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Sustainability in Environmental Education: Away from pluralism and towards solutions

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Abstract

Researchers in education for sustainable development have argued that sustainability is not fixed but socially constructed, and that sustainability issues should be represented as a continuous quest rather than indisputable targets that can be anticipated, planned and regulated according to predetermined guidelines. These scholars often doubt that there is one 'right' way to be sustainable. Considering the immensity of environmental sustainability challenges, such as climate change, species extinction, and pollution, this article takes a different perspective. The author will argue that without acceptance of unsustainability as a concrete challenge that requires concrete positivistic solutions, the challenge of addressing unsustainable practices becomes unsurmountable. The author will argue that there is a need for clear articulation of 1. What (un)sustainability is; and 2. What the key challenges and causes of (un)sustainability are; and 3. How the sustainability challenges can be meaningfully addressed. This article will outline a number of helpful frameworks that address obstacles to sustainability, ranging from population growth to unsustainable production and consumption practices. In particular, these solutions include investment in family planning policies to counter the effects of overpopulation, and alternative production frameworks, such as Cradle to Cradle, The Blue Economy and Circular Economy that differ from the conventional frameworks such as eco-efficiency, and have the potential to move the quest for sustainability beyond 'business as usual'. This article will conclude with the broader reflection that without goal-oriented critical learning explicitly providing alternative sound models of sustainability, democratic learning may never permit transcendence from unsustainable models. In order to overcome the practical impasse inherent in much of neoliberal education, educators can begin to close ranks and realize that each has valuable strengths that can help in the reconstruction of education for sustainability.

Keywords: The Blue Economy. Environmental education. Industrial ecology. Sustainable consumption.

Introduction

Researchers of sustainability in environmental education (EE) and education for sustainable development (ESD) supporting pluralistic tradition of learning have emphasized that we do not and cannot know what the most sustainable way of living is, emphasizing the importance of a pluralistic approach that aims at acknowledging, stimulating and engaging divergent perspectives, views, and values (e.g. VAN POECK; VANDENABEELE, 2012). Thus, EE and ESD researchers have discussed sustainability in terms of 'openness', 'plurality', and 'reflection' (e.g. JICKLING, 2005; WALS, 2009; JICKLING; WALS, 2013; MORLEY et al, 2014). Wals (2010) has argued that sustainability is characterized by uncertainty and warned that the quest for sustainable actions and outcomes needs to be tempered in favor of more reflexive and plural learning. Learning processes, they have argued, should not be based on predetermined outcome, for instance in the form of knowledge, skills or behaviour but rather understood as 'posing difficult questions' (BIESTA, 2006) and 'telling good stories' (JICKLING, 2005). These scholars often assume that sustainability is not fixed but socially constructed, and that sustainability issues should be represented as a continuous quest rather than as indisputable targets that can be anticipated, planned and regulated according to predetermined guidelines (e.g. VAN POECK; VANDENABEELE, 2012). These scholars often doubt that there is one 'right' way to be sustainable.

This article takes a different perspective, arguing for more goal-oriented approaches born out of concern about the immensity of environmental challenges and the urgent need to address them (e.g. BONNETT, 2004, 2012). It will argue that some approaches to sustainability offer better practical solutions, while a search for pluralism does not self –evidently help advance the cause of sustainability. If all learning outcomes are considered equally valid as long as they have emerged from a pluralistic process, this might even lead to an 'anything goes' relativism (WALS, 2010) and abandonment of the quest for sustainability (CHERNIAK, 2012). Instead, the author will argue that there is a need for clear articulation of 1. What (un)sustainability is; and 2. What the key challenges and causes of (un)sustainability are; and 3. How the sustainability challenges can be meaningfully addressed.

To address the first question from the beginning, I shall address the concept of unsustainability developed in my previous publications (AUTHOR, 2011; 2012a, 2012b, 2013, 2014a, 2014b), identifying environmental sustainability, or the integrity of the ecosystem of which humans are a part to be the central area of concern. Its definition excludes sustainability conceptions having to do with social and economic sustainability, assuming that environmental sustainability is closely related to challenges ranging from poverty elevation to social equality (for the elaborate discussion of this AUTHOR 2012c, 2014c). By locating sustainability within this environmental domain, climate change, pollution, natural resource crises and extinction of species can be identified as key elements of unsustainability. The other two questions will be addressed in the following sections of this article.

The author will argue that without acceptance of unsustainability as a concrete challenge that requires concrete solutions, the challenge of addressing unsustainable practices becomes unsurmountable. In line with perspective outlined by Webster (2007) in his description of the course on the Circular Economy, modeled after ecologi-

cal cycles, this article will develop a number of comprehensive frameworks targeted at solutions to real sustainability issues.

This article will focus on the possibility of finding solutions to the major sustainability challenges, drawing on two recently published volumes, Human Dependence on Nature by Haydn Washington (2013) and Sustainable Business: Key issues by Helen Kopnina and John Blewitt (2014). Publications of Intergovernmental Panel for Climate Change (IPCC, 2014), The United Nations Environmental Program (UNEP) and Millennium Ecosystem Assessment (MEA) link many environmental problems to the processes of industrialization, production and consumption and population growth. Indeed, as Washington (2013) has asserted, the greatest two 'elephants in the room' are population growth and consumption. Yet, one of the greatest paradoxes of sustainable development (and by extension, much of ESD) is that both better health and wider economic equality are propagated, leading to both population and consumption growth around the globe. It is questionable whether population growth and economic welfare can be sustained without further compromising the needs of the biosphere and its capacity to accommodate human needs. If economic development resulting in population and consumption growth has created current ecological problems in the first place, it can hardly be used as part of the solution (REES, 2009; WASHINGTON, 2013; KOPNINA; BLEWITT, 2014). Surprisingly, EE and ESD journal publications rarely address this dilemma. Yet, the objectives of elevating poverty without addressing current unsustainable levels of consumption in the developed world (following the well-known fact that we might need a few "Plant Earths" to sustain the American lifestyle), is likely to lead to breaching ecological limits.

> While "raising the standard of living" may be nebulous shorthand for the worthy aim of ending severe deprivation, translated into shared understanding and policy the expression is a euphemism for the global dissemination of consumer culture – the unrivaled model of what a "high standard of living" looks like. But to feed a growing population and enter increasing numbers of people into the consumer class I a formula for completing Earth's overhaul into a planet of resources: for ever more intensified uses of land and waterways for habitation, agriculture and farming; for the continued extraction, exploitation, and harnessing of the natural world; and for the magnification of global trade and travel' (CRIST, 2012, p. 141-142).

Alternative and viable solutions to address environmental problems need to be advanced through EE and ESD.

Environmental problems range from climate change to the depletion of natural resources, to biodiversity loss, and pollution. We shall address each of them in turn in the following section and then proceed to outline the most hopeful sustainability frameworks. Finally, we shall discuss the significance of these frameworks in the context of EE and ESD in the concluding section.

Sustainability challenges

We shall start the discussion of sustainability challenges with climate change. Anthropogenic factors contributing to climate change include the increased emission of

greenhouse gases (GHGs). Aside from GHGs, other chemicals, such as sulfur dioxide, can cause smog and acid rain. While public and government interest had already been ignited in the 1980s, the main driver of corporate strategic change was the adoption of the Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC) in 1997.

Policy instruments for meeting emissions targets included regulation, carbon pricing and subsidies. Actions taken by developed and developing countries to reduce emissions were to include support for renewable energy, improving energy efficiency, and reducing deforestation. Some countries have agreed to legally binding limitations in their GHG emissions in two commitment periods between 2008 and 2012, and between 2013 and 2020. The Protocol included the so-called Flexibility mechanisms: Joint Implementation (JI), international emissions trading, and Clean Development Mechanism (CDM).

In December 2012, no new treaty came about to replace the expiring Kyoto Protocol and consequently there was no prospect of binding agreements covering the period up to 2020. Climate change summits have done little more than '[promise] more talks about talks' (THE ECONOMIST, 2012:62). A recent report by IPCC (2014) suggested that oceans could rise significantly by 2100, which would devastate coastal cities; three-quarters of tropical rainforests could die, creating feedback loops that would only further expedite further climate change; crop yields would fall drastically and draughts would become more common and more severe.

In the last decade, company responses included voluntary agreements and partnerships; emissions reporting and reduction targets; and even the incorporation of carbon disclosure into standard company reporting. Yet despite efforts at mitigating climate change, emissions reductions have not materialized, partially due to the fact that emissions trading depends not only on its economic design but also on politics surrounding this process (PINSKE; KOLK, 2009, p. 109). The latest report from the UNEP reveals that in 2012, GHG emissions were 20% higher than in 2000. If emissions are not cut, they will reach 58 gigatons in 2020, which will increase the global temperature much higher than the minimal target of 2 degrees and significantly raise the ocean level.

In order to find solutions to the climate change, the role of the powerful industrial lobbies that have a stake in oil dependency and promoting climate skepticism needs to be addressed by the public, governments and businesses. In order to ensure that the future of business – and indeed society – is secured, the solution lies in long-term investment in renewables.

Another significant environmental issue is biodiversity loss. According to the International Union for the Conservation of Nature (IUCN) over 19,000 species out of the 53,000 assessed to date are threatened with extinction. Within the next 40-50 years, the coral reefs, upon which about one quarter of the ocean species depend, will have disappeared. It means that about 25% of the mammals and about 41% of the amphibians on this planet will be extinct. The convergence of population growth, expanding agriculture, deforestation and climate change is likely to create immense challenges for humanity and will certainly worsen the biodiversity crisis. The UN's 3rd Global Biodiversity Outlook report (http://www.cbd.int/gbo3/) stresses that ocean pollution and

deforestation are proceeding at an unprecedented rate, destroying rich habitats upon which many species depend.

However, a lot of 'sustainability' rhetoric masks the fact that vast amounts of what used to be diverse habitats have been converted into productive wood factories (for example, those used by Forest Stewardship Council), in both developed and developing countries. More than half of Finnish forests, for example, have been planted for timber production, and an increasing proportion of forests in Indonesia are used for palm oil plantations for biofuels or crops. So far the rate of extinctions has not slowed down and more radical solutions are necessary in order to address biodiversity loss.

Biodiversity is finite, and so are 'natural resources'. The Limits to Growth report (MEADOWS et al., 1972), has demonstrated that an economy built on the continuous expansion of consumption as well as population growth is not sustainable in the long term. Traditional views of sustainability often ignore the 'elephant in the room'- population growth which tends to exacerbate sustainability challenges. If population growth continues (or even stabilizes at the current level), something radical needs to happen with the way we currently produce and consume. Yet, it seems impossible to decouple the current system of production and consumption from the underlying political and ideological processes of neo-liberal democracy.

Last but not least, there is an issue of pollution and waste. Since the Industrial Revolution, many great discoveries and transformational inventions have been made. Unfortunately, some of them have backfired. There are many examples of technology-caused disasters that have occurred since the turn of the twentieth century. These disasters have caused heightened public awareness of environmental health risks and wide-spread public protests in Western countries in the 1970s. However, some of the worst episodes of industrial disasters have occurred outside of Western countries. The worst accidents of the previous century were the Bhopal Disaster in India in 1984, or The Chernobyl disaster in 1986 in Ukraine. More recently, the disaster at the nuclear power plant near Fukushima devastated parts of Japan in 2011. Oil spills in areas ranging from the Gulf of Mexico to Nigeria and the Arctic have become commonplace as well.

What should be even more threatening is not so much the occasional industrial disaster but everyday pollution such as particulate matter emitted by cars, or massive amounts of plastic waste found in the oceans, seas, lakes, rivers and city parks. Perhaps one of the greatest challenges to sustainability is the production of waste that ends up either in landfills or incinerators. In most cases, only a small proportion of physical throughput ends up as a product, the rest going into the process of making it, packaging and transportation. Traditional corporate responses to this challenge have been to minimize the damage by introducing the concept of eco-efficiency.

However, as we shall discuss below, the Circular Economy, Cradle to Cradle, and the Blue Economy approaches suggest that being less bad is not good enough. Eco-efficiency may reduce resource consumption and pollution in the short-term, but it will not eliminate the root causes of the problem. Rather, the current eco-efficiency framework tackles problems without addressing their source, sustaining a fundamentally flawed system.

Thus, the locus of the problem is in processes associated with industrial development, patterns of production and consumption, and population growth.

Addressing overpopulation

Investment in family planning, contraception, education, and change in cultural perceptions need to be considered a crucial opportunity for sustainability investment. A whole range of social and environmental problems, including poverty, could be if not solved but definitely diminished by stabilizing population growth. If businesses fail to recognize overpopulation as a threat to sustainability and fail to invest into solving it, all other efforts at sustainable production, consumption, and indeed business development are likely to fail in the long term.

Addressing consumption

Considering the challenges outlined in relationship to consumption, the following sections explore the possibility how the things we produce and consume can be possibly made sustainable.

Consumer choice editing

Individual consumer's sphere of influence can be too small to initiate significant change, and many consumers may be simply unwilling to consider sustainable options when offered many (cheap) choices of products. Many green consumption specialists have suggested that efforts to encourage sustainable living depend on structural changes that require political and corporate leadership. Consumer choice editing or restriction of unsustainable products can help eliminate unsustainable choices (BLOWFIELD, 2013).

Sharing economy

Sharing economy, also called Collaborative Consumption, involves the new sharing that reduces waste, saves money and becomes more self-sufficient, all without buying more stuff.

There is also a growing trend in websites such as ifixit.com, which provide free product information and repair manuals, reducing some of the barriers to maintaining and repairing goods and electronics. Strangers can now leverage technology and access an ever growing number of sites to share cars, rooms, items and tasks. The Sharing economy is said to connect people to their communities, save money, and be environmentally-conscious. Examples of sharing include car sharing and computer-leasing companies. Yet not everybody wants to share, and many items can simply not be shared. However, sharing and leasing has implications for how businesses can create value. Keeping a product in use for longer implies that direct sales of new products decrease, impacting ongoing profits that could otherwise be made.

These interventions into the manufacturing process can be seen as opportunities for new business. For example, instead of selling a product, a retailer could rent it and

create a new revenue stream focusing on maintenance. This could require capital outlay to set up a new business unit and trained staff to undertake the work (TENNANT; BRENNAN, 2015). This is a challenge to mainstream business operations and requires that new strategies be implemented.

Understanding sustainable consumption

Marketing psychologists, business economists, and even retailers discovered long ago the opportunities offered by the knowledge of human psyche in devising clever marketing strategies to entice the consumers to their product. Sustainable businesses still have to come to terms with what certain social, cultural and perhaps 'natural' human tendencies can be beneficial to their sustainable business. Defining the universals or certain features of our human behavior may be difficult, as they are culturally variably expressed, yet the global spread of consumer culture under industrial conditions is undisputable. Examples of such human universals can be either harmful or hopeful. The use of technological innovation to improve the production and medical technologies leads to both increased population growth and more extensive land use. The drive towards improving one's status through moving into the middle class through material possession leads to growth in consumption.

In adopting some of Kaplan's insights from the article "Human Nature and Environmentally Responsible Behavior," and assuming that certain universal human propensities do exist, a number of suggestions for businesses wanting to promote sustainability (and still make profit!) can be made:

1. Be sensitive to going with the grain, to recognizing and working with the motivations and inclinations characteristic of us as humans and do not expect 'sustainable action' to spontaneously emerge;

2. Treat the human cognitive capacity as a resource;

3. Engage the powerful motivations for competence; being needed, making a difference, and forging a better life;

4. Rather than going against the grain of human nature by telling people to be good, to minimize damage, to economize and to pick up their trash, solutions should be found in the human universals themselves.

If individual choices can be channeled in a way that would allow individuals to go with and not against the grain of human nature, some positive changes could be seen. Part of this human nature is also diversity of individuals. While some segments of population can learn to care about disadvantaged members of society or other species, others will be motivated by profit. Recognizing this has significant implications for business practice, as we shall further explain in the sections on alternative frameworks of sustainability below.

Realizing impacts: direct and indirect

Environmentally and socially significant behavior can be defined by its impact.

Social psychologist Paul Stern (2000) distinguished between at least two types of environmental impacts: direct and indirect. Some behavior, such as clearing forest or disposing of household waste, directly causes environmental change. Other behavior is indirectly significant, for instance storing your pension funds in a bank that makes unsustainable investments (of which most of us are not even aware). Examining tax policies and ability to choose an investment bank that invests in renewable energy can have a greater impact than turning off your lights at home. The deeper causes of environmental problems lie within international development policies, commodity prices on world markets, patterns of investment and consumption and not behaviors of individual consumers that are often unable (because the choices are simply not there or they cannot afford them) or too ill-informed or unwilling to be 'sustainable'.

Realizing that indirect impacts of policies supporting health and global consumption have a detrimental effect on the long-term availability of resources for future generations, leads to a more critical strategic thinking about addressing environmental problems (REES, 2009).

Private and public action

Similarly, private and public sphere environmentalism can differ greatly in their impact. Consumer researchers and psychologists have focused mainly on behaviors in the private sphere: purchase, use, and disposal of personal and household products that have environmental impact.

However, private actions may remain invisible or insignificant to others, given the relatively small impact of one individual in the world of seven billion citizens. While your own decision to become a vegetarian might reduce a bit of environmental burden, participation in certain public actions, being member of NGOs that promote vegetarianism or lobbies for animal-friendly policies at the government level can have a much more profound effect. However, the sense of guilt and impotence in solving huge environmental problems may be indeed beyond the scope of individual human capacity to resolve.

While private actions, such as attempts at responsible consumption, may contribute to some improvements, as the proponents of 'think globally act locally' campaign would claim, public actions can have a much greater impact. While one can use public transport as a matter of personal choice, lobbying with the government can have a much greater effect on greater availability, dependability, affordability, and attractiveness of public transport to all segments of population.

Similar observation can be made about social actions, such as giving change to the homeless on the street (private action), and being involved in organizations that attempt to address the underlying causes of urban poverty (public action). Certainly, 'walking your talk' is also important. Many companies have discovered that speaking about sustainability without effective action can lead to public skepticism, as in the case of climate change.

Business and NGO cooperation

Businesses working together with NGOs present another opportunity for both business and non-profit interests to mutually benefit. The danger for business lies in appearing too soft for its stakeholders. Sometimes cooperating NGOs need to strike compromises between gaining funds and re-asserting their mainstream position in the society through co-operation. There is a danger of losing potential donors who think that such cooperation could compromise ENGO's principles. However, the gains over-weigh the risks. For example, the banks can highlight their green investment marketing strategy by using environmental NGO's logo.

By using WWF's panda logo on the climate credit card, the Dutch bank Rabobank achieved symbolic gain. This gave the bank a competitive advantage over other banks and legitimized its climate-related messages, providing the rationale for Rabobank to formally engage with WWF in partnership formation. On the other hand, WWF has gained extra credit with corporate leaders as a supporter of green investment (Van Huijstee and Glasbergen 2010).

Green investment

Many people would agree that money makes the world go around. It cannot be stressed enough how important green investment is. Consumers have the ability to choose where their pension funds are invested, and supported by transparent investment policies of banks, could make a huge difference. Yet, before businesses and financial institutions invest in anything than appears green or sustainable, they need to realize certain very salient paradoxes and bottlenecks.

Business and technological solutions

Sustainability is not easy to achieve and many conventional sustainability approaches have simply failed to address both social and environmental problems. The World Business Council on Sustainable Development (WBCSD) Vision 2050 report calls for a new agenda for business. With its best-case scenario for sustainability and pathways for reaching it, it is a 'platform for beginning the dialogue that must take place to navigate the challenging years to come'. However, not all business solutions outlined in the report prescribe, let alone require, that businesses follow these pathways to sustainability beyond what is immediately required by the stakeholders – shareholders on the one hand, and to a lesser degree customers, NGOs, and pressure groups on the other.

The Dow Jones Sustainability Indices (DJSI) define the role of corporate sustainability leaders as achieving 'long-term shareholder value by gearing their strategies and management to harness the market's potential for sustainability products and services while at the same time successfully reducing and avoiding sustainability costs and risks'. This role, specified among other indicators as 'Meeting shareholders' demands for sound financial returns, long-term economic growth, open communication,

and transparent financial accounting', says very little about the challenges associated with climate change or species extinction.

It is largely through informed business investment that some of the greatest sustainability challenges can be confronted. Future corporate leaders may need to consider strategy that goes beyond basic accountability to the shareholder and promises of perpetual economic growth and returns on investment in order to ensure that the most glaring social and environmental problems are addressed.

Besides growing population and unsustainable consumption, one of the biggest challenges of our time is returning to the closed loop system, in which nothing has to be wasted. This calls for intelligent innovation. Amory Lovins, of the Rocky Mountain Institute, a think-tank that promotes energy-efficiency, argues that a combination of thoughtful design and new technology can minimize or even eliminate the need for many modern amenities such as air-conditioning through architecture and the use of natural landscapes.

In the following section, we aim to introduce most promising, although not always conventional, approaches to production and consumption, and demonstrate how they differ from conventional views on sustainability. We shall also focus on the key principles of these alternative systems and delineate their implications and applications.

Business ecology and industrial ecology

The term 'business ecology' has been adopted by many companies and organizations and can refer to a number of different concepts. One of the central concepts is business ecosystem. Business ecosystem refers to the network of organizations – including suppliers, distributors, customers, competitors, government agencies and so on – involved in the delivery of a specific product or service through both competition and cooperation.

Based on Commoner's (1971) idea of modelling industrial economy on ecological principles, Frosch and Gallopoulous' (1989) introduced the concept of an "industrial ecosystem'. This ecosystem analogy was based on observations of ecosystem functions and emphasized the optimization of energy and material flows within an industrial system, focusing on not just the minimization of waste, but also its complete elimination from industrial cycle. This elimination (or rather full use) is made possible by the exchange of by-products between industrial actors, whereby the waste from one production process becomes an input to another.

In the framework of business ecology, business in the "ecosystem" affects and is affected by the others, creating a constantly evolving relationship in which each business must be flexible and adaptable in order to survive, as in a biological ecosystem. Focusing on connections between operators within the 'industrial ecosystem', Graedel (1996) has developed the industrial ecology approach aimed at eliminating undesirable by-products. Similar to this is the concept of industrial ecology. Industrial ecology is the multidisciplinary field of research which combines aspects of engineering, economics, sociology, toxicology, and the natural sciences to study material and energy flows through industrial systems.

Industrial ecology adopts a systemic point of view, designing production processes in accordance with local ecological constraints, and attempting to shape them so they perform as close to living systems as possible. This framework is sometimes referred to as the 'science of sustainability', and its principles can also be applied in the services sector. From an industrial ecology perspective, any given efficiency measure has several types of environmental impacts. Since environment is often a free input, a price-based rebound effect is not expected, but other indirect effects, such as spillover of environmental behavior, can occur.

Biomimicry

Biomimicry is defined as a "new science that studies nature's models and then imitates or takes inspiration from these designs and processes to solve human problems" (BENYUS, 1997). Biomimicry relies on three key principles. First, nature as model, refers to the study and emulation of nature's forms, processes, systems, and strategies to solve human problems. Second, nature as measure refers to the use of an ecological standard to judge the sustainability of technical innovations.

Third, nature as mentor uses ecocentric stance in viewing and valuing nature for what we can learn from it, and learning to appreciate its diversity. Diversity that is utilized from a holistic perspective, as healthy ecosystems are complex communities of living things, each of which has developed a unique response to its surroundings, working in concert with other organisms to sustain the system as a whole.

Cradle to Cradle

In Cradle to Cradle: Remaking the Way We Make Things, McDonough and Braungart (2002) support the framework that does not reach for sustainability as it is usually defined, but seeks to create industrial systems that are essentially positive and waste-free. The Cradle to Cradle (alternatively C2C, or Cradle 2 Cradle), was dubbed by some 'the next industrial revolution'. This alternative production model proposes to re-design products so that after their life cycle has ended, they can serve as 'food' for new products. Within these frameworks lies the promise to create economies that purify air, soil and water relying on solar and wind power, generating no toxic waste by using safe, healthful materials that replenish the earth or can be perpetually reused, yielding benefits that enhance all life. These alternatives present a great opportunity for sustainable production and elimination of waste. At the moment, however, these sustainability solutions do not come close to achieving their objectives.

McDonough and Braungart ask us to contemplate not just minimizing the damage the way eco-efficiency does, but eliminating waste altogether. Eco-efficiency is targeted at minimizing the damage by 'slowing the process of destruction' and 'making a bad design last longer'. By contrast, C2C proposes a positive framework of being 'all good'.

Key principles of the Cradle to Cradle

As opposed to conventional eco-efficiency, the C2C framework stresses eco-effectiveness.

C2C identifies three key principles which should inform human design:

1. Waste equals food
2. Use current solar income
3. Celebrate diversity

1. Waste equals food.

Waste does not exist in nature because the processes of each organism contribute to the health of the whole ecosystem. A cherry tree's blossoms fall to the ground and decompose into food for other living things. Bacteria and fungi feed on the organic waste of both the trees and the animals that eat their fruit, depositing nutrients in the soil in a form ready for the tree to use for growth. One organism's waste is food for another and nutrients flow indefinitely in cycles of birth, decay and rebirth. In other words, waste equals food and it would help if we thought that way too. We understand the world in large part with the help of the verbal and visual metaphors we use and business, and education for that matter, uses military metaphors as a way of communicating and understanding what it does. Just consider how many times terms like strategies, targets, and logistics are used.

John T. Lyle (1996) has argued that uunderstanding these regenerative systems allows engineers and designers to recognize that all materials can be designed as nutrients that flow through natural or designed metabolisms. Materials designed as biological nutrients, such as textiles and packaging made from natural fibers, can biodegrade safely and restore soil after use.

While nature's nutrient cycles comprise the biological metabolism, the technical metabolism is designed to mirror them. This is considered as a closed-loop system in which valuable, high-tech synthetics and mineral resources circulate in cycles of production, use, recovery and remanufacture. The concept of industrial metabolism was used by Ayres and Kneese (1969) and referred to understanding material and energy flows at the national level and within urban areas. Products can be fully dismantled so that their elements can be returned to biological or technical metabolisms. Ideally, every product can be designed from the outset so that after its life cycle is over, the product will continue to live by becoming a nutrient within either a biological or technological cycle. Within this framework, designers and engineers can use scientific assessments to select safe materials and optimize products and services, creating closed-loop material flows that are inherently benign and sustaining.

However, in the case of business, a number of waste methods require that reverse logistics is considered. If products are to be up-recycled, how are they taken back to the manufacturer or a third party? This requires collection, sorting and transportation, all of which can be costly. Tennant and Brennan (2015) note that if markets for secondary goods or materials are not mature, or refurbished goods are perceived as being of lower quality than new, this can impact the ability of businesses to generate revenue.

2. Use Current Solar Income

Living things thrive on the energy of the sun. Trees and plants manufacture food from sunlight, an effective system that uses the earth's unrivalled and continuous source of energy income. Despite recent precedent, human energy systems can be nearly as effective. C2Csystems -from buildings to manufacturing processes- tap into current solar income using direct solar energy collection or passive solar processes, such as daylight, which makes effective use of natural light. Wind power-thermal flows fueled by sunlight can also be tapped.

3. Celebrate Diversity

Healthy ecosystems are complex communities of living things, each of which has developed a unique response to its surroundings that works in concert with other organisms to sustain the system. Each organism fits in its place and in each system the fittest thrive. Similarly to the bionics and biomimicry, C2C takes nature's diversity as a prototype for many models for human designs, tailoring designs to maximize their positive effects in order to "fit" within local natural systems and to enhance the local landscape where possible. McDonough and Braungart have successfully designed a number of urban areas and buildings taking into account local climate, materials and both human and ecological needs.

In short, by modeling human designs on nature's operating system -generating materials that are "food" for biological or industrial systems, tapping the energy of the sun, celebrating diversity- C2Cdesign creates a new paradigm for industry, one in which human activity generates a wide spectrum of ecological, social, and economic values and thus results in ‘upcycling’.

Product design impacts the ease and success of all re-use methods and strategies as Design for Recycling (DfD) and Design for Disassembly and Design for Remanufacturing (DfREM) attempt to factor in these requirements at the design stage of the manufacturing process. These can include standardization of components, and designing products so that they can be upgraded (Tennant and Brennan 2015).

However, we should note that the return to pre-industrial designs is not desired by most businesses (as there is little money to be made by asking people to return to their traditional dwellings and it does not sound ‘progressive’). Thus, most of C2C houses are based on innovative designs. Also, the founding fathers of C2C system have been blamed for profiting from the lucrative certification system, monopolizing the market and keeping authorship rights to their concepts, preventing its wide usability. In his blog post, McIntire-Strasburg (2008) hopes that C2C design will flourish if its owners would decide to open source C2C, or if other business professionals will shift to other similar certification systems. The compromise between a building that is both profitable to its makers and has a possibility to be widely used in the region (thus, affordable to all) is one of the greatest challenges of application of C2C.

Circular economy

In their 1976 research report to the European Commission in Brussels, 'The Potential for Substituting Manpower for Energy', Walter Stahel and Genevieve Reday-Mulvey (1981) sketched the vision of circular economy and its impact on job creation, economic competitiveness, resource savings, and waste prevention. These authors put forward the argument for a "self-replenishing economy", based on a "spiral loop system" through product-life extension activities that cycle materials: re-use, repair, reconditioning and recycling. The term circular economy encompasses more than the production and consumption of goods and services, including a shift towards renewable energy and the role of diversity as a characteristic of resilient and productive systems. The idea of a circular economy synthesized a number of existing strands of work and specifically enabled the analysis and communication of its broad economic potential.

The functional economy emphasizes turning products into services ("product service shift", or PSS), arguing that selling the use or function of the product rather than the product itself would enable the efficient cycling of materials and simultaneously give incentives for innovation (SCOTT, 2011). Importantly, Stahel (1984) argued that product life extension activities should lead to an increase in job creation as labour is required to keep products in use through each use-phase. The circular economy should be "restorative by intention", where environmental impact is decoupled from economic growth. To be restorative implies that businesses have a positive environmental impact (HAWKEN, 1993).

Ellen MacArthur Foundation

The application of circular economy at an economic level has risen to prominence since 2012 World Economic Forum (WEF), with the launch of Towards a Circular Economy Report by Ellen MacArthur Foundation. The report emphasized factors such as increased design for re-use, new or enhanced recovery models and access over ownership models that promote greater circularity as well as a lucrative business opportunity. The Ellen MacArthur Foundation is a registered charity with the aim of giving the concept of circular economy a wide exposure and appeal. The Ellen MacArthur Foundation works in education, business innovation, and analysis and provides businesses, educators, and policy-makers with the number of useful case studies and practical resources to inspire and enable the transition to circular economy.

The circular economy reports developed by the Foundation, with analysis by McKinsey & Company, established a clear framework and economic case for a transition to the circular economy. The reports highlighted a combined annual trillion dollar opportunity globally in net material cost savings for companies making the transition to circular economy. The Foundation has created the Circular Economy 100 programme, a global platform bringing together leading companies, and enabling them to benefit from subsequent first mover advantages (http://www.ellenmacarthurfoundation.org/business/ce100).

The circular economy framework reaches beyond the aim of minimizing the damage (as the destructive system should not be made efficient) by eliminating it altogether. Educational program on circular economy contrasted with an older mechanical worldview that modelled the economy as a linear 'take-make-and-dump' process with 'only a crude and partial feedback device - the market, and a one-sided materialistic view of the rational consumer' (WEBSTER, 2007, p. 40). Courses on sustainability within this framework can be instructed by both deep ecology and more 'practical' industrial ecology insights.

The Blue Economy

Initiated by former Ecover CEO and Belgian businessman Gunter Pauli, the Blue Economy is an open-source movement bringing together concrete case studies, initially compiled by the Club of Rome (MEADOWS et al., 1972). Pauli founded the open source Zero Emission Research & Initiatives network (ZERI) in 1994. Pauli is also credited with coining the term "upcycling" as opposed to 'recycling' or 'downcycling'. There are parallels between the Blue Economy and Cradle to Cradle in that waste is not per se an issue, but the concern should be with what is done with it. ZERI's main guiding principle is "...everything is to be reused by generating additional value", with a target of zero emissions (PAULI, 2011, p. 15). As the official manifesto states, 'the waste of one product becomes the input to create a new cash flow'. The concept of the Blue Economy is better understood either as an economic model or an innovative business model that permits social and technological organization to respond to basic human needs.

ZERI is promoting "innovative business models" that are "capable of bringing competitive products and services to the market responding to basic needs while building social capital and enhancing mindful living in harmony with nature's evolutionary path" (http://www.theblueeconomy.org/). Based on 21 founding principles, the Blue Economy insists on solutions being determined by their local environment and ecological characteristics. These principles are quite similar to C2C and circular economy models discussed above.

The steady state economy

Herman Daly (1991; 1994) has observed that while the environment establishes absolute limits on how far the industrial economy can expand, there are no environmental limits on the development of a culture's symbolic systems (or what is being referred to here as the life-and-community-enhancing cultural commons). Daly has pointed out that "sustainable development" may be possible if materials are recycled to the maximum degree possible, and if one does not have growth in the annual material throughput of the economy. Daly's ideas are largely based on ecological economics and the notion of the 'steady state economy' which is an economy of relatively stable size, featuring stable population and stable consumption that remain at or below planetary carrying capacity. This means 'economy with constant stocks of people and artifacts, maintained at some desired, sufficient levels by low rates of maintenance "throughput",

that is, by the lowest feasible flows of matter and energy from the first stage of production to the last stage of consumption' (DALY, 1991, p. 17).

Summary of sustainability frameworks

Below you will find an overview of hopeful sustainability frameworks that go beyond conventional canons and carry the promise of transforming the economy and society without harm to environment.

Table 1 – Overview of frameworks

Thinkers	Concepts/Frameworks	Level of Application	Seminal Work by Year
Robert Ayres and Allen Kneese	Industrial Metabolism – understanding material and energy flows at the national level and within urban areas.	Industrial System	Ayres and Kneese (1969)
Barry Commoner	Ecological principles used to structure national economy	National	Commoner (1971)
Walter Stahel	Circular or loop economy through product life-extension.	Product Design	Stahel (1984) Stahel and Reday-Mulvey (1981)
Robert Frosch & Nicholas Gallopoulous	Industrial ecosystem	Industrial System	Frosch and Gallopoulos (1989)
Paul Hawken	Circular economy, restorative economy	Community	Hawken (1993)
John T. Lyle	Regenerative Design	National, industrial	Lyle (1996)
Thomas Graedel	Earth system ecology - biological systems and industrial systems influence each other therefore they should be studied from a synthesized perspective.	Industrial System	Graedel (1996)
Janine Benyus	Biomimicry Design Framework based on looking at form, functions, and processes in natural systems.	Product Design	Benyus (1997)
Gunter Pauli	Coined the term "upcycling". Developed the concept of the Blue Economy complementing the Limits to Growth Report.	Enterprise Development	Pauli (2010)
Michael Braungart and William McDonough	Cradle to Cradle (C2C) Design Framework. Introduced concepts of technical and biological nutrients	Product Design	McDonough and Braungart (2002)
Herman Daly	Steady State Economy: ...an economy with constant stocks of people and artifacts, maintained at some desired, sufficient levels by low rates of maintenance "throughput"	Ecological Economics	Daly (1994)

Source: adapted from Tennant and Brennan, 2015.

Conclusion

We have argued that pluralistic approaches to education tend to ignore the power hegemonies present within neoliberal education that wants to maintain status quo. In reproducing neoliberalism that is open to all ideas, but privileges none, marginalizing or radicalizing alternatives that challenge the status quo, pluralism allows for anthropocentric or unsustainable practices to continue. In other words, educational pluralism in regard to 'sustainability' masks the perpetrators of unsustainability, disables students' ability to make hard choices by leading them into endless circles of discussion, contestation, and negotiation without specified ends. Without goal-oriented critical learning targeted at disclosing existing power hegemonies, explicitly providing alternative sound models of sustainability, democratic learning may never permit transcendence from unsustainable models.

In order to overcome the practical impasse inherent in much of neoliberal education, educators can begin to close ranks and realize that each has valuable strengths that can help in the reconstruction of education for sustainability. The frameworks outlined above represent the promises for the future. By teaching our students concrete frameworks pertaining to sustainability we might achieve nothing less than transition to the sustainable society possible.

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