Interdisciplinarity: a key for real-world learning

Jane Dalrymple and Wendy Miller, GEES Subject Centre, University of Plymouth

The group that discussed interdisciplinarity as an aspect of troublesome knowledge and as a key to threshold concepts at the GEES 2006 summer conference explored the issues inherent in working across disciplines within higher education.

It is contended that interdisciplinary working is needed in order to explore the 'real world' problems that are the focus of intellectual endeavours. This is especially so with providing a response to some of the most pressing manifestations of unsustainable human-environment interactions – social injustice and wars, ecosystem degradation and destruction (overfishing, loss of biodiversity, deforestation, climate change, fossil-fuel dependence, etc.). These are all problems that the subjects of geography, earth and environmental sciences explore.

The nature of disciplines

In order to arrive at an understanding of interdisciplinarity, the nature of disciplines themselves needs to be explored – in this instance, with the focus on the GEES subjects.

The word discipline derives from the Latin word disciplina – literally 'the instruction given to a disciple'. Compared to the word subject, which describes a skill and knowledge base, the term discipline brings dimensions of access and boundaries, with associations of profession, elitism, and exclusivity. Key words that come up in discussing the nature of disciplines include territory, discourse, identity, belonging, and status, as described by Becher (1989) and others.

Disciplines have originated in different contexts, geographically and historically, and provide a lens on the world. It can be unhelpful to label ourselves and divide ourselves up, however, it is clear that different disciplines have different philosophical strands, narratives, content, frameworks, and temporal timescales; there are different approaches in terms of detail.

Each discipline can be said to have three elements to its structure: observable objects, phenomena resulting from their interactions, and laws or sets of axioms to account for and attempt to predict the phenomena (Boisot, 1972). Disciplinary structures allow in-depth investigation of specific phenomena through analytically simplifying external factors, and through sustained, systematic enquiry. They provide 'triangulation' points in the production of knowledge on specific issues, through disciplinary organisations, journals and books.

Yet, the term 'silo' thinking or acting conveys the potentially defensive, protective and inward-looking nature of dividing up academic and intellectual territories into 'tribes'. Instead of benefiting from cross-fertilisation and multiple perspectives, both academics and students get partial glimpses from viewing problems through the facet of one particular discipline or sub-discipline.

Environmental science is often called 'an interdisciplinary discipline'. Rather than being self-contained, other disciplines (e.g. engineering, chemistry, geography, geology) surround the environmental science tribe, passing information in and getting information back – a porous shell. Environmental Science is a recently-created discipline – perhaps comprised of 'renegades from another discipline', or 'jacks of all trades, masters of none'.

It was suggested that Geography can be seen as situated 'in the middle' of a continuum of disciplines, with physics at one end and history at the other; or alternatively, the discipline of synthesis, depicted as intersecting circles (Fig. 1). Although perhaps an old-fashioned way of looking at it, this acknowledges that geography does recognise other disciplines. In reality, it is just not possible to have discreet and distinct labels as they all blur into another; when is an environmental scientist a geographer? Or a physicist an engineer?

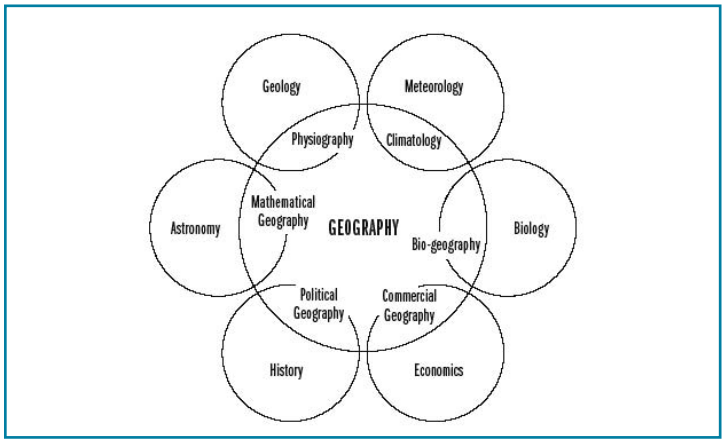

Figure 1. Geography and its sub-fields (Fenneman, 1919)

There is a real sense of identity involved. Disciplines are in a continual process of constructing and reconstructing identities – with individuals identifying themselves by joining a group, or by defining themselves as opposed to a group. Being open to 'the other', makes one vulnerable, and yet also a dangerous person. Whilst is good to be open to possibilities, there is a need for a strong identity in order to survive in the disciplinary context of higher education.

The group discussed whether people start out as (e.g.) a lawyer type, or whether studying law reinforces what you already are. From the beginning of academic studies, learner identity is powerful. To be a geographer provides a sense of home; physical geographers re-organised into a faculty of social sciences can lose that sense of identity and belonging.

Disciplinary understandings are drawn on to make sense of the world. Within the context of the ever-increasing production of research, it can also be seen as a protective mechanism to avoid a sense of drowning in information. To define and refine a sub-discipline helps to make this even more manageable, and to retain a sense of expertise amongst many other competing viewpoints.

Over time, disciplines mutate, and proliferate from within, resulting from the ever-increasing accumulation of knowledge. The process of specialisation, fragmentation and recombining leads to the suggestion that it is in the hybrid zones that creativity is to be found; more innovations occur, lacunae and gaps are identified (Chettiparambil, 2006).

The nature of interdisiciplinarity

In attempting to get at the heart of what is entailed in interdisciplinary working, the related concepts of pluridisciplarity, multidisciplinarity, and transdisciplinarity were raised. For example, many environmental science courses do not follow a truly interdisciplinary approach, but instead provide a collection of disciplines throughout different modules and levels; however, it is recognised that interdisicplinarity is more than this; it is where the academic crosses the divide and creates a new knowledge. It involves true collaborative learning – bringing different perspectives from the culture of the 'home' discipline, and being open to perspectives from other disciplines. The communities of

disciplinary practice interact through boundary negotiation and communication (Wenger, 1998).

Transdisciplinarity is an expression of a unitary type of inquiry emerging, where disciplines are integrated to the point beyond demarcations, whereas interdisciplinarity comprises a dynamic of supplement, complement and critique. One demand during the US student protests of the 1960s was for a move within university education towards more holistic concepts that related more to real life than the disciplinary structures. Interdisciplinarity came to denote reform, innovation and progress. Metaphors of knowledge production moved from static logic of foundations and structures to dynamic conceptions of networks, webs, systems and fields (Chettiparambil, 2006).

Interdisciplinary working is said to foster deep, or third-order, learning - or, alternatively, critics have suggested that interdisciplinarity leads to a superficiality, dilettantism and blandness with its own bureaucratic machinery. Familiarity with the main principles, concepts, theories and debates of a discipline has been seen as the best way to produce graduates with the knowledge, skills and values that are needed by individuals, society and the economy. However, an OECD report (1982) noted that: 'communities have problems, universities have departments'.

The group discussed how the term interdisciplinarity is used to convey both a process and an outcome. The problems being addressed and the solutions arrived at can be interdisciplinary, but the process of exploring them is, by and large, still discipline-based. This raises the questions of whether interdisciplinarity needs to be explicit or implicit, and whether the entire curriculum needs to be interdisciplinary-based.

Approaches to teaching

There are some aspects of learning and teaching that foster interdisciplinarity, or indeed that cannot take place without an interdisciplinary approach. These include problem-based learning, fieldwork, IT (e.g. GIS, simulation, models), and collaborative work. One simple example is an exercise with first-year students to show the need for interdisciplinary perspectives. They are asked to write up global and national issues, such as climate change and globalisation on a board, and draw the links between them. It becomes obvious that these problems cannot be tackled in isolation – just like the interconnected disciplines.

Problem-based learning is a resource for interdisciplinarity working, as it can be taught in groups of, say, 12-15, which students generally have been used to in their sixth forms. During the swap-shop session at the Plymouth conference, PBL had been promoted as an approach for deep learning; it is a process in which the idea of the 'discipline expert' is dispensed with. The PBL literature says that the process should be as 'real' as possible, with the problem to be defined very broadly.

Interdisciplinarity needs to be lived from the beginning of a course and demonstrably valued. The fact that students come in with fixed ideas from the school curriculum provides a main stumbling blocks for learners in taking interdisciplinarity on board. They have already constructed a learner identity – a sense of personal and group belonging, status, tribe and territory. Students will be thinking of themselves as being of a particular discipline, and need to have the idea of interdisciplinarity explained from day one with total conviction – they don't know what to expect in their first year, so the opportunity needs to be seized then.

Most interdisciplinary courses are based on active learning strategies and promote higher-order critical thinking skills, of analysis, synthesis, application and evaluation. They include methods such as:

> "collaborative, cooperative learning, discovery and problem-based learning, writing and maths across the curriculum, and methods of assessment that are multi-dimensional, including qualitative and quantitative measures, normed measures, and self-assessments." [www.unm.edu/~castl/Castl_Docs/Packet1/Interdisciplinary%20Teaching%20]

Types of learning involved in interdisciplinary working are seen to be those that are: self-directed, creative, expressive, feeling, online, continual, reflexive. The OECD (1972) noted key aspects of interdisciplinarity to involve:

> Teaching relationship: facilitator
> Level 1: Guidance and personal development
> Level 2: Specialisation and vocational training
> Level 3: Introduction to research

It is both within the process and product of the curriculum, and from the very beginning (i.e. induction), that the nature, value and necessity of interdisciplinarity needs to be made, both implicitly and explicitly. The approach needs to be overt, covert and integrated in order to be successful. A field course is often the place for GEES students where this is made clear – i.e. a 'real world' situation.

Although there is a continuum of knowledge, within education the paradigm is that of discreet blocks of knowledge, skills and understandings. Students who have grown up with a disciplinary paradigm need to move from absolute to parallel truths and knowledge. They need to take on different views of 'the truth' and accept that different people in a discipline have different views; even within one department, it is unlikely that there will be a collective view. In terms of a passage through threshold concepts, the disciplinary structure can be perceived as in Boulding's General Systems Theory, through a 'hierarchical arrangement of complexity' enabling a building of knowledge – an epistemological hierarchy (see Box opposite).

Futures for interdisciplinarity

Several steps need to be taken before interdisciplinarity can become a reality within most higher education institutions. There are artificial boundaries that need to be removed in order to enable working across disciplinary borders. The structures in the institution, e.g. timetabling, modular curricula and facilities, are oten major stumbling blocks – affected also by the flows of money.

Lack of interdisciplinary working can be variously attributed to unwillingness, the fact that it involves stepping outside of individual comfort zones, or a lack of opportunity. Commitment to interdisciplinary working is not seen as a route to academic success. Instead, interdisciplinarity can be seen as a burden in teaching; it is no longer the enthusiast who collaborates, but rather the person that the department needs to do more teaching hours – rationalisation has taken its toll.

It is important to develop a collective vision amongst staff; there needs to be an opportunity for academics to experience the nature of interdisciplinarity, to enhance staff collegiality. This requires commitment, tolerance, understanding – perhaps not easy – and, of course, the resources (time and space) in order to allow this to happen.

Students need to be given the vocabulary, especially for interdisciplinarity related to employability. During the induction, in

Boulding's Systems Levels:

Frameworks: static structures, atoms, anatomy, etc.
Simple dynamic: clockworks, machines, both simple and complex.
Control or cybernetic: the thermostat. Transmitting, interpreting and acting on information to maintain a variable around a constant level.
Open: self-maintaining structure, e.g. the cell.
Genetic-societal: e.g. the plant, a 'cell society'.
Animal kingdom: mobility, teleological behaviour and self-awareness.
Human level: self-consciousness, self-reflexive.
Social organisation: set of roles and transmission of knowledge, symbols, emotions, etc.
Transcendental: ultimates, absolutes and inescapable unknowables.

Adapted from Chettiparambil, 2006

first, second and third years, the students need to be explicitly informed about how their endeavours to date have drawn on interdisciplinary perspectives. The links with developing the key skills for future careers can be made: communication, groupworking, etc. are all attributes that are fostered through working with other 'tribes' and perspectives.

Bringing together students from different disciplines to work together is instructive for most; for example, at Plymouth, a group of students from different departments have been looking at the problem of a disaster in the Plymouth Naval Dockyard. At Hertfordshire, there is twinning between certain courses, e.g. journalists and environmental scientists, however this is known to be logistically difficult, and so requires commitment from a team or individual.

The Experiential CETL at Plymouth will also be aiming to help different disciplines work together, for example, in joint field courses. This requires careful forward planning in order to be successful. Fieldwork is all about observing, recording and reflecting - skills which cross any disciplinary divide. In one example, academics from fine art, sociology and geography were all taken to the same area and asked what they would do in terms of fieldwork. Although they expressed it differently, their ideas indeed involved the same processes of observing, recording and reflecting. Such joint experiences provide opportunities for rich crossover. (See Harland (2006) on fieldwork for all disciplines.)

Even to ringfence just one day in the timetable for interdisciplinarity working would enable this cross-fertilisation and learning to happen to some extent. Case studies of successful interdisciplinarity working do indeed exist, with many examples from the US, and increasingly more within the UK.

Interdisciplinarity involves changes to the current political economy of knowledge production. The Dearing Report (1997) notes that different students will want different depth and breadth, but goes on to recommend:

> "we believe that introducing breadth more extensively would assist students to respond to the social, economic and cultural changes they will be facing throughout their lives by assisting them to think divergently and to integrate information and knowledge from a variety of sources."

It called for courses broad enough to "enable specialists to understand their specialism within its context." Richard Paul (1987) contends that interdisciplinary courses do produce strong critical thinking, i.e.:

> "distinguishing evidence from conclusions, relevant from irrelevant facts, and facts from ideals; assessing the validity of assumptions and arguments and recognising internal contradictions, implicit value judgements, unstated implications of arguments, and the power and appropriateness of rhetorical devices."

In other words, interdisciplinarity encourages 'multilogical' thinking – the ability to think accurately and fair-mindedly within opposing points of view and contradictory frames of reference. It is exactly these high level analytical skills that employers are often looking for rather than a discipline-specific expertise: Chettiparambil (2006) notes that 40% of jobs for graduates recently advertised in the UK are open to applicants from most if not all disciplines. In essence, interdisciplinarity is a state of mind:

> "an attitude that combines humility with open mindedness and curiosity, a willingness to engage in dialogue, and, hence, the capacity for assimilation and synthesis." (Emory University, Appendix C).

The group concluded: interdisciplinary working is not going to be easy, but it is definitely worthwhile.

References

Becher, T. (1989), *Academic Tribes and Territories - intellectual enquiry and cultures of disciplines*, Milton Keynes: SRHE / Open University.

Boisot, M. (1972), Disciplinarity and interdisciplinarity. In OECD, *Interdisciplinarity - Problems of Teaching and Reserach in Universities*, Paris: OECD, 89-97.

Boulding, K (1952), General Systems Theory - the skeleton of science, *Management Science* 2(3): 197-208.

Chettiparambil, A. (2006), *Interdisicplinarity: a literature review*, Report for the Higher Education Academy Interdisciplinary Teaching and Learning Group.

Dogan, M. and Pahre, R. (1990), *Creative Marginality - Innovation at the Intersections of Social Sciences*, Oxford: Westview Press.

Emory University, www.emory.edu/ACAD_EXCHANGE/1999/mayjune99.qawitte.html www.emory.edu/TEACHING/Report/AppendixC.html

Fenneman, N.M. (1919), The circumference of geography, *Annals of the Association of American Geographers*, 9:3-11.

Harland, T. (2006), Out of the ordinary: recapturing the liberal traditions of a university education through field courses, *Teaching in Higher Education* 11(1): 93-106.

Spronken-Smith, R.A., Dickinson, K.J.M., and Pickering, N. (2006), *Teaching in HE*, University of Otago.

OECD (1972), *Interdisciplinarity - Problems of Teaching and Research in Universities*, Paris: OECD.

OECD (1982), *The University and the Community: the problems of changing relationships*, Paris: OECD.

Wenger, E. (1998), *Communities of Practice*, Cambridge: Cambridge University Press.

Discussion group members

Jennifer Blumhof (University of Hertfordshire, Env. Science), John Bradbeer (University of Portsmouth, Geography), John Maskall (University of Plymouth, Env. Science), Pete Walton (Oxford Brookes University, Geography), Colin Trier (University of Plymouth, Env. Science), Ruth Weaver (University of Plymouth, Geography/CETL), Jane Dalrymple (GEES Subject Centre).

Wendy Miller: wendy.miller@plymouth.ac.uk
GEES Subject Centre, University of Plymouth, Plymouth PL4 8AA.