# Beyond the veil: Reconfiguring STEAM for a Sustainable and Equitable Science Education

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It is the 5<sup>th</sup> of July...

Why are we here to talk about STEAM?

Which drivers? Whose voices? What questions?

#### 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.

problem?

So what is the

#### 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.

#### Where does STEM + Arts come from?

#### **Big Science:**

a term used by historians of science to describe a series of changes in <u>science</u> which occurred in industrialised nations during and after World War II, as scientific progress increasingly came to rely on large-scale projects usually funded by national governments or groups of governments.

Big budgets; big teams and big machines: e.g.
 Ernest Lawrence's cyclotron at his Radiation
 Laboratory ushered in an era of massive machines as the tools of basic scientific research.



The Tevatron, the world's highest-energy protonantiproton collider, shut down on Sept. 30, 2011.

#### **Technoscience**

empirical verification requires experiments using constructions, such as the Large Hadron Collider, costing between \$5 and \$10 billion.[2]

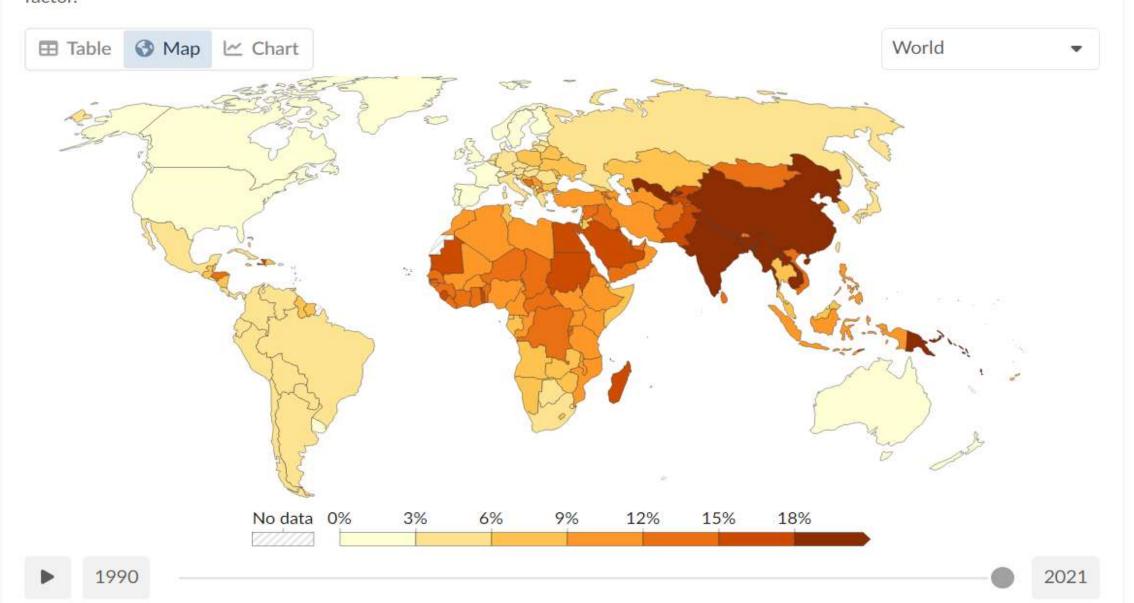
"the world has become the laboratory" (Latour, 1992)

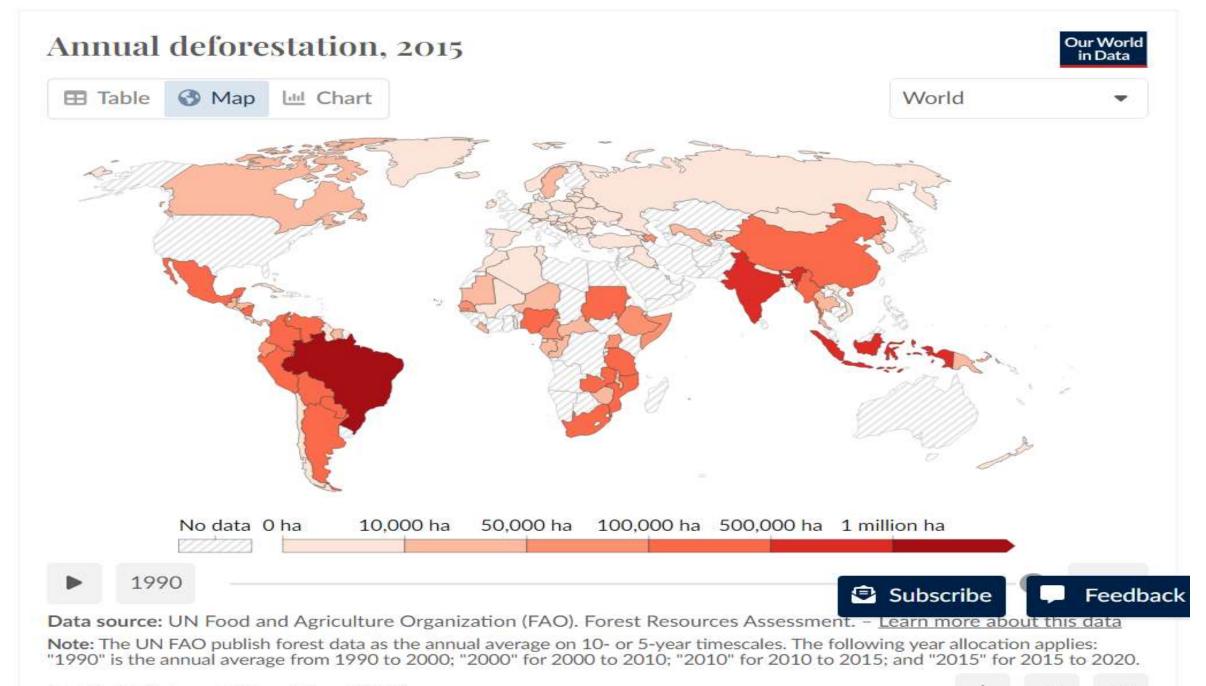
- Shifting from public research to commissioned research
- Pragmatic & Interventionist focus cause and effect
- Promise & Risk
- Requiring to gain the public's trust and to demonstrate gains and impacts...

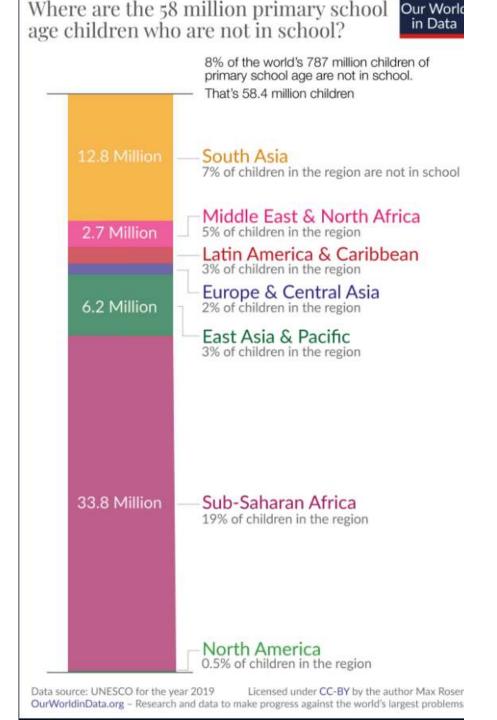
#### Share of deaths attributed to air pollution, 2021



Share of deaths, from any cause, which are attributed to air pollution – from outdoor and indoor sources – as a risk factor.

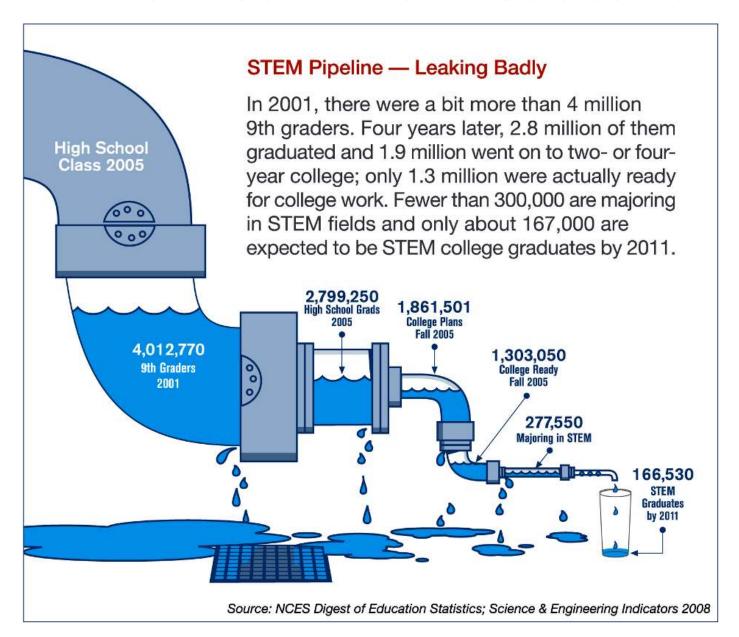






8% of the world's primary school age children are not in school

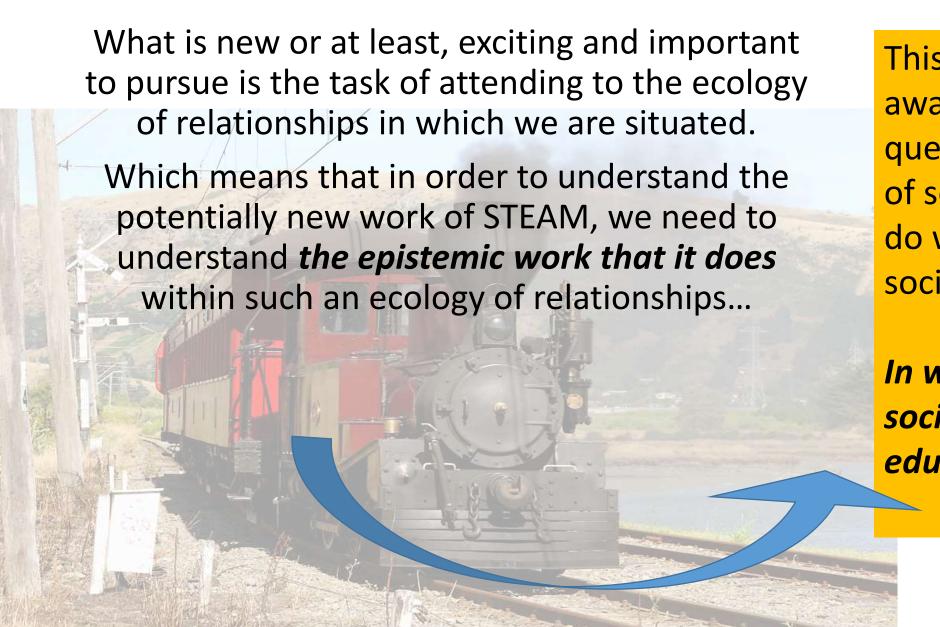
#### In the meantime in education...



# A in STEAM... Advertising? Appealing? Appeasing?

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...



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?

### If Science or Arts have anything new to offer...

This means moving out of their ritualistic contexts...

... and quite literally stepping back,

as it were, and watching our imagination come into play...

... Taking into account of **the** interplay between the artist and the beholder drawn into the magic circle of conjuring of an image ...

Creating an illusion between actions and expectations that is, in fact, real

[Gombridge, 1959; p. 167]



BRIDGES – Building Reflexivity and response-ability Involving Different narratives of knowledGE and Science

**SENSE:** Sensory Exploration of Nature in School

[Aberdeen City Council; ODA/Scottish Government;

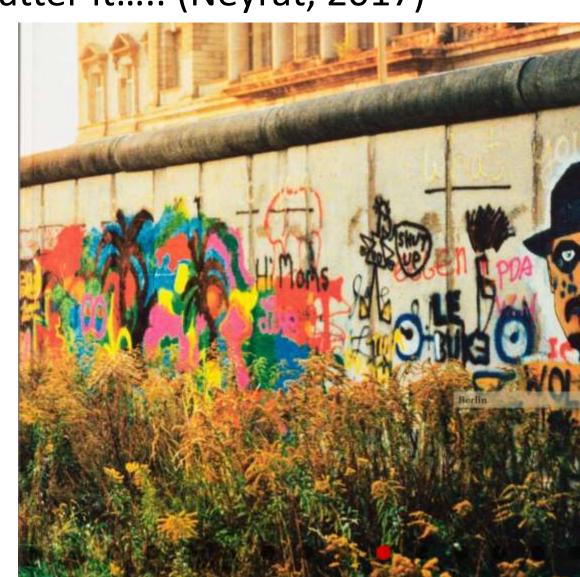
Paul Ricoeur described aesthetic perception as a kind of world's disclosure, as the phenomena of the world are made present to us, and we are present to ourselves, through everyday interactions (Josephsson et al., 2022).

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

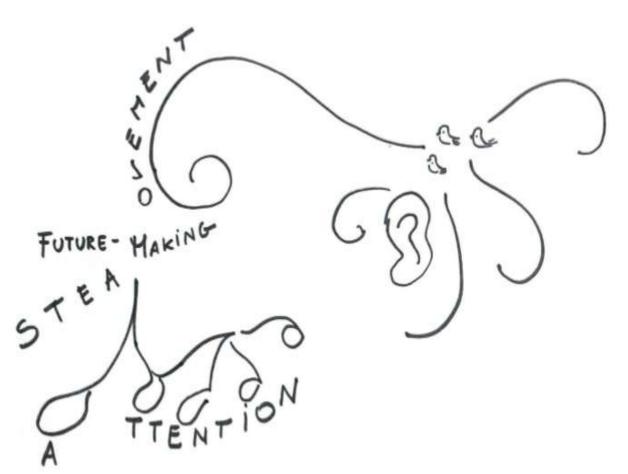
"What did you do today? I just went for a walk, I took some pictures..." (Eggleston interviewed by BCC, 1980)



# What is the world asking of me?

#### Introduction to Part 2

Pamela Burnard and Laura Colucci-Gray

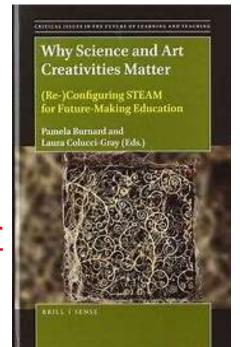


The body is not a passive decoder of information, but an <u>active</u> <u>interpreter, tuning in</u> with the internal and the external world.

In educational terms this means greater sensitivity to how we

perceive, make-with and in-habit a shared world.

<u>Aesthetic Attention or</u> <u>Attentiveness</u>



## Ostergaard (2020): The teaching of the phenomenon,

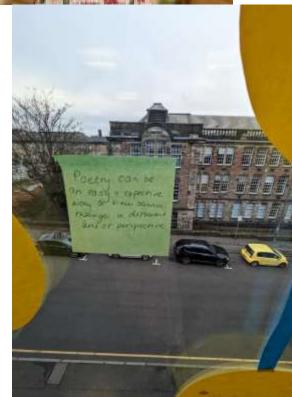
The emphasis is not on music notation or on the science of sound and vibration, but in what happens between the tambourine and the hand, the inside and the outside...



How does this practice displace the canonical gaze from telling to listening..?

From delivery of knowledge to being with and makingwith...

From mono-sensorial classrooms where one sense dominates to ateliers of plural and diverse sensibilities...



#### From Technology to Time

To attend... & To attendre...

to lean towards; to wait for; to care for...



**From Technology to Time**: moving away from a model of expertise to making-with soil and with its stories.

Each tool afforded different ways of making community with soil...

The spade, the pen, the brush, the hands...





DIGGING = Bringing soil to the surface

Practical, Scientific and Artistic actions







#### From Engineering to an Ecology of relationships

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:

"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).

- 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?

#### From Mathematics to ... Making-with

Or Sympoiesis, not simply making new things, but "making-with." (Haraway, 2016)



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?

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).

#### 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.

# ALTERNATIVE ENDING SLIDE- WITH SOME REFLECTIVE QUESTIONS

- How do we pay attention to the spaces in which we operate...
- And the how do we allow for expanding, slowing down, deepening the time for action?
- How do remain alert to the ways we enter in relationship with our participants? Do we participate and partake in the journey?
- How do we attend to the hidden curriculum of the materials and what this carries?



## Thank you!

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