The Ins and Outs of Transdisciplinary Research

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A (very) Brief History of Academic Disciplines in Western Universities

Medieval

Trivium:

- Logic (thinking)
- Grammar (representing)
- Rhetoric (communicating)

Quadrivium:

- Arithmetic (the Discrete At Rest)
- Astronomy (the Discrete In Motion)
- Geometry (the Continuous At Rest)
- Music (the Continuous In Motion)

The Enlightenment

- Science
- Philosophy
- Theology

‘Renaissance Man’ = polymath e.g.

Leonardo da Vinci (1452-1519)

Francis Bacon (1561-1626)

René Descartes (1596-1650) and many more.

Modern Universities

Humanities: History; Languages and linguistics; Literature; Performing arts; Philosophy; Religion; Visual arts

Social sciences: Anthropology; Archaeology; Area studies; Cultural studies and ethnic studies; Economics; Gender and Sexuality studies; Geography; Political science; Psychology; Sociology;

Natural sciences: Biological sciences; Chemistry; Earth sciences; Physics; Space sciences

Formal sciences: Computer sciences; Mathematics; Systems science

Professions and Applied sciences: Agriculture; Architecture and design; Business; Divinity; Education; Engineering; Environmental studies and Forestry; Family and consumer science; Health sciences; Human physical performance and recreation; Journalism, media and communication; Law; Library and museum studies; Military sciences; Public affairs; Social work; Transportation

“Discipline” refers to:

- A particular branch of learning
- A body of knowledge

- “Disciplines have contrasting substance and syntax . . . ways of organising themselves and of defining the rules for making arguments and claims that others will warrant. They have different ways of talking about themselves and about the problems, topics and issues that constitute their subject matters.” Schulman, 2002, p. vii

Each discipline:

- has its own intellectual history, agreements and disputes about subject matter and methods
- has a set of traditional pedagogies and its own discourse of reflection and reform
- has its own community of scholars

Disciplinary Differences

- Questions asked about the world
- Set of assumptions employed
- Methods used to build subject-matter knowledge (facts, theories, concepts)

However…

- Disciplines are not rigid unchanging and boundaried objects
- Today’s understanding of a discipline takes into context different ideas and social constructs

Modern research

“Disciplines are defined by their conceptual specificity; the encounter between different conceptual structures is the core of interdisciplinarity.” Bromme, R. 'Beyond one's own perspective' in *Practising Interdisciplinarity.* Weingardt P, Stehr N. , editor. Toronto: University of Toronto Press; 2000. pp. 115–133.

“Experience without theory is blind, but theory without experience is mere intellectual play.” Immanuel Kant

“If we knew what it was we were doing, it would not be called research, would it?” Albert Einstein

UK Research Excellence Framework (2009)

REF main panel	REF Units of assessment	Total FTE submitted to 2008 RAE	2008 RAE Units of assessment		No. FTE submitted to 2008 RAE
A	Clinical Medicine	3,568	1	Cardiovascular Medicine	361
			2	Cancer Studies	679
			3	Infection and Immunology	650
			4	Other Hospital Based Clinical Subjects	1,625
			5	Other Laboratory Based Clinical Subjects	253
	Public Health, Health Services and Primary Care	1,202	6	Epidemiology and Public Health	545
			7	Health Services Research	506
			8	Primary Care and Other Community Based Clinical Subjects	151
	Allied Health Professions, Dentistry and Nursing	2,939	10	Dentistry	399
			11	Nursing and Midwifery	642
			12	Allied Health Professions and Studies	1,458
			13	Pharmacy	440
	Psychology, Psychiatry and Neuroscience	2,440	9	Psychiatry, Neuroscience and Clinical Psychology	780
			44	Psychology	1,660
	Biological Sciences	2,357	14	Biological Sciences	2,357
	Pre-clinical, Human Biological and Sports Science	1,081	15	Pre-clinical and Human Biological Sciences	581
			46	Sports-Related Studies	500
	Agriculture, Veterinary and Food Science	1,016	16	Agriculture, Veterinary and Food Science	1,016
B	Earth Systems and Environmental Sciences	1,179	17	Earth Systems and Environmental Sciences	1,179
	Chemistry	1,151	18	Chemistry	1,151
	Physics	1,686	19	Physics	1,686
	Mathematics and Statistics	1,933	20	Pure Mathematics	685
			21	Applied Mathematics	852
			22	Statistics and Operational Research	396
	Computer Science and Informatics	1,846	23	Computer Science and Informatics	1,846
	Engineering	4,459	24	Electrical and Electronic Engineering	842
			25	General Engineering and Mineral & Mining Engineering	1,455
			26	Chemical Engineering	235
			27	Civil Engineering	513
			28	Mechanical, Aeronautical and Manufacturing Engineering	1,039
			29	Metallurgy and Materials	375
C	Geography and Environmental Studies	1,121	32	Geography and Environmental Studies	1,121
	Architecture, Built Environment, Town and Country Planning	1,035	30	Architecture and the Built Environment	631
			31	Town and Country Planning	404
	Economics and Econometrics	839	34	Economics and Econometrics	839
	Business and Management Studies	3,501	35	Accounting and Finance	160
			36	Business and Management Studies	3,341
	Law	1,673	38	Law	1,673
	Politics and International Studies	1,269	39	Politics and International Studies	1,269
	Social Work and Social Policy & Administration	1,244	40	Social Work and Social Policy & Administration	1,244
	Sociology and Anthropology	1,257	41	Sociology	929
			42	Anthropology	328
	Education	1,697	45	Education	1,697
D	Area Studies	571	47	American Studies and Anglophone Area Studies	87
			48	Middle Eastern and African Studies	133
			49	Asian Studies	151
			43	Development Studies	200
	European Languages and Studies	1,935	50	European Studies	457
			51	Russian, Slavonic and East European Languages	118
			52	French	387
			53	German, Dutch and Scandinavian Languages	223
			54	Italian	100
			55	Iberian and Latin American Languages	236
			56	Celtic Studies	106
			58	Linguistics	308
	English Language and Literature	1,853	57	English Language and Literature	1,853
	Philosophy, Theology and Religious Studies	1,049	60	Philosophy	577
			61	Theology, Divinity and Religious Studies	472
	History, Archaeology and Classics	2,688	62	History	1,763
			59	Classics, Ancient History, Byzantine and Modern Greek Studies	415
			33	Archaeology	510
	Art and Design	2,036	63	Art and Design	1,702
			64	History of Art, Architecture and Design	334
	Music, Drama, Dance and Performing Arts	1,005	65	Drama, Dance and Performing Arts	433
			67	Music	572
	Library, Information, Communication, Cultural and Media Studies	845	37	Library and Information Management	297
			66	Communication, Cultural and Media Studies	548

Traditional Scientific Method

- Observable
- Empirical
- Measurable
- Reasoned

Traditional ‘Historical’ Method

- Primary and Secondary Sources
- External Criticism (authenticity/provenance)
- Internal Criticism (reliability of accounts)
- Synthesis (reasoning from the above)

C. P. Snow ‘The Two Cultures’ (1959)

1. “the increasingly constructivist world view suffusing the humanities, in which the scientific method is seen as embedded within language and culture”
2. “the scientific viewpoint, in which the observer can still objectively make unbiased and non-culturally embedded observations about nature.”

Interdisciplinary Research

- Interdisciplinary research “refers to the integration of discrete bodies of knowledge with each other to create new knowledge syntheses.” (Gabriele et al 2006, 11).
- Interdisciplinarity “concerns the transfer of methods from one discipline to another” (Nicolescu 2008, 2).
- “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.” (National Academy of Sciences)

However…

- "Concealed reality of interdisciplinarity" (Klein)
- Research isn't termed interdisciplinary
- Researchers detach subject from disciplinary frameworks
- Fill gaps in knowledge
- Re-draw disciplinary boundaries to include new knowledge space and professional roles (Klein)

Interdisciplines

- Social psychology
- Biochemistry
- Environmental engineering
- Psycholinguistics
- Ethno-musicology
- Cultural anthropology

Examples

- Lavoisier (1789) theorised that animals' bodies are combustion machines for carbon and hydrogen. To refute this idea, physiologists had to undertake chemistry. This in turn led to an understanding of respiration and hence biochemistry.
- In the 1960s, clinical neuropsychologists had to use the methods of cognitive psychology to develop models of neurological function. This produced a new discipline: cognitive neuroscience.
- Molecular biology developed in response to: breakthroughs from the discovery of the structure of DNA; new technologies; complex research problems

Multidisciplinary Research

"takes place at the edges of traditional disciplines and across traditional subject boundaries. The Research Councils believe that novel multidisciplinary research is needed to solve many, if not all, of the next decade's major research challenges." (RCUK)

However…

- Communication between disciplines but not interactive, no feedback-loop.

- Example: role of *perspective* in cubism, poetry, physics, communication, educational theory

Transdisciplinary Research

- “Transdisciplinarity concerns that which is at once *between* the disciplines, *across* the different disciplines, and *beyond* all discipline. Its goal is *the understanding of the present world*, of which one of the imperatives is the unity of knowledge.” (Nicolescu 2002, 44).
- Transdisciplinarity tends towards an active engagement and transformative praxis with constructive problem solving. It is sometimes called ‘Mode 2 knowledge’ (Gibbons, Nowotny et al)
- “Transdisciplinary research is an appropriate form of research when searching for solutions to problems in the life-world with a high degree of complexity in terms of factual uncertainties, value loads and societal stakes. Through bridging different scientific and social knowledge components it can significantly improve the quality, acceptance and sustainability of such solutions.” (Weismann et al 2007)

Aims

- Triangulation – verification of results
- Complementarity - overlapping of different facets
- Initiation – uncovering paradoxes
- Development – using one method to inform another
- Expansion – adding scope to research

Theories

- Jean Piaget, *L'épistémologie des relations interdisciplinaires, in L'interdisciplinarité - Problèmes d'enseignement et de recherche dans les universités, OCDE, Paris, 1972, proceedings of an workshop hold in Nice in 1970.*
- Jantsch, E. 1972. “Towards Interdisciplinarity and Transdisciplinarity in Education and Innovation”, in *Problems of Teaching and Research in Universities*, OECD, Editor, 97-121.
- Nowotny, Helga et al. (1994) *The new production of knowledge: the dynamics of science and research in contemporary societies.* Sage
- Thompson Klein, Julie et al. (2001). *Transdisciplinarity: Joint problem solving among science, technology, and society. An effective way for managing complexity.*
- Pohl, Christian & Hirsch Hadorn, Gertrude (2007) *Principles for Designing Transdisciplinary Research*
- Nicolescu, Basarab (2002) *Manifesto of Transdisciplinarity.* State University of New York Press.

Transdisciplinarity

“Transdisciplinarity is the new "in vivo" knowledge, founded on the following three postulates :

1. There are, in Nature and in our knowledge of Nature, different levels of Reality and, correspondingly, different levels of perception;
2. The passage from one level of Reality to another is insured by the logic of the included middle;*
3. The structure of the totality of levels of Reality and perception is a complex structure: every level is what it is because all the levels exist at the same time.”

(Basarab Nicolescu, *Manifesto of Transdisciplinarity)*

The Included Middle

1. The axiom of identity : A is A.
2. The axiom of non-contradiction : A is not non-A.
3. The axiom of the excluded middle : There exists no third term T which is at the same time A and non-A.
4. However, quantum physics enables a third term T (the included middle) which is at the same time A and non-A. This is the logic of complexity.

Some challenges

- Structural Challenges, such as disciplinary and Faculty boundaries.
- Cultural Challenges, such as differing research methodologies.
- Linguistic Challenges, such as semantics and nomenclature.
- Financial Challenges – finding funding for cross-disciplinary research is especially difficult.
- “When I use a word,” Humpty Dumpty said, in rather a scornful tone, “it means just what I choose it to mean -- neither more nor less.”

Typical issues in Transdisciplinary Research

- Quality
  - (“aren’t you lowering the quality of what you are doing?”)
- Transgression
  - (especially between science and society)
- Accountability
  - (who is responsible for TD research?)
- Methodologies
  - (which methods to use and how to mix methods)

Nowotny, H. 2003. “The Potential of Transdisciplinarity.” *Rethinking Interdisciplinarity.* 1 May. Interdisciplines.

Summary definitions

- Interdisciplinary research applies the methods from one discipline to another.
- Multidisciplinary research combines researchers from different disciplines to address a common question.
- Transdisciplinary research is across, beyond and above all disciplines.