevant disciplines and, if possible, transdisciplinary areas to which the project relates, and includes at least one senior academic, is essential. It is important that the committee has some commitment to, or at least appreciation for, transdisciplinary work. The committee, if appropriately constituted, is then the most appropriate site of decision-making about administrative and academic matters to do with the project. These include important matters such as the entry credentials of the student and whether they are adequate for the degree, whether the project in fact represents a transdisciplinary one, requirements for appropriate coursework, progress through the project and selection of examiners. This role for a supervisory committee avoids problems associated with the diversity of transdisciplinary students and their requirements, and puts the onus on the student and the committee members to navigate the administrative and academic requirements, rather than requiring this of disciplinary departments. Once again, the most appropriate mode for the committee, particularly in resolving disputes relating to administrative and conceptual territory, is a collaborative, consensus mode.

Establishing an additional body or program for transdisciplinary research projects, that augments the gate-keeping and support roles of the committee, may further support and facilitate this type of research training, and assist in maintaining both perceived and actual standards, particularly in the acceptance of students into transdisciplinary higher degrees (Liscombe, 2000). Whether such additional initiatives help or hinder the general acceptance of transdisciplinary projects and initiatives by disciplinary units is unclear.

Many of the frustrations of transdisciplinary students revolve around administrative problems and resource issues associated with the allocation of maintenance funds, designation of their enrolment status and their supervisors, access to resources including space and the naming of their degrees. Many of these can be overcome relatively easily if contingency for transdisciplinary projects, particularly cross faculty ones, and policy associated with them, are developed and consistently adopted. Giving decision-making authority to the supervisory committee is the first step, but this must be accompanied by accommodation in the design of forms, templates and guidelines. Relatively minor changes can make the difference between the student feeling valued by the university and feeling like an isolated misfit.

Undergraduate teaching

Attempts to conduct undergraduate teaching in line with transdisciplinary approaches have encountered major obsta-

cles, for similar reasons as those outlined above, but exacerbated by the need for comprehensive and relatively fixed curricula, grading standards, consistency between students, etc. These requirements, not to mention the administration of courses, preclude much of the flexibility required for transdisciplinarity.

Yet, there are clearly important skills required for this type of research, which could be included in disciplinary undergraduate teaching, and are consistent with the current focus on generic skills. These include teamwork, communication, critical thinking and acceptance of diversity. In addition, the maintenance of broad, general courses in early years, especially if they include subjects from different disciplines, e.g. history and philosophy with science and engineering, legal studies with commerce, psychology with medicine, create not only a broad base of knowledge, but also mix different styles of learning and different intellectual approaches, broadening the student's repertoire of learning and thinking. There are also good examples of successful transdisciplinary courses that involve teams of academics from different disciplines (Davis, 1995). As well as creating valuable transdisciplinary learning environments for students, these also provide opportunities for interaction and collaboration among staff.

A burgeoning area that has strong potential for the development of transdisciplinary approaches is undergraduate double degrees. Despite university fees, and other financial pressures on students, an increasing number are choosing to extend their time at university to study in two disciplines. While universities are accommodating this trend by providing double degree programs, there are very few attempts to value-add to these programs by integrating the discipline areas. Rather than encouraging the skills of integration, transcendence of boundaries and communication across disciplines, the programs may in fact passively encourage students to compartmentalise and separate their discipline-based knowledge. Some universities have responded by offering interdisciplinary subjects in areas such as environment and natural resource management that they encourage double degree students to complete (eg. ANU).

Other disciplines such as Law introduce 'Perspectives' subjects that present a variety of examples of intersections of other disciplines with legal theory and practice (e.g. University of Melbourne, Southern Cross University). An initiative at the University of Wollongong will develop initiatives for double degree students specifically designed to enhance skills of integration and transdisciplinarity (Educational Strategic Development Grant, W. Russell, 2004). The skills that

could potentially be gained through such initiatives would better prepare students for research or work in either transdisciplinary or disciplinary environments, in an era of dynamic knowledge production and innovation.

Recruitment

One ongoing obstacle to the development of transdisciplinary research is the recruitment process. In fact, one of the features contributing to the stability of disciplines is their association with labour markets. 'Disciplines are organised ... into degree-granting units that ... give degree-granting positions and powers to persons holding these degrees' (Turner, 2000). While competition in markets for undergraduate students has led to the creation of new study areas, often transdisciplinary in nature, such as tourism, forensic science, home economics and cultural and communications studies, these often have a vocational focus, and do not necessarily reflect new areas of research or knowledge application.

For scholars or students who move into transdisciplinary areas, unless they are able to find a transdisciplinary department or institute in that particular field, there are few employment opportunities in universities. Similarly, existing academics may have limited freedom to move into transdisciplinary areas,

constrained by undergraduate teaching requirements and potentially also be departmental research priorities. This not only creates a disincentive, but also potentially restricts the conduct of transdisciplinary research to limited, short-term excursions by individual staff members, rather than to career-long and intergenerational endeavours.

How can transdisciplinarity be promoted through recruitment within the existing disciplinary structure of universities? Perhaps the idea of free-floating transdisciplinarity could be extended to the creation of new positions, either in programs directed at attracting staff into transdisciplinary areas and approaches, or discretionary programs that opportunistically create positions when talented transdisciplinary researchers are found. Such staff, as well as conducting their own research across disciplines, could be involved in transdisciplinary undergraduate and research training initiatives, and could teach in more than one academic unit, creating further opportunities for cross-fertilisation and collaborative links across campus. Administering such positions centrally, or at a faculty level, would allow flexibility to be maintained, and may avoid some of the problems of competition for staff places and resources between units.

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Conclusions

Transdisciplinarity is regarded by some as a useful approach to particular areas of research activity and by others as an approach that should be adopted more generally, augmenting or even replacing disciplinary research (e.g. Vanderburg, 2003). There is little doubt of the value of this approach in investigating complex and multidimensional issues that increasingly demand our attention, including sustainability, climate change, social policy and globalisation. While more research – research that goes beyond the rhetorical and investigates the actual operation and success of transdisciplinary endeavours – is needed, transdisciplinarity arguably plays an important role in the development of new areas of knowledge production and application.

It has become the dominant *modus operandi* of many research agencies and organisations, including industry and community bodies (Gibbons et al. 1994; Turpin and Garrett-Jones 2000). Despite rhetorical enthusiasm for transdisciplinarity and its identification with innovative, socially relevant research activity, its institutionalisation in universities has been more limited, however. While I see this as a problem, I have not argued for a radical change to the status quo. The structural stability and self-perpetuating nature of university disciplines make them a logical basis for the physical and administrative structuring of universities. The material and social costs of a radical shift from this mode would be great. In addition, the flexible, fluid nature of transdisciplinary work makes institutionalisation something of an anathema to it. The choice here is not an either/or one.

It is precisely the tension between disciplinarity and transdisciplinarity that is productive, important both in the evolution and shaping of disciplines and in the critical, contextual evaluation of academic research and its place in society (Weingart 2000). Given the tendency of disciplines to prevail, maintaining this tension requires that universities invest in accommodating and facilitating transdisciplinarity, in research and teaching. This requires that the emergent qualities of transdisciplinary research be identified, valued and rewarded. The challenge is to embrace new modes of thinking, researching and interacting and to follow new directions of enquiry. For universities to fulfil their role in providing dynamic, independent knowledge production for the public good, there need to be academics and students within universities who courageously and creatively work across disciplinary boundaries. Of course, this requires that there are those who work within, and therefore maintain, academic disciplines.

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