BIRMINGHAM CITY University

Exploring the Design Thinking – STEAM Nexus
with a view to building a Higher Education STEAM curriculum

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BIRMINGHAM CITY UNIVERSITY

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STEAM house

OVERVIEW

Projects

      DT.UNI

      STEAM INC
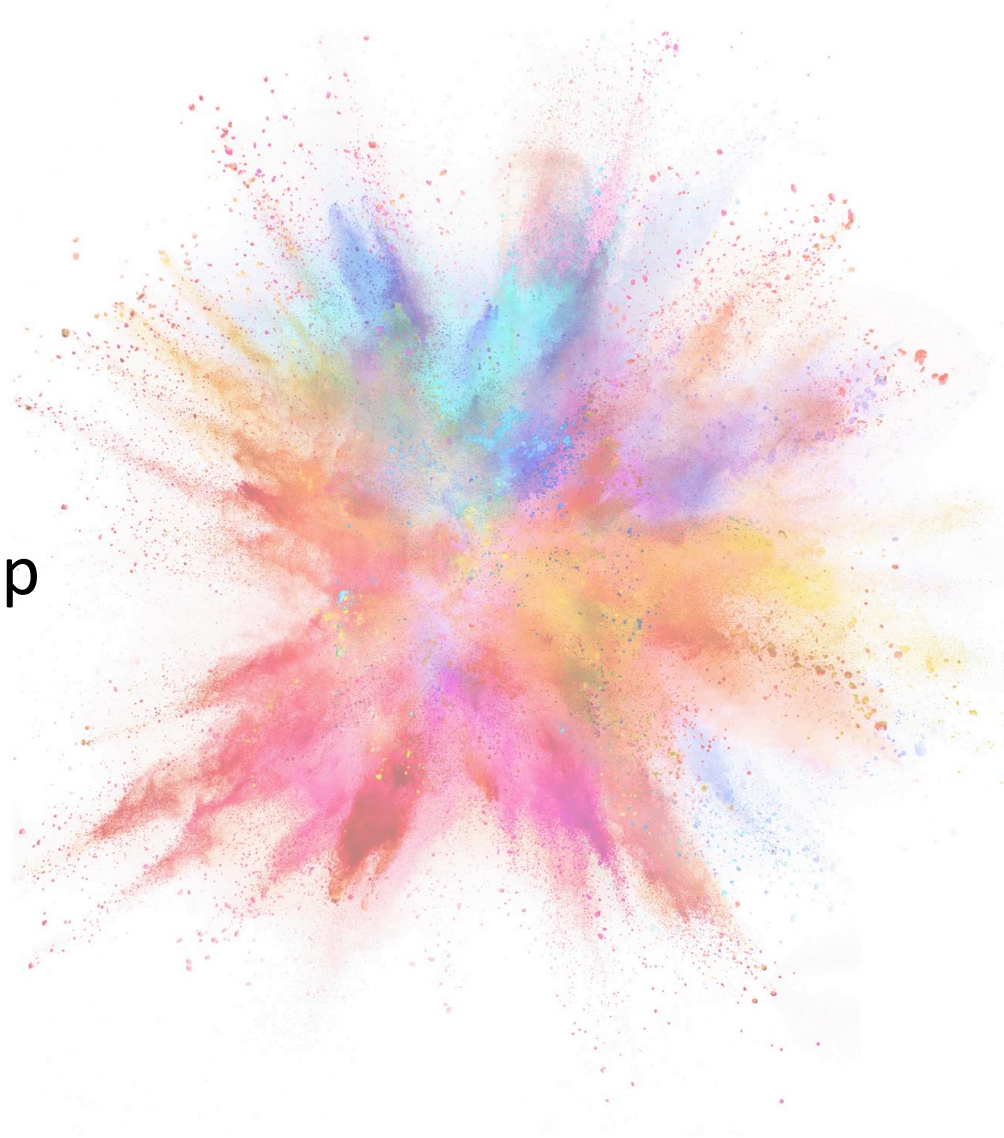
DT-STEAM Nexus

      BCU Focus Group

      Example(s)

      Tensions

      Challenges

Curriculum Design

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DT.Uni.
Design Thinking Approach
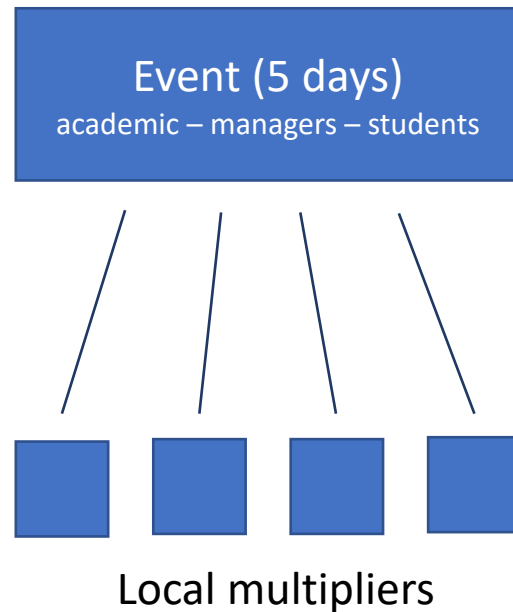for an Interdisciplinary University

Co-funded by the
Erasmus+ Programme
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DT.Uni 2017-2020

Training DT Trainers:

- Learning DT techniques & tools
- Reflecting
- Sharing

Event (5 days)
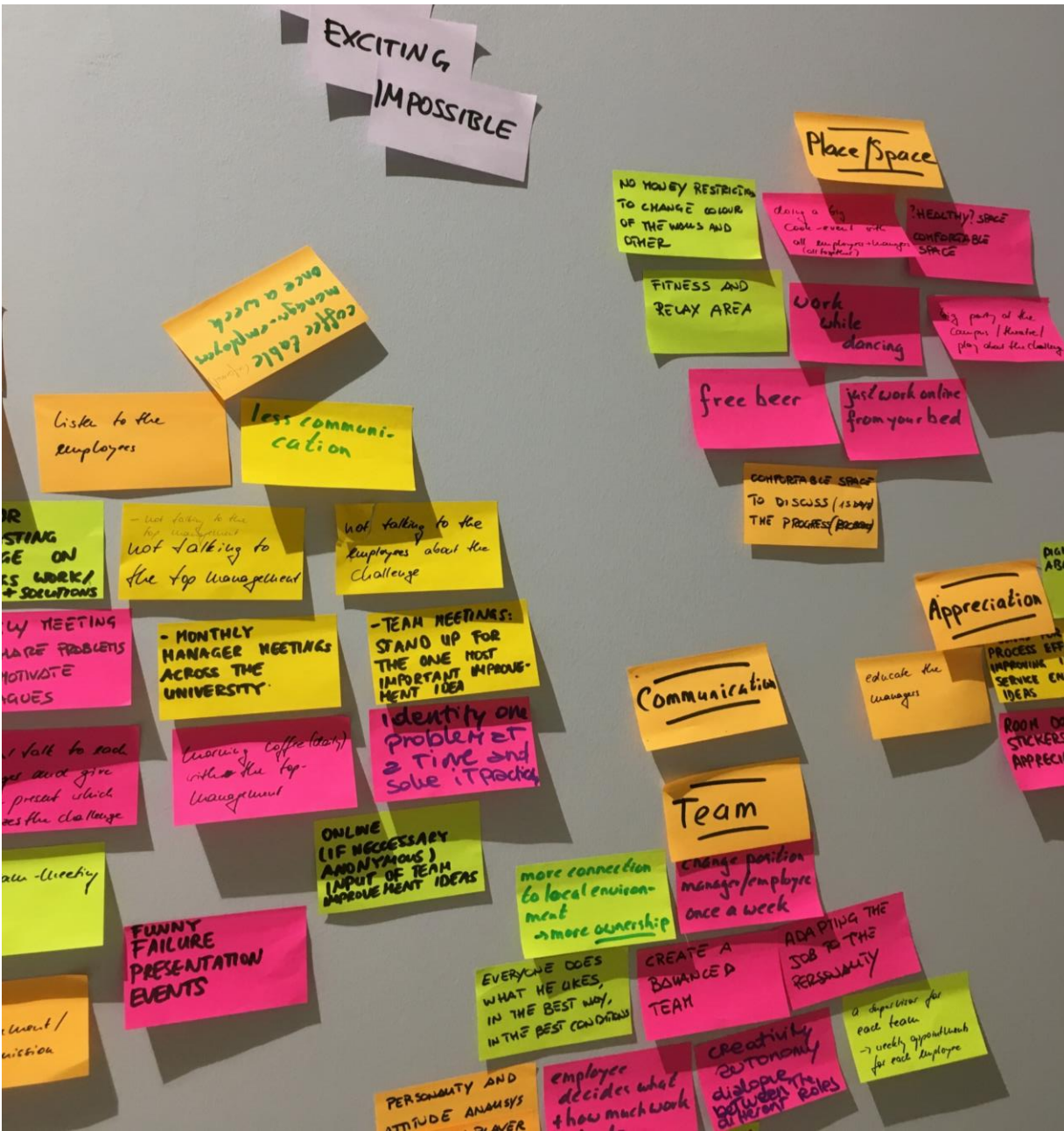academic – managers – students

Local multipliers

From LINEAR to CREATIVE thinking

DT methods & processes (group-based) 'vs.' DESIGNERLY THINKING (mindset change; individual)

Moving from being discursive to being more creative, experimental and innovative

Source: Mosely et al. (2018) with reference to Nigel Cross' work

EXCITING

IMPOSSIBLE

Place/Space

NO MONEY RESTRICTING TO CHANGE COLOUR OF THE WALLS AND OTHER

?HEALTHY? SPACE

COMFORTABLE SPACE

FITNESS AND RELAX AREA

Work while dancing

free beer

just work online from your bed

coffee meeting manager-employee once a week

Listen to the employees

less communi-cation

COMFORTABLE SPACE TO DISCUSS (13 DAYS) THE PROGRESS (BOARD)

not talking to the top management

not talking to the employees about the challenge

DIGITAL

- MONTHLY MANAGER MEETINGS ACROSS THE UNIVERSITY.

- TEAM MEETINGS: STAND UP FOR THE ONE MOST IMPORTANT IMPROVE-MENT IDEA

Appreciation

educate the managers

PROCESS EFFIC IMPROVING IN SERVICE ENV IDEAS

Communication

Identity one problem at a time and solve it practice

ROOM DOO STICKERS APPRECIA

Team

ONLINE (IF NECCESSARY ANONYMOUS) INPUT OF TEAM IMPROVEMENT IDEAS

more connection to local environ-ment → more ownership

change position manager/employee once a week

FUNNY FAILURE PRESENTATION EVENTS

EVERYONE DOES WHAT HE LIKES, IN THE BEST WAY, IN THE BEST CONDITIONS

CREATE A BALANCED TEAM

ADAPTING THE JOB TO THE PERSONALITY

a supervisor for each team → weekly opportunity for each employee

PERSONALITY AND ATTITUDE ANALYSIS

employee decides what & how much work

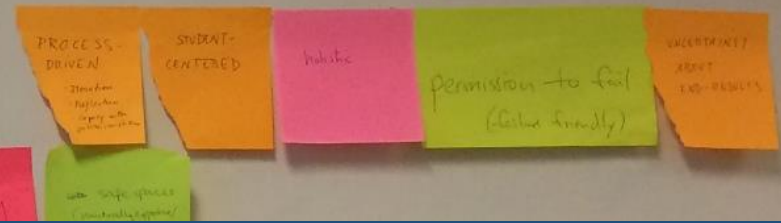creativity autonomy dialogue between the different roles

STEAM INC Experience 2019-2022

DEFINE

1. Drafted a **collaborative 'definition' of HE STEAM** from insights and intersection across current **European HE STEAM approaches**

CREATE

2. Produced **methodologies** for the implementation of STEAM thinking in **HE curricula, policy and engagement**.

EVALUATE

3. Created an **evaluation framework** for measuring the **effectiveness of STEAM processes in HE**.

STEAMhouse
Powered by BIRMINGHAM CITY University

ual: university of the arts london

A! Aalto University

ARS ELECTRONICA

UNIVERSITY OF AMSTERDAM

Trinity College The University of Dublin

TECHNISCHE UNIVERSITÄT DRESDEN

Culture (s) (eg - equal footing for arts + science)

within paradigm (eg. process-driven)

A Higher Education approach to STEAM potentially involves:

- a culture (or cultures) that puts the Arts and Sciences on an **equal** footing
- operating within a paradigm that is **process-driven**, student-centred, holistic and provides permission to fail alongside being comfortable with uncertain end-results
- being **collaborative**, diverse and delivered through safe spaces
- establishing a mindset of **radical openness**, flexibility, reflection, experimentation and curiosity
- generating qualities that **promote learning**, cooperation and multi-modality
- supporting practices that are transdisciplinary and emphasise **prototyping and making** whilst considering modes of assessment
- developing competencies of **critical thinking**, creativity and communication whilst investigating how these can be applied to generate solutions

Qualities / Characteristics	Sources	Qualities / Characteristics	Sources
Balance and Navigation	Chappell et al (2019)	Inclusivity	Bequette & Bequette (2014) Pollock et al 2017; Segarra et al. 2018
Collaboration, Cooperation, Reciprocity	Bertrand & Namukasa (2020): Chappell et al. (2019); Drozd et al. (2017), Guyotte et al. (2014); Pollock et al. 2017; Segarra et al. 2018.	Imagination	Bequette & Bequette (2014); Bertrand & Namukasa (2010), Chappell et al. (2019)
Communication, Dialogue	Bequette & Bequette (2014); Chappell et al. (2019); Guyotte et al. (2014)	Immersion & Play	Bertrand & Namukasa (2020); Chappell et al. (2019); Drozd et al (2017)
Connecting (people, knowledge, environment, processes); Contextualisation, Bigger Picture	Bequette & Bequette (2014), Burnard et al. (2021), Chappell et al. (2019) Clark & Button (2011), Drozd et al. (2017); Guyotte et al. (2014)	Innovation, Advancing Knowledge/Methods	Bertrand & Namukasa (2010), Kim et al. (2018)
Creative Thinking, Synthetic Thinking	Bequette & Bequette (2014), Chappell et al. (2019), Conradty & Bogner (2018), Guyotte et al. (2014)	Interdisciplinary, Transdisciplinary	Bertrand & Namukasa (2020); Chappell et al. (2019); Drozd et al. (2017); Guyotte et al. (2014); Pollock et al. 2017
Critical Thinking/Reasoning	Bertrand & Namukasa (2021), Chappell et al. (2019) Guyotte et al. (2014)	Meaning-making	Guyotte et al. (2014) Segarra et al. 2018
Cultural Sensitivity	de la Garza 2019, Segarra et al. 2018	Problem-based (problem finding, framing and solving), Authentic	Bequette & Bequette (2014); Bertrand & Namukasa (2020); Clark & Button (2011); Drozd et al. (2017); Guyotte et al. (2014); Kim et al. (2018) Segarra et al. 2018
Curiosity	Bequette & Bequette (2014), Bertrand & Namukasa (2010	Process-orientated	Bequette & Bequette (2014); Bertrand & Namukasa (2020); Chappell et al (2019); Guyotte et al. (2014)
Empowerment, Agency; Make/Do	Bertrand & Namukasa (2020), Chappell et al (2019) Guyotte et al. (2014)	Project-based Partnership	Drozd et al. (2017); Guyotte et al. (2014)
Empathy	Guyotte et al. (2014)	Reflection	Bertrand & Namukasa (2020); Guyotte et al. (2014); Segarra et al. 2018
Ethics, Trust	Chappell et al. (2019) Guyotte et al. (2014)	Risk-taking	Bequette & Bequette (2014); Chappell et al. (2019)
Experimentation, Failure, Iterations	Bequette & Bequette (2014) Bertrand & Namukasa (2010)	Shared/Common Language	Guyotte et al. (2014); Van Gansbeke and Groenewould (2020)
Holistic	Drozd et al. (2017), Guyotte et al. (2014)	Tolerate Ambiguity & Low Specificity	Bequette & Bequette (2014)

Publications & Resources
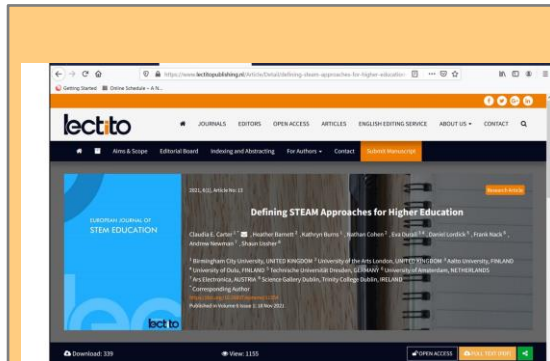
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Durall et al. (2022) 'Transdisciplinary education and innovation through STEAM'. In: Rajanen et al. (Eds) *Proceedings of the Mini-Conference on Transdisciplinary Research and Design (TRaD 2022). INTERACT No. 6, June 2022.* University of Oulu, Finland, pp. 26-33.
https://interact.oulu.fi/site/files/2022-06/interact-6-2022.pdf

STEAM INC Website
http://steaminnovation.org/resources/methods/
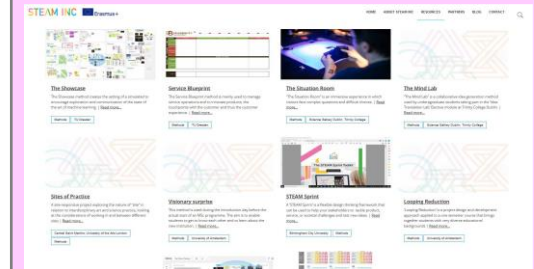
Newman et al. (2022) 'Implementing STEAM Approaches in Higher Education', *ISEA 2022 Proceedings* (forthcoming). (Presented 16/6/2022)

Differences between multi-, inter- and trans-disciplinary

Multidisciplinary
In parallel
Some synthesis to draw
elements together

Interdisciplinary
Some fusion
Exploration and blurring of boundaries

Transdisciplinary
Wider participants with new,
unexpected idea creation and fusion or
transformation in multiple ways

Source: Durall et al. (2022)

DT-STEAM NEXUS

Nexus DT-STEAM

| framing | inspiring | exploring | challenge-addressing | innovating |

- problem-**solving**
- **user centric** / perspective
- context important
- **iterative**
- **divergent-convergent**
- **prototyping**
- works well for collaborations
- thinking about the future
- flexible in terms of methods
- trust in the team
- non-hierarchical

- problem-**centred**
- **societal** perspective
- context important
- **including different perspectives**
- **fuzzy; different types of knowledges**
- **doing, experimenting, innovating**
- collaborative (**inter-/transdisciplinary**)
- thinking about the future
- flexible in terms of methods
- **mutual respect**; trust; **build relationships**
- non-hierarchical

| define | explore | create | prototype | evaluate |

The systemic design framework

Example of DT and STEAM Fusion (although not explicit about it)

Focusing on the shared benefits of all living things

Focus on existing assets – physical and social – and how we can re-use, nurture and grow these

Creating safe, shared spaces and language to bring in multiple and marginalised perspectives

Making things to see how they work and help more things emerge

From the micro to macro, from root cause to hopeful vision, from the present to the future, from the personal to the wider system

Seeing a project as one element in a wider movement for change

PEOPLE AND PLANET-CENTRED

INCLUSIVE AND WELCOMING DIFFERENCE

CIRCULAR AND REGENERATIVE

ZOOMING IN AND OUT

TESTING AND GROWING

COLLABORATING AND CONNECTING

Tensions within and between STEAM-DT

Ontology
What actually exists in the world that we can acquire knowledge about?
Truth claims (Realism …. Relativism)

STEAM-DT have the potential to operate at the CRITICAL REALISM (rather than naïve realism or relativism) spectrum, supporting critical and HOLISTIC FRAMING to addressing 21st century challenges. However, some of the RHETORIC AND POLICIES about STEAM are narrowly framed aiming to produce versatile employees for a capitalist economic system aligned to MAINSTREAM NEO-LIBERAL POLITICAL ENDEAVOURS. DT is also often expected to lead to prototypes that result in marketable products, although it has also been used more EXPLORATIVELY to scope current demands and constraints and future sustainability options (e.g. Systemic Design Framework).

Epistemology
How do we acquire/study 'knowledge'?
(Objectivist, Constructionist, Subjectivist)

STEAM and DT have potentially the scope of using a wide range of EXISTING AND CREATING NEW TOOLS/METHODS for use within collaborative endeavours. The scope for INSPIRATION AND INNOVATION especially within STEAM seems particularly pertinent. DT also shows many different interpretations and SCOPE FOR NEW VARIATIONS AND MODELS of operation/implementation, especially with it increasingly being APPLIED BEYOND DESIGN SUBJECTS AND PROFESSIONALS. There is also some focus on emphasising AMBITIOUS INTER- AND TRANS-DISCIPLINARY APPROACHES over multi-disciplinary or solely academic focused inter-disciplinary endeavours.

Philosophical Perspectives
Generalised views of the world that guide action. Reveal the assumptions that informed the choices made about
purpose, design, methodology, methods

Within DT there appears to be a distinction between 'DESIGN THINKING' and 'DESIGNERLY THINKING' potentially leading to different interpretations, choice of methods and focus of attention or claims made. Similarly within STEAM, at least four strands can be identified, namely (1) the MAKER-SPACE TRADITION of doing collaboratively with civic society and SMEs; (2) adding the A to STEM so that creative subjects GAIN FUNDING AND HIGHLIGHT RELEVANCE in a political/educational climate that prioritises technology, maths and science subjects; (3) STEAM being a bandwagon for SUSTAINABILITY and more CREATIVE AND CRITICAL, REALITY-INFORMED AND SOCIETALLY RELEVANT LEARNING; and (4) producing more AGILE, MULTI-SKILLED AND INNOVATION-DRIVEN EMPLOYEES / WORKFORCE.

Challenges across DT-STEAM Nexus

- Both not widely known or used across HE

- Balance between rigour and flexibility; danger of becoming formulaic

- Framing – **Process** – Outcomes/Outputs

- Mindset – Skills

- Lack of time

- 'Deficiency' and 'Inferiority' mode of thinking unhelpful

- Are groupings bad or ok?

- Building understanding, trust, common language

- Institutional barriers (see e.g. Carter et al. 2021)

Specific Challenges

DT

- A process and/or mindset?
- Learning by doing?
- Particular approaches – inflexible / dogmatic
- Too many approaches – time-consuming and confusing
- Do we need designers in DT applications?

STEAM

- Some disciplines/people feel excluded
- What mix / how many disciplines as a minimum to be STEAM?
- Bad experiences of other disciplines (at school or work)
- Seems better at focusing OUT than focusing IN
- Definition and role of A in STEAM (catalyst, equal partner, illustrator …)
- Multi-, inter- or trans-disciplinary?
- Capitalist / neo-liberal rationale vs. Disruptive / critical

Implications for Curriculum Design:

Many choices and value judgements needed and wide variety of possible outcomes

- Easier to run workshops or sessions rather than whole modules across courses / faculties

- Can/should Embedding Sustainability and Zero-Carbon Transition become the focus for STEAM(-DT) sessions / modules / courses and staff CPD?

- Investment of Time – Training – Space – Experimentation – Staff Retention

- Weak/strong multi-, inter- or trans-disciplinary?

- How much depth / disciplinary knowledge? How much flexibility?

- Do we always need designers and artists involved?

- Opportunities for UG / PG / PhD Research Projects

- Assessments (shift in what is assessed and how?)

⏰ Fad or Future?

Hans Dieleman (2013, p69) characterises transdisciplinarity as linking "reflective action and artful doing" and emphasises "spaces of experimentation and imagination" (p.68); it "should be considered as both a **transformative process as well as an epistemological, ontological and methodological endeavor**".

Source: Dieleman, H. (2013). From Transdisciplinary Theory to Transdisciplinary Practice: Artful Doing in Spaces on Imagination and Experimentation. In B. Nicolescu and A. Ertas (Eds) *Transdisciplinary Theory & Practice,* Chapter 5, pp67-85. The Academy of Transdisciplinary Learning & Advanced Studies (The ATLAS).

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