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Authors	Morgan, Dai C.;Byrne, Edmond P.;Nesbit, Susan;Ellis, Naoko;Hemmes, Kas;Orozco-Messana, Javier
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Process, Improvisation, Holarchic Learning Loops and all that Jazz: Experiences in Transdisciplinary Education for Sustainable Development

Dai C. Morgan[1], Edmond P. Byrne[2]*, Susan Nesbit[3], Naoko Ellis[4], Kas Hemmes[5] and Javier Orozco-Messana[6]

[1]Centre for Sustainable Development, Department of Engineering, University of Cambridge.
[2] Department of Process & Chemical Engineering, School of Engineering, University College Cork, Ireland.
[3]Department of Civil Engineering, Faculty of Applied Science, The University of British Columbia, Canada.
[4]Chemical and Biological Engineering, Faculty of Applied Science, The University of British Columbia, Canada.
[5]Faculty of Technology, Policy and Management, TU Delft, The Netherlands.
[6]Departamento de Ingeniería Mecánica y de Materiales, Universitat Politècnica de València, España.

Abstract

This paper explores the experiences of an 'Interdisciplinary Sustainability Assessment Laboratory' ('ISA Lab') workshop, which took place over a week at Universitat Politècnica de València during April 2017. The workshop drew together students from a range of disciplines from across engineering and science, law and the social sciences and from a range of countries and backgrounds, including North and South America, Europe and Asia. It also facilitated a rich co-creative learning environment as it was led by (engineering) academic faculty from across Europe (Spain, UK, Netherlands and Ireland) as well as North America (Canada), as well as local experts who helped provide participants with appropriate context and guidance. The workshops culminated with a number of presentations from respective student groups, where they outlined an integrated development plan for a selected real life local project.

A necessary constraint of the workshop involved the fact that faculty came from several geographic locations, and thus had an incomplete understanding of the local project descriptions in advance, while the students had even less so. Nor did the six faculty members have a clear idea of the workshop structure or format for the week ahead, except for having produced a bespoke presentation based on their own backgrounds and expertise. Indeed, the faculty team were licenced to essentially develop a five day workshop plan from an outline concept. Nevertheless (or perhaps because of these contextual circumstances), the resultant contingency, allied to a highly motivated group of faculty, students and local experts actually led to a highly creative and productive week of co-created learning opportunities and ultimately inspiring emergent outcomes at a number of levels. From faculty developing and improving on workshop structure and delivery collaboratively and 'just in time', to students who initially struggled with concepts and roles, the week culminated in the formulation and presentation of a series of socially sensitive and comprehensively elaborated development plans. Like a piece of harmoniously improvised jazz, this was a collective journey laced with creativity, improvisation and inspiration, which surpassed even our most ambitious goals. This paper describes the process and provides reflections (from both faculty and students) through a number of strands which permeated the workshop. It also speculates on the wider learnings gained from this exercise in project based learning which both facilitated and required innovation, reflection, connection and improvisation amid an ethos and setting of open transdisciplinarity.

1 Introduction and Background

This paper emanates from and is inspired by an 'Interdisciplinary Sustainability Assessment Laboratory' ('ISA Lab') workshop which took place from 10-14th April 2017 at Universitat Politècnica de València (UPV), Spain. The workshop was overseen by a team of six faculty (the listed authors) from a number of European and North American institutions, all of whom are involved in Engineering Education for Sustainable Development (EESD) related scholarship. They were joined by Masters students from a range of disciplines, mainly engineering and architecture related programmes (in Engineering for Sustainable Development, Chemical Engineering, Energy, Built Environment, Architecture, Green Infrastructure) but also from Law. Diversity was further enhanced by the fact that students had various cultural and linguistic backgrounds ranging from across Europe, North and South America and Asia. Local experts were at hand too from the Valencia region, who helped guide and advise students (some of whom were studying locally at UPV) on the respective projects covered. The week culminated in student groups presenting their respective proposals concerning a sustainability informed plan for the development of a designated site or area in the Valencian Community which had been outlined to the groups at the start of the week. The work of the student groups was also underpinned by a series of lectures, given by both faculty and by invited experts, which were aimed at helping contextualise, inform and stimulate the students in their work.

The projects outlined to students were identified in advance by the workshop host and leader Javier Orozco-Messana, who had also assembled a team of local experts who could be used as consultants by the students throughout the week. These were, respectively, the neighbourhood of Benicalap, a relatively low income neighbourhood in the north of Valencia which is bounded by a busy highway, but which also includes a historic building (Casino del Americano) and adjacent public park/gardens which had potential as a local amenity, park and recreational area (for locals and visitors alike). The other project was for the island of Taberca, a Mediterranean island located about 4 km offshore and 18 km due south of Alicante. The island is very popular with day trippers during the summer who take a boat out to it for lunch, but is far less frequented during the winter months. Nevertheless, only the western peninsula of the island is developed with restaurants and houses, while the remainder of it has a number of walkways as well as an old lighthouse and building. The task of the project teams was to see how these could be sensitively developed as an amenity, perhaps for cultural or educational purposes, within an overall 'sustainability' ethos, while considering a mix of environmental, social, economic and technical dimensions. Essentially, the projects encapsulated the essence of the kind of challenges we wish to prepare engineers for; i.e., they are current, real life, open ended problems with no obvious solutions, requiring multi−actor engagement and inter− and transdisciplinary approaches, while reflecting the kind of messy problems they are likely to encounter in their professional careers. Furthermore, such inter− and transdisciplinary approaches and opportunities are recognised as critical for sustainability teaching and learning (Coops et al., 2015; Byrne & Mullally, 2016).

2 Development of workshop structure – a co-created learning journey

Apart from some project descriptions for the projects outlined above, and a requirement for each of the faculty to bring with them a presentation on an agreed area of their own personal expertise which would help guide the students over the course of the week (to be delivered on consecutive mornings), the structure of the week was largely left open and was not predetermined. It was largely up to the faculty team to help

develop and create the programme 'on the run'. The impending task of improvisation appeared both daunting and exhilarating, though mainly the former! While the largely blank sheet presented to us facilitated a lot of creativity, it also necessitated a high degree of cohesion and at times negotiated consent, and a willingness to be receptive to, incorporate and build upon differing perspectives and ideas. The fact that this team was assembled from all corners of the globe, from varying disciplines, backgrounds and areas of expertise and outlook, and who had previously known each other to varying degrees (or in some cases, not at all!) simply added to the mix.

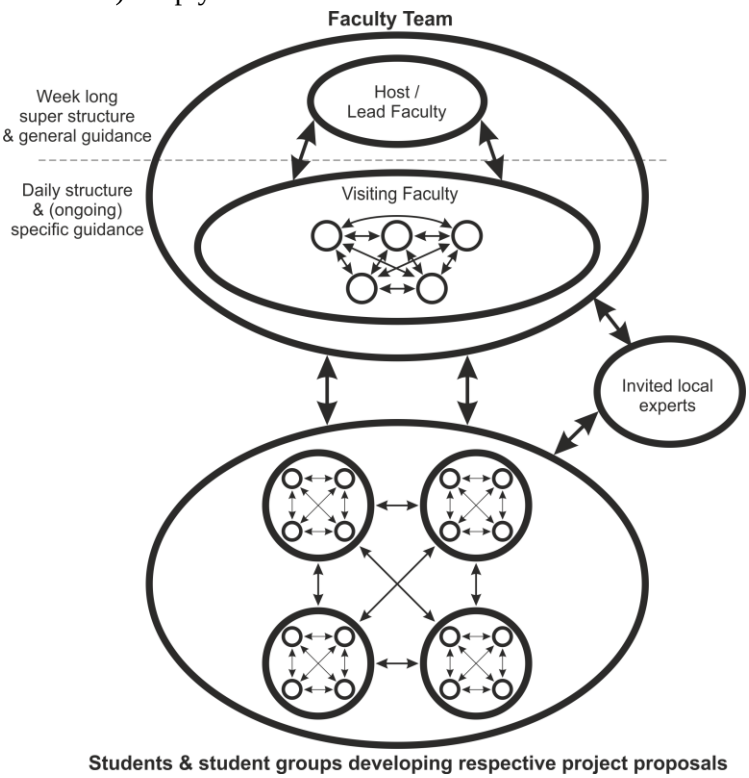


Figure 1 Holarchic learning and interacting relationships during workshop week

So, while we had the common objective of delivering a programme which aimed to give student volunteers from each of our own Institutions an inter and transdisciplinary experience in finding sustainability oriented solutions to real problems across the Valencia Community over the course of a week, we had no rigid pre-planned structure for doing this. Moreover, we agreed that in seeking out possible courses of action and in developing proposals, we were at one in agreeing that for the students, there were no pre-planned solutions or uniquely correct answers, as we sought to provide guidance and interventions alongside an outline brief and a general direction of travel, asking how might any developments proposed be more sustainable ones. As ever, there was also the consideration that no development might be the best option! Thus as we engaged with this process, the idea of a holarchic learning loop (inspired by the holarchic ecosystems model proposed by Kay et al. (1999) and the panarchic model developed by Holling et al. (2002), which considered system evolution in terms of multi-level adaptive recursive change and positive and negative feedback processes, as opposed to being governed by linear deterministic causal change) emerged in our minds over the course of the week. As faculty leads, we were just a step or two (at most!) ahead of the students in creating a guiding structure which we hoped was sufficiently open and stimulating to provide the scope and time for creative endeavours, while at the same time provide sufficient guidance to produce a meaningful

plan. We were improvising and playing off each other(/s ideas) in designing the week, while also being influenced by how the students were reacting to the programme and what they were producing. Meanwhile the students, in their respective groups, and between groups were learning from each other (with their diverse backgrounds) and from the faculty leading and structuring the week as well as from invited local experts. The overall result was a rich network of co-created and co-dependent mode of iterative learning (Figure 1) (see Roxa et al., 2013; Williams et al., 2013; Roxa & Martensson, 2015; Verwoord & Poole, 2016). The 'plan' description which follows is an output of this iterative process and thus emerged largely throughout the week.

	Daily Objective:	**9−11am**	**11.30am−1pm Working Session A**	**3−5pm Working Session B**	**Evening exercise**
Mon.	**Meet, greet, & settling in**	Faculty convene to discuss mechanics of workshop week.		Opening introductory session with students; Outline case studies and group selection.	Short personal reflective exercise on day's work.
Tues.	**Blue skies – Creative possibilities**	'Setting the scene' lectures from faculty, plus Q&A.	Ice breaker session − group exercise(s) aimed at developing teamwork, trust.	Group exercises: Identify possible criteria for achieving 'sustainability', and how can we determine (project) success?	Short personal reflective exercise on day's work.
Wed.	**Setting the goals and identifying the "best" conceptual design**	'Setting the scene' lectures from faculty, plus Q&A.	Local experts/ faculty present detailed account of respective case studies, plus Q&A. Group brainstorming.	Groups identify clusters of ideas/interventions around common themes, and add more in iterative process. Present outline of outputs (as a mind map) to all.	Groups brainstorm to seek novel/clever approach to presenting their proposals/ approach to the chosen case study.
Thur.	**Refining & Preparing your design**	'Setting the scene' lectures from faculty, plus Q&A.	Group working session.	Develop selected ideas/innovations, including presentation.	
Fri.	**Final Preparations & Presentations**	Groups work on presentations.	Group Presentations to peers/faculty. Personal reflective feedback on week's work: what worked, what could be enhanced.		

Figure 2 Outline timetable for workshop week.

In addition, the exact structure of the actual workshop emerged as an iterative process. While the lead faculty provided a conceptual overarching super structure (i.e. a lecture based session each day followed by two working sessions) and some general guidance, it was up to the faculty team to collectively come up with a detailed structure for the week. To this end, an outline agenda (incorporating daily themes, staging points, respective session themes and guiding questions) was developed at an initial kick off meeting by the faculty team on the first morning before being presented to the students that afternoon for the students' first session. This agenda was further developed, finessed and enhanced by the faculty as the week went on, as they were iteratively influenced by progress of the students and the direction of the programme. This

was done in parallel with the student working sessions each afternoon, where faculty worked in the same room (alongside the students and just a step ahead of them (Figure 4 b)), while also being available to interact with the students on their respective projects. Figure 2 represents the actual workshop structure for the week which emerged and accompanying daily themes. Evening social gatherings also helped provide a useful gel for the group. These included students and faculty working together to develop a fresh, healthy vegan meal, walking tours of Valencia and evening social meals. These gatherings helped break down barriers in the early part of the week, but as the week progressed, they provided a space for collaborative reflection, free thinking and exchange of ideas as the projects came to fruition.

Each day began with a pair of 'setting the scene' lectures given by the faculty team (Figure 4 a)), where faculty presented on aspects of sustainability drawn from their own disciplinary perspective and expertise. This covered a wide range of areas from carbon capture and storage, problem framing, integrated design process (at product, process and building level), energy systems, creativity and planning for green infrastructure (Figure 3), and was followed by an open question and answer/discussion session. Faculty subsequently recorded abridged versions of their lectures for public consumption on the UPV website.

Academic/Institution	**'Setting the scene' lecture title**	**Online URL (where available):**
Javier Orozco Messana, UPV	*ISA lab challenge; Workshop on Sustainability*	https://media.upv.es/#/portal/video/a53d11f0-04c9-11e7-b987-ab956caf10fc
Edmond Byrne, UCC	*Context, Framing, Risk, Uncertainty, and Integrative Approaches to Complex Sustainability problems*	https://media.upv.es/#/portal/video/a7bf5210-1eca-11e7-abe0-251981d50228
Naoko Ellis, UBC	*Campus as a living lab*	https://media.upv.es/#/portal/video/eb342660-1eca-11e7-abe0-251981d50228
Dai Morgan, U. Cambridge	*Integrated Design Process*	https://media.upv.es/#/portal/video/ea0cd1f0-25b0-11e7-abe0-251981d50228
Susan Nesbit, UBC	*The Seven Questions to Sustainability*	
Kas Hemmes, TU Delft	*How to improve energy systems to become more sustainable?*	https://media.upv.es/#/portal/video/22bf8190-1f9a-11e7-abe0-251981d50228

Figure 3 Workshop 'Setting the scene' lectures.

Morning lectures were followed by two working sessions which allowed students to work in their teams and discuss aspects of their respective projects with local experts and faculty. These session had various themes and were primed by various guiding questions which the faculty developed. For example, for the first session on day two, groups were asked to consider the following: *'What is our design process? What problems might we encounter? – Teams discuss the steps they will follow to create their preliminary conceptual design. Submit a graphic of the process.'* Corresponding overarching guiding questions for this session included: *'What are sustainability design criteria? What are the important contextual issues for your project? What are some blue-sky design ideas?'*

A feature of these sessions that helped provide structure was a short focus piece delivered at the beginning of the first working session each day by one of the faculty or local experts to help prime or stimulate the group ahead of their designated session task. These included an insightful presentation by architect and urban planning expert, Arancha Muñoz-Criado of Harvard University Graduate School of Design, who drew on her wide international experience in speaking about strategic green infrastructure planning and the need to design urban infrastructure around natural systems and to make physical connections/greenways

between larger green areas. She also pointed out that in communicating with people, they need a story or narrative to relate to, and while the populace don't necessarily always understand ecology, they do readily identify with and understand (narratives around) cultural heritage and family.

3 The Jazz influence; listening and improvising

One of the session introductory pieces, which was proposed during the initial faculty brainstorming session, involved playing part of a TED talk/performance by jazz artist Stefan Harris, entitled *'There are no mistakes on the bandstand'* (Harris, 2011). This largely self-explanatory piece on the value of jazz improvisation (essentially every 'mistake' is an opportunity in jazz; thus the only mistake is when no one accepts/reacts to a note) seemed a useful way to help get the creative juices flowing among the student groups from the start, while also encouraging the establishment of an ethos throughout the workshop which encouraged cohesion, innovation, creativity and exploration among the students. As Davies suggests: *'We don't micromanage in jazz. ..if I want the music to get to a certain level of intensity, ..the best way for me to it is to listen'* and in doing this *'you engage and inspire the other musicians – and they give you more and gradually it builds'* and thus naturally evolves.

Listening, collaborative development and improvisation were thus explicitly privileged over the course of the week, rather than competition and trying to dominate with the best ideas, by force of personality or inflexible plans. That said, the dissenting voice - or the metaphorical bum note, i.e., one which perhaps didn't chime with the preceding melody or set of ideas - was also welcomed to challenge the status quo and ensure that group think didn't take hold.

This seemed to chime very well among the students, though as the week went on, the faculty could increasingly identify with the metaphor too, in particular with the interactive and iterative process of engagement we ourselves experienced both in developing the programme session details 'on the hoof', in a way that required the faculty to listen and learn from each other and from our students (as graphically described in Figure 1). While challenging at times, this was ultimately hugely fruitful and rewarding. As this was the first time we had come together as a group, we also each discovered we needed patience and a willingness and capacity to adjust so as to harmonize with the rhythms of our colleagues and the group. This relied heavily on listening and creativity to develop an agreed evolving plan for the week as it progressed, while modifying and developing our presentations and advice to students during the project sessions to better fit the needs of the workshop. This meant staying present, active and engaged throughout.

Moreover, it was also quite obvious how this also strongly resonated as a valuable metaphor for engaging with sustainability issues themselves: *"Jazz musicians obviously improvise [because..] their assumption is ..that we can collaboratively create through the interaction of constraints and possibilities rather than either order or disorder."* (Montuori, 2003). And it is that 'structure' versus 'creativity' dialectic that lies at the heart of many sustainability narratives and conceptions (Byrne, 2017). Jazz improvisation (and the inherent listening involved) therefore worked well as a metaphor on a number of levels (indeed it can be applied to learning more generally (Montuori, 1996)), and thus continued to resonate throughout the workshop as a whole. This was aided too by the lecture content, which included introducing de Bono's

creative six hats concept (de Bono, 1985) for example, as students were encouraged to put on their 'creative' and 'feeling' hats to drive the ideation process, as these were often the ones that come less easily.



Figure 4 ISA Lab activities (clockwise from top left): a) 'Setting the scene' lecture, b) students and faculty groups during working session, c) group evening recreational meal, d) final presentations.

4 The music

Following on from the jazz metaphor - the output of jazz is spontaneous music, so what music did our groups make? Right up to the final day, the faculty guiding the workshop were never quite sure how this might play out in terms of ultimate output and presentations. Would there be evidence that the group had become more than the sum of their (disciplinary and individual) parts? Three of the four groups worked on the same project (the Benicalap district) and, as a result, there were concerns amongst faculty and students alike that the solutions might look very similar and could make for a rather repetitive afternoon.

Those fears proved wholly unfounded, with each group presenting a distinct take on the problem and a unique approach to telling their story. Whether developing a systems map to understand and illustrate the different dynamics which influenced the problem or drawing inspiration from the lectures to frame the problem in terms of green infrastructure at multiple scales - the presentations used a range of themes and techniques to organise their individual and collective contributions.

There was some evidence of students disciplinary background in the presentations and a technical underpinning to some of the proposed concepts (the projects of course needed to be feasible, cost-effective and safe!); however, there was also evidence that they had stepped beyond their own (chiefly technical)

disciplines as a group to come up with a more holistic approach, benefiting from building on each other's ideas and strengths to address multiple dimensions of performance in an integrated way.

Whilst all the projects acknowledged the principle of stakeholder engagement as being essential in assessing and progressing the concepts developed, one group brought that notion into their mechanism of delivery, presenting their concept from the point of view of an individual stakeholder, a fictional local thirty year old woman named Pilar (Figure 5), who took it upon herself to engage her local community in a social regenerative project, and whose enthusiasm and leadership helped draw down funds and support from the city's municipal budget and a visit from the mayor.



Figure 5 'Pilar' and the associated group presentation

This storytelling approach provided a unique perspective on the development and went beyond intellectual and technical engagement, towards a more empathetic approach to the solution and its potential beneficiaries, and made for a truly inspirational presentation. Other groups took different approaches, but all came up with excellent ideas, including for example, proposing a local community garden, vertical urban food production system and local farmer's market, developing multifunctional, educational and arts and craft spaces (which could help develop 'Falles' festival materials), a greywater sustainable urban drainage system, enhanced local transportation options and mounting of PV solar panels on public buildings.

5 The learning

Overall the workshop, like a wonderful piece of improvised jazz came together for a terrific final crescendo of creativity and innovation. The journey however, was none less thrilling, in part because of the open ended and uncertain nature of the project, for students and faculty alike. Formal and informal student feedback was generally universally positive (while containing some useful feedback suggestions), and the feedback of the following student reflected the general tone:

"We did not have a single team leader. We were all leaders at different stages of the workshop and that worked very well for me. I also think that the faculty did a good job of supervising our team work without narrowing down the scope of our brainstorming sessions.

The TED talk video played during one of the afternoon sessions resonated strongly with me and I thought that it was very useful in helping us build on top of each other's ideas instead of simply discarding them as 'wrong' or 'outlandish'."

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