Re-visioning STEAM?

The exciting provocation of displacing the visual in science education and re-configuring humans and more than humans' co-habitation in a world in transformation

Laura Colucci-Gray

Professor in Science and Sustainability Education

Moray House School of Education and Sport,

University of Edinburgh

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ARCTIC OCEAN
Greenland
Svalbard (Nor.)
ARCTIC OCEAN
United States
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Iceland
Norway
Sweden
Finland
Russia
United Kingdom
Ireland
Den.
Neth.
Estonia
Latvia
Belarus
Ger.
Pol.
Ukraine
Kazakhstan
Mongolia
France
Rom.
Georgia
Spain
Portugal
Italy
Bulgaria
Azer.
Uzb.
Turkm.
Kyrgyzstan
Tajikistan
ATLANTIC OCEAN
Turkey
Greece
Tunisia
Lebanon
Syria
Iraq
Iran
Afg.
China
N. Korea
S. Korea
Japan
Morocco
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Pakistan
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Djibouti
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Somalia
Cambodia
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Kenya
Dem. Rep. of Congo
Rep. of the Congo
Tanzania
Angola
Zambia
Malawi
Madagascar
Indonesia
Papua New Guinea
Solomon Islands
Fiji
Peru
Brazil
Bolivia
Paraguay
Namibia
Botswana
Zimbabwe
Mozambique
Swaziland
Lesotho
Australia
Chile
Argentina
Uruguay
South Africa
New Zealand

Overview of this talk

- STEAM education as a boundary-object, performative, theory-practice construct connecting with *multiple sectors in society serving different educational agendas;*

- Re-formulation of STEAM education as an ecological and ethical practice: of *being-in, attending to and making-with the world;*

- *Examples of projects drawing on STEAM approaches re-configuring science education in the current climate…*

A gathering of STEAM…a rather simple idea…

Conventionally defined as STEM- Science, Technology, Engineering and Mathematics

With the addition of Art

With the ambition to promote uptake of scientific subjects and to serve the needs and demands of a growing economy.

… not so new!

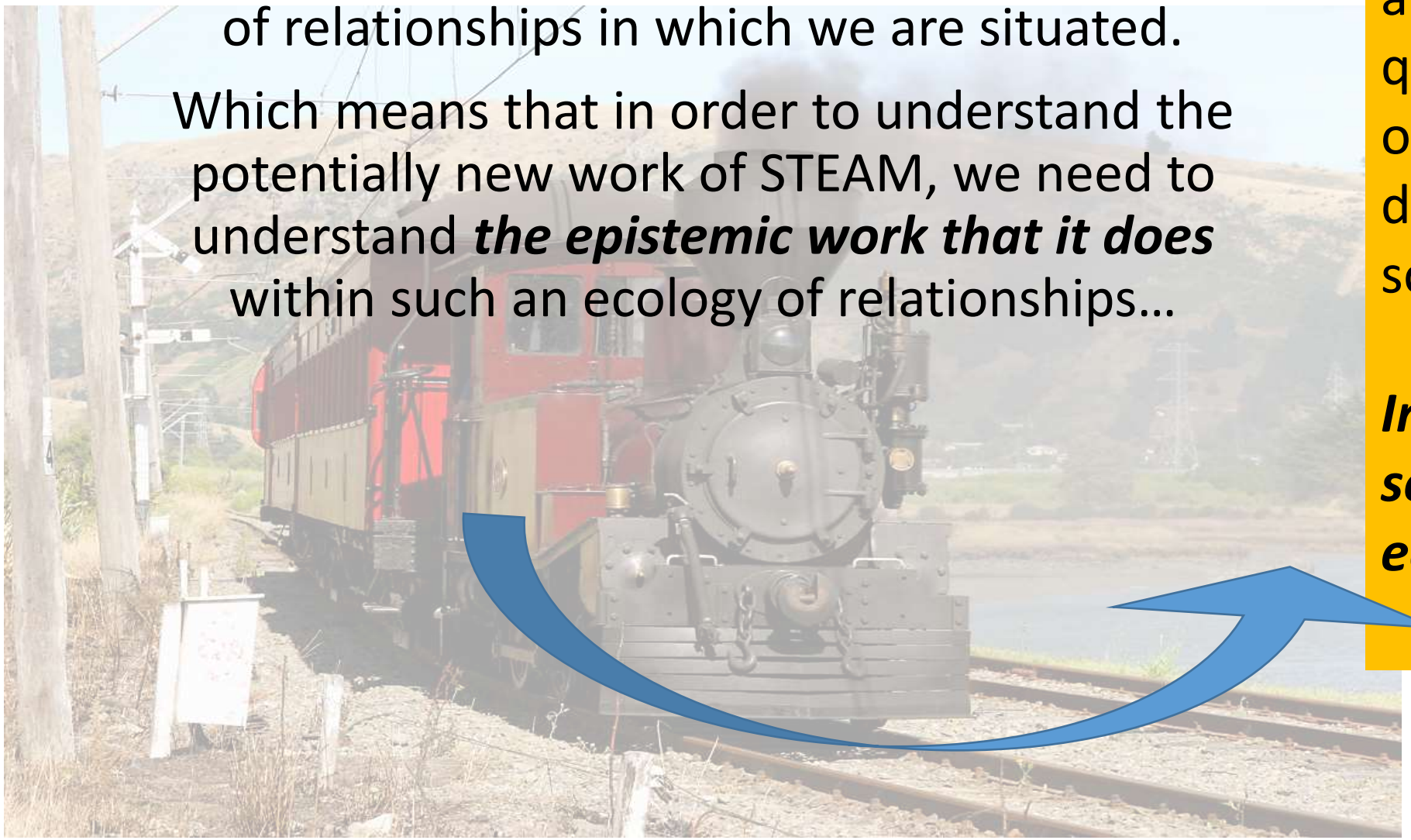
Art is kept generic; its function not particularly defined

Largely proposed as handmaiden to STEM education: to promote interest, to appeal; to enhance creativity and innovation and even, to promote inclusion in science for particular groups of students.

Cultural Learning Alliance (2017). *STEAM.* Why *STEM* can only take us so far. Available at : CLA-STEAM-Briefing-A4.pdf (culturallearningalliance.org.uk). Accessed on 14.11.2021

What is new or at least, exciting and important to pursue is the task of attending to the ecology of relationships in which we are situated.

Which means that in order to understand the potentially new work of STEAM, we need to understand ***the epistemic work that it does*** within such an ecology of relationships…



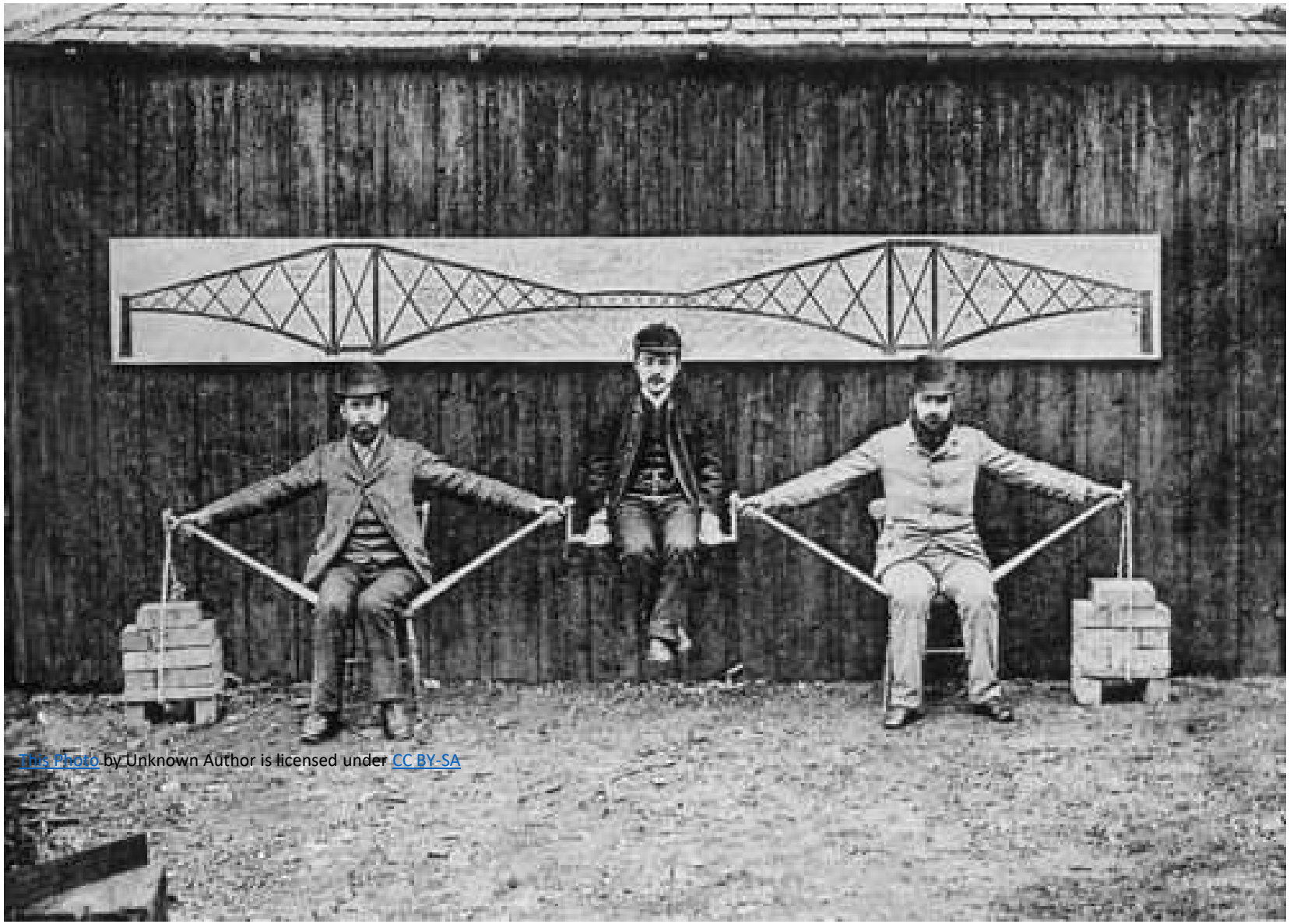
This means moving away from the old question: what kind of science education do we need for society?

In what kind of society does science education take place?

The view from the Bridge of Forth - Edinburgh

Second longest cantilever railway bridge across the Firth of Forth in the east of Scotland, 9 miles (14 kilometres) west of central Edinburgh. Completed in 1890, it is considered a symbol of Scotland (having been voted Scotland's greatest man-made wonder in 2016), and is a UNESCO World Heritage Site

A cantilever…?



… with arms stretching horizontally outwards…

The view from the Bridge of Forth

The bridge uses 55,000 tonnes of steel and 110,000 cubic metres of masonry, incl. granite from Aberdeen, Arbroath rubble, sand, timber, coke and coal. Steel was delivered by train. The cement used was Portland cement manufactured on the river Medway. It required to be stored before use and up to 1,200 tonnes of cement were kept in a barge, moored off South Queensferry.[53]

The bridge as an educational event in science education (1):

Disciplinary content knowledge:

Marine food webs (S)

Coastal erosion (S,T,E)

Exchanges of CO2 between oceans and atmosphere

Formation of clouds and fog over the forth (S,T,E,A,M)

Edinburgh – Railway bridge over the Firth of Forth

Epistemic work

A bunch of disciplinary subjects

The bridge as an object in front of us

A solid surface underneath the seats

A relatively neutral utility: the bridge stands there as an assemblage of screws, bolts and facts, with no past and no future.

The bridge as an educational event in science education (2):

A socio-cultural view:

Purposeful design;

Mobilisation of materials and energy to create new forms and new structures;

Movement of people and goods is elevated from the sea and shifted to the land;

Commerce, transport, tourism and economic and social needs are met with a ***pragmatic*** solution;

Edinburgh – Railway bridge over the Firth of Forth

Epistemic work

Not a bunch of facts but a material and performative knowledge;

It arises from human action in the environment which develops and changes ***in the world .***

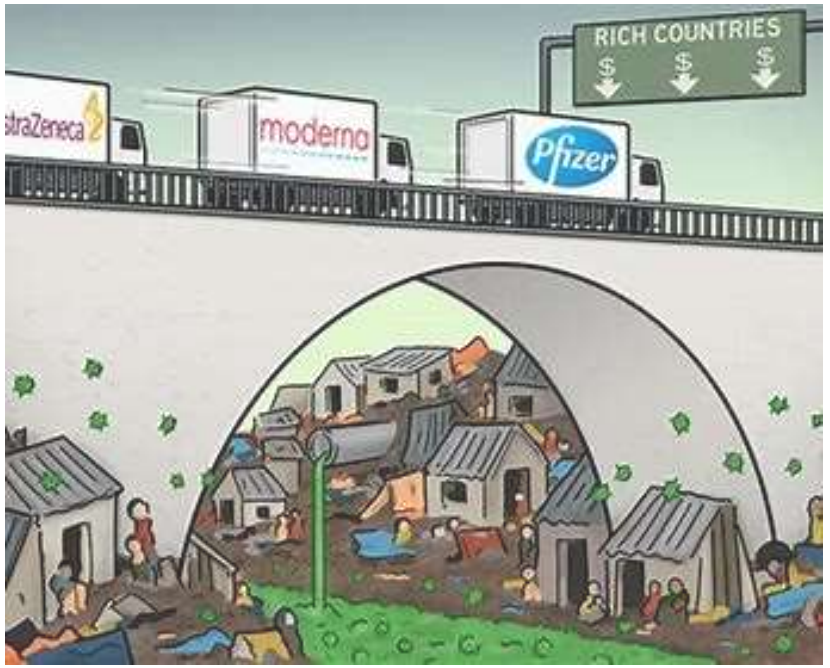
Society changed from a marine life regulated by the rythm of the tides to a terrestrial view regulated by **the beat** of industry and **the speed** trade

Techno-Social change

The rate of social and ecological change *recorded and measured through data* over the past 100 years has been so dramatic and perceptible to be comparable to the forces of **evolutionary change…**

The movement from STEM to STEAM, with its emphasis on real-world applications, promises to meet the changing needs of a globally connected world…

1. We are both and at the same time beneficiaries and (un-)equal accomplices in the processes of socio-ecological transformations



2. Such socio-technical change is not simply intellectual but hugely experiential; differential access to energy use influences the ways we 'see' the world, what priorities we identify and what needs and then of course, how we relate with others, in different ways…

Critical voices from the Sciences, the Arts and the Humanities

Val Plumwood (Philosopher and eco-feminist):

…we're still largely trapped inside the enlightenment tale of progress as human control over a passive and "dead" nature, that justifies both colonial conquests and commodity economies.

The real threat is … our own inability to see past the post-enlightenment consumption extravaganza we so naively identify with the good, civilized life to a sustainable form of human culture. The time of Homo reflectus, the self-critical and self-revising one, has surely come. Homo faber, the thoughtless tinkerer, is clearly not going to ***make it***.

How can we *draw together* matters of concern so as to offer […] a view, of **the difficulties that will entangle us every time we must modify the practical details of our material existence?**

(Stephan, 2015)

Ecologies of Dis-connection

Everything is not necessarily as in process, interconnected and ‘entangled’ as we might imagine. ‘**Rather than being a totality, nature should be understood locally,** as a means of allowing the creation of a temporal procedure of mediation, **as detour—spatial and temporal—allowing us to measure the relations we produce and the material limits belonging to these relations**.’ [Frédéric Neyrat, Preface to Horl’s General Ecology, 2017]

Attending to the mundane and the ordinary; put on the table the stuff of everyday human existence, **attending both to the relation and to the limit,** the connection and what could shatter it….. (Neyrat, 2017)

W. Eggleston
"The Democratic forest"
1976

"What did you do today? I just went for a walk, I took some pictures…" (Eggleston interviewed by BCC, 1980)

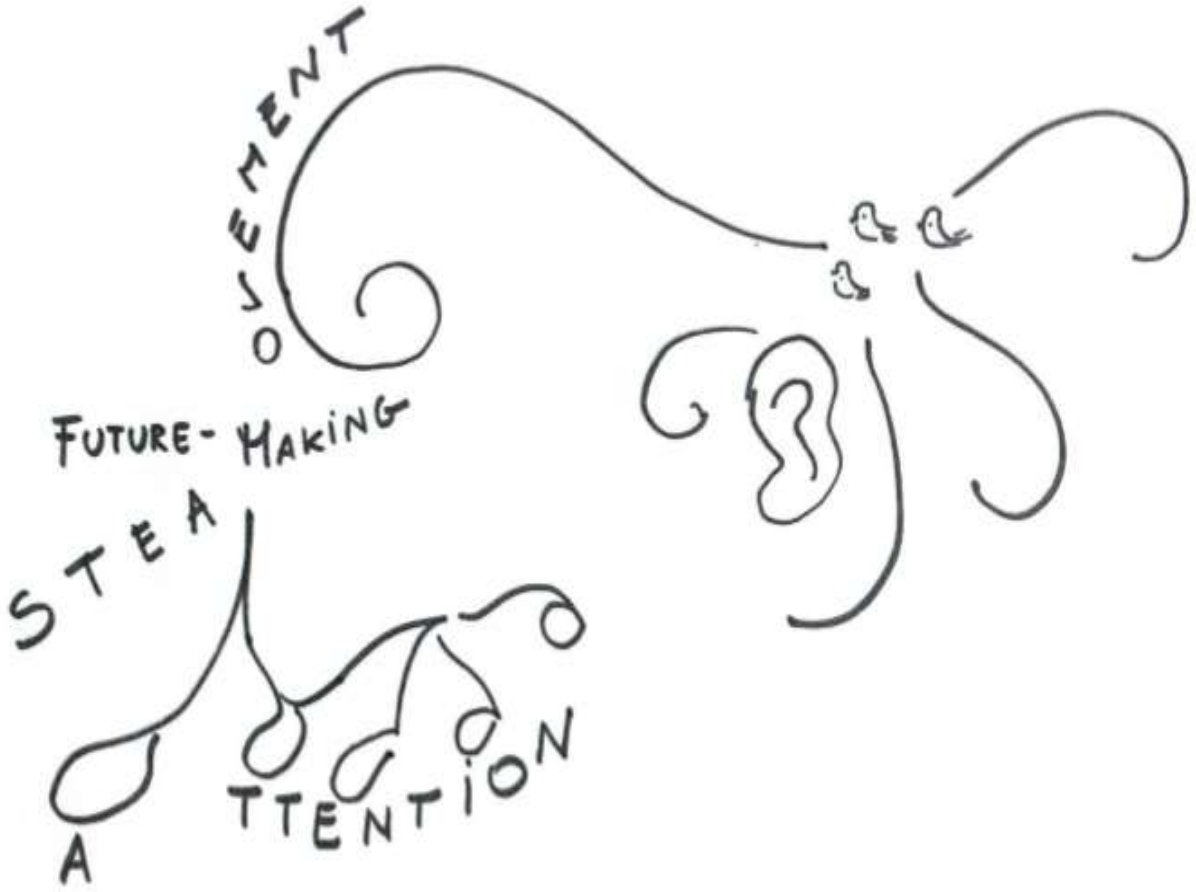

INNDÆLING
SLÖKKVILIÐS
FYRIR ÚÐAKERFI


Stigleiðsla
slökkvibúnaður
hindrið ekki aðgang

Paul Ricoeur described **aesthetic perception** as a kind of world's disclosure, as the phenomena of the world are made present to us, and we are present to ourselves, through everyday interactions (Josephsson et al., 2022).

Introduction to Part 2

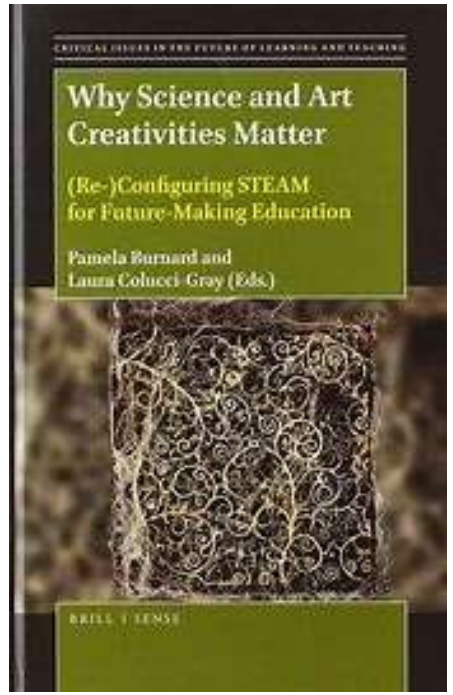
Pamela Burnard and Laura Colucci-Gray



The body is not a passive decoder of information, but an active interpreter, tuning in with the internal and the external world.

In educational terms this means greater sensitivity to how we perceive,
make and
Inhabit
a shared world.

Aesthetic Attention or *Attentiveness*



In science education...

- Convergence of practical epistemologies (Wickman, 2006 and 2017; Østergaard, 2017 and 2019; Gray, 2023); and feminist, socio-materialist accounts (Braidotti, 2019; Burnard, Colucci-Gray and Cooke, 2021) which have more recently concerned themselves with the **'affective turn'** (Alsop, 2016; 2017).

- Affect is akin to 'undergoing something' and encompasses the various capacities of physical bodies to affect and to be affected through forces and intensities that are visceral (see Cichosz, 2014: 56).
- All matter is alive and in process: a complex, interwoven web of materials, all affecting each other, competing, forming alliances, initiating new processes and dissipating others. Humans are inextricably enmeshed in these webs that Bennett calls assemblages.

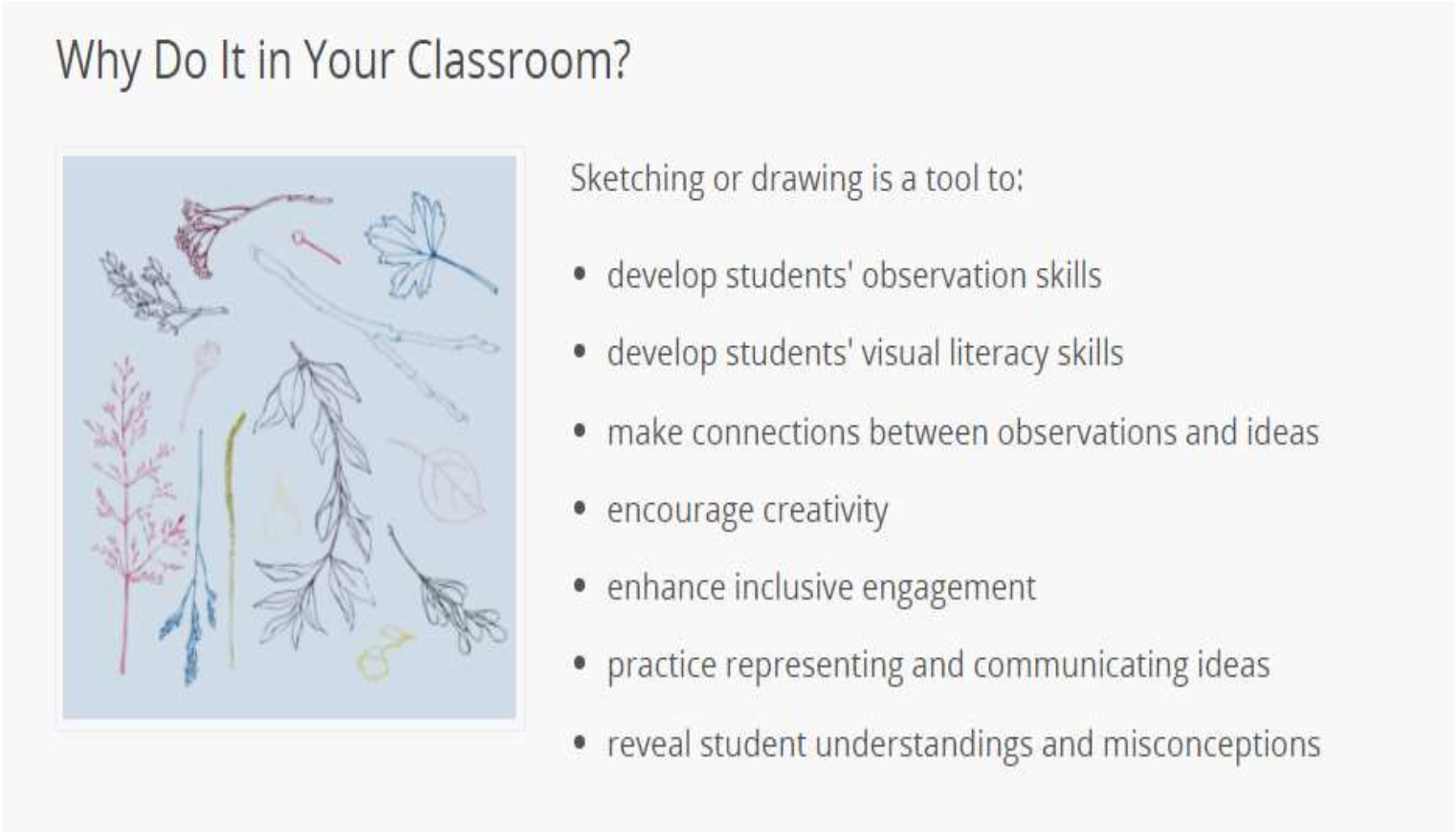
- **Sensory encounters** enable us to **draw relational engagements with an ecology of materials** as “one measures a bowl with water, or water with rocks, or rocks with hardness” (De Freitas & Sinclair, 2020, p. 100796). which Deleuze and Guattari (1988, p. 31) referred to as “minor” gestures.

- In this way, humans and non-humans partake in the same way in the process of knowing; not by taking a position from above or from outside but by engaging in practices through which *“the world is differently articulated and accounted for” (*Barad, 2007, p. 149).

STEAM education as convergent attentionality (a)

1. The Arts as a means to support model-making, thinking and doing

(see Thurley, 2016, Segarra et al., 2018; Brown, 2019).



https://plantingscience.org/teachercommunicatingscience/sketching-and-drawing-in-science-class

Both Arts and Sciences implicated in processes of ‘divergent attentionality’ (b)

Ostergaard (2020**): Teaching of the phenomenon**,

The emphasis is not on music notation or on the science of sound and vibration, but in what happens between the tambourine and the hand, the inside and the outside…

Cooke (2020): listening to the more-than-human

Cooke, p. 413 in Burnard & Colucci-Gray (2020)

FIGURE 17.5 Touching … slowly

This involves being attentive to how the senses make and create. Masschelein defines attention as related to care, being at, being present, listening to, going along with and implying a "kind of waiting … [as related] to the [French] verb attendre" (Masschelein, 2010: 48). In my project this has involved making with senses in the workshops with the music student teachers and their course

As time passed, the children held the litter more in the palms of their hands and they looked closely at the pieces, some bringing them close up to their faces. They spoke about the texture and the lustre; they discussed where the objects should be placed in the mandala. They placed the pieces with care and with intention. Some pieces were placed and then re-placed, perhaps turned slightly or relocated to make sense with other pieces already there. Most of the placements they discussed with each other; I remained a silent observer. There was much animated chatter and exclamation throughout. There were many utterances of disgust but then also many of surprise and wonder. "I wonder how that got there?" was heard several times. Parts of shoes were of particular interest and they prompted the question: "Why would anyone want to throw this away?"

Francis, p. 395 in Burnard & Coluccci-Gray (2020)

- What type of science do we presently represent, as well as what we might represent, and upon what bases might we decide?
- To what extent do we invite affective experiences in the science classroom; let them guide the reshaping of subject boundaries and the remaking of new forms of co-living?

The withering of the plants triggered the quest for water; and validation of learning lies in the yield, in the garden's looks.

(Burnard, Colucci-Gray & Cooke, 2022, p.188).

"As the plants continued to grow, so did the children's status in the school, from pupils and learners to curators-guardians-gardeners-cultivators.

In the acquisition of skilled practice there was a cultivation of an **acquaintance, of a relationship of familiarity, of kinship"**

(Burnard, Colucci-Gray & Cooke, 2022, p.188).

As Haraway maintains, learning to stay with the trouble of living and dying together on a damaged earth requires sympoiesis, not simply making new things, but "making-with."

"What is at stake. . .is a theory of ecological relationality that takes seriously organisms' practices, their inventions, and experimenting crafting interspecies lives and worlds . . . an ecology inspired by the feminist ethic of response-ability" (2016, p. 168).

Making; not as an act of simple improvisation but as the careful, attentive and persistent gesture of redirecting attention to the quest for one's and others' sustainability.

"You can't hurry the salt dough to dry unless you put it in the microwave and cracks may form";

"you can't hurry the ink to dry unless you blow on the paper and then ink may spill…"

How do we work with things according to their pace which may not be the same as your pace?

How does such change impact the spaces, equipment, attitudes and purposes of science education curricula?

What does STEAM mean for science education:

1. **From Creativity to Pluriversality of creativities** (which is different from a plurality of people deemed to be creative or do creative things) to critique the politics of the visible, and foster a redistribution of what is seen and heard in a science education environment.

2. **Experimenting with newly authored ways of doing and being in science education, drawing on** an assemblage of physical, emotional, psychological, and affective forces.

3. **'Democratising' ways of sensing and doing, by** producing and instigating multiple and heterogenous knowledge pathways **as sites of democratic trans-corporeality** that are plural, eruptive and radically generative in science education.

As Haraway (2008) argues:

To hold in regard, to respond, to look back reciprocally, to notice, to pay attention, to have courteous regard for, to esteem: all of that is tied to polite greeting, to constituting the polis, where and when species meet. (p. 19)

Thank you!

Laura Colucci-Gray
Moray House School of Education and Sport,
University of Edinburgh

Laura.Colucci-Gray@ed.ac.uk