2013 UCC Colloquium Series on Environment, Planning & Sustainability

Sustainability and Modern Society

Trans-disciplinarity in Education for Sustainability

Dr Ger Mullally, Dept. of Sociology
Dr Edmond Byrne, Dept. of Process & Chemical Engineering

ACE Sustainability and Modern Society Seminar Series

Institutional background

- Environmental management
- CCC-Public Academy
- Environmental Citizenship
  Sept 2013 Conference: *'Trans-disciplinary conversations on transitions to sustainability'*
- M.Plan Colloquium Series
- ISS21 Transformations

Also:

- TAPPS
- EESD13: 'Rethinking the Engineer'

Sustainability and Education

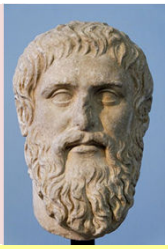
- **Sustainability** has emerged as a complex space that incorporates social, political, and ethical issues and not only nature-oriented concerns and environmental anxieties. It is broader in scope and incorporates spatial and economic themes as well as social practice … we need a "paradigm shift" toward **trans-disciplinary thinking** (Jabareen 2012: 2249).

- [The] modern paradigm of disciplined (and, indeed, highly disciplinary), curriculum-centred **education** at once expresses and transmits the deep structure of what Stephen Toulmin has called "cosmopolis" – a world ordered and unified from above in keeping with modern values of universality, autonomy, equality, sovereignty, competition and control; a world in which differences are construed as dangerous, contingent and ultimately irrelevant (Hershock 2010: 32)

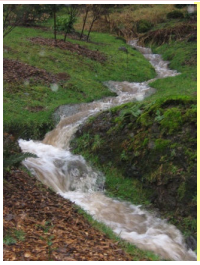
Historical Context; Differing Perspectives on Reality

Eleatic and **Platonic** schools of thought (e.g. Parmenides, Democritus and Plato) developed ideas around **atomism, determinism,** the **impossibility of real change.**

Many of these ideas would later provide basis for **modern scientific thinking**.



Plato 428–427 BC



Others, e.g. **Heraclitus,** the **Milesian school** held differing perspectives on the nature of reality and the universe. Heraclitus is attributed with the quotation:

$\pi\alpha\nu\tau\alpha\ \rho\varepsilon\iota$ *(panta rhei)*

'Everything changes' (change is constant) or
'You can't step into the same river twice'.

Historical Context; Differing Perspectives on Reality

Heraclitus thus proposed that nature is **context** and **time dependent, contingent, uncertain** and **irreversible.**

- ..a view **compatible** with the **Second Law of Thermodynamics** (and the concept of entropy).
- ..though ***in contrast*** with a **deterministic** worldview inherent in, e.g. **Newton's Laws**.

Heraclitus (535 - c.475 BC) by Johannes Moreelse, (c. 1630)

Plato disagreed:
'How can that be a real thing which is never in the same state?'

...differing perspectives on reality from classical times.

Early Modernity; First (humanistic) origins (Toulmin)

Amid relative peace and prosperity in **16th Century** Europe, a flourishing of those reflecting on the **human condition**, celebrating its inherent **complexity** and **unpredictability** e.g. **Erasmus** (1467-1536), **de Montaigne** (1533-1592) and **Shakespeare** (1564-1616).

Desiderius Erasmus (left) and Michel de Montaigne: *"The only thing certain is nothing is certain."*

These **humanists** were **sceptical** of any sort of dogma (theological or intellectual) or presumed certainty, in favour of an *'urbane open mindedness and skeptical tolerance'* whereby *'they regarded human affairs in a clear-eyed, non judgemental light'* (Toulmin, 1990).

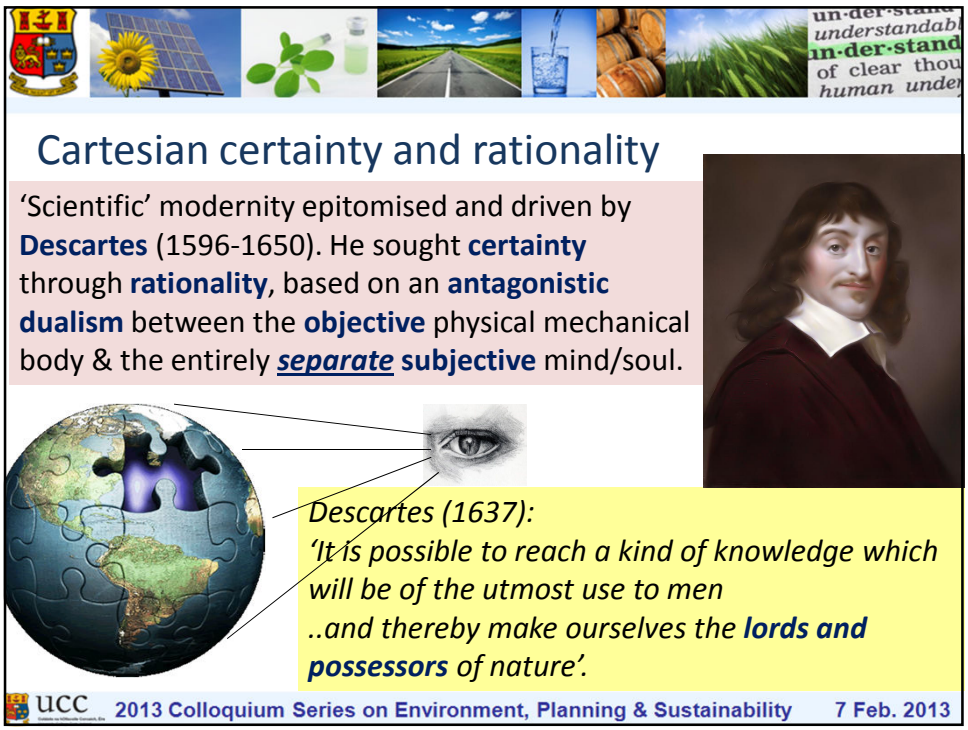
17th C crisis and quest for certainty

17th Century Europe: mood of **catastrophe, chaos** and **crisis** amid sectarian **30 years war** and **changing climate** (mini ice age) precipitated a yearning for **certainty**.

This heralded the well recognised (second) origin of modernity resulting in repercussions for both science and religion over 400 years.

In Science: facilitated the development of a scientific paradigm based **purely on rationality** which sought to **eradicate uncertainty.**

In Religion: a **strengthening of dogma** and 'factual' interpretations of faith among the warring churches.


understandabl
un·der·stand
of clear thou
human under
Cartesian certainty and rationality
'Scientific' modernity epitomised and driven by **Descartes** (1596-1650). He sought **certainty** through **rationality**, based on an **antagonistic dualism** between the **objective** physical mechanical body & the entirely ***separate*** **subjective** mind/soul.
Descartes (1637):
'It is possible to reach a kind of knowledge which will be of the utmost use to men
*..and thereby make ourselves the **lords and possessors** of nature'.*
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understandabl
un·der·stand
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human under
Modernity and the Two Cultures
The world of Galileo, Descartes, Newton and Laplace is essentially **mechanistic, deterministic, reductionist** and ***context free.***
Since the **mid 1600's**, **rational science** and **relational humanities** have carried different concepts of reality, each often distrustful of the other. In 1965 Cambridge physicist **C.P. Snow** famously identified (and bemoaned) this break in **'The two cultures'.**
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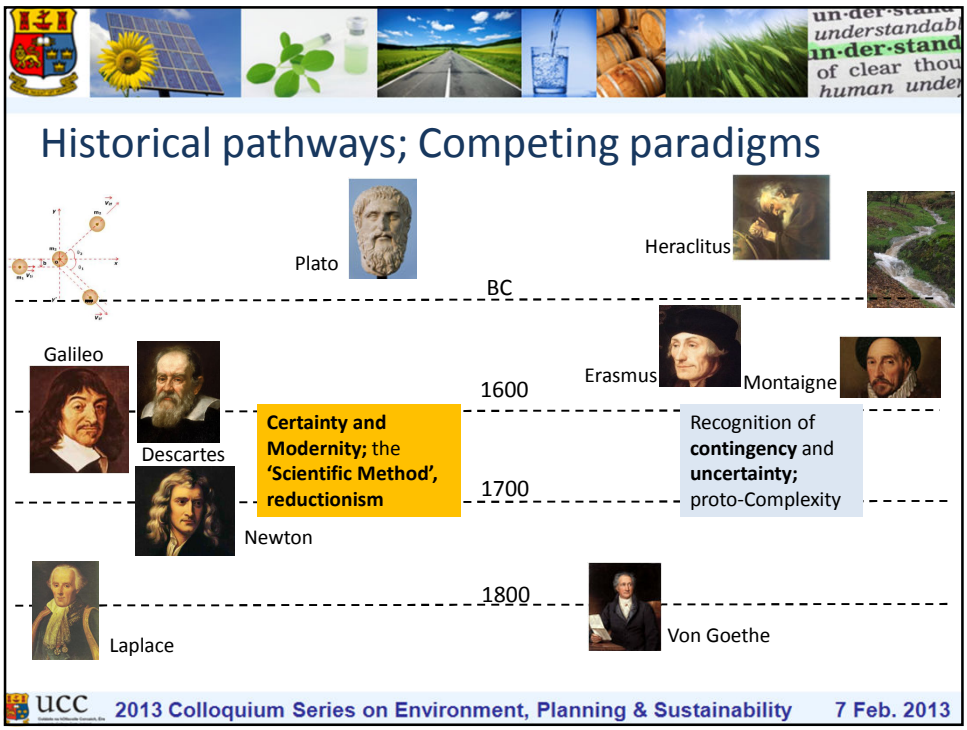
Historical pathways; Competing paradigms
Plato
Heraclitus
BC
Galileo
Erasmus
Montaigne
1600
Descartes
Certainty and Modernity; the 'Scientific Method', reductionism
Recognition of contingency and uncertainty; proto-Complexity
1700
Newton
1800
Laplace
Von Goethe
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Reductionist Modern Paradigm: Blind to Complexity
'We are blind to the problem of complexity.
This blindness is part of our barbarism. It makes us realize
that in the world of ideas, we are still in an age of barbarism.
We are still in the prehistory of the human mind.
Only complex thought will allow us to civilize our knowledge.'
(Edgar Morin, 2008)
Edgar Morin
On Complexity
Sustain-ability by Design
'The big messes are all a result of our failures to recognize complexity and act accordingly'
(John Ehrenfeld, 2012)
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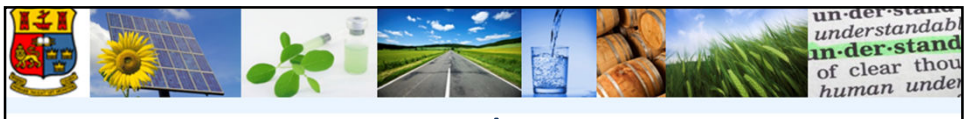
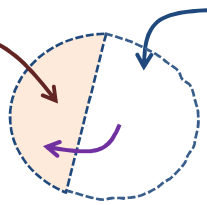


Complexity

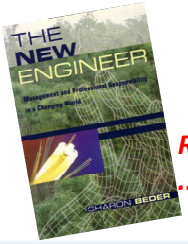
- Complexity theory decentres the notion that science involves **certainty** and certain knowledge and reaffirms **contingency** and the inescapable necessity of including **social logics** in decision-making
- …recognition that the natural and social sciences are analytically engaged with complexity
- …a source of metaphors useful for theorising **novelty** (Welsh 2010: 36)

The Real World: Uncertainty a Constant

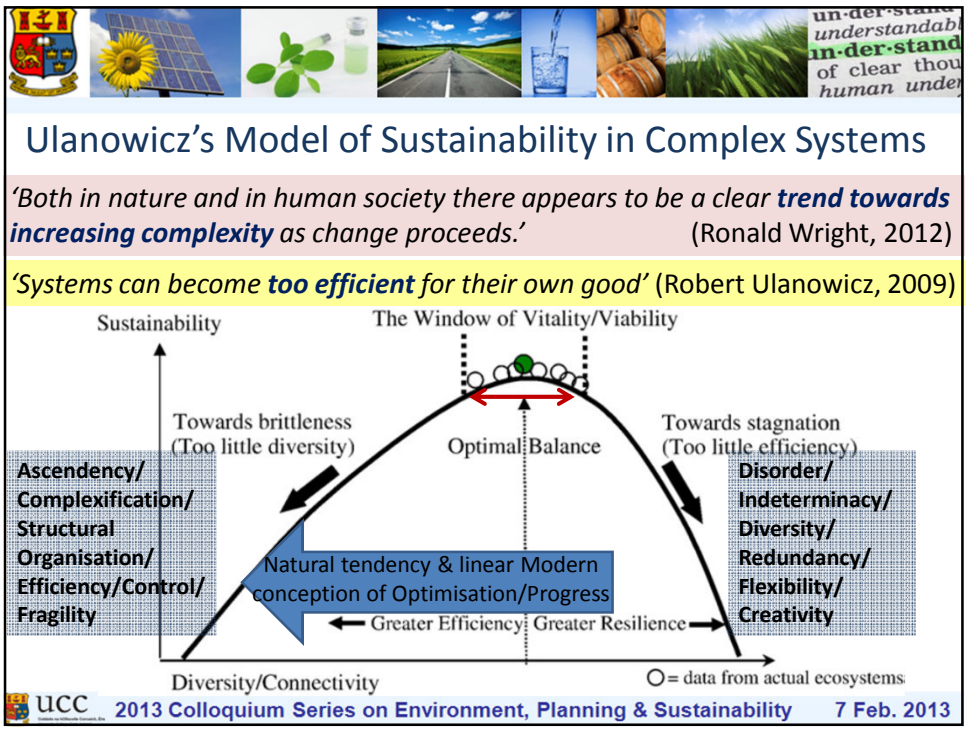
Traditional engineer/scientist (adept at solving in the) **Linear realm:** **Closed quantifiable systems**, all possible outcomes known which can be **identified** and **predicted** or assigned probabilities.
e.g. **machine** operations



Complex realm:
Open systems with **infinite unknown possibilities** to which probabilities cannot be assigned ('unknown unknowns'), enables **creativity, evolution, inherent uncertainty** and **risk, context, agency, values, emergence, self organisation,** e.g. **human** activity and agency, wicked problems



Requires 'new engineer'/ ..scientist/ economist/…


Ulanowicz's Model of Sustainability in Complex Systems
'Both in nature and in human society there appears to be a clear trend towards increasing complexity as change proceeds.' (Ronald Wright, 2012)
'Systems can become too efficient for their own good' (Robert Ulanowicz, 2009)
Sustainability
The Window of Vitality/Viability
Towards brittleness (Too little diversity)
Optimal Balance
Towards stagnation (Too little efficiency)
Ascendency/ Complexification/ Structural Organisation/ Efficiency/Control/ Fragility
Disorder/ Indeterminacy/ Diversity/ Redundancy/ Flexibility/ Creativity
Natural tendency & linear Modern conception of Optimisation/Progress
Greater Efficiency
Greater Resilience
Diversity/Connectivity
= data from actual ecosystems
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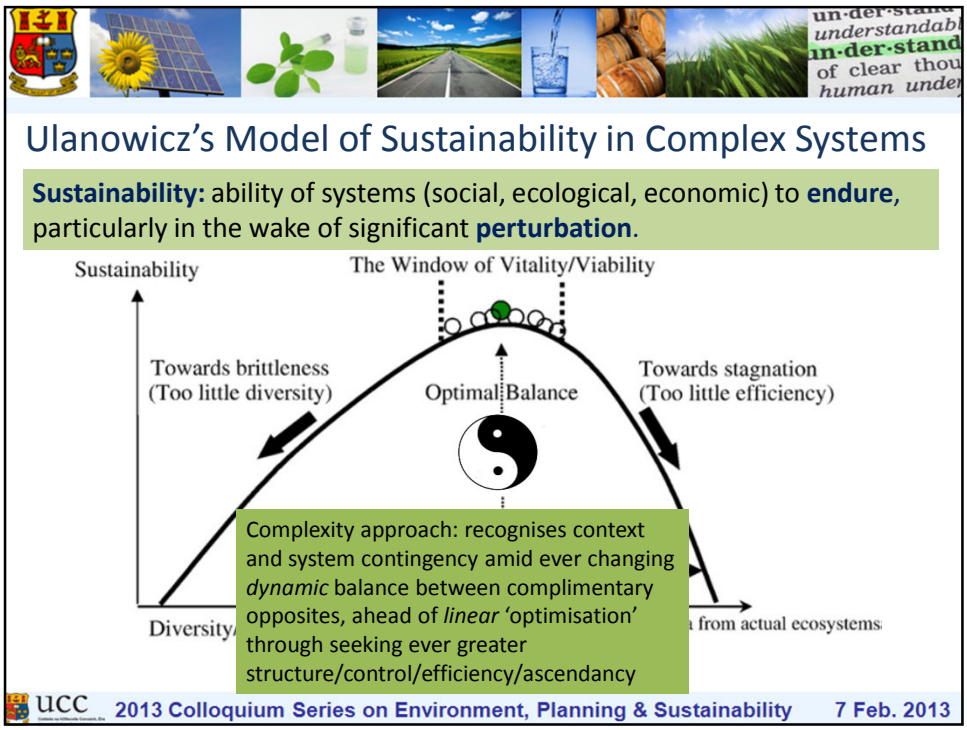
Ulanowicz's Model of Sustainability in Complex Systems
Sustainability: ability of systems (social, ecological, economic) to endure, particularly in the wake of significant perturbation.
Sustainability
The Window of Vitality/Viability
Towards brittleness (Too little diversity)
Optimal Balance
Towards stagnation (Too little efficiency)
Complexity approach: recognises context and system contingency amid ever changing dynamic balance between complimentary opposites, ahead of linear 'optimisation' through seeking ever greater structure/control/efficiency/ascendancy
from actual ecosystems
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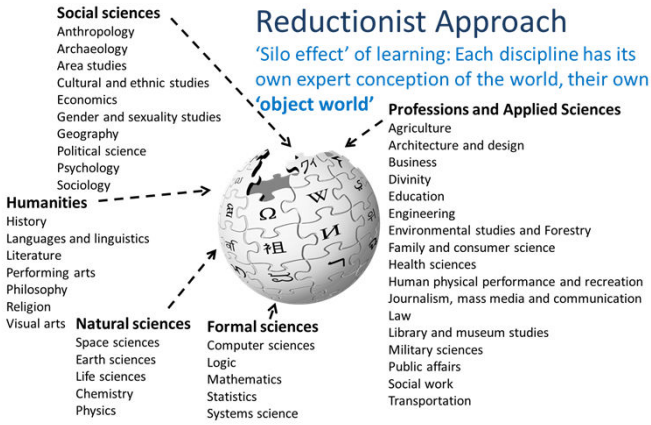
Separation vs. Complexity: Educational Implications

In our own disciplinary spheres, we tend to **reduce** the world around us to our own particular **'object world'**: *'all else being equal'*



Separation vs. Complexity: Educational Implications

In our own disciplinary spheres, we tend to **reduce** the world around us to our own particular **'object world'**: *'all else being equal'*

This approach serves to strip the **real, complex** and **wicked** world around us of ***context***.

..which may be both useful and necessary for sending people to the moon, designing a pump-pipeline system, etc...

..But is **hopelessly inadequate** in dealing with problems of modernity - 21st Century crises (ecological, social, economic) – crises it in fact helps **precipitate** and which are posited in a **finite** and **constrained world**.

Separation vs. Complexity: Educational Implications

- As well as expectations about teaching and learning, students will also have expectations based on disciplinary leaning – reflecting C.P Snow's **'two cultures'**, there may be resistance to learning **"outside of comfort zones"** (Golding 2009: 10)
- 'We are never confronted with science, technology and society', Latour says 'but with a gamut of weaker and stronger associations' …we can say that we do not live between 'two cultures', but in a **complex, over-determined, interconnected matrix** (Luckhurst 2007: 59).

Separation vs. Complexity: Educational Implications

- The '**Age of Separation**' (of disciplines, self, states, communities, etc.) is thus inappropriate and counterproductive in dealing with the problems of modernity that it causes..
- ..instead open contingent **trans-disciplinary conversations** and **collaborations** are required to best utilise disciplinary (as well as extended peer community) knowledge.

Complexity and the University

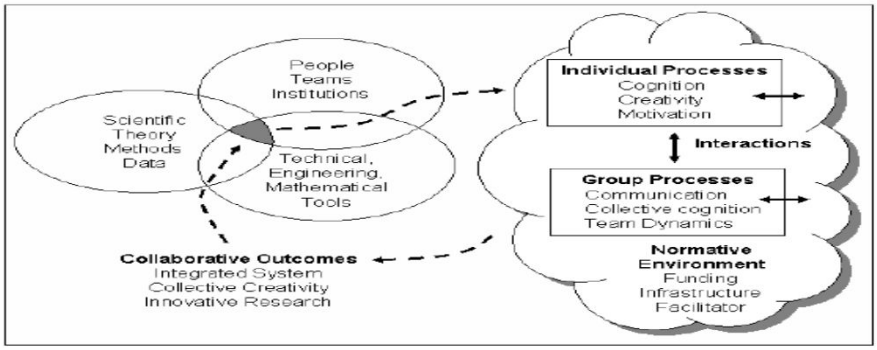
- Third Level Education: zoo or ecosystem? (Hershock 2010: 34-35)
  - A zoo ideally contains a comprehensive range of animals and plants that make up a particular ecosystem, but segregated into separate exhibits …prohibiting the realization of the relational dynamics constitutive of an ecosystem … individual members of species are not free to interact in ways that would bring about a self organizing, novelty generating complex system
  - Zoos are high in variety, ecosystems are high in diversity
- Political Zoology

Cultivating a 'Knowledge ecosystem'

- Cross-disciplinary learning
- [cross disciplinary] collaborations are in some ways analogous to ecosystems. The primary entities involved are humans, bodies of knowledge and tools. For effective collaboration to emerge, these must be linked within a 'knowledge ecosystem', the dynamics of which depend on individual processes interacting with group processes in some normative environment
- …not simply a matter of placing the right people with the right knowledge together. It depends on orchestrating the environment and interactions such that innovative approaches emerge through effective sharing of knowledge within and among participants – the evolution of a knowledge ecology. http://www.ecologyandsociety.org/vol13/iss2/art8/
  - Deana D. Pennington (2008) Cross-disciplinary collaboration and learning

Fostering Innovation

Fig. 1. Conceptual model of innovation emerging when people from different disciplinary perspectives effectively integrate scientific knowledge with advanced tools through a complex system of individual, group, and environmental interactions.



http://www.ecologyandsociety.org/vol13/iss2/art8/

Centre of the Study of Higher Education, University of Melbourne

- *Assessment of levels of interdisciplinary understanding and engagement*

1. ***Unidisciplinary****:* Disciplines are seen as separate and isolated. **Students** at this level tend to be uninterested in other disciplines (and potentially xenophobic of them), while dogmatic about their own discipline or unreflective beliefs.

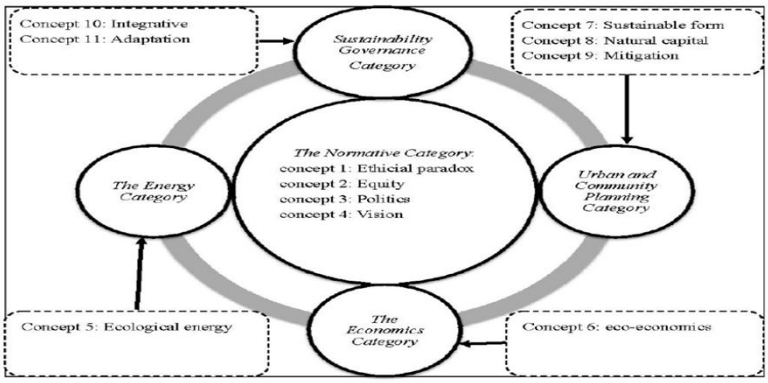
2. ***Awareness of other disciplines****:* Students at this level are aware of different disciplines and their different methods and purposes. However they tend to have stereotyped, superficial beliefs about other disciplines as well as misconceptions and inaccuracies. They also tend to see each discipline as offering its own separate and incommensurable perspective.

3. ***Pluralism and multidisciplinary****:* Students at this level have an accurate understanding of the methods and findings of different disciplines. They use the different disciplines to provide multiple ways of approaching a common problem or issue, but do not integrate the perspectives. They see the various perspectives in terms of a smorgasbord of possible choices, rather than attempting interdisciplinary integration.

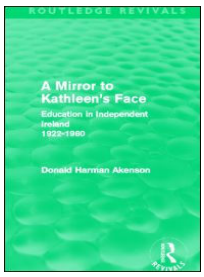
4. ***Interdisciplinary****:* Students at this level are truly interdisciplinary and attempt to develop one reasoned perspective from the various disciplinary perspectives and methods, which they support by evidence from multiple disciplines. They engage in sophisticated integration, and have a clear sense of purpose for why the disciplines needed to be integrated (Golding 2009: 13)

An Urban Planning Perspective (Jabareen 2012)

Figure 1. The Conceptual Framework of Education for Sustainability: Categories and their Concepts.



Reflection and Reflexivity



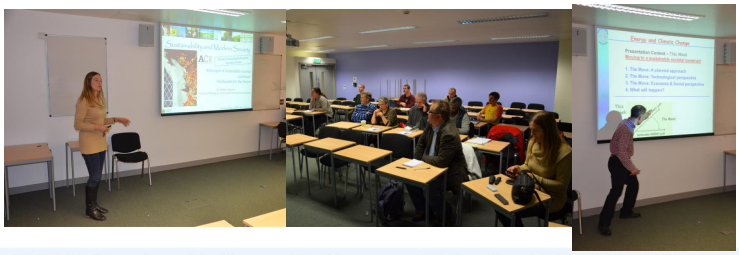
First published in 1975, Donald Akenson's book was at the forefront of a radically new approach to the study of Irish educational history**. Instead of investigating the evolution of the schools as an isolated process, he explores the complex interrelations of Irish education**, institutions and society, treating the schools as cultural litmus paper. By presenting Ireland's schools as a reflection of the society that produced them, Professor Akenson demonstrates that they are, in truth, "**a mirror** to the face of Kathleen ni Houlihan".

Oscar Wilde – Picture of Dorian Gray
Refection and Reflexivity

Trans-disciplinary Conversations

UCC Adult Continuing Education Seminar Series (Oct-Nov 2012)

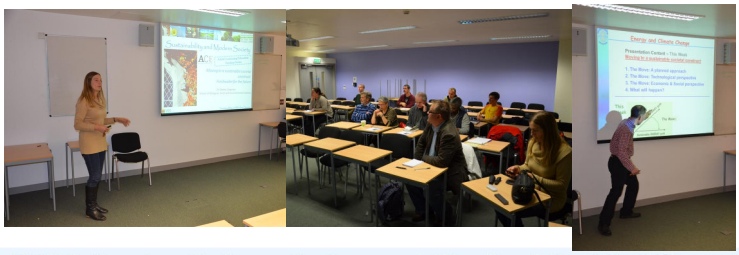
- Economics & Politics, International Studies, Philosophy, Planning and Sustainable Development, Process & Chemical Engineering, Biological Earth & Environmental Sciences, Art & Design, Physics, Sociology, Government/Adult Continuing Education, Law



Trans-disciplinary Conversations

This Series helped stimulate some of these conversations..

e.g. Scientifically established need to halt rising CO_2 levels..
But how would we actually go about dong this in practice?..
..raises several ethical, sociological questions..



Education for Sustainability;
promoting Complexity Thinking & Independent Thinking

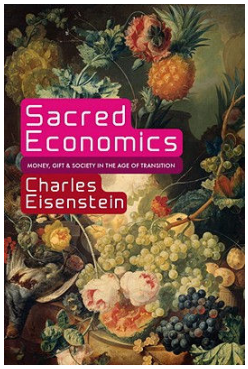
- Education for Sustainability above all means the creation of space for **social learning**. Such space includes: space for **alternative paths**, space for **new ways of thinking**, **valuing** and **doing**, space for **participation** minimally distorted by **power relations**, space for **pluralism, diversity** and **minority perspectives**, space for **deep consensus** and **respectful disagreement**, and **differences**, space for **autonomous** and **deviant thinking**, space for **self-determination**, and finally, space for **contextual difference** (Corcoran and Wals 2004: 224).

Healing the Modern Schism

- Enhancing higher education 'involves undoing the divorce between the technical and ethical – a **healing of the modern schism** between knowledge and wisdom' (Hershock 2010: 39)

- "Knowledge speaks, but wisdom listens"
(Jimi Hendrix)

- Sacred Economics, **Charles Eisenstein** (2012) http://sacred-economics.com/ (0-2:00 of 12:09)



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