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From the Anthropocene to Mutual Thriving: An Agenda for Higher Education in the Ecozoic

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Abstract: Higher education in the global North, and exported elsewhere, is complicit in driving the planet's socio-ecological crises by teaching how to most effectively marginalize and plunder Earth and human communities. As students and activists within the academic system, we take a firm stand to arrest this cycle, and to redirect education toward teaching how to create conditions for all life to thrive. In this paper, we articulate a research and education agenda for co-constructing knowledge and wisdom, and propose shifts in the 'ologies from the current, destructive modes to intended regenerative counterparts. We offer to shift from an ontology of separation to that of interconnectedness; from an epistemology of domination to that of egalitarian relationship; and from an axiology of development to that of plural values for world- and meaning-making. Such paradigm shifts reflect the foundational aspirations of the consilient transdiscipline of ecological economics. We analyze several introductory university textbooks in economics, law, and natural sciences, to demonstrate how destructive 'ologies are taught in North American universities, and how such teaching implicitly undermines critical inquiry and effective challenge. Our strategy for change is to provide a new theoretical framework for education: the regenerative 'ologies of the Ecozoic', based on biophysicality, embedded relationality, pluralism, and the sustainable well-being of all members in the community of life.

Keywords: Higher education; Ecozoic; justice; sustainability; pluriverse; interdependence; relationality; ecological economics; research agenda; textbooks

1. Introduction: Towards Pedagogies for the Ecozoic

The Ecozoic is a term originating from the work of eco-theologian Thomas Berry [1] that describes a future era distinguished by mutually enhancing relationships between humans and the global

community of life. In this paper, we contrast the Ecozoic to our current era, one that goes by many epithets—Capitocene, Plantationocene, Civilicene [2–5]—but one epithet we single out in particular: the Anthropocene. The Anthropocene, we purport, is an era distinguished by a human othering of ‘nature’ and of the subsequent domination of this ‘other’. We posit that the global ecological crisis we face in the form of extreme weather events, increasing social inequality, environmental injustice, loss of biodiversity, climate change, and massive species extinctions, are expressions and outcomes of a worldview that fails to see humans as deeply embedded in ‘nature’ and to act accordingly.

In envisioning the Ecozoic, Berry highlighted the critical role of universities, asking “whether they will continue training persons for temporary survival in the declining Cenozoic Era or whether they will begin educating students for the emerging Ecozoic” [1]. Our claim is that universities have yet to rise to this challenge. While there have been some attempts at “greening” curricula, updating courses, and piecemeal integration of sustainability concerns and environmental issues [6,7], such steps are, on the whole, inadequate. The challenges besetting the Anthropocene call for radical reorientations of curricula, practices of engagement with communities outside the academy, re-conceptualizations of what knowledge itself is, and a re-thinking of how this knowledge is being produced. Higher education, in short, has a central role in bringing the planet beyond the Anthropocene and into the Ecozoic era, and we believe that it is currently failing in this task.

Therefore, in order to imagine this shift from the western cosmological perspectives of human/other-subject/object relationships to an Ecozoic understanding of a global community of life centered on subject/subject relationships, we focus on the role of academia as a key purveyor of social and intellectual norms. We argue that the academy itself must become a subject of transformation. Building on this critique, we then introduce and develop the concept of ‘becoming Ecozoic’ or ‘Ecozoic-thinking-being (*senti-pensar*)’ as a salve to ‘Anthropocentric thinking’. We suggest it as a useful concept for ecological economics and other embedded approaches to knowledge and understanding to draw upon, in order to promote their emancipatory capacities and to more fully move towards a shared imagined future on a planet that is “symbiotically alive to a multiplicity of nonhuman critters and things” [4].

Such calls have been made in the past. For example, Brown and Erickson [8] call for the re-embedding of the normative disciplines: law, political science, finance, ethics and economics, into the biophysical foundations of human society. They also highlight ecological economics as a promising example of a discipline that advocates reforming higher education so as to address the ecologically destructive nature of society, as well as a discipline which has made some headway toward such an end. We feel, however, that the problems besetting ecological economics from fulfilling its greatest ambitions center around the fact that the discipline finds itself embedded within a larger neo-liberal system—a system built upon categories of an ontology of separation, an epistemology of domination, and an axiology of development. Here we make the case for a more ambitious research and teaching agenda for ecological economics, informed by an Ecozoic perspective, and focusing, in particular, on these three categories.

We examine the ontologies, knowledge practices, and axiologies currently limiting our capacity to transcend the Anthropocene, by analyzing undergraduate textbooks. The textbooks are scrutinized as artefacts, tools, and social objects, through which understandings of the world are put forth, and through which students learn the rules and facts as handed down from the path-dependent intellectual legacy of Western Enlightenment thought. In this method, we are also part of a tradition: Foucault saw the 17th and 18th century scientific texts positioned within society almost as epistemology on its own - the textbook was fact, was knowledge itself situated within a conceptual system [9]. This notion was later reiterated by Paxton [10], who likewise emphasized how statements become ‘fact’ explicitly because they are found in textbooks.

Next, we describe our vision for what pedagogy, textbooks, and other forms of learning–knowing could look like within a ‘pedagogy for the Ecozoic.’ Here we argue that the Ecozoic requires new approaches and new textbooks to tell a different story that more accurately reflects both new and old

understandings of interconnectedness; engages with conceptualizations of the human and of being; reaffirms and celebrates other ways of knowing; and emphasizes our embeddedness in nature while building greater respect for the species alongside which we have co-evolved over the vast space of evolutionary time.

Ecozoic Pedagogy is both a practical response to biophysical realities and an ethical response to the dire present. Its process or praxis is of equal importance to its content, and we focus on the mutual transition of both. In this manner, our goals are two-fold: (1) to nourish the growth of healthy, joyful, self-determining, self-regulating, moral human beings, embracing in process and outcome, what Albert Schweitzer's poetically called "a reverence for life" [11]; and (2) to inspire a praxis in defense of that life, tending students' capacities to build coalitions of solidarity powerful enough to effectively dismantle systems and structures of domination and oppression, and, in their stead, to build, maintain, and reproduce equitable systems and thriving multispecies communities. This reorientation of collective social life towards the service of its own maintenance as an ecologically embedded subset of life is fundamentally our goal. We conclude by suggesting that our 'ologies of the Ecozoic'—ontology of interconnectedness, epistemology of egalitarian subject to subject relationship, and axiology of plural values and world-making practices—can be used to examine current curricula and lay out what a research agenda for ecological economics and other normative disciplines could look like.

This paper emerged from a university-led collaboration, "Leadership for the Ecozoic", a graduate student training and research partnership. We write as a group of students, scholars, and activists from seven different nations, of diverse genders, and racial, ethnic, and cultural backgrounds. We share the fact that we are all from elite educational faculties and consider ourselves complicit in the decline of life's prospects. Acknowledging our positionality as within that system, we argue that if we are presently, in many ways, "learning to plunder", [12] it is our hope that we might learn, and learn to teach, both the emergence and the maintenance of Berry's "mutually enhancing relations" [13].

2. Theoretical Framework

In order to transition intentionally, equitably, and, hopefully to the Ecozoic, we must first understand and address the conceptual structures and assumptions that contribute to the aforementioned crises of the Anthropocene. We identify ontology, epistemology, and axiology as dimensions in which normalized and rigidified concepts and assumptions must shift in order to realize the Ecozoic [13]. While these dimensions are deeply entangled, we address them separately for analytical purposes.

In outlining this tripartite framework, we draw on the work of many scholars, activists, and thinkers whose ideas and actions foster radical and transformative paradigm shifts across various domains of knowledge and practice (e.g., [1,13–23]). These contemporary thinkers themselves draw on others from both within and outside of the Western traditions. Collectively, this diverse group grapples with common assumptions about the nature of reality, power, and knowledge, while imagining creative and grounded visions for "a world where many worlds can fit," a concept aligned with the Zapatistas' increasingly well-known dictum of the pluriverse [24,25].

Philosophically, the outstanding predecessor in regard to our 'ologies' of the Ecozoic is the British philosopher, Alfred North Whitehead. His concept of the philosophy of organism, or, as it is more commonly called, process philosophy, reveals clear parallels to our proposed movement beyond separation and domination, and towards a new valuation or axiology beyond development. The philosophy of organism is an attempt to move beyond metaphysical categories such as substance/essence and subject/object into a relational scheme of world-unification whereby the underlying entity of valuation—rather than a substance or essence of sorts as in Aristotelian or Cartesian metaphysics—is itself the recognition of the interconnectedness of all things [26]. Thus, instead of 'perceivers' and 'things perceived,' we are to come to recognize the deep interconnectedness of all things as that which gives value to the world.

Other figures who are important in this school of thought are Teilhard de Chardin and John Cobb. Environmental ethicists, likewise, have been engaging with such ideas for decades and we would be remiss to not mention some key figures in this movement who have both contributed to and, again, preceded, our ideas. These include Aldo Leopold and his land ethic [27]; Arne Naess and the deep ecology movement [28]; Ramona Cristina Ilea and her work on extending ethical arguments to animal rights and environmental movements [29]; ecofeminism and its emancipatory potential as expressed by pioneers such as Val Plumwood [30]; and lastly, Gregory Cajete and his work in bringing issues of indigenous ecology more to the forefront of Western environmental thought [31].

In aligning ourselves with radical thinkers who have gone before us, we aim to build upon a well-established critical genealogy of, and alternatives to, Eurocentric narratives of modernity, colonialism, and development [32–48]. We use the word “ontology” as a set of claims and practices around what the real is, and how that understanding is enacted across time and space [34,35]. Epistemology, as applied within our framework, refers to how humans and nonhuman agents represent the real (or reals) [36–38]. Finally, we acknowledge that ‘value’ is what brings the real into being [39], and employ axiology to assess how value assumptions, and the beliefs and actions they justify, interact with ontology and epistemology to contribute to the crises of the Anthropocene. In building and applying this framework, we hope to identify how shifts across these dimensions can contribute to realizing the Ecozoic.

2.1. *Ontology of Separation*

Underpinning scholarship, religious traditions, and social institutions in the Anthropocene is an ontological dualism that conceives of humans and nature as separate domains [1,49–51]. This dualism has two deep roots; one found in Ancient Greek philosophy and Plato in particular, and the other in Aristotle’s accounts of the differences between humans and other sentient beings. In several of his dialogues, Plato defines and delineates what he calls the realm of ideas, an eternal and unchanging realm of entities existing beyond the material world [50]. This metaphysical separation places human beings in a distinct class apart from other beings with Plato purporting that while there exists another ‘world’ of sorts beyond the material, only humans and the human mind can access it. This separation was subsequently seized upon by neo-platonic and Christian philosophers, and was incorporated into Christian philosophy and, by extension, the collective consciousness of the emerging Christian West during the Middle Ages [49].

Even more widely and deeply influential is the Judeo-Christian creation story found in the Book of Genesis. There are several features of this narrative which help set the stage for an ontology of separation. Perhaps the most important are the doctrine of special creation, that humans are created in the image of God, and that nature itself is profane and in need of redemption so that we may retake our rightful place in paradise [52].

This separation was further developed and instantiated in the modern consciousness with the expansion of modern science during the Enlightenment period [33,49,53]. Thinkers such as Galileo Galilei, Rene Descartes, and John Locke articulated a dualistic metaphysics which separated the living world into distinct categories corresponding to their mechanical philosophy and its doctrine of primary and secondary qualities [53–55]. Descartes in particular, widely hailed as the father of modern philosophy, emphasized a distinction between the human mind and the world of matter with his doctrine of *res cogitans* and *res extensa* [56]. These dualisms ultimately resulted in a further division of the world into categories of subjects and objects [57]. Thus, the Anthropocene is largely defined by ‘othering’—humans viewing both non-human nature and each other as ‘other’ [1,58–60]. This ontological division has profound implications, particularly in determining who has rights, and by informing who counts as a who [41,42,61,62].

It is with the increasing number of scientists, academics, theologians, indigenous leaders, and activists voicing opposition to such views that we stand and take our position. Scholars such as Thomas Berry, Arturo Escobar, Anna Grear, Donna Haraway, Robin Wall Kimmerer, Bruno Latour, Maria

Mies, and Vandana Shiva are prominent among those who have recognized the fallacy of separating humans and the ‘natural world’. We stand with them in our efforts to reimagine *homo sapiens*—or ‘*homo insapiens*’ as Margulis and Sagan argue [16]—and *homo economicus*, to embody the reality that human species are interdependent and inherently embedded within ecosystems [58,62–64]. In aligning ourselves with these thinkers and their ideas, we acknowledge that the full complex world is rendered largely invisible through an ontological lens that reduces the real to discrete entities [41], independent variables, factors of production, and allopoietic systems [15].

2.2. Epistemology of Domination

While an ontology of separation inhibits the acknowledgement and honoring of complexity, we identify similar implications stemming from epistemological norms of the Anthropocene that are prevalent within higher education. We agree with those who identify the epistemic crisis of our age as one of domination. Within our framework, an epistemology of domination refers to the hegemony of narrow and exclusionary definitions of knowledge and the knowable, and the consequent marginalization of other ways of knowing and being [8,25,65]. As both outcome and evidence of this epistemic domination, power resides with the self-appointed people and institutions that determine, epitomize, and rigidify definitions of knowledge—namely, science, many if not most of the professions, and attendant notions of expertise [66]. Alongside science and experts, rationality and objectivity dominate the epistemic landscape [57,67]. An outcome of this domination is the creation and imposition of universals that invalidate and make invisible the alternative and non-Anthropocentric ways of perceiving the world and creating knowledge [68,69].

An epistemology of domination, like the ontology of separation, has roots in Judeo-Christian texts and was further developed and justified in the modern era by Francis Bacon and Rene Descartes [56,70]. This approach to learning places exclusive emphasis on the human, and more specifically on the male, as the agent of knowledge creation or discovery. According to Bacon, the world was to be conquered and pried into to reveal her ‘feminine’ secrets, a belief that is manifested in the scientific and colonial practices of the ‘Enlightenment’ period and remains standard in Western approaches to studying and knowing the world of humans and nature [39,52]. The standardization of this epistemic approach has profound implications for people, institutions, communities, and beings whose existence defies rational, reductionist, and scientific constructs of knowledge and being. Opposing narratives are deemed ignorant, worthless, and are often made invisible by a dominant epistemology that refuses to acknowledge other ways of knowing and being [33,71].

Going beyond an epistemology of domination, our vision requires an epistemology of relationality between human and other-than-human beings [46,65]. Drawing from Amerindian anthropology, moreover, we claim that humans do not have monopoly over the world of meaning [43,72,73]. Nonhumans are active meaning-making beings in that they represent the world in other-than-symbolic forms. For example, anthropologist Eduardo Kohn’s work with the Runa of the Ecuadorian Amazon offers unique ethnographic evidence on the intrinsic sign-producing capacities of nonhumans such as plants, and animals [43].

2.3. Axiology of Development and Progress

In considering problematic and rigidified assumptions that define life in the Anthropocene, we assess how Western ontological and epistemological norms interact with and inform axiological emphases on progress and development; emphases that grow directly and easily out of the idea that nature itself is profane and that the project of progress is to regain our rightful place in paradise. In particular, we identify the growth narrative, propounded by an anthropocentric, Western world system, as a problematic product of the epistemological and ontological assumptions previously explored. We thus employ axiology as an analytical tool for assessing how values are produced and mobilized to advance a singular, hegemonic vision of the real. In particular, we analyze how the values of ‘progress’,

‘growth’ and ‘improvement’ are used to naturalize and justify development-oriented paradigms across the world at the expense of local practices of cultural and economic difference [20,36,74].

Social institutions produced by or aligned with this hegemonic worldview are predicated upon a narrow definition of progress that directly or indirectly justifies the oppression of certain people and non-human beings [20,36,74]. In particular, colonial and development-oriented notions of universal history and progress reify humans as subjects and all other beings as objects without rights [13,14]. They also cast other ways of being as inferior and regressive, potentially even immoral and in need of salvation [75]. In transitioning out of the Anthropocene, it will be necessary to re-embed social institutions in the relational and complex interdependence of ecosystems and lifeworlds.

Given the problematic evolution and implications of an axiology of development, we align ourselves with the likes of Charles Darwin, Lynn Margulis, Robin Wall Kimmerer, and others who have proposed axiologies of relationality and reciprocity. Darwin, of course, disrupted ontological and epistemological Biblical anthropocentrism by connecting humans to all living beings on the planet [76]. Margulis extended and deepened this realization with her conceptualization of symbiosis, extending the web of life down to the microscopic, and thus further challenging the separational and hierarchical ontologies and epistemologies that emphasize human exceptionalism [77]. To state it in terms of Nuu-chah-nulth scholar Umeek E. R. Atleo, the principle of interdependence—“(l)iving in balance and harmony with diverse life forms”—should be applied to every dimension of existence [46]. This relational approach thus seeks to de-center the human in socio-ecological and normative systems, while attending to the knowledge-making capacities of other-than-human beings. In this tradition, current academics such as Kai Chan, Rachele Gould, and Alder Keleman Saxena are developing and expressing relational values in the axiological realm as an alternative to the purely anthropocentric instrumental and intrinsic value distinction [78,79].

Furthering the work of the aforementioned thinkers and practitioners, we believe that a paradigm shift in education [19,80], particularly in the field of ecological economics [8,81], is a necessary and collective endeavor [20,46]. We therefore propose a framework to support shifts away from a paradigm characterized by: an ontology of separation between humans and the larger community of life; an epistemology of expert knowledge and domination that either invalidates non-modern systems, or renders local beliefs invisible or non-scientific; an axiology of progress perpetuating a universal view of history and culture; and finally, a development and growth-oriented pedagogy that displaces alternative local and place-based social, cultural, and economic practices.

3. Methods

As humans, we explain the world in a certain way based on what we believe to be true; however, it is through the very act of naming, categorizing, and ordering that we become embedded in what Heidegger referred to as the “*gestell*,” and thus, the way we exist in and interpret the world [82]. This process of enframing is especially relevant to higher education in the Anthropocene when popular introductory textbooks make implicit or direct claims of the universality of their theories and values; claims which reify and give ontological status to the same epistemological and analytical tools that created them. This circularity helps to reinforce what John Law refers to as the “one-world world,” an ontologically and epistemologically homogeneous world that claims superiority, while discounting and making invisible other realities [41].

The aim of the investigation was to identify whether a set of widely used textbooks supports our claim of perpetuating problematic ontological, epistemological, and axiological assumptions; thus, selected introductory textbooks from the authors’ respective areas of formal educational training were reviewed. These disciplines included economics, law and governance, and applied natural sciences (see Table 1). From these disciplines, ten textbooks, readily available at university libraries in Canada and the United States, were randomly selected and analyzed to determine their pre-analytical assumptions. The texts chosen were considered to be typical of, and foundational to, their respective fields. Each reviewer made an initial independent analysis of the textbook and received feedback from their advisors.

A second, more refined analysis was then carried out. From this second round, a subset of the authors reviewed the documents to identify the emergence of common themes. They then assigned these themes to different groupings of pre-analytical assumptions to develop the aforementioned framework.

Table 1. Textbooks of the Anthropocene.

Discipline	Textbook	Author	Year
Economics	<i>International Economics: Theory and Policy</i> (8th ed.)	Krugman, P. & Obstfeld, M.	2009
	<i>Microeconomics</i> (4th ed.)	Krugman, P. & Wells, R.	2015
	<i>Microeconomics</i> (4th ed.)	Parkin, M.	1998
	<i>Corporate Finance</i> (11th ed.)	Ross, S., Westerfield, R.W., Jaffe, J & Jordan, B.D.	2016
Law and Governance	<i>Energy Policy Analysis: A Conceptual Framework</i>	Hamilton, M. S.	2013
	<i>Comparative Legal Traditions</i>	Glendon, M.A., Carozza, P.G. & Picker, C.	2008
	<i>The Practice and Policy of Environmental Law</i>	Ruhl, J.B., Nagle, J.C., Salzman, J. & Klass, A.B.	2010
Applied Natural Science	<i>Scientific Farm Animal Production: An Introduction to Animal Science</i> (8th ed.)	Taylor, R.E., & Field, T.G.	2004
	<i>Living in the Environment</i> (1st Canadian ed.)	Miller, G., & Hackett, D.	2008
	<i>Principles of Conservation Biology</i> (3rd ed.)	Groom, M.J., Meffe, G.K., & Carroll, C.R.	2006

4. Results

Despite the broad disciplinary variety in our textbook sample, we found consistent propagation of an ontology of separation, an epistemology of domination, and an axiology of development. Little, if any, space within the textbooks was provided for the critical review of the base assumptions upon which policy recommendations and theoretical models stand, or for the ideology which underpins them. We discuss these findings in the following section.

4.1. Ontology of Separation

The examined textbooks revealed an ontology of separation between humans and nature, with the promotion of human exceptionalism and human ‘beingness’ over the non-human. The law and governance textbooks [83–85] demonstrated the separation in the conceptualization of the environment as a separate entity to the social institution of law. Legal rights and responsibilities were thus afforded to humans only. Environmental governance assumes nature as ‘other’ and seeks generally to either preserve or conserve the environment principally for the benefit of humans or take a ‘command and control’ approach to pollution control, again for anthropocentric reasons. Non-humans are confined to the realm of objects that can be appropriated and/or protected by the law as the traditions of Common Law and Civil Law rest on the assumptions that the real is divided into: (1) objects of rights such as lands, forests, and minerals; and (2) natural and juridical persons, such as humans, civil organizations, and corporations exerting rights over the former. Discussions of emerging ecosystem governance concepts in Ruhl et al. [85] did not acknowledge the embeddedness of human systems, such as law, within Earth’s ecological systems.

Economics textbooks [86–89] revealed similar conceptions of a separation between the human and nature. Being, or the subject of an exchange, was conceptualized by the majority of the economics textbooks to be limited to either that of a ‘consumer’ or a ‘person’; a person being a category that includes human beings or their created corporations. No value was afforded to other animals or nature except for in relation to their monetary value to humans. Symptomatic of a human-nature dualism, Parkin [88], in his textbook on microeconomics, situated the sphere of the human economy outside that of Earth processes with no explicit connection between economics and the cycles and

thresholds of the natural world. Natural resources were defined “as gifts of nature that we use to produce goods and services” and were further separated into the categories of “to be used repeatedly” or “exhaustible” [88].

This ontology of separation continued into the environmental sciences and animal husbandry textbooks [90–92]. The textbook examining animal husbandry was concerned only with animals as a form of wealth creation, i.e., live ‘stock’, reducing their existence to units of exchange. Little regard was placed upon engagement between and amongst the more-than-human and human world or even animal welfare. Encouragingly, biological and environmental science textbooks were less ontologically wedded to human-nature dualism, but still valued ecosystems predominantly for their utility to humans, holding fast to attempts to convert biodiversity’s value into monetary terms (e.g., payment for services) rather than overtly recognizing the incommensurability of wilderness, nature, ecosystems, biodiversity, etc. Such a narrow view results in an ongoing positivistic enframement of the environment where the lives of both the human and more-than-human are limited to biophysicality and economic value.

4.2. Epistemology of Domination

All four textbooks reviewed within, or related to, the field of economics reinforced an epistemology of domination by making implicit claims that highly abstracted models are objective and universal. In the microeconomics texts, economics was represented as a science, implying that every economy proceeds strictly in line with a series of interrelated mathematical equations, which requires that all human action be either abstracted out or reduced to that of the ‘rational consumer’. Similarly, the text in international economics treated supply, demand, and trade as expressions of natural laws, with mathematical functions and identities fulfilling a position of platonic ideals. None of the texts acknowledged other economic schools of thought and all made claims to the universal application of their discipline. Such exclusion in effect not only provides a limited understanding of today’s economic and political context, but also reinforces a classroom uncritical of the modern economic complex, strengthening its domination over other conceptions of economics.

The texts in the field of law [83–85] furthered the epistemology of domination through parallel and overlapping pathways. Both texts subscribe to private property and economic rationalism as pre-analytic assumptions. Glendon’s text in comparative law [83], which provided an overview of the history, theories, and methods of Civil and Common Law, recognized only legal traditions with roots in the Roman Empire, rendering invisible place-based legal ‘stories’ and ‘beliefs’. Such omission undermines the role that Eastern law and culture have played in the creation of a ‘Western’ legal canon [71]. The state was considered the main law-producing unit while collective subjects such as Indigenous communities were presented as only capable of producing ‘local customs’. Similar to the way in which the textbooks in economics failed to recognize methodologies outside of neoclassical economics, the invisibility of different legal traditions and their contributions in law textbooks fortified an epistemology of domination through the self-given right to assimilate knowledge without recognition and/or failing to acknowledge anything outside of the claimed ‘universal’.

The three textbooks which fell under the umbrella of natural sciences supported an epistemology of domination and reinforced claims to universality. Within the conservation biology text [90], all humans were understood to be, and accepted as being, destructive creatures with dominion over land, failing to recognize ways in which humans have acted in mutual benefit with non-humans. The environmental science text [91] reduced all life to mere biophysicality, disallowing the possibility of exploring anything further than the mere economics of existence. The animal science text [92] explicitly positioned nature as an entity to be exploited for humans’ benefit. Such positions are evident in and reinforce the ontology of separation, as discussed above.

4.3. Axiology of Development and Progress

The examined textbooks also revealed an axiology of development and progress: a siren song of unceasing wealth accumulation. Progress was defined as economic growth and continues to be among the most naturalized concepts in the social and policy domains [40].

Within the law and governance textbooks, tenets of legal theory and practice ran parallel with the narratives of economic development. Legal systems are characterized by ongoing politics of coloniality, reinforcing power asymmetries between nations and social groups, and justifying economic exploitation. Analyses of environmental law and policy textbooks identified frequent trade-offs between economic and environmental concerns, while the pursuit of economic growth has been tempered and has continued to be managed by a top down approach. The growth paradigm was also evident in environmental law [85], which was largely concerned with the management of pollution and natural resource conservation. Such limited area of focus was indicative of attempts to ‘systematize’ and control resource extraction, which is tightly coupled with economic growth. The existence of this paradigm was not exempt from the introductory textbook in animal science [92], where animals were viewed as a utilitarian means to an end; the end being the anthropocentric end of producing greater economic wealth.

The axiology of development continued in textbooks introducing microeconomics, international economics, and finance. Here, well-being is limited in definition to the purely material and ‘beneficial’ was measured predominantly in terms of Gross Domestic Product (GDP). These textbooks depicted growth not only as good, but moral and as the key to resolving problems for both humans and the environment. The finance textbook [89] geared students towards becoming the rational, self-interested ‘economic man’ (*homo economicus*) that is required in neoclassical economic theory. Students are taught the knowledge and skills required to manage a firm’s potential for value creation, regardless of ethical considerations for current or future generations of life’s commonwealth. In this way, the firm/corporation becomes a means to an end. Combined with utilitarianism, these texts facilitated economic man’s goal to maximize wealth in the short-term and achieve the materialistic gain that he/she chooses to pursue.

5. Discussion: Ecozoic Pedagogy—How Should Learning Take Place in the Ecozoic?

Having critiqued the pre-analytic assumptions at the basis of education in the Anthropocene, we now provide alternative philosophical grounds for building the pedagogy of the Ecozoic. We insist that the ontology of separation, the epistemology of domination, and axiology of development and progress be abandoned. In their place, our system of education must teach students to understand and experience our interconnection and interdependence with all of Earth’s ecosystems and beings. By broadening our notions of value beyond mere utility to humanity, we will prepare students to confront the “efficient plunder” [12,93] paradigm of the current educational and civilizational ethos, and we will re-embed human societies within the natural world.

5.1. An Embedded Mode of Being

The educational process we advance is, in essence, what might amount to becoming Ecozoic. Students and teachers are a part of this process, beginning with higher education and scaling out to all of our institutions. We must focus our pedagogy on the attunement of the human being in respect to their myriad facets: minds, bodies, senses, emotions, and spirit, to the comings and goings of what Tim Ingold has called the ‘meshwork’ [94]. This re-education of attention [95] to the deeply interlaced threads of the comings and goings of all beings that make up ‘nature’ and culture, is truly what it means to ‘think ecologically’ [96]: all of us, at all levels and species, are indelibly intertwined [97]. This is not a matter of mechanism or materialism, but of relation: a result of life being the origin of *telos*, where mattering begins to matter [98]. All beings interact as subject/subject, from the level of individuals, all the way up to watersheds and communities, to polities, and the planet.

This stance implies an emphasis on multiple, generative ways and means of knowing beyond mere rationalism, and the education and culture it is based upon and reinforces. The legitimacy of forms and means of knowledge that have fallen ‘outside’ this modernist and colonialist logic has been winnowed out by limited philosophical filters. In the quest by mainstream Western society for domination and ontological hegemony [66,99], we have created the Anthropocene, and diminished our own knowledge and wisdom. The necessary epistemological shift will allow a more complete understanding of the world’s complexity, drawing in what is now unfortunately cast—though encouragingly less and less so—as ‘informal’ sources, such as traditional ecological knowledge [100].

Expanding our epistemological boundaries to include relational, embodied, and embedded epistemologies, will only enrich our educational world. This is not a call for an ontological relativism, for we are mindful of the cautionary note of the Zapatistas that “[t]here are words and worlds that are lies and injustices” [101–103]. It is in this context, and from this place, that we will un-learn our Anthropocene ways and become re-enchanted with the natural world [104]. The task ahead, as Paulo Freire [105] insists, is that of re-inventing the human, and we imagine this re-embedding as connecting our social and normative systems within the broader community of life. Freire argues that education can, and should, be a mutually constructed process, in which humans, as subjects, transform both each other as well as reality itself [105]. This process must be carried out in the context of a relationship between students, teachers, and Earth. These very relations are in themselves a form of pedagogy [106,107].

This shift in pedagogical orientation can re-emphasize the relationship between teacher and student, and frame learning as the ‘construction of meaning’ instead of the ‘transmission of knowledge’ [108]. Learning is increasingly understood as a social process [102], mediated by cultural contexts [99]. For example, Gruenewald [109] extends critical pedagogy to encompass the element of place, creating a link between the classroom and the ‘real world’ outside, encouraging students and teachers to go beyond classroom simulations to include local, social, and ecological contexts, as well as cultural politics. Similarly, Prádanos’s [110] “pedagogy of degrowth,” calls for a classroom that trains students to question the social desirability and ecological sustainability of the growth-driven system, and to envision alternatives.

In this sense, the entirety of this project must be conscious of the fact that it operates in the complex web of oscillating and cyclical histories of oppression, power asymmetries, and colonialist dynamics. For us to engage in a process of Ecozoic co-liberation, we must, as individuals and communities, be cognizant of our positionality, privilege, and marginalization, within this ongoing history, and display a willingness to change and adapt on a personal, as well as, societal level [66]. This process engenders a commitment to supporting the self-actualization of all community members [111] and must be supported and encouraged by an Ecozoic education.

5.2. Education Becoming Ecozoic

By indoctrinating students with the destructive ideologies detailed in the preceding sections, the conventional education system is complicit in the domination and plunder of nature - ecocide, and the concurrent drastic diminishment of alternative ways of human living on Earth - ethnocide [99]. This system facilitates the concept of “*gestell*”, or “enframing”, mentioned above [82], that casts all forms of nature as available and destined for human consumption, in essence constituting a standing reserve, available for plunder. To transition into the Ecozoic, the sciences and humanities must transcend this frame and build in an integrative manner in its stead, a manner of shared thriving. This shift would have profound effects throughout every traditional discipline of the academy.

Consider the following examples of finance, trade, law, and public policy.

5.2.1. Finance

An Ecozoic system of finance would be based on a value system which reverses the undersupply of public goods and advances ecological goods, that nurture both social and ecological systems—thus

broadening the concept of public goods in the process. Finance for the Ecozoic would incorporate the notions of sustainable scale, just distribution, and efficient allocation when it engages in value creation [112]. Students would be taught to recognize the socially created and embedded nature of money, and its attendant social and biophysical power relations, rather than treat it only as an independent, neutral tool for facilitating barter [113]. Thus, finance education in the Ecozoic would feature cradle-to-grave effects of wealth creation and conceptualize what it means to create non-monetary value, how to fund the creation of that value, and how to incentivize that process [114]. A broader understanding of why and for whom and what value should be created, must be adopted at every level of finance education. For example, funding rewilding has shared benefits for our socio-ecological system. No longer is it appropriate to ask solely “did I or my firm attain a satisfactory return on investment?,” rather, we must teach our students to ask whether their investment created a beneficial advancement for all parties impacted.

5.2.2. Economic Trade

While the national level is a convenient way of measuring trade, it is too simplistic and reductive for a planet in peril. Trade must be viewed through a lens of interconnectivity, with the intertwined material and social aspects of trade embedded in socio-ecological systems that span multiple ecosystems. Students of international commerce would be taught to think in much greater depth about the geopolitical and community-level contexts and scales of trade, as well as the interplay among them, and learn to make decisions on the basis of ensuring the mutual thriving of ecosystems near and far, on which we and other beings depend. Our shared ecosystems often span national boundaries. The nation-state model is, consequently, too individualistic and unrealistic for understanding the full effects of trade. For example, students should be taught about approaches such as “green supply change management,” which does incorporate environmental considerations; however, they must be challenged to think beyond the greening of the firm’s direct consumption and production—the cradle to grave approach—and evaluate impacts through the more interconnected bio-regional and socio-ecological lenses [115].

5.2.3. Law

Understanding who and what has value will also need to be addressed within the legal field. While environmental law currently takes the human as its subject and nature as its object, the emerging field of ecological law involves broader frameworks such as multi-criteria evaluation and decision-making, that incorporate complex and incommensurable values, including value systems in relation to the environment. These are not constrained to economic value and anthropocentric concerns as is the current practice [116]. Students of law in the Ecozoic would be taught an ecological law emphasizing a politics of care which seeks to promote harmony between human groups and life’s commonwealth [117]. The ontology of interconnectedness demands a move of crucial importance, namely, to expand the law beyond the normative, the human, and the state [117,118]. This theoretical and practical approach ought to problematize notions of representation, agency, standing, rights, and even justice to include sentient and semiotic beings such as forests, animals, and plants [43,118,119]. A legal ontology for the Ecozoic then should not only consider the prescriptive attributes of the law as a system of norms, but also its world-making capacities as a system of socio-ecological relations [62,120].

5.2.4. Governance and Public Policy

The fundamental concern of Ecozoic era education in governance is to teach students to design and implement policies that pursue the long-term survival of our entire ecological community and that improve the welfare of all its members. Further, we must review these policies to ensure that our good intentions actually yield desirable outcomes. Public policy students should be taught to reject ‘domination-driven development’ schemes in favor of ‘mutually enhancing well-being’ at all levels of government which impact our ecological and social systems. Our stakeholders are not only

people, but also other-than-human beings within our socio-ecological communities. The task, then, is two-fold. First is the extension of what we conceive as both the polis and the public [121]. Future students would subsequently learn that justice must be extended—procedurally, distributionally, and recognitionally—for all members of our ecological community, rather than the self-chosen few [122]. Second is re-embedding. Students must be taught to create and analyze public policy through the lens of complex and interconnected systems. One potential framework for analysis is that of “deep sustainability” [123]. The actions of government both direct—purchasing and provisioning—and indirect—regulating individuals and industry through taxation and subsidization—cannot continue to operate at odds with social thresholds and environmental limits. Rather, students must be taught to prioritize environmental and social goals, followed by economic ones. Such a reprioritization of goals, paired with a less anthropocentric conception of stakeholders, is the beginning of a necessary shift at the policy making level to prevent ecological collapse.

5.3. Praxis and Future Research

If textbooks are to remain relevant within the Ecozoic, they must incorporate embedded, mutually relational values. Crownshaw et al. [100] further advise that education itself in its entirety must become “holistic, transdisciplinary . . . [and] cognizant of ecological limits.” Since socio-ecological systems vary widely across Earth, we eschew standardized education and its inherent insensitivity to local needs and cultures, and “[i]nstead, essential components of scientific and particularly ecological literacy will need to be adapted locally, with place-based curricula” [100]. This approach localizes the fruits of contemporary civilization’s scientific achievements within the lands from which they came.

Consequently, not only the ‘education of’, but the fields of inquiry themselves, must be integrated in a way that moves beyond transdisciplinarity. Social science will continue to further join ecology and Earth system sciences as necessary co-components of research. A focus of future research should be an analysis of how broad social structures contribute to biodiversity loss, and how they might contribute to conservation and rejuvenation. The holistic, transdisciplinary, and consilient way of educating, drawn from systems theory, ecology, and relational thought, will come to replace the reductionist and individualistic tendencies of current educational practice [124,125]. It is our hope that this expanded form and content of education can yield introspective, passionate earthlings who are perceptive and capable of practicing multiple ways of being, knowing, and doing [126]. For the Ecozoic to manifest on the necessary global and geological scale, we will need humans who honor, not only the individual, but also the community, the ecosystems, and the more-than-human world. To do so, we will need approaches and textbooks that tell a story aligned with the Ecozoic. These must accurately reflect scientific understandings of interconnectedness, and engage with the multiples means and ways of knowing—the differing perspectives and cultures that constitute the entirety of humanity’s responses to the question, “what does it mean to be human and alive?” [99].

6. Concluding Remarks and Next Steps

Ecozoic pedagogy is both a practical response to biophysical realities and an ethical response to the dire present. Its process or praxis is of equal importance to its content, and we focus on the mutual transition of both. In this manner, and to reiterate from above, our goals are two-fold: (1) to nourish the growth of healthy, joyful, self-determining, self-regulating, moral human beings, embracing in process and outcome, what Albert Schweitzer’s poetically called “a reverence for life” [11]; and (2) to inspire a praxis in defense of that life, tending students’ capacities to build coalitions of solidarity powerful enough to effectively dismantle systems and structures of domination and oppression, and, in their stead, to build, maintain, and reproduce equitable systems and thriving multispecies communities. This reorientation of collective social life towards the service of its own maintenance as an ecologically embedded subset of life is fundamentally our goal.

With our textbook analysis, we have highlighted the pervasiveness of an ontology of separation, an epistemology of domination, and an axiology of development across a wide range of subjects in

higher education. We have then explored how re-orienting toward an ontology of interconnectedness, an epistemology of egalitarian subject to subject relationship, and an axiology that includes plural values and world-making practices, is fundamental to both content and pedagogical requirements for transforming higher education to “become Ecozoic”, and away from the modes of “efficient plunder” of the Anthropocene. Table 2 summarizes a proposal that the ontology, epistemology, and axiology of the Ecozoic form a critical framework for both analysis and world building.

Table 2. Educational Transformations: Becoming Ecozoic.

'ologies	Anthropocene (Predominant)	Ecozoic (Emergent)
Ontology	Separation, dualism	Interconnectedness, 'meshwork'
Epistemology	Domination, science	Relationship, co-production
Axiology	Development, progress	Plural values, plural world-making practices
Learning/Teaching		
Pedagogy	Banking method	Co-production of learning
Tools	Textbooks	Alternative texts, being, doing

Any research agenda based on our findings should be situated within the existing struggles attempting to reshape the current structure of academia. Our hope is that our framework can be used to perform a rigorous review of movements and experimental reforms from both within and outside the walls of academia. Higher education institutions that have attempted alternative models of pedagogy, such as Hampshire College, Evergreen State College, Antioch College, Goddard College, The New School, State University of New York College of Environmental Science and Forestry, EARTH University in Costa Rica, and Universidad de la Tierra in Oaxaca and Chiapas, Mexico, to name just a few, can be analyzed through the lens of this framework. Likewise, programs around the world which promote mutually enhancing relationships between humans and Earth, but are situated in traditional academic structures, can also be assessed with the framework in order to learn from the specific challenges and transformations that they face/are part of.

Following the co-production of learning our approach to pedagogy, we propose that students across diverse disciplines design and run their own peer-to-peer seminars examining how their education can become Ecozoic. Our framework can help to reflect on fundamental questions of “what are we trying to learn to do in academia?”, “what is our knowledge for?”, and “what world are we creating?” University reform then becomes a broad co-created world-making process as student-led seminars use our framework as a tool, a lens, an organizing concept, a vision, and/or a pathway. Importantly, what becomes of this process is undefined as of yet, and will look different in different institutions, communities, and countries.

As the standard teaching tool within institutions, some alternative textbooks, or core texts, that have motioned towards ontological plurality can also be reviewed using the ‘ologies of the Ecozoic’. For example, the Curriculum Open Access Resources in Economics (CORE) textbook and accompanying online portal was launched in 2013, and by 2018 had already transformed introductory economics curriculums in more than 100 universities worldwide due to its innovative, accessible style [127]. CORE represents a movement away from the strict delineation of neoclassical economics towards economic pluralism, and while it may not reflect the full framework presented in Table 2, the success of this text in transforming curriculum should be examined more closely.

The framework could also be used to assess the many pedagogies considered ‘alternative’ today, from Freire [105], Gruenewald [109], and Pradanos [110] discussed earlier, to the primary school pedagogies such as Waldorf, Ivan Illich’s un/de-schooling, and forest schooling. A systematic review of the literature on the practices and impacts of these alternative pedagogies could help elicit lessons from alternative primary schooling around the world, revealing existing barriers to transformation and potential new pathways to investigate.

This broad process can be a way to identify places, people, and movements already engaged in this work; and thus, the stories of challenges, successes, and novel insights into world-building and transforming higher education can contribute to setting a clearer research agenda. Ecological economics provides one compelling example of an alternative approach to economics that has waxed and waned between a radical departure from the mainstream and serving a master discipline. At its inception, clear ontological foundations were purposefully avoided in order to establish a shared conceptual space for people from many fields [128]. Spash [129,130] and others [131,132] have called for an ontological foundation to be established, with healthy debates over deep and shallow ecological economics. We agree with assertions that the field must be more firmly based on the understanding of the biophysical [133–135] and social [136,137] embeddedness of human economic activity.

Looking back at the ethical and scientific principles on which ecological economics was founded should serve as a starting point to clarify its goals and refocus its research agenda for the Ecozoic [138]. Ecological economics uses basic concepts of sustainable scale, just distribution, and efficient allocation or entropic thrift, that is, achieving a satisfactory quality of life with the minimal ecological cost, as the means to achieve the stated goals of well-being, justice, and sustainability [112,139]. However, clarifying the ontological, epistemological, and axiological groundings of these stated goals could potentially enable ecological economics to fulfill its paradigm shift vision. Through this lens, ecological economics can also clarify the methodological pluralism [140] that serves as the foundation to its epistemologies. This is not to say that methodological pluralism is not a valuable approach, but the vague ideological construction lacks boundaries, resulting in an often-superficial transdisciplinary rhetoric [129].

To summarize, we propose using our framework to carry out:

- Case studies of alternative and alternatives to textbooks, and their potential impact on curriculum and program development in higher education;
- A systematic review of primary school pedagogies and their impact on world-building/co-creation of knowledge/becoming Ecozoic;
- Case studies of programs that promote mutually enhancing relationships between humans and Earth within traditional academic institutions;
- Case studies of alternative universities as a systems approach to pedagogy; and
- Student-led seminars across disciplines to explore how we may all participate in the restructuring of education to become Ecozoic.

In conclusion, through a close examination of a sample of textbooks used for disseminating the foundational knowledge of disciplines, we find that anthropocentric ontology, epistemology, and axiology are upheld and perpetuated in universities in North America and throughout the world. Ecological economics is an example of one attempt to reorient a field around an Ecozoic narrative reflecting the biophysical and social embeddedness of the economy. Beyond ecological economics, we further challenge all disciplines and transdisciplines to question their unexamined assumptions using the 'ologies of the Ecozoic' framework offered in this paper, and in so doing, collectively begin to transform higher education and, ultimately, co-create the Ecozoic era.

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