



Propagating an Integral and Transdisciplinary Approach to Sustainability Education

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TRANSDISCIPLINARY PERSPECTIVES ON TRANSITIONS TO SUSTAINABILITY

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ROUTLEDGE

'The homogeneous worldview of mechanical reductionism is incapable of encompassing the complex nature of sustainability. Treating a richly heterogeneous world demands a more appropriate metaphysics. The collected authors, whose interests span a multitude of disciplines, embark here upon the task of formulating such a vision adequate to the task of maintaining the human endeavor.' - Robert E. Ulanowicz, *University of Maryland, USA*

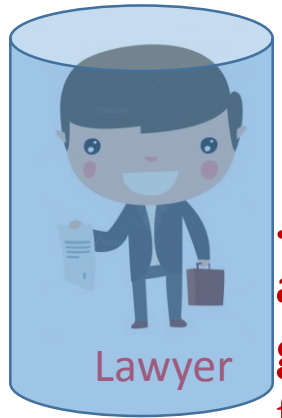
'This is an essential read for anyone interested in how researchers can help catalyse more practical and ambitious actions that do justice to the full depth of sustainability challenges. With humour, authority, humility – and great breadth of experience – the authors drive energetically through the daunting thicket of barriers, to help inform and inspire diverse kinds of much-needed transdisciplinarity.' - Andy Stirling, *University of Sussex, UK*

'Byrne, Mullally and Sage present a rich collection of perspectives on the increasing alignment of inter- and trans-disciplinarity with sustainability. Spanning theory and practice, the book situates new approaches in a history of arguments for alternative modes of thought and action. Chapters steer readers through the plurality of definitions, narratives, and philosophical frameworks of the core concepts. They also consider the role of technology, legal and political contexts, infrastructure and education within Ireland and the larger European context.' - Julie Thompson Klein, *Wayne State University, USA*

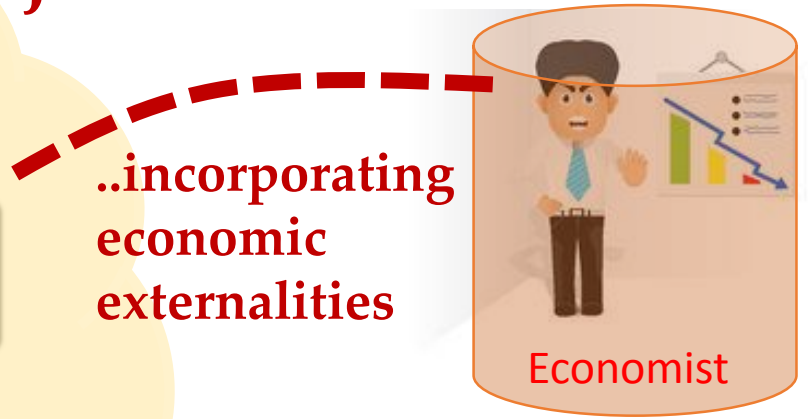
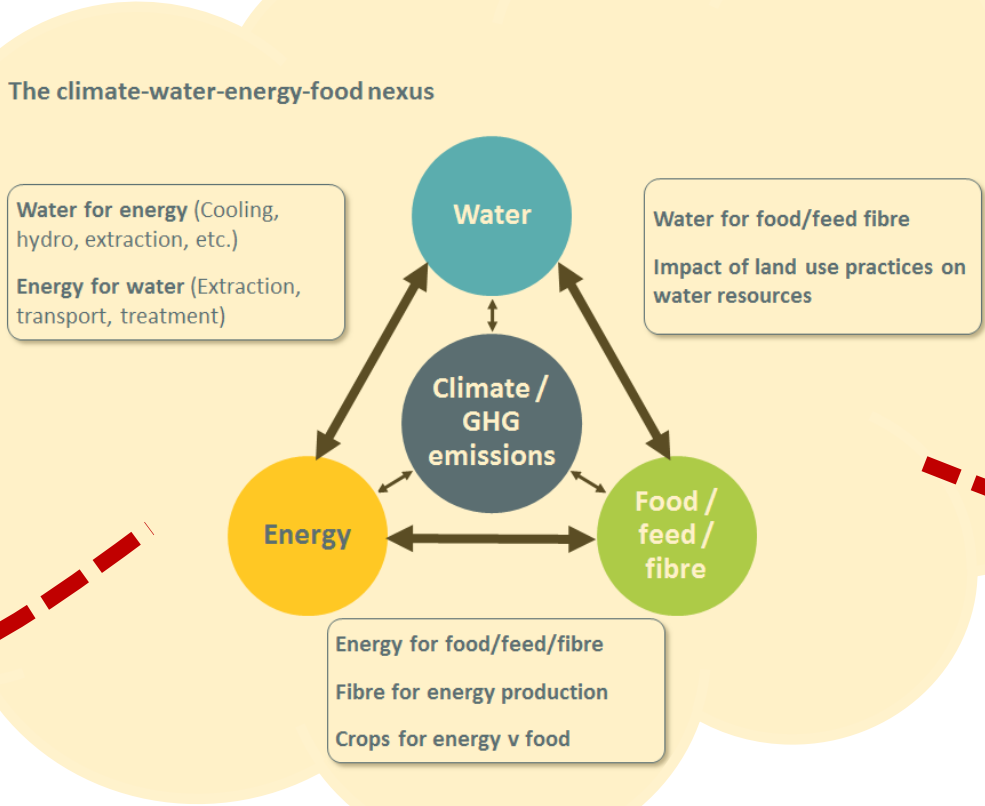
Demonstrating how a university can, in a very practical and pragmatic way, be re-envisioned through a transdisciplinary informed frame, this book shows how through an open and collegiate spirit of inquiry the most pressing and multifaceted issue of contemporary societal (un)sustainability can be addressed and understood in a way that transcends narrow disciplinary work. It also provides a practical exemplar of how far more meaningful deliberation, understandings and options for action in relation to contemporary sustainability-related crises can emerge than could otherwise be achieved. Indeed it helps demonstrate how only through a transdisciplinary ethos and approach can real progress be achieved. The fact that this can be done in parallel to (or perhaps underneath) the day-to-day business of the university serves to highlight how even micro seed initiatives can further the process of breaking down silos and reuniting C.P. Snow's 'two cultures' after some four centuries of the relentless project of modernity. While much has been written and talked about with respect to both sustainability and transdisciplinarity, this book offers a pragmatic example which hopefully will signpost the ways others can, will and indeed must follow in our common quest for real progress.



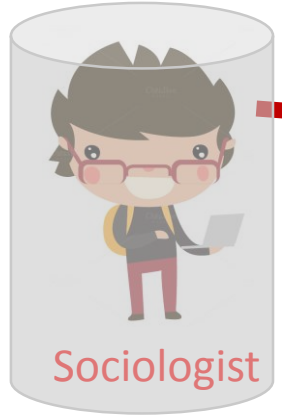
A Problem of... ..disciplinary silo-ised 'object world' views



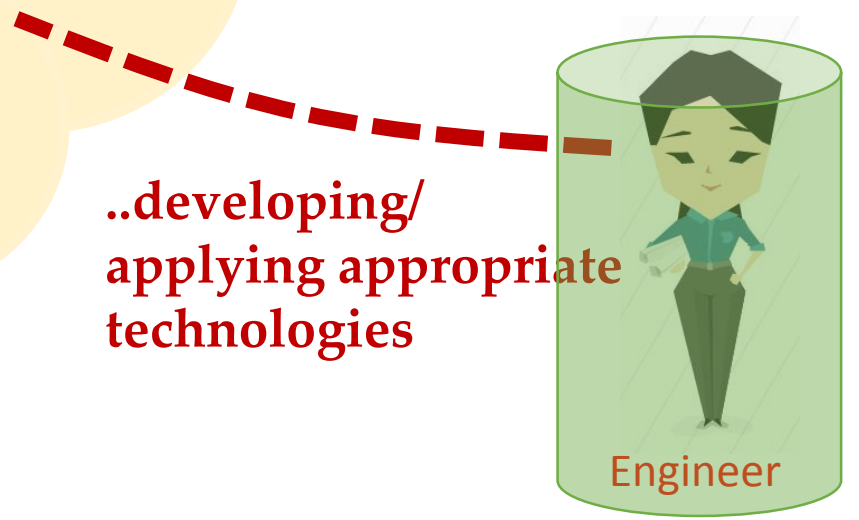
**..developing/
applying a
global legal
framework**



**..incorporating
economic
externalities**



**..how humans relate to world around them through stories,
myths, (meta-)narratives; ultimately an issue of ethics**



**..developing/
applying appropriate
technologies**



Transdisciplinarity; seeking emergent knowledge built on strong disciplinary pillars, while transcending them



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‘Unitas multiplex’ (Morin, 2008)

‘Unity amidst diversity and diversity through the unity’ (Klein, 2004)

Morin, E., 2008. *On Complexity*. Hampton Press.

Klein, J. T., 2004. Prospects for transdisciplinarity. *Futures*, 36, 515-526.



Our Conclusion..

If engineers require a broader conception of their role - recognising inherent complexity and interconnectedness when faced with contemporary meta-problems, then their formative educational experience must go *beyond* the (absolutely necessary) requirement for development of the technical and disciplinary basics which facilitates the *solving* of *well-defined decontextualized unique solution technical* problems.

PE 3009 Q2 2013 (Solⁿ)

$\Delta H = 53 - 10 = 43 \text{ m}$

Bernoulli:

$$\frac{P_1}{\rho g} + \frac{v_1^2}{2g} + z_1 = \frac{P_2}{\rho g} + \frac{v_2^2}{2g} + z_2 + \frac{4fL_1}{2gD}$$

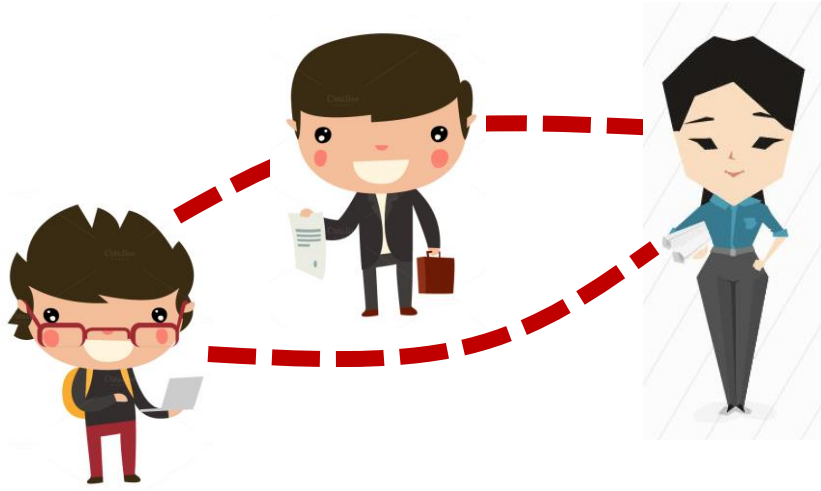
$v_1 = v_2$

$$\Rightarrow 0 = 3 + 30 + \frac{4(0.006)(30)}{2(9.81)(0.1)} v^2 + K \frac{v^2}{2(9.81)}$$

$$0 = 33 + 0.367 v^2 + K(0.051) v^2$$

$$0 = 33 + [0.367 + K(0.051)] v^2$$

$\sqrt{\frac{-33}{-0.367 - K(0.051)}} = v$ curve for (1)

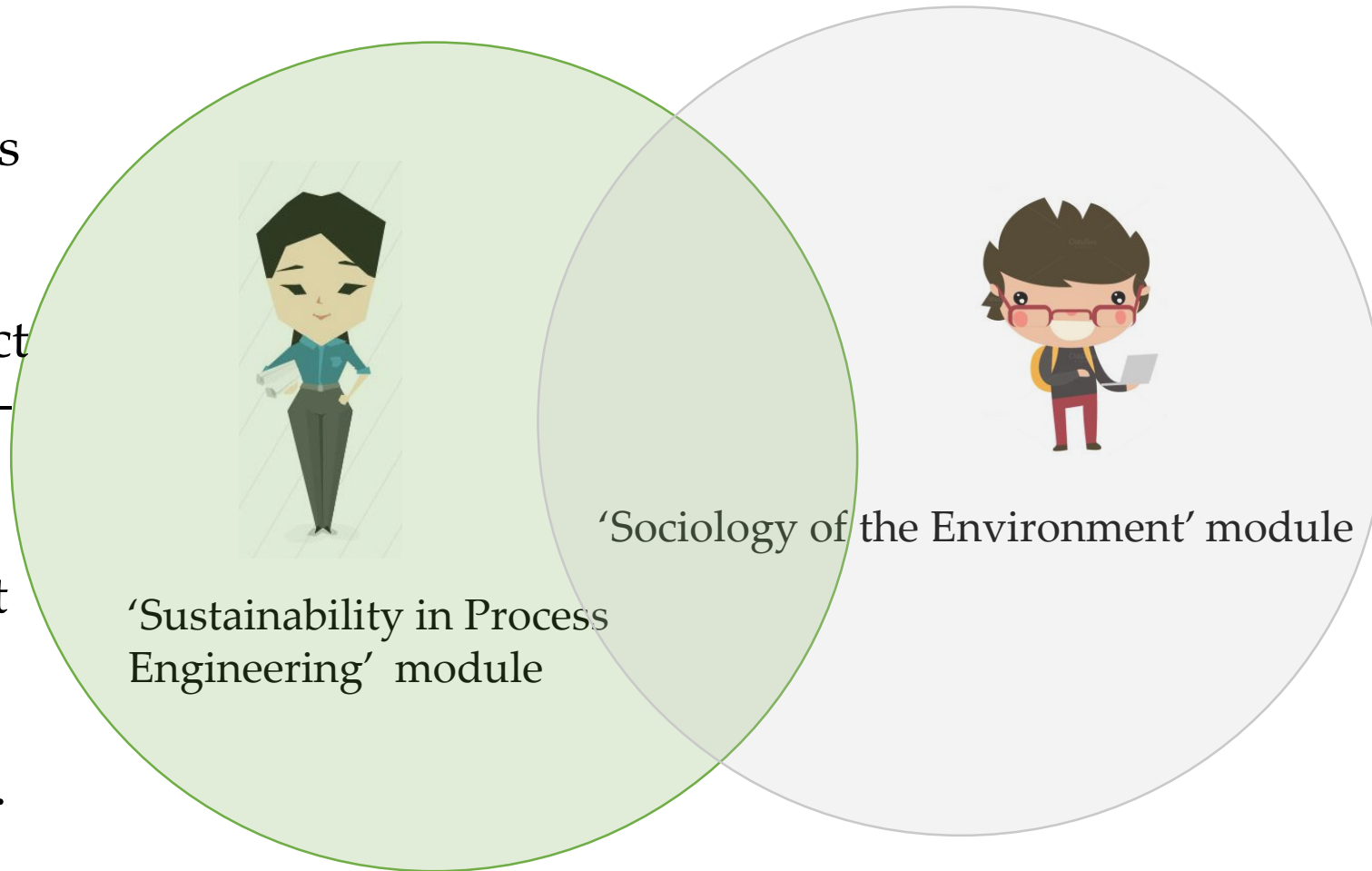


..If we are to expect contemporary engineers to work with *other* disciplines and *integrate* respective knowledges in the generation of requisite new knowledge and perspectives to *frame* and *address complex contemporary meta-problems*, then we couldn't really expect them to achieve these aims by merely 'talking the talk' and then hoping that they would just do so post-graduation.



Our 'Solution'..

..bringing our respective students together for an assignment on some chosen aspect of 'sustainability' – and where we applied an *integral* approach aimed at facilitating productive reflective learning.





Task Description

- A joint/common assignment (15% of module grade) involving:
 - PE3011 Sustainability in Process Engineering** (Year 3 of a 4 year Bachelor degree in Process & Chemical Engineering).
 - SC3029 Sociology of the Environment** (Year 3 of Bachelor of Arts degree, majoring in sociology and other humanities subjects as well as Year 3 of BSc Government).
- 2015-16 iteration: 42 students participated, including 26 from the engineering module.
- Five weekly one hours sessions, plus presentations
- Ten groups of four or five each. International visiting students (Denmark, USA, Brazil).
- Each group chose some aspect of '**sustainability**' to research, develop; and present.
- Primed by documentary on **conceptions of progress** in contemporary globalised society, including the examination of environmental, social, economic and ethical dimensions.
- **Integral model** chosen in structuring/delivering module.





Integral Model

SUBJECTIVE

- **Personal understandings** of reality as filtered through/constructed by personal lens of each individual

OBJECTIVE

- The **material**, facts, disciplinary interpretations, meanings and norms

INTER-SUBJECTIVE

- Emergent **collective/cultural understandings**, including socio-cultural norms

INTER-OBJECTIVE

- **Structural framework/nature** of the module/assignment, including class times/duration, location(s), assessment, delivery mode(s), participants profile, lecturer(s)

(Esbjèorn-Hargens et al., 2010; Renert & Davis, 2010)



Integral Model Facilitation

Domain:	<i>How it was facilitated:</i>
Objective	In-class content , including viewing documentary on conceptions of progress in contemporary globalised society. Assignment description and module material (handouts, slides, required reading, etc.).
Inter-Objective	Structural context ; five weekly 1 hour sessions in designated room, assignment (requirements, grades) and delivery structure (designed to facilitate each of the other domains).
Subjective	Post module personal reflection highlighting personal learning gained from the exercise (400-600 words).
Inter-Subjective	Collective in-class discussions stimulated and structured by lecturing team, both after documentary (acting as stimulus and 'ice-breaker') and around the group exercise .



'Sustainability' topics chosen

Group	<i>Chosen 'sustainability' topic</i>
A	Sustainability and Ethics
B	Waste
C	Industry and Sustainability
D	Inaction and Sustainability
E	Entropy
F	Globalization and Inequality
G	Homogeneity & Diversity
H	Defining Progress
I	Awareness & Behaviour
J	Consumption & Consumerism



Feedback: Personal Reflection - from an Engineering Student

*“As an assignment I felt it was interesting to engage with a different discipline than engineering; something we did not have an opportunity to do for the first three years of the degree. The main benefit of this was the **different viewpoints and experiences** that the **sociology students** were able to bring to the conversation. The Erasmus exchange student was able to provide insights into how the topic of **sustainability is evolving in Denmark**; something we could only speculate about. Their **cultural** attitude was also evident as they seemed to **value environmental conservation** at a level greater than that of the Irish. However, there were a number of **drawbacks** to this joint assignment; in particular, the **government student** failed to properly **engage** with the subject of sustainability. Instead he opted for a **business as usual** approach where he suggested that we should **continue to research** into the subject. The **lack of a sense of urgency** in his approach was **frustrating** and seemed more like a means of maintaining the current global paradigm. **Therein lays the problem** however; that **sustainability means different things to individuals** and may be the reason why real change is so difficult to implement.”*



Feedback: Survey

32 out of 42 students completed at least part of this survey (76% response rate)

<i>In relation to both <u>your module</u> and the accompanying assignments:</i>	Worst		Best			Avg	S.D.
	1	2	3	4	5		
1. How did they help you personally engage with and reflect on issues around sustainability? [SUBJECTIVE]	-	1	6	13	12	4.13	0.83
2. How did they help you develop a deeper understanding of issues around sustainability? [SUBJECTIVE]	-	1	5	14	12	4.16	0.81
3. How well was the module structured in a way that facilitated engagement and learning around the relevant issues? [INTER-OBJECTIVE]	-	-	10	12	10	4.00	0.80
4. How well did the module facilitate peer to peer and group engagement and learning? [INTER-SUBJECTIVE]	-	-	3	18	11	4.24	0.62
5. How well did the material presented facilitate engagement and learning around the relevant issues? [OBJECTIVE]	-	1	6	12	12	4.13	0.85



Feedback: Survey

Can you highlight any aspects of the module or its delivery that you found particularly useful?

Hearing others opinions and further discussing them [Inter-Subjective]

It was very good to discuss the topics amongst the class. It feeds more 'real' to open a dialogue rather than be fed research done by others. [Inter-Subjective]

Helps give a deeper understanding by giving different perspectives and looking at topics from different points of view. [Inter-Subjective]

Allowing students to give their opinion – debating [Inter-Subjective]

The aspect I found most useful was the greater understanding I obtained of "true" sustainability'. Not the sustainability model that has been marketed to us of continued consumption but in a greener way. This module clearly outlined the problem with this model of growth and has made me more conscious. [Subjective]



Feedback: Survey

How might exercise 'be improved'?

Only structural issues (inter-objective) came to the fore, e.g.:

- **tiered room** used was not most conducive to good group interaction,
- **duration** of the student **presentations** could be longer
- could be better **balance** between **student numbers** from respective modules



Conclusion

A four quadrant **integral model** was applied to a **transdisciplinary** joint exercise between **engineering and social sciences students**, which involved exploring meta-problems around **sustainability**.

The exercise worked very well in stimulating **productive dialogue** and **shared understandings across disciplinary boundaries**.

Formal student **feedback** showed the student learning experience to be **overwhelmingly positive**.

While feedback highlighted some (relatively fixable) **shortcomings** in **structural delivery (inter-objective)**, students felt that the other domains of the integral model were **very well covered**, in particular the **inter-subjective** domain which was addressed through designed opportunities for **peer-to-peer, lecturer-student and intra-class dialogue and discussion**.



Los Cuatro Postes, Ávila, Spain

Thank you!