Transformative STEAM Educators Developing Students' Capabilities For Resolving Global Sustainability Crises

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ABSTRACT

This paper discusses about (a) the urgent global problem of unsustainable development of the Earth's natural systems, and (b) a promising way forward in the form of a transformative educational perspective that integrates STEM education and Arts education. I illustrated how this transformative STEAM curricular and pedagogical perspective is currently being implemented by educators in universities and schools across Indonesia, Nepal, Hong Kong, Southern Africa, Philippines and Australia. A detailed account can be found in two recently published books that provide insightful accounts of both the theory and practice of transformative learning and STEAM education for sustainable development This paper provides a synopsis of the main ideas.

Keywords: *sustainable development,* transformative educational, *STEM education, art education.*

1. MATERIALISTIC WORLDVIEW

The Age of Enlightenment in 17th century Europe gave birth to the modern scientific worldview. Since then education systems have engaged students of the natural sciences (and related disciplines) in learning to understand at arm's length (i.e., objectively) the world *out there*: the material world of naturally occurring phenomena, processes and events.

Technology has always been intimately linked with scientific progress, from the first microscopes that revealed a hidden universe to the machinery of space exploration that detects the beginnings of our universe. Today, our rapidly globalizing materialistic worldview, armed with immensely powerful technologies, is producing mixed results.

Few would disagree that our materialistic worldview has enhanced our lives by providing advanced health systems and medical interventions, global communication and transport systems, labor-saving devices, pest-resistant GM food crops, robotization of industrial production, and so on. However, these advancements of modernity are not beyond critique in terms of the *human interests* they are designed to serve, especially when driven by the imperatives of the global market economy.

1.1. Unsustainable Development

One of the most pronounced downsides of our materialistic worldview is the way it is aiding and abetting the extinction of life on Earth, as a consequence of ushering in the *Anthropocene*, a geological era in which the 'human footprint' is irrevocably disrupting our planet's natural systems.

Climate change is giving rise to extreme weather conditions that are acidifying the oceans, fanning catastrophic wildfires, and decimating ecosystems and biodiversity. Plastic production, consumption and nonrecyclable waste is polluting rivers and oceans, and microplastic particles are killing marine wildlife and intruding toxically into our food chains.

1.2. Disconnect

So, why do we persist in acting destructively towards our natural ecosystems that give rise to and support life on Earth? Why do we have such disrespect for the natural world? What *values* (i.e., deep-seated beliefs) drive our destructive habits of mind and social practices? My view is that we have become estranged from the natural world, partly as a result of an unduly materialistic worldview that privileges the *false binary* of humanity over nature, and partly as result of our metropolitan lifestyles that have largely divorced us from living in, or having intimate connection with, the natural world.

Our disconnect from the natural world becomes even more deeply entrenched when we educate (indoctrinate?) young people *exclusively* in the materialistic worldview of the natural sciences, which directs them to examine nature solely through the lens of *cold logic* (or objectivity) embedded in the socio-cultural myth of *value-neutrality*. A narrow patriarchal myth that feminist science has recently critically exposed

2. TRANSFORMATIVE LEARNING

An ambition that I share with like-minded colleagues is to ensure that STEM education is driven by a broad concept of the public good, one that incorporates UNESCO's four dimensions of sustainable development. To this end, we have embraced a social philosophy of transformative education to guide the design and implementation of socially responsible STEM teaching and learning approaches.

Our aim is to develop students' *transdisciplinary capabilities* for engaging as *ethically astute citizens* in sustainable development debates, decision-making and social practices for the benefit of their families, workplaces, communities and the biosphere of the planet; to the benefit of our children, grandchildren, and beyond.

Transformative learning involves students developing a range of *transdisciplinary capabilities* in conjunction with STEM-related disciplinary knowledge, skills and values. Transdisciplinary capabilities expand students' ways of knowing about and valuing their inner worlds, especially how their valued belief systems frame (limit) their understanding of the outer world and their participatory relationship with it.

Transformative learning activities bring students' (largely implicit) value systems to consciousness, enabling them to assess the viability of their established and emergent values as they engage in educative conversations with fellow students and the teacher. Using cognitive, emotional, social and spiritual development methods, students learn to reconceptualise and reshape the dialectical relationship between their outer and inner worlds.

We have found it useful to articulate an operational definition of transformative learning as five interconnected ways of learning deeply about the relationship between one's inner and outer worlds.

- *Cultural-self knowing* (self-realisation): learning to engage in critical self-reflection to understand the framing of one's culturally situated self, in particular how the (mostly invisible) premises underpinning one's worldview – shared values, beliefs, ideals, emotionality, spirituality – give rise to one's cultural identity and govern one's habituated way of being in, making sense of, and relating to the social and natural worlds.

- *Relational knowing* (connecting): learning to connect empathically and compassionately with culturally different others - especially those of diverse genders, ethnicities and spiritualities - and to appreciate firsthand the innate beauty of the natural world.

- *Critical social knowing* (political astuteness): learning how and why political, institutional, and economic power has structured historically our social realities by creating seemingly natural (and deterministic) categories of social class, race, sex, vocation, intelligence, etc.; and how this mostly invisible power governs (restrains) our lifeworlds, our relationships with others, and our relationship with the natural world.

- *Visionary and ethical knowing* (altruism): learning to engage in creative, inspirational and discursive processes of idealising, imagining, poeticising, romanticising, meditating on and negotiating a collective vision of what a better world *could* (ideally) be and, importantly, what a better world *should* (ethically, morally) become.

- *Knowing in action* (agency): learning to consciously develop the capacity to help make the world a better (sustainable) place, committing to making a difference, and taking action locally while thinking globally.

3. ART EDUCATION

So, this brings me to the question of how the Arts can help to save us from ourselves, from our misguided destructive tendency of exploiting the natural world as a combination of infinite resource and trash can? The 'us'

I am referring to are science, technology, engineering and mathematics (STEM) educators in schools and universities worldwide who have invested their professional lives in transmitting a hegemonic materialistic worldview to their students, many of whom graduate to become reproductive STEM teachers of future generations. And thus the same wheel continues to turn.

As a decades-long mentor of STEM educators undertaking Arts-enriched postgraduate research, I have witnessed the power of the Arts to elicit STEM students' critical reflective insights into their nonmaterial worlds – the world *in here* - the subjective realm of personal experience wherein lie our sedimented values that underpin our cultural identities and social practices.

The Arts provide powerful transformative learning and teaching methods for enabling us to transform the worldviews of our students, to expand their inner horizons, to become more fully human. These methods, which derive from four domains - *aesthetics, ethics, creativity, rhetoric* – empower students by developing their *transdisciplinary capabilities*:

- To give expression to their (deep-seated) values by engaging in (a) narrative, performative, musical, artistic, poetic genres and (b) modes of reasoning that transcend the false binary of objectivity versus subjectivity (*rhetoric*).
- To imagine the heartfelt joy of participating in an ideal world of intact natural systems (*creativity*).
- To justify a commitment to conserving ecosystems and fostering biodiversity (*bioethics*).
- To fall in love with the beauty and spirituality of the natural world (*aesthetics*).

4. CODA

I am advocating that STEM educators need to embrace the Arts for the purpose of expanding and enriching the worldviews of their students. As agents of salvation of a deeply troubled world, our future citizens need to be capable of navigating insightfully the dialectical relationship of their external and internal worlds. To enact the moral imperative of fully educating our students (especially new teachers), STEM educators can benefit from collaborating with their Arts-based colleagues to develop *interdisciplinary* STEAM curricula, assessments and pedagogies.

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