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Exploring posthuman ethics: opening new spaces for postqualitative inquiry within pedagogies of the circular economy

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Abstract

This article discusses closed-loop systems, namely Cradle to Cradle and circular economy, in the context of sustainable education. These circular models, at least ideally, promise absolute decoupling of resource consumption from the economy. This article presents student assignments applying these models to Hennes & Mauritz, a clothing retail company, and insect food producer, Protix.

While the discussion of circular economy revolves around the economic benefits of closed-loop systems, it rarely addresses posthumanism. Posthumanism is related to postqualitative theory, inspired by Gilles Deleuze and Felix Guattari. Deleuze and Guattari emphasize that nature has become intertwined with technology and culture. In the cases discussed, combining both techno- and organic materials produces ‘monstrous hybrids’. It appears that fully circular solutions are rare as absolute decoupling is limited by thermodynamic (im)possibilities. This realization still has to be developed in environmental education. Within this posthumanist inquiry, the larger lesson from the case studies is the necessity of teaching about degrowth in production, consumption and corporate strategy. In pedagogical terms, this article aims to generate a more critical discussion within the environmental education community about how postqualitative inquiry can provide different and distinct perspectives from qualitative inquiry in the context of the circular economy.

Keywords: circular economy; clothing industry; Cradle to Cradle; degrowth; food industry; greenwashing; posthumanism; postqualitative inquiry; sustainability

Introduction

Academic and policy experts recognize that demographic, political, social and economic factors, such as an increase in population, production and consumption, are at the core of ecological degradation, climate change, biodiversity loss and pollution (Victor & Jackson 2015; Sullivan 2020). While the level of consumption is higher in developed countries, what exacerbates these issues is that industrial development and neoliberal economic ideology are no longer limited to one area (global North or West) (The Economist, 2015a). While some countries have gone through the demographic transition to lower fertility, despite declining mortality, some countries maintain high birth rates (The Economist, 2015b; The Economist, 2019), the middle classes are expanding globally, people are living longer, and migration occurs to developed higher consumption countries (The Economist, 2015a; Dodson, Dérer, Cafaro & Götmark, 2020). Feeding this ever-increasing and demanding population will require current food production systems to double, aggravating land, water and other natural resource scarcity (Garnett et al., 2013). The double

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challenge of demography and consumption calls for a radical rethinking of production (Lidicker, 2020; Washington & Maloney, 2020).

A closed-loop or circular production system is known as Cradle to Cradle (C2C) offers an opportunity to radically revise the current take-make-waste system of production (McDonough and Braungart, 2010) and counter the built-in obsolescence in consumer products (Bulow, 1986). Both within the so-called biological (or organic, thus biodegradable) and technological (encompassing human-made materials) cycles, circular production is supposed to eliminate waste and limit, if not halt, the use of virgin materials (Borello et al., 2016).

While paying lip service to ‘regenerational economy’, ‘upcycling’ and ‘added values’ (McDonough & Braungart, 2013), many companies claiming to contribute to the circular economy merely scratch the surface. Buchmann-Duck and Beazley (2020) emphasize that circular economy’s practitioners (but also academics’) evasion of scrutiny is especially problematic as circular economy parades itself as a vehicle of absolute decoupling of natural resource consumption from economic growth. The framing of circular economy as ‘the new engine of growth’ also trumps over consideration of nonanthropocentric (so, not just human-welfare oriented) approaches to biodiversity (Buchmann-Duck & Beazley, 2020; Taylor et al., 2020). Thus, acknowledging circular economy’s limitations (Buchmann-Duck & Beazley, 2020) and making a distinction between ideal, realistic and subverted circular practice is helpful (Kirchherr et al., 2017), especially in education because this is where awareness and motivation start. What types of lessons can students learn from such cases and what can be done better?

Placing *education for circular economy* in the broader context of environmental education (EE), we note that the educational research literature is now replete with papers that address why EE must change and move toward postqualitative processes, based on the work of French philosophers Gilles Deleuze and Felix Guattari (Deleuze & Guattari, 1980; Guattari, 1989). Their research that allows for multiple, nonhierarchical entry and exit points in data representation and interpretation applies in the case of critical inquiry. Postqualitative theory, which allows for multiple, nonhierarchical data representation and interpretation, is applied in the case of learning from a circular economy.

In *The Three Ecologies*, Guattari (1989) proposes that data representation is conditional on an extended understanding of ecological processes as an assemblage of ‘social’, ‘mental’ and ‘environmental’ flows (Guattari, 1989:34). These forces, in turn, are not only traversed through but also constituted by technology – an observation particularly relevant in the case of sustainability discourse. Namely, in production processes, technology cannot be separated from ecology in the sense that raw materials from nature are needed to create objects that we use. According to Barad’s (2007) theory of agential realism, the phenomena that comprise our world, which she refers to as ‘the ontological inseparability of intra-acting agencies’, is at once an epistemology, an ontology and an ethics.

Guattari (Ibid, p. 135) emphasizes that at present, ‘nature has become inseparable from culture’ and that ‘ecosystems, the mechanosphere and the social and individual universes of reference’ are interdependent, and intimately entangled. For students learning about sustainability in general and circularity in particular, this signifies a turn towards understanding the system or theory or industrial production that takes, makes and wastes, rather than a mere methodology of how things are made.

In the past, environmental education research has been largely grounded within humanist theories, regulating what can count as knowledge (contribution to social and economic welfare). The postqualitative inquiry explored in this article opens up a new space for posthumanism. Much of sustainability rhetoric focuses on social and economic – thus, humanist – aspects of sustainability, and thus, research on circular economy tends to focus on societal benefits (Kopnina & Blewitt, 2018). By contrast, ‘research after humanism’ (Lather, 2019; St. Pierre 2019) indicates that post-humanist ethics need to be taken into account. In the case of circular economy, one may inquire which types of economic activities can give back or contribute (in a sense of regenerative or

reciprocate interaction) to greater-than-human-world (what in more instrumental/functional interpretations is called 'natural resources' or 'ecosystem services').

As this special issue emphasizes, theory, not methodology, serves as grounding for education and pedagogical theorists and practitioners (e.g., Lather, 2019; St. Pierre, 2019; Mazzei, 2021). Many of these concepts are Deleuzian- and Guattari-based, that is, philosophical and not methodological, working with multispecies (or trans-species) connections. 'Thinking with the theory' and the use of theory to think with the data (and use data to think with theory) can be used as new analytic for postqualitative inquiry (Jackson & Mazzei, 2017). These researchers working with concepts in ways that engage realist accounts of students' experiences and not representations as interpreted by the researcher. While in the past EE research has been largely grounded within humanist interpretative representation theories as regulating what counts as knowledge, the post-qualitative inquiry explored in this special issue opens up a new space for examining what exactly is learned from the circular economy concept and practice. Publications in journals such as *Qualitative Inquiry* and *Reconceptualizing Educational Research Methodology* illustrate this sea-change.

In the case of teaching for the circular economy, this implies the examination of case studies (data) leads to consequent questioning of theory (is circular economy possible/realistic in the first place?). Put simply, what can circular economy give back to the environment, through both empirical and theoretical lenses? How can students be taught to think critically about production processes? What are the ways forward in the circular economy?

The aim of a circular system is, ideally, to eliminate the consumption of scarce materials (De Man & Friege, 2016). In nonconsumables, the product service shift (PSS), or the switch from ownership to leasing, is recommended (Kopnina & Blewitt, 2018). Pay-per-use service schemes (Sousa-Zomer et al., 2018) can facilitate *infinite reuse* of products and energy (McDonough & Braungart, 2010). The durability or 'reuse' in clothing industry is subject to debate – while some retailers, manufacturers or even academics speak of 'circular fashion' (e.g., Poldner, 2020), embracing hashtag #circularfashion, others suggest that it is greenwashing (e.g., Benson, 2020). These choices for (relatively) sustainable clothing will be explored in the first case study.

In the case of food, circularity can signify a range of transition from vegan to vegetarian lifestyles, to entomophagical (eating insects) diet (Gahukar, 2011; van Huis et al., 2013; van Huis, 2017). Entomophagy is common in various groups across the world where indigenous insects are easily available and are consumed in both raw and processed forms and increasingly used in Western products (Gahukar, 2011). In Western countries such as The Netherlands, entomophagy is becoming an emerging trend (Heijkants, 2021; Kuiper, 2021). Considering that the insect production is better than beef, given that standard livestock farming is contributing to greenhouse gas emissions (Garnett et al., 2013), if space and energy used for production, packaging, distribution, transport and waste (what ends up in the toilet) are considered, the 'circularity value' of insect food needs to be critically explored. Growing insects requires high temperatures, and some calculations show that mealworm production, for example, compares to that of chicken and pigs in terms of emissions (Heijkants, 2021; Kuiper, 2021). The students explore this in the second case study.

This inquiry aims to appeal to both students and faculty as an example of 'action research' capable of moving EE inquiry beyond qualitative interpretative/representational methodology toward postqualitative methods. This article also aims to complement other papers proposed for this special issue in ways that assist readers in translating the philosophical complexities of new empiricisms and new ethics into actual pedagogy that challenges students and faculty to extend/expand their own thinking into (realist) real experiences. This article discusses how Bachelor business students apply their understanding of circular frameworks to corporate case studies. The postqualitative focus is on how to get teachers or educational researchers to think beyond research as the application of methodologies such as narrative inquiry to confront larger topics of (un)sustainability? How could students be more actively involved in displaying, mapping

and creative reporting of ‘living’ experiences for a critical exploration of engagements and learning? How could researchers present live student experiences so that the audiences can make their interpretations and conclusions (within critical discussion settings)?

In the sections below, C2C principles and the 9-R strategy are elaborated on, and then, the case studies, strengthening students’ critical thinking about the circular economy, are examined. Based on the analysis of these case studies, recommendations for foregrounding postqualitative inquiry in didactics of degrowth in business education are made.

C2C Principles

C2C identifies three key principles of alternative production systems: (a) waste equals food, (b) use current solar income and (c) celebrate diversity. *Waste equals food principle* can be exemplified by the cherry tree’s ‘waste’ being food for other species or soil when decomposed. *The use renewables principle* particularly supports the sun and wind energy. *Celebrate diversity* refers to the natural diversity of ecosystems, with the aspiration not just to imitate natural processes in industrial processes but also to respect and preserve biodiversity (Stevens et al., 2020). In material products, such as clothes and food, application of C2C principles can mean the transition to the types of materials that have, ideally, no negative, or at least, realistically, little effect on the environment.

The C2C certification schemes distinguish categories Material Health, Material Reutilization, Renewable Energy, Water Stewardship, and Social Fairness (Cradle to Cradle Certified, 2020). This certification addresses the inputs associated with all the production outputs, use and disposal, including the product itself, pollution, waste by-products as well as delivery (Ünal & Shao, 2019). On the level of material health and reutilization, the conventional production systems make products of mixed materials difficult to separate and recycle or as ‘monstrous hybrids’ (McDonough & Braungart, 2010). C2C products are supposed to be easy to disassemble so the product can be refurbished, repaired or retained in its present form to go on to meet another need (Iacovidou et al., 2017). C2C products take nature’s diversity as a prototype for tailoring designs to maximize their positive effects and enhance the local landscape (McDonough & Braungart, 2010). Biomimicry designs, for example, imitate the complexity of natural forms, as well as their function and reciprocity with other natural elements (Stevens et al., 2020). Somewhat similar to C2C, circular economy evaluations using the 9-R scale are intended to inform producers’ choices at various stages in the product’s life.

Circular Economy’s 9-R Hierarchy

This example ties in with various levels of the 9-R hierarchy of circular production, developed in part by the Dutch Council for the Environment and Infrastructure (RLI, 2015) and revised in consequent reports and publications (e.g., Kirchherr et al., 2017; Potting et al., 2017). This 9-R hierarchy of circular production starts with the R of Refuse (R-1) or ‘make product redundant by abandoning its function or by offering the same function with a radically different product’ (Potting et al., 2017). Refuse means ‘doing without’, thus stimulating degrowth. Obviously, refusing food and clothes is not an option, but refusing to buy new clothes and reusing the ones owned and shared, or consuming more sustainable (e.g., in terms of greenhouse gas emissions) or ethical (in terms of animal welfare) food that ‘meet basic human needs’ can be seen as fitting within the hierarchy.

Reduce (R-2) still comes before Re-use (R-3) in the 9-R hierarchy. In C2C critique, reduction and eco-efficiency only extends a wasteful system of production. For example, ‘saving electricity’, while it still comes from fossil fuels, only stretches fossil use longer. Even the well-intentioned recycling is ‘downcycling’ (McDonough & Braungart, 2010). However, reduction rather than the complete elimination of harm might be the most realistic and achievable for material products.

Infinite reuse implies that no new products need to be made; thus, Refuse (to make or buy) is essential to an overall degrowth strategy (O'Neill, 2012). The objectives of degrowth 'are to meet basic human needs and ensure a high quality of life, while reducing the ecological impact of the global economy to a sustainable level, equitably distributed between nations' (O'Neill, 2012:225). O'Neill (2012) proposes a measure of degrowth transition to the aim of stimulating the non-GDP-related quality of life as the true measure of progress, such as social welfare indicators. Infinite Reuse can be said to satisfy the ultimate goal of the closed-loop systems to decouple the economy from environmental pressures (Ghisellini et al., 2016).

Perhaps potentially the most transformative (but also with the most potential for greenwashing) is the R of Rethink. This can involve anything from clever green marketing and window-dressing to rethinking how to eliminate the need for virgin or recycled materials.

Repair (R-4) is meant to counter the built-in obsolescence (Bulow, 1986). Refurbishment (R-5) refers to restoring defective products to their original condition. Remanufacture (R-6) refers to developing a new product with parts of old products (Potting et al., 2017). Repurposing (R-7) implies reusing products for other purposes. Recycling (R-8) is the most labour- and energy-intensive of the options (Ghisellini et al., 2016). Recovering (R-9) of materials and burning them to produce energy is positioned as the lowest option in the hierarchy. There is a big difference between energy derived from, for example, sun and biofuels, derived from burning remains of timber industry's production.

The Danger of Subversion

The danger of subversion of greenwashing in the circular economy is particularly prominent when it is seen as the 'new engine of economic growth' (EMF, 2013: 64). McDonough & Braungart's book, *The Upcycle* (2013), illustrates this danger. McDonough & Braungart's optimistic belief that upcycling is possible conceals the fact that material production and consumption are limited by the laws of thermodynamics. De Man and Friege (2016) inquire whether the politically attractive message of a circular economy that promises to enable continued economic growth while radically reducing the level of waste production is scientifically correct. The authors note that to start with the 'waste equals food' principle, in reality, waste is rarely 'food'. De Man and Friege (2016) also emphasize that creating endless material cycles without continuously adding energy would be counter to the Second Law of Thermodynamics. In the case of 'natural cycle' or natural nutrients, the assumption that natural nutrients are limitless, regardless of their quantity, is incorrect. Finally, regarding the technological cycle, De Man and Friege (2016) note that industrial waste necessitates treatment and disposal of at least some parts of products (e.g., petroleum waste and nanoparticles). Considering these limitations, a massive scale of change is needed in politics as well as a worldwide corporate strategy, including critical thinking about the circular economy, especially in the cases of material products such as food and clothes.

Circular Economy in Education Programmes

Sustainable business or circular economy programmes became widespread in and outside of The Netherlands. In The Netherlands, many courses focused on sustainability and circular economy (often emphasizing 'corporate partners' and offering opportunities for corporate internships) are offered. It is worth noting that environmental, social and economic sustainability issues are often conflated at all these educational levels in the context of their formal integration in vocational/higher education. The various dimensions of sustainability are organized in several subjects, ranging from environmental (climate change, biodiversity loss, pollution, resource depletion, etc.), to social and ethical (human rights, equality, nondiscrimination, etc.) and economic sustainability. Hereby it is important to note that economic sustainability might have an opposite effect than

environmental one due to an increase in consumption of natural resources associated with economic growth. EE, education for sustainable development (ESD) and sustainable development goals (SDGs)-oriented courses occur at both undergraduate and postgraduate levels. For example, the so-called Environmental Studies Programs, an interdisciplinary programme that focuses on developing competence and skills concerning environmental management combined with social and economic sustainability subjects, many of them falling within the humanist (anthropocentric) tradition such as alleviating poverty and eliminating hunger, fair division of natural resources, equal pay and human rights (for a review of some Dutch programs see Kopnina 2020). Various courses are subdivided into modules ranging from more technical or technological subjects (e.g., the working of windmills) to more socio-economic and political contexts (promotion of wind energy by governments, social resistance or acceptance, etc.). With a plethora of sustainability programmes, it is important to consider whether they engage in posthumanism (Lather 2019; St. Pierre 2019) or ‘sustain the unsustainability’ (Blühdorn 2007).

While, as this special issue points out, conceptual shifts in EE are informed by new ethics that connects humanist with the ethics of posthumanisms, new materialisms and new empiricisms, in the case of learning from circular economy this implies learning what environment means beyond its utility. The postqualitative inquiry also implicates conceptualizing activities within framings as new posthuman engagements within the real lived experiences in school classrooms and field experiences, viewed through many, varied conceptual diffractive lenses. The example of the type of education that engages students in postqualitative inquiry and the two case studies that students discussed are presented below.

The Case Study: Student Presentations of Supposedly Circular Products

The Hague University of Applied Sciences (HHS’s) International Business (IB) faculty offers the elective minor sustainable business. This minor is designed as a critical thinking course that, among other subjects, presents theory and practice of circularity. In this minor, different theoretical frameworks, ethical dilemmas and the practice of environmental and corporate governance are discussed. The course considered alternatives to conventional sustainability approaches and ecologically benign models of production, and particularly degrowth economy, steady-state economy, C2C and circular economy.

The case studies involve randomly selected student presentations of IB’s minor sustainable business, presented in April 2021. The student presentations below were part of one of the five modules of the minor, called Politics, Business and Environment. This module focuses on topics of business, politics and economic development, and involves both pragmatic and ethical questions. Pragmatically, the students are asked which business needs to be improved and in what way? If circularity is taken as a definition of (or pragmatic steps) towards sustainability, what types of industries need to improve? Is it business in general, from service to manufacturing, which types of manufacturing industries need the most improvement? Are some branches already (or inherently) more sustainable than others (e.g., service industry might not require any material resources, at least ideally)? For theoretical background, the students were assigned some of the readings mentioned in the introduction of this article, as well as literature related to business and environmental ethics. As reflective of postqualitative inquiry, the teaching method, exercised, in this case by researcher and author of this article, the didactic method involved de-centring researcher privilege by letting students conduct and reflect upon their research – in this case, case studies of circular economy and de-centring prescribed data collection methods and interpretation in search of unified theories/conclusions. Besides these presentations, held at the end of the course, the students were engaged in various interactive activities (during the COVID-19 outbreak period, mostly online), including the debate about the (im) possibility of decoupling economic activity from resource consumption and the role-play called ‘The Shell game’.

Assignment specifications included examination of supposedly circular or C2C-certified products or processes, considering the C2C principles and the 9-R scale. The students were asked to evaluate Ellen MacArthur Foundation's case studies using the circularity evaluation tool: <http://circulareconomytoolkit.org/Assessmenttool.html> or C2C case studies <https://www.c2ccertified.org/resources/collection-page/case-studies> using either toolkit for circular economy from the same web site or C2C certification/accreditation. The students needed to decide on whether the product was a case of greenwashing, on the way to a circular economy, or a best-case study. The students were explained some of the background used in the Introduction of this article. Despite the difficulties of absolute decoupling, the students were told during lectures it is important not to 'throw the baby out with the bathwater'.

Case Study 1: Hennes & Mauritz

One of the groups took the case of Hennes & Mauritz (H&M), a Swedish clothing company, sells 'fast fashion at cheaper prices'. The company was created in Sweden, in 1947, and has produced hundreds of various collections. Exploring H&M's engagement with the circular economy, the students addressed the company's statement:

'Two of the biggest challenges facing our planet today are climate change and resource depletion. Both contribute to biodiversity loss and worsen existing human rights problems. As a global fashion company, we have a significant impact on the health of our planet, which is why we want to be climate positive by 2040' (<https://hmgroup.com/sustainability/circular-and-climate-positive/circularity-and-our-value-chain/>).

Consequently, the students have examined H&M's action plans, such as circular products, and the company's expressed commitment to 'create products that are made to last from safe, recycled and sustainably sourced materials that can recirculate multiple times'. Noting that 'processing raw materials such as cotton is often associated with concerns for working conditions and intense water and chemical use', H&M promises to use 'recycled or other sustainably sourced raw materials' (Ibid). The students also notice that since H&M advertises making clothes from reused materials, some of them recycled plastic, one can speak of repurposing. However, as students have noticed, some materials are better not repurposed, for example making clothes from plastic bottles as plastic is not made to be recycled (it degrades and omits toxic materials in the process) (McDonough & Braungart, 2010). Also, students have quoted from an online blog, that according to their analysis, applied to greenwashing within H&M: 'Companies sticking a clothing collection box in their stores or using a bit of recycled materials does not magically make them "circular"' (<https://mygreencloset.com/circularity-in-fashion/>).

In their analysis, the students praised the aspiration to make clothes that last (thus highlighting the Reduction of demand for new clothes in the hierarchy scale), at least if consumer behaviour supports that durability. However, not much Repair and Refurbishment is apparent as students noted, the fabrics can be downcycled at best. According to the students' presentation, downcycling is perhaps most realistic in the case of fabrics. As for the 'sustainably sourced raw materials', the students could only find references to organic cotton, which, they have found out, requires more land and water to grow as pesticides, fertilizers and genetically manipulated crops are avoided. So, while toxicity associated with intensive cotton cultivation is avoided, other issues, including land clearing and biodiversity loss, are still present. The production of new clothes for millions of H&M consumers and the volume of materials needed for it is hardly addressed.

Case Study 2: Protix

Since 2009, students quoted the web site, ‘Protix has grown from two desks at an attic to an important player in the international insect sector’. Its features include a factory producing high-quality insect proteins derived from grasshoppers, crickets and mealworms (<https://protix.eu/protix-journey/protix-history/>). According to the web site, the insect-based ingredients promise to ‘feed the planet’ (<https://protix.eu/wp-content/uploads/Press-release-2016-BITS.pdf>).

The students have noted, using one of the texts they have read for their course, that while ‘eating insects is much better than beef’, it is not fully circular. As the company web site indicates, the aspiration is reduction, thus the R of reducing, of protein intake. Waste of the end ‘product’ in the toilet – ‘no fertilization materials made from poo’, as one student put it, is not discussed. Packaging is not discussed on the company web site either, but from the images provided on the web site, the students deduced that it is standard plastic packaging. It was also not clear to students from the web site where the insects will be ‘produced’, kept and distributed thus raising the question of transportation (if the insects are not bred locally) and electricity use.

Students have noted that their desk research points out that there are fewer insects due to climate change, the use of agricultural insecticides, and indeed, in some parts of the world where entomophagy is common, a decline in insect numbers. As one student put it, ‘what will the birds eat if humans eat all the insects that they farm and kill off others in the open [intensive agriculture] fields?’ Another student said: ‘This does not feed the planet, but just people’.

Discussion

Turning to two case studies revolving around the notion of circularity, the work of Guattari (1989) on technological worlds fundamentally questions an a priori distinction between technology, ecology, politics and a nonhuman world, but also foregrounds different modes of discourse involved in the notion of sustainability. In both clothes (e.g., H&M) and food (e.g., Protix), production, technology cannot be separated from ecology, as cotton goes through a factory to become a shirt, or an insect turns into packaged ‘snack’.

One of the larger issues revealed by student presentations is greenwashing. The *waste equals food principle* of C2C only applies to food packaging as food waste after digestion (faeces, urine) is rarely discussed when ‘circular food’ is mentioned. Alternative (to those made of petrochemical waste) packaging materials are more expensive, albeit ecologically more benign (The Economist, 2018). Besides, advanced biotechnological recycling technologies for biodegradable bioplastics are still in an embryonic stage (Borrello et al., 2016). ‘Organic’ packaging can also present a problem, as it can only be used once before being composted, and is likely to require land clearing for massive production (Kopnina, 2017).

We recall, however, that Guattari (1989) emphasizes that nature has become intertwined with technology and culture, which in the case of production of anything, from food to clothes, requires learning about not just the method of production (or what the companies claim they do), but a system that merges and erases these distinctions. In the case of packaging, the actual fusing of technology and ‘nature’ in a so-called ‘plant bottle’ of Coca-Cola (Kopnina, 2018), which combines both techno- and organic cycle materials, produces ‘monstrous hybrids’ (McDonough & Braungart, 2010). The same can be said of organic cotton mixed with other supposedly circular materials used by H&M (and likely disposed of by consumers in mixed garbage containers after use), or an insect food product packaged into plastic and later, after being eaten, flushed down the toilet.

In the case of consumables, such as food items, circularity is impossible without considering what happens to waste products that end up in the toilet. Complete recycling seems a ‘thermodynamic impossibility’ as it cost infinite quantities of energy (Man & Friege, 2016:6). In this case,

the postmodern assemblage theory of French philosophers takes up a distinctly concrete feel, as it can be seen as not only framing social complexity, such as society aspiring to sustainability but also the products or artefacts it produces. Deleuze and Guattari's emphasis on fluidity, exchangeability and the multiple functions through entities that create their connectivity can also signify the hybrid monsters of the modern age. Thus, with products fusing nature into technology or culture, little real nature is left (perhaps, Deleuze and Guattari would doubt there is such a thing in the first place), but with those that believe in the objective reality of biodiversity loss, belief in 'added ecological value' or upcycling is rarely warranted in the case of consumables. These findings point to the need of critical reflection within the theory and the intra-actions that re-engage theory via references across several principles of C2C theory. This goes to realist expectations of both students (as inquirers) and critical use of literature (theory), as well as practice that demonstrates greenwashing.

Some of the companies seek to utilize harmless materials or to realize the product-service shift, others merely seek to optimize their product without the needed overhaul of the *entire* business model and supply chain, or consideration of financial 'sacrifice' needed to switch to a more sustainable material (Kopnina, 2019). For example, plastic packaging made of petrochemical waste products is typically cheaper than the more chemically complicated types of less harmful or enzyme-dissolvable plastics (The Economist, 2018) or bioplastics. Biodegradable elements in the cheaper products may be far from the ideal of biomimicry (Stevens et al., 2020), which not only imitates forms from nature but also makes the designs – with package and transport – fully benevolent. Also, while mimicking nature, biomimicry can create problems (Potts et al., 2018) – for example replacing bees with autonomous robots results in detrimental impacts to biodiversity but also neglects the values associated with natural pollinators, such as their intrinsic worth (Buchmann-Duck & Beazley, 2020). Similarly, eating bees or other insects without thinking about other species higher in the food chains is not likely to solve the issue of multispecies sharing of natural resources. Daly (1991: 184) notes that real production and consumption are in *no way circular*. The growth economy sees outputs returned as fresh inputs (ibid. p. 197). As the examples above showed, neither supposedly 'sustainable' clothes nor insect food directed at minimizing consumption. Thus, a distinction between ideal and less ideal practice is crucial, both in business and education contexts (Kirchherr et al., 2017; Kopnina & Blewitt, 2018).

While the examples above show shortcomings of production processes that claim to be circular, it is also possible to conceive of better examples that take the core principles of circularity into account. These can be found in preindustrial production systems, and also innovative products and systems. To avoid unwarranted optimism in techno-fixes and greenwashing, these innovations need to be critically examined and if necessary attuned. Other solutions are already present in the form of low-hanging fruits as most corporate strategies embrace win-win situations: for example, saving energy by companies directly translates into saving money.

While it still has a long way to go in practice, circular economy can be potentially transformative. It is thus crucial to make a distinction between ideal and subverted practice. Within biological/organic cycle, for example, both the method of production and the type of food produced need to be considered alongside with the question of what happens after consumption – what ends up in the toilet, if 'waste is food' principle is to be followed. Within technological cycle products can be evaluated by 9-R strategy. Good examples can be found in preindustrial production systems, for example in vegan diets or in clay containers that used to be used for transportation and storage. This does not mean reverting to preindustrial lifestyle, putting producers at a disadvantage, as production can be also innovative, for example, by focusing on materials that harness energy of sun and wind, are durable and need little maintenance.

Pedagogical/Ethical Lessons

Student presentations of food and clothes cases serve to illustrate part of the PBE course that teaches critical thinking but also uses both empirical cases and theory in a productive feedback loop. Projecting/extending this small sample from the course indicates how ‘presentations’ can be creatively explored as living videos/audios of experience. Based on these student presentations, we can speculate on critically challenging students to extend/expand their own experiences/reporting to include more living accounts of their engagements with circular production. Many examples of live presentations work to get beyond the mere representation of what the industry says sustainability is. The next step in the learning process could be expanding rich descriptions of involvement in environment-related projects using props, for example ‘circular’ items to illustrate real experiences and/or imaginative possibilities. Thus, this preliminary exploration of critical case studies provides a perspective that educational inquiry cannot directly address but needs to become more cognizant about. Postqualitative is itself critical of ‘business as usual’ in the research process (Kopnina, 2014). The students are already engaged in realist inquiry. In education, a sustainable business curriculum should consider limitations to the circular economy and focus on degrowth (O’Neill, 2012) as a more challenging but potentially transformative part of corporate strategy.

One of the challenges is that circular products need to be both locally produced with a minimum environmental footprint, simultaneously meeting the demand of global consumers, which might be uninterested in or unable to afford sustainable products. Isenhour (2010) notes that consumers might be either uninformed or unmotivated, or tricked by the supposedly ‘green’ marketing that stimulates the consumption of new products, causing a rebound effect. Also, an individual’s sphere of influence is limited, and not all consumers are environmentally conscious. Consumer responsibility can be seen as a strategy of corporate and political power holders to ‘defend their ability to resist the regulation of resource-intensive, polluting or socially damaging products’ (Isenhour, 2010:456).

Many companies are still engaged in greenwashing. Worryingly, Ellen MacArthur Foundation (EMF), the most influential promoter of circular economy, presents supposed ‘best case’ companies that keep churning out new products. None of the companies on the list attempt to halt the production and come up with transformative infinite reuse business models, praising new ‘circular’ products instead (Kopnina & Blewitt, 2018; Kopnina, 2019). This lack of transformative corporate action is explained by the fact that halting production means that corporate players focused on manufacturing cannot conventionally make a profit – thus rather preferring ‘business-as-usual’ (Isenhour, 2010; Kopnina, 2021). In literature as well as in the student analysis, it appears that fully circular solutions are limited by thermodynamic (im)possibilities. This is related to the fact that absolute decoupling in material production and consumption rarely occurs (Victor & Jackson, 2015; Washington & Maloney, 2020).

Returning to ‘research after humanism’ (Lather, 2019; St. Pierre, 2019) and posthumanist ethics, in the cases above students learn to inquire which types of economic activities can be seen regenerative or reciprocate to greater-than-human-word. Both in application to fabrics/textiles and food, the claim of circularity is still centred around the notions of ‘natural resources’ or ‘ecosystem services’ rather than intrinsic value or sharing. As one student expressed it, ‘what is left for the birds’ after the insects are cultivated and consumed by humans remains unclear.

Environmental educator might speculate about options that could exist in presenting postqualitative data, for example using videos of presentations (recorded during COVID-19 necessitated online lessons) so that readers/viewers can see the ‘real’ live engagement. While anonymity considerations restrict this possibility, videos could be part of mini-case studies, hopefully even when ‘business’ interests are implicated. Postqualitative inquiry is often realist, following Barad’s (2007)

'concept' of agential realism. While this realism may indeed be challenging in the contexts of circular economy, educators could find more creative agential realist ways of presenting real images, through speculative realism.

Generally, courses that engage with circularity critically promise to provide evidence, on the ground, that creates openings of curriculum reconstruction and pedagogical application. Exposing (environmental) educators to circular principles as well as real-world application adds important concepts to science/environmental education. The case study applications for business education and explicit connections to other 'educations' are purposefully interdisciplinary. The conceptualization and complexities of the circular economy implicate both political economics of EE and posthuman perspectives on (new) materialism. One could conceive of student presentations as mini-cases grounded in agential realism, opening postqualitative possibilities for student engagement in applying posthumanist ideas with the realities of material engagements. These examples challenge readers to engage EE experiences differently, as realist.

Returning to Deleuze and Guattari (Deleuze & Guattari, 1980), the multiple, nonhierarchical entry and exit points in data representation and interpretation apply to the case of noneconomic or nonrationalist/instrumentalist motivation for 'doing sustainability'. If the circular economy is to be truly ecologically beneficial or at the very least, less harmful, its contribution to the environment, especially in the case of consumables, needs to be better understood. Where and how are 'sustainable' clothes of H&M produced (e.g., is organic cotton – a virgin material – really 'circular')? Where and how are insects collected or 'farmed', and what remains for other species? Is food waste (what ends up in the toilet) from eating insects still counted toward circularity? These are the types of questions that posthumanist inquiry highlighted in the special issue of this journal needs to address.

Conclusion

In the case studies discussed above, absolute decoupling, upcycling and infinite reuse remain ideals. Far from adhering to Refuse or Reuse principles through product service shift (PSS), most companies continue production using virgin or recycled resources. The greatest challenge for manufacturers is finding a way to make money while supporting environmentally conscious consumers, while the greatest challenge for (business) students is learning how the system of production can be, ideally, decoupled from what Deleuze and Guattari called assemblages and what in Cradle to Cradle terms, means monstrous hybrids. As discussed in this article in connection to case studies of clothes and food, while Deleuze and Guattari's theory of assemblages emphasizes fluidity, exchangeability and the multiple functions through entities that create their connectivity, such connectivity and intermixing might mask a dissolution of nature as a real entity into 'natural' or circular products. Both food and clothes are produced by taking things from nature – cotton, insects, etc. – and turning them into products or artefacts used exclusively for human consumption, leaving little for biodiversity, other than lip service to multispecies connections. While this article reflects this author's (and lecturer's) commitment to circularity, it is the students' experimentation and speculative thought about the challenges of constructing and engaging in circular projects that offer the most 'food for thought'.

'Thinking with the theory', in the case discussed above, of unsustainable production, but also of more hopeful alternatives, such as the R of refuse, the steady-state economy and degrowth, and the use theory to think with the data (in this case, student-produced case studies) was used here as new analytic for postqualitative inquiry. In working concepts and problems together, student presentations of case studies demonstrate that the emergent ethics of posthumanisms require questions as complex as how to decouple resource consumption from the economy and as simple

as, after our clothes are stitched and our food is prepared, what will be left for the birds to eat? As ‘postqualitative’ inquiry is emerging as a politics refusing humanist methodologies and re-evaluating qualitative inquiry concepts, pedagogical lessons from learning *for* and *about* circularity provide different ways of viewing, thinking and living within ontological imaginings of a sustainable world. As such, this article is a plea to build on the momentum surrounding non-anthropocentric work within environmental education, while also encouraging cross-pollination between environmental education research and the growing bodies of literature dedicated to reconstruction of categories such as ‘nature’, ‘biodiversity’ and ‘environment’, as real, albeit critically endangered entities, threatened by industrial production and pretence of full decoupling and circularity.

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