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Learning and loving of nature in the Anthropocene

How to broaden science with curiosity and passion

Abstract

This article argues that teaching the basic, scientific aspects of nature is not only compatible with a more curiosity and passionate approach, but that in the era of the Anthropocene it is necessary to bridge the gap between this rational approach and a passionate approach to motivate engagement and societal action towards sustainability. Sometimes, these two approaches have been seen as incompatible, but they should rather be seen as complementary. It is thus urgent to explore and explain this two-sidedness that is our greatest challenge today: to facilitate more factual knowledge and information about the complex interactions in nature, while at the same time stimulate wonder, curiosity and care for the nature on which we depend. Clearly, education at all levels should embrace a scientific approach, also promoting curiosity and motivate passion, yet with somewhat different emphasis on these three educational elements at different levels. In this article, we argue that the curiosity and passion components should be more prominent in primary school, at the more advanced levels the scientific approach should be in front, however still supplemented with a strong motivation of curiosity and passion. Following this argument, we also try to show that critical thinking can both inhibit and promote an experience of belonging to nature. Critical thinking, in which we approach nature with rational reasoning, norms and value analyses may distance us from an immediate and more intuitive connection with nature. On the other hand it is precisely in the complex balancing of facts, norms and values that we experience the situatedness of knowledge, and in that gain an understanding of being part of nature.

Key words

Anthropocene, curiosity, deep ecology, rationality, sustainability, teaching

“For a society dependent on innovation and growth, the crucial question is how pedagogy and education may nurture curiosity throughout childhood, and how to avoid checks and pitfalls.”¹

1 Markus Lindholm, “Promoting Curiosity? Possibilities and Pitfalls in Science Education”, *Science & Education* 27, no. 9-10 (2018): 989

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Introduction

In this article, we (a philosopher, Bostad and a biologist, Hessen) argue that the notion of a distinction or even incompatibility between fact-based knowledge (in the classroom) on the one hand, and curiosity-driven experiences² of nature on the other, forms a central problem of the philosophy of sustainable education today. Following this argument, we pursue another somewhat obvious tension, *viz.* that between learning objectives and competencies related to critical thinking on the one hand, and, on the other, the learning of facts. We argue that there is a necessary link between the two: to be critical in the sense of questioning dogmas, sorting out arguments, values and norms, as well as articulating different experiences, feelings and emotions, often, though not necessarily, creates learning and understanding. This is found in large swaths of modern eco-philosophical thinking—wonder without knowledge is blind, and knowledge without wonder is devoid of breath. At the same time, it is important to be aware of the difference between intrinsic and instrumental value. While intrinsic value is characterized by the fact that goals and means work together, instrumental value is defined as the value or worth of objects that provide a means to some desirable end, often to human needs and wants. Here, too, we must not choose between either/or. Value-based arguments for nature protection will commonly pull in the same direction as the more instrumental, ecosystem-service oriented arguments.

The pedagogical context

While we believe our perspectives have relevance to the teaching of ecology, evolution and sustainability in general, we will specifically draw upon Norwegian cases and examples. The Norwegian Education Act is grounded by the “Objective Clause”³ which states that education for all should build on fundamental values, such as respect for human dignity and for nature.⁴ It also states that pupils and apprentices should be able to “think critically and act ethically and with environmental awareness.”⁵ Further, the newly approved Core curriculum⁶ states that schools should, across all disciplines and subjects, contribute to the development of joy of being in nature as well as awareness of how lifestyle impact nature

2 Even though many studies have argued that curiosity is fundamental for learning and knowledge, and as such should be a basic part of scientific development, “ideas on how pedagogy may promote or hamper curiosity are nearly absent.” Lindholm, “Promoting Curiosity?”, 989.

3 Opplæringsloven, § 1-1, Formålet med opplæringen, [The Norwegian Education Act, the objective clause], https://lovdata.no/dokument/NL/lov/1998-07-17-61/KAPITTEL_1#KAPITTEL_1. English translation, Ministry of Education, *Core curriculum – values and principles for primary and secondary education*, accessed December 18, 2019, 5, <https://www.regjeringen.no/contentassets/53d21ea2bc3a4202b86b83cfe82da93e/core-curriculum.pdf>

4 “Education and training shall be based on fundamental values in Christian and humanist heritage and traditions, such as respect for human dignity and nature» («Opplæringa skal byggje på grunnleggjande verdier i kristen og humanistisk arv og tradisjon, slik som respekt for menneskeverdet og naturen (...).” *The Education Act*, § 1-1.

5 “Elevane og lærlingane skal lære å tenkje kritisk og handle etisk og miljøbevisst”. *Education Act*, § 1-1.

6 The *Core Curriculum* is based on the values and principles of primary and secondary education (the values as expressed in § 1-1 of *The Education Act*). It was approved September 1, 2017, to be implemented in 2020.

and the climate (§ 1.5),⁷ as "human beings are part of nature and are responsible for taking good care of it."⁸

What does "belonging to nature" mean today and how can children and young people be inspired to experience this? Further, which basic dilemmas and challenges arise between the requirement for rational and critical thinking on the one side, and the feeling of belonging and coexisting in nature on the other? Clearly, a mechanistic, rational, empirical and science-based teaching should not be replaced by an emotion-based education. An awareness of our dependency on and relatedness to nature should augment these other approaches. Again, ecosystem services⁹ in its broadest sense do indeed encompass both the emotional side (human wellbeing) as well as the monetary side, while at the same time being a knowledge-based approach.

While having an anthropocentric approach, the main rationale for this concept is the demand of a sustainable use of nature, which is beneficial to "nature itself" (the bio-centric perspective). A growing human population still depends on a dwindling natural environment, with expanding global footprints, climate change, and species loss and ecosystem degradation as we enter the Anthropocene.¹⁰ For most of human history, we have been few and vulnerable to a mighty nature, but this has now reversed and humans have apparently gained "control" over nature, which has prompted a kind of hubris. This changed balance between nature and humanity also calls for a new type of awareness around the human-nature relationship, consisting of an acceptance not just concerning whether humans still depend on nature, but also that we must perceive ourselves as part of nature. The human-nature dichotomy, which is rooted both in the desire to gain control over nature (and in religiosity, i.e. seeking distance from the "immoral" beasts of nature), has provided an instrumental view of nature that persists.

In the following, we will scrutinize the ideal of rational, empirical and science-based education, and discuss how deep ecology may promote curiosity and wonder, as well as a sense of relatedness with and responsibility toward nature that can inspire normative actions. Further, we claim that critical thinking informed by deep ecology is needed to reveal the hidden curriculum of sustainable education, and thus function as a bridge-building position of promoting value reflection and a curiosity-driven learning about and loving of nature.

7 "Skolen skal bidra til at elevene utvikler naturglede, respekt for naturen og klima- og miljøbevissthet."

8 "Mennesket er en del av naturen og har ansvar for å forvalte den på en forsvarlig måte".

9 The Economics of Ecosystems and Biodiversity, *Ecosystem Services*, accessed December 18, 2019, <http://www.teeb-web.org/resources/ecosystem-services/>

10 The Anthropocene is not yet the official name of the human epoch, but it was coined as such by Paul Crutzen to raise awareness of the human footprint and is widely accepted. See Paul J. Crutzen, "Geology of Mankind". *Nature*, 415 (2002): 23, doi: <http://dx.doi.org/10.1038/>; and Henrik Hovland Svensen, Thomas Hylland Eriksen, and Dag O. Hessen, "En røff guide til Antropocen". *Nytt Norsk Tidsskrift*, 33, no. 1–2, (2016): 71-83.

Value-based ecology

When the Norwegian philosopher Arne Næss launched the concept of “deep ecology” in the early 1970s,¹¹ it was an implicit counterpart to the scholarly and scientific ecology that was conceived as “shallow” by some, because it was entirely rational, mechanistic and devoid of normative statements and feelings. Indeed, ecology was—and still is—based on facts, calculations, mass-balance, equations, statistics and models. It may be descriptive, but it searches for general phenomena, predictability, numerical approaches and above all the “laws and rules of nature.” Ecology strives to be perceived as a hard science, and not as ecology in the sense of environmental protection or “green values.”¹² There is nothing wrong with this—in fact, ecology *should* be strictly scientific and rational. As such, it is not in conflict with bringing values onto the scene regarding the management and protection of nature (indeed, ecologists themselves generally are quite “green”, with implicit values in common with deep ecology). Hence, it is plausible to see “deep ecology” as a complementary approach to the strictly science-based ecology, and not as a competing branch of ecology.¹³

These two conceptions also have different goals and approaches. Scholarly ecology is aimed towards a *description* and *understanding* of nature without normative ambitions. Deep ecology (or derivatives thereof) is motivated by biocentric values, albeit also by human wellbeing, and is rooted in normative arguments. Interestingly, despite most ecologists’ conception that the understanding and management of nature should be based on facts and rationality, the basic concepts of deep ecology (e.g. the intrinsic value of nature and the biocentric or philosophical arguments of the moral status of all species), has had significant impact on nature management and conservation. Many nature protection acts, conventions, red lists for threatened species and so on, are explicitly based on biocentric arguments. Despite these layers of legal and normative protection, populations, species, habitats and ecosystems are still declining at an alarming pace,¹⁴ causing a growing desire to implement also the *rights* of nature.¹⁵ Neither human rights nor nature’s rights can be directly grounded in scientific arguments, but we can make inferences about what justice requires based on what we know to be necessary for the flourishing of humans and nature.¹⁶ The steadily decline of nature and biodiversity, as recently highlighted in the UN Intergov-

11 See Arne Næss, «The Shallow and the Deep, Long-Range Ecology Movement: A Summary», *Inquiry* 16, no. 1-4 (1973): 95-100, DOI: 10.1080/00201747308601682.

12 Peder Anker, “Science as Vacation: A history of Ecology in Norway”. *History of Science* 45, no. 4 (2007): 455–479, <https://doi.org/10.1177/007327530704500404>.

13 Nina Witoszek and Andrew Brennan (eds.), *Philosophical Dialogues: Arne Naess and the Progress of Philosophy* (Lanham, Maryland: Rowman & Littlefield Publishers, 1999).

14 WWF – State of the Planet, 2017 and 2018.

15 Guillaume Chapron, Yaffa Epstein and José Vicente López-Bao, “A rights revolution for nature”. *Science*, 363, no. 6434 (July, 2019):1392-1393. <http://science.sciencemag.org/content/363/6434/1392.full>.

16 Martha Nussbaum, *Frontiers of Justice: Disability, Nationality, Species Membership* (New York: Harvard University Press, 2006).

environmental Science-Policy Platform on Biodiversity and Ecosystem services¹⁷ strongly calls for the whole suite of arguments, from the strictly scientific to the more value based.

It is also worth to point to the fact that there are wide cultural differences in this context, both within and among nations and regions, with regard to values and feelings towards all species and nature.¹⁸ Biophilia, i.e. "love of nature" implies that we possess an innate tendency to seek connections with nature and other forms of life, and this may be evolutionary imprinted but also culturally modified. It has been argued that some kind of "biophilia" is an innate property of humans,¹⁹ but still the "deep ecology"-oriented passion for nature is by and large an urban, Western, modern phenomenon, and arguments for not only the moral but also juridical rights of nature would no doubt be perceived as rather far-fetched in many societies. To explore the cultural diversity in relations to nature is far beyond the scope of our paper, hence we restrict the discussion to modern, Western education. We also believe this is timely, as the root of unsustainable development seems to be found here, in our part of the world.

Trends and pitfalls of science education

—a short glimpse of the history of science education textbooks

The way in which the natural sciences, broadly speaking, have been presented in primary school textbooks (again based on Norwegian textbooks) has by and large been strictly fact-based and non-normative, with the exception of some post-1970 textbooks in ecology. These have at times been criticized (perhaps rightly so) for presenting a naïve and idealized version of nature as good, harmonic and "in balance", while human activities are represented by polluting industries, black smoke, toxic waste and so on.²⁰ Chemistry may have consequently earned a bad reputation (and biology a correspondingly good reputation), but despite a somewhat biased representation, there is no doubt that this raised awareness among young people about man-made environmental degradation.

In the history of science education, textbooks illustrate the tension between representatives for different interests and ideologies—a tension that, in Norway, is established between primary school teachers' emphasis on pedagogy, socialization and student-centring on the one side, and, on the other, an academic tradition at the universities specializing in rigorous science-based curricula. According to Svein Sjøberg,²¹ this tension dates back to the end of the 19th century, when science-based curriculum is mentioned in the 1869

17 Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem services (IPBES), accessed December 18, 2019, <https://www.ipbes.net>.

18 Kay Milton, *Loving Nature. Towards an Ecology of Emotion* (London: Routledge, 2002).

19 Edward O. Wilson, *Biophilia* (New York: Harvard University Press, 1984).

20 Svein Sjøberg, *Naturfag som allmenndannelse – en kritisk fagdidaktikk* (Oslo: Ad notam Gyldendal, 1998).

21 Svein Sjøberg, «O-fagsyndromet,» in *Sann opplysning? Naturvitenskap i nordiske offentligheter gjennom århundrer*, ed. Merethe Roos and Johan Tønnesson (Oslo: Cappelen Damm, 2017).

“Education Act on Schools in the Countryside” (“*Loven om almueskolen paa landet*”)²² as “description of the soil” and “knowledge of the nature”.

However, even if the academic tradition has been influential, integrated textbooks in the natural sciences since the introduction of a nine-year primary school system (in contrast with many other countries, including other Nordic countries, where the natural sciences are divided into individual subjects),²³ and our Norwegian tradition of outdoor schooling and outdoor life, and an ethical conduct and guardianship towards nature, are an integrated part of our heritage. This is exemplified by the quote from the Norwegian discussion in the early 1900s on teacher education and launching of a program for Educational Colleges “The daily education in the different subjects must find its free path to imagination and reason, out to the forest and the field, to the fjords and the mountains.”²⁴

By and large, however, education in the natural sciences – in biology and ecology included – is predominately aligned didactically as strictly fact-based and devoid of “soft values” and normative discussions. Again, reductionism (in the strictly scientific sense) and empiricism is a premise for novel insights and the success of the natural sciences. However, even though the ideals of science persist, they are presented in meaningful and value-related contexts (whether as “text in context” or “text in culture”)²⁵. But, one may ask, as we do here, if there is a current demand for supporting approaches related to ecology, climate, and the loss of diversity. We point at three pitfalls of this trend: 1) a loss of the trans –and multidisciplinary view in the shadow of scientific diversification, which maintains the division between the “two cultures”^{26, 27}; 2) a lack of critical thinking that promotes curiosity and wonder; and 3) a “denial of nature”²⁸ and a missed opportunity to bring urgent attention to environmental risks, which should be a main goal of natural science education today.²⁹ While the first two issues are most directly related to the educational aspect, we will argue that the third forms a very important premise for the other two. Hence, we briefly discuss the first two issues before turning to a more in-depth discussion of the third.

22 As around 90 % of the Norwegian population were living in the countryside, this act is considered the start of the Norwegian primary school, see Reidar Myhre, *Den norske skoles utvikling: Idé og virkelighet* (Oslo/Gjøvik: Gyldendal Norsk Forlag, 1982), 20 and Liv Kari Bondevik Tønnessen, *Norsk utdanningshistorie* (Bergen: Fagbokforlaget, 2011), 17.

23 Sjøberg, *Naturfag som allmendannelse* and Hessen, “Naturvitenskap – dannelse eller bare utdannelse”, in Bernt Hagtvædt and Gorana Ognjenovic, (eds.) *Dannelse, tenkning, modning, refleksjon* (Oslo: Dreyer, 2011).

24 Torstein Kristivik and Erling Høverstad, *Ein norsk lærarhøgskule. Historisk utsyn og program* (Kristiania: Steenske forlag, 1919), 197. Our translation.

25 Erik Knain, *Scientific literacy for participation. A systemic functional approach to School science discourses* (Rotterdam: Sense Publishers, 2015).

26 Charles Percy Snow, *The two cultures* (Cambridge: Cambridge University Press 1959).

27 It has also been argued that the humanities as well as the social sciences have overlooked or banned the natural sciences and reinforced this split. See Hessen (2011) and Sjøberg (1998).

28 Arne Johan Vetlesen, *The Denial of Nature. Environmental philosophy in the era of global capitalism* (London: Routledge, 2015).

29 Worldwatch Institute, *State of the world* (2018), <http://www.worldwatch.org/bookstore/publication/earthed-rethinking-education-changing-planet-state-world-2017>.

Presentations and practices of natural science education

Reductionism as a key criterion for scientific success is undebatable, despite the widespread criticism that has at times rendered reductionism as almost an abuse, synonymous with “narrowmindedness”. However, among the natural sciences, it is now widely recognized that the pieces also must be puzzled together to understand “how the engine works”.³⁰ For example, the understanding of genetic networks (pleiotropy) and epigenetics, metabolic functions, brain and consciousness, biodiversity and ecosystem processes, and climate change with its drivers and impacts, all demand a broad range of approaches and contributions from multiple disciplines—including outside the natural sciences. Indeed, regarding the latter, insights into climate drivers are based on insights derived from a wide range of natural science disciplines, but there are also societal drivers related to politics, economics, psychology and social norms, and solutions need to be sought among all these disciplines. While this is well understood among researchers who are, to an increasing extent, cooperating in large consortia, the field of education lags behind.

Another problem with most current education practices and their too-“narrow” presentation of the natural sciences is that it often becomes a matter of cramming facts at the expense of reflection, curiosity, critical thinking and a more holistic understanding.³¹ “Reports on science education elaborately assess how preschool children demonstrate cognitive readiness for science, but do not consider or discuss possible long-term mechanisms which could hamper or promote deep curiosity and the persistent joy of learning. (National Research Council 2007, 2012).³² One of the classic misunderstandings in pedagogy, according to Dewey, is the idea that the students only learn something about the particular topic being focused on at a specific time and place,³³ missing everything else that could have been acquired in the situation—i.e. the creation of long-lasting attitudes, sympathies and antipathies—which, all in all, are likely just as important as it creates a deeper understanding. These attitudes, emotions and beliefs could be far more relevant and basic for the future. Indeed, as Dewey states, “What avails is to win prescribed amounts of information about geography and history, to win ability to read and write, if in the process the individual loses his own soul: loses his appreciation of things worthwhile, of the values of which these things are relative”.³⁴ While Dewey focuses on the apparently implicit socialization taking place during education as “collateral learning,” Östman refers to the “content included in subsidiary forms of learning as companion meaning, which either follows on automatically when teaching knowledge content, or becomes collateral learning when one

30 Marc H.V. Van Regenmortel, “Reductionism and complexity in molecular biology” *EMBO Reports* 5, no. 11 (Nov. 2004): 1016-1020, doi: 10.1038/sj.embor.7400284.

31 Andrew Gilbert, and Christie C. Byers, “Wonder as a tool to engage preservice elementary teachers in science learning and teaching”. *Science Education* 101, no. 6 (Nov. 2017): 907–928. <https://doi.org/10.1002/sce.21300>.

32 Lindholm, “Promoting Curiosity”, 989.

33 John Dewey, *Experience and Education* (1938) <https://archive.org/details/ExperienceAndEducation/page/n19>.

34 Dewey, *Experience and Education*, 20.

learns scientific meanings. Such meanings can, for example, be concerned with the nature of knowledge and people's relations to nature."³⁵

As such, it is striking, first of all in the Norwegian policy documents and curriculum reforms—as Kvamme pointed out in his analyses of the values of environmental ethics³⁶—that values are primarily thematized in the humanities, but without the inclusion of conceptions of and experiences with nature. Nature, on the other hand, is treated in the natural sciences, but without an emphasis on values and norms.

Rachel Carson frames this in the following statement: "It is more important to pave the way for the child to want to know, than to put him on a diet of facts he is not ready to assimilate."³⁷ However, the conclusion should not be to replace facts with feelings, but rather that facts are always presented in an environment of values, norms, contexts and culture that are to be made visible and reflected upon in a curiosity-driven environment—for the students as well as for the teacher. This relates not only to the way the topic is communicated, keeping Richard Dawkins' much quoted "science is the poetry of reality" in mind, but also to the fact that learning always happens in a certain place at a certain time and that implicit norms and values are present.

One telling example³⁸ may illustrate how narrowly presented facts can fail to introduce the real importance of a topic: on what happened to be the final day of the climate meeting COP 21 in Paris in 2015, a student organization in Norway proposed to remove photosynthesis from the school curriculum. After all, what was the purpose of this boring equation with its hard-to-remember stoichiometry? This initiative may very well illustrate how education has failed to put photosynthesis into perspective: It is not only a wonderful reaction in and of itself, it is also by far the most important reaction (and equation) on Earth. The consumption of CO₂ by photosynthesis has shaped the climate over billions of years and made this planet habitable for ourselves and other animals that depend on oxygen and organic matter. The balance between photosynthesis and respiration is also crucial for the carbon cycle and the climate. What could be more motivating than contextualizing photosynthesis into this grandeur?

Education for the Anthropocene

This brings us to the third challenge of contemporary science education. Education about nature has increasingly become detached from experiencing the physical nature itself (as

35 Leif Östman, "Education for sustainable development and normativity: a transactional analysis of moral meaning-making and companion meanings in classroom communication", *Environmental Education Research* 16, no. 1 (2010): 75-93, DOI: 10.1080/13504620903504057.

36 Ole Andreas Kvamme, "Blurring the image of the other? The Recontextualization of Environmental Ethical Values in Norwegian Education Policy Documents" in *Challenging Life: Existential Questions as a Resource for Education*, ed. Jari Ristiniemi, Geir Skeie and Karin Sporre (Münster: Waxmann, 2018), 359–382.

37 Rachel Carson, *The sense of wonder* (New York: Harper & Row, 1956).

38 <https://www.aftenposten.no/meninger/debatt/i/Mjq5/elevorganisasjonen-vil-ha-fotosyntesen-ut-av-laereplanen-hva-er-da-skolen-til-for-kathleen-rani-hagen>.

has our everyday life). To some extent the situation reflects a long-lasting aim of civilization: to gain control over nature, and to create distance from the “immoral” beasts of nature. It also reflects the fact that an increasing proportion of humans live in cities and urban areas, is separated from nature. A dichotomy between nature and humans is generating a “detachment” that is one of the causes of the continuing overuse and degradation of nature and biodiversity³⁹) as well as the climate crisis⁴⁰ (IPCC 2019 a, b; <https://www.ipcc.ch/srcl/> and <https://www.ipcc.ch/sr15/>). As argued by Lenton and Latour (2019),⁴¹ a new level of self-awareness is here urgently demanded.

One aspect of the human detachment to nature is that our ultimate dependency on “ecosystem services” has become a purely theoretical insight, often imbued with economic incentives (i.e. “the value of nature” in its narrowest sense). A second aspect is the abstraction of nature—nature may seem irrelevant to the daily life of most humans because it is so distant, both literally and figuratively. This abstraction may, in some cases, also lead to a romanticized vision of nature as “good” or harmonic, in balance, and so on. Clearly, nature may be *felt* as good, but this is quite different from actually *being* good. Partly, both the strictly instrumental view of nature and the overly romantic view are based on the dichotomy between nature and humans—we, too, are part of nature, as “culture-nature”, yet have remarkable skills reflecting both the good and the bad, i.e. we have the capacity of normative reflections.

The reason that these considerations are not a matter only of academic interest is that nature must be deeply involved in education in the Anthropocene, first of all to motivate engagement and societal action towards sustainability. As the human footprint on Earth has expanded dramatically, in terms of climate change, decreased populations and species loss, education at all levels, from kindergartens to universities, has become pivotal not only for knowledge on how humans, climate and ecosystems interact, but also to bring about change in values and behaviour. The changes should definitely build on scientific insights, but also on curiosity and passion or involvement in nature. Here is the major point raised by the Worldwatch Institute’s *Earth Ed’ State of the World Report*, with its telling subtitle, “Rethinking Education on a Changing Planet.”⁴² A number of contributions in this volume discuss topics such as “social and emotional learning for a challenging century” and “bringing the classroom back to life,” but the overarching message is that of a critical thinking encompassing what is often labelled “*bildung*”⁴³ (for lack of an appropriate English term). By

39 I.e. The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), *Global Assessment Report on Biodiversity and Ecosystem Services. Summary for Policymakers* (2019), <https://ipbes.net/global-assessment-report-biodiversity-ecosystem-services>.

40 Intergovernmental Panel on Climate Change (IPCC), *Special Report on Climate Change and Land* (2019), <https://www.ipcc.ch/sr15/>. IPCC, *Special Report on Global Warming of 1.5 °C* (2019), <https://www.ipcc.ch/sr15/>.

41 Timothy M. Lenton and Bruno Latour “Gaia 2.0. Could humans add some level of self-awareness to Earth’s self-regulation?”, *Science* 361, no. 6407: 1066 (2018), science.org,14.9.2018.

42 Worldwatch Institute, *Earth Ed. Rethinking Education on a Changing Planet* (Washington D.C.: Island Press, 2017).

43 For a more thorough description of the concept of “*bildung*”, see for instance Gert J.J. Biesta, *The beautiful risk of education* (Paradigm publishers, 2014), Bostad, Å se seg spørrende omkring. *Introduksjon til en ny pedagogisk*

using the term “bildung” in this context, we want to highlight that education is not only a process where children are introduced to the shared body of knowledge, history and culture, but also a tradition aiming at individual and collective autonomy.⁴⁴

There is always the “paradox of pedagogy”, in which there is no direct path from knowledge to understanding and changing attitudes, and beyond that, no one can force anyone to agree upon any values. This is also emphasized well by Foros and Vetlesen,⁴⁵ who argue for a stronger implementation of environmental concern in the upbringing of children, addressing the responsibility both of parents and of educational systems.

With the current, unsustainable trajectory of the world, it should be widely accepted that the time is ripe for a new and broader approach to teaching ecology and natural sciences in general (as well as economics). Let us again underline the basic premise of our argument: that the broader approach does not imply a replacement of “classical” natural sciences with a value-oriented ecology, but rather that textbooks and teaching in the natural sciences should simultaneously be upgraded with facts related to climate change, species decline and ecosystem degradation while encompassing more curiosity-driven value-based discussions, ethical dilemmas, discursive strategies, and concern for nature.

The teaching and pedagogical encouraging of different ways of having a more passionate relation to nature should naturally belong to the very basic levels of upbringing, i.e. kindergarten and primary schools. Higher levels of education could then tap into these passions, since they are not only important to maintain but are necessary “bridges” to learning about and loving nature. That we, citizens of the Western world, are still geared for continuous economic growth despite knowing that this ultimately cause destruction of nature, reflects a “denial of Nature”, as argued by Vetlesen⁴⁶, and this urges a reinstatement of nature’s value outside of its exploitative usefulness for human ends.

Without being emotionally touched by or having experienced a kind of belonging and closeness to nature, there is no strong motivation for change or action. Love, caring, and developing feelings of gratitude towards something, are after all the best motivators for protecting it. Metaphorically, both halves of the brain need to be engaged—not just the left, rational hemisphere (and indeed, in reality, both halves are engaged in a suite of decisions). Both in Vetlesen’s *The Denial of Nature* and his somewhat misanthropic follow-up book *How Shall We Answer Our Children?*,⁴⁷ the ultimate answer, or recipe, is to encourage children and young people to develop passion and responsibility for nature, and a sense of belonging by going *into* nature, rather than *out in* nature.

filosofi (Oslo: Gyldendal, 2017), Anders Burman and Per Sundgren, (eds.) *Svenska bildningstraditioner* (Stockholm: Daidalos, 2012), Bernt Hagtvedt and Gorana Ognjenovic, (eds.) *Dannelse, tenkning, modning, refleksjon* (Oslo: Dreyer, 2011), Rune Slagstad, Ove Korsgaard and Lars Løvlie, *Dannelsens forvandlinger* (Oslo: Pax forlag, 2003) and Ingrid Straume, *Danningens filosofihistorie* (Oslo: Gyldendal forlag, 2013).

44 Bostad, Å se seg spørrende omkring, Ingerid Straume, “Paideia” in *Cornelius Castoriadis: Key Concepts*, ed. Suzi Adams (London: Bloomsbury, 2013), 143-153.

45 Per Bjørn Foros and Arne Johan Vetlesen, *Angsten for oppdragelse* (Oslo: Universitetsforlaget, 2015).

46 Vetlesen, *The Denial of Nature*.

47 Arne Johan Vetlesen and Rasmus Willig, *Hva skal vi svare våre barn?* (Oslo: Dreyer, 2018).

Belonging to nature—a privileged position?

One could argue that the followers of deep ecology and ecophilosophy have failed in their appealing to more sustainable actions, among policymakers as well as in schools and society as a whole. Criticism has been raised that the focus on a genuine experience of nature, being part of and enjoying its rich existence by way of simple means, as argued for instance by Arne Næss who argues for the reinstatement of nature's value beyond its exploitative usefulness for human ends,⁴⁸ has failed to encourage and motivate sustainable actions and behaviour. From this perspective, norms are seen as a reflex or an immediate effect of a very special form of experiencing nature: that is, a direct and free access to and experiencing of belonging to nature, or the somewhat privileged position of "searching for a closeness to an enigmatic and exhaustive nature."⁴⁹

Now, even if this is a criticism Næss himself already predicted in 1973, arguing that as the

"focus on environmental ontology has been a recipe for disaster rather than a success for deep ecology and its supporters, I suggest that a proper environmental position should be based on critical thinking and moral principles rather than on ontological assumptions about human experiences of the world."⁵⁰

there is a tension between empirical grounded norms based on experiences of belonging and critical thinking. At the same time, this tension between giving arguments for a position and showing or formulating some basic values and principles illustrates the heart of the appeal to ecophilosophy: intuitively based personal experiences are all too pluralistic and manifold to be generalized into an ontology, but at the same time they form the basis of a moral conviction that motivates actions. Presenting arguments and reflecting critically about the human–nature relationship leads therefore to a wide range of intuitively based announcements that are more or less common, such as "every life-form has a worth of its own, independent of its usefulness for human beings."⁵¹

Thus, with regard to the position above taken by the followers of deep ecology and their emphasis on belonging to nature it is worth stressing that this may consist of a plurality of experiences that in their diversity establish basis for critical thinking. Deep ecology encourages us to

48 See the 25 guidelines in Per Ingvar Haukeland, *Dyp glede* (Oslo: Flux, 2008).

49 Kjell Madsen, "Den objektive nærhet- om Arne Næss' tillitsfulle skeptisisme" in *Filosofi på norsk 1*, ed. Inga Bostad (Oslo: Pax, 1997), 106.

50 Arne Næss, "The Shallow and the Deep, Long-Range Ecology Movement: A Summary", *Inquiry*, 16, no.1-4 (1973): 95-100, DOI: 10.1080/00201747308601682.

51 Arne Næss, "Sustainability! The Integral Approach", in *Conservation of biodiversity for Sustainable Development*, eds. Odd Terje Sandlund, Kjetil Hindar and Anthony H. D. Brown (Oslo: University of Oslo Press, 1992), 303-310, available in SWAN, vol. 10.

“stop giving reasons when you announce something you personally find *intuitively* obviously true or correct, or something that you cannot imagine yourself giving up except for reasons you have never heard of and cannot see how they could be convincing (...). To stop giving reasons is not the same as being dogmatic or less scientific or deep.”⁵²

Critical thinking is thus understood as broader than simply giving more or less rational arguments for something: critical reflection in this context also implies the ability and competence to identify that which is value-based—i.e. to distinguish between what are values and what are empirical statements and other types of claims, attitudes and views; to separate but also justify norms and values; to not take dogmas for granted; to ask critical questions of others; and to request theories and valued-based arguments. In this sense, critical thinking is not only consistent with having values ending in intuitive claims, it forms the common ground of deep ecology: critical thinking leads to ethical reflections.

The question remains as to whether these intuitively experienced insights are common for human beings, and if we may develop arguments from them and end up with basic values or if they are too diverse. The followers of deep ecology would argue that if children and youth in science education are allowed to experience the joy and wonder of being in (and part of) nature, they will develop shared values regarding their responsibility for nature, as well as the inherent rights and dignity of all species. Thus, as we see it, it is neither necessary nor desired to develop a predetermined methodology for a kind of value-awareness, but rather it is a strength imbedded in critical thinking as such that an open plurality and variety in methodology are encouraged.

The fundamental argument against a mechanistic view of nature, according to the deep ecology of Arne Næss, seems to be the way in which it cuts human reality off from real nature, where the world is an aesthetic and emotional as well as a physical experience.⁵³ Næss himself was inspired by the idea of ataraxia, an individual quest for a state of tranquillity or equilibrium, found as far back as ancient Rome with the philosopher Pyrrho of Elis and the zetetic philosophers. Such an experience or state of mind is often attained in nature—though not always—and it provides a form of enduring and intense joy. In addition, it is associated with a retirement from (or disapproval of) material pressures, achieving a rich life with simple means and working for the rights of all living beings to develop their potential, and even with escaping from relationships with other people for the benefit of non-human nature.⁵⁴

The defence of an “ecological justice” or “environmental justice”—that is, an equal distribution of environmental risks and benefits, including non-human species, may be encouraged by the use of deep ecology in education, according to Kopnina and Gjerris⁵⁵

52 Næss, “Sustainability! The Integral Approach.”

53 Madsen, “Den objektive nærhet”, 106.

54 Inga Bostad, “The Life and Learning of Arne Naess: Scepticism as a Survival Strategy”. *Inquiry* 54, nr.1, (2011): 42-51, Doi: 10.1080/0020174X.2011.542945

55 Helen Kopnina and Mickey Gjerris. “Are Some Animals More Equal than Others? Animal Rights and Deep Ecology in Environmental Education,” *Canadian Journal of Environmental Education*, 20 (2015): 109.

who stated that “deepened understanding and appreciation of the intrinsic value of nature and animals, regardless of one’s theoretical position, can be used in support of building a more sustainable relationship between humans and the rest of the planet. In education, such positions are often associated with ecological justice”.

By contrast, there is also a trend towards a pluralism that opens up for a relativistic and neutral-oriented pedagogy consisting of an anxiety towards taking positions and responsibility for educating the coming generations: that is, a “current notion of pluralism which has led to the reduction and even disappearance of any issues (rights or otherwise) related to the non-human world in environmental education/education for sustainable development.”⁵⁶

To sum up thus far: we are seeing a growing tendency for education in schools to confront two pitfalls—on the one hand, that the emphasis on value-based openness in the classroom creates a neutralization of science-based knowledge and passivates the teachers’ judgment; and on the other hand, how goal compliance (i.e. management by objectives and sub-goals related to specific learning goals) may become obstacles to a holistic critical reflection on our shared responsibility for nature and the environment. In e.g. the Norwegian school subject syllabi the competence goals with an emphasis on outcomes, form the basis for assessment in the various subjects. Our concern is that the everyday life of the student is consistently marked by the double standard of acquiring the skills of critical thinking on the one hand while at the same time experiencing him/herself more or less intuitively as part of nature. As we have argued in this article; critical thinking can both inhibit and promote an experience of belonging to nature: Critical thinking in which we approach nature with rational reasoning and ethical reflection may on the one hand distance us from an immediate, passionate and more intuitive connection with nature. On the other hand it is precisely in the complex balancing of facts, norms and values that we may experience the situatedness of knowledge, and in that gain an understanding of precisely human cohesion with the nature of which it is part.

A hidden curriculum of unsustainable life—growth ideology and alienation

“The dominant stream of education for sustainable development literature emphasizes an instrumental view of nature that supports the current unsustainable development”⁵⁷, is Kopnina and Gjerris’ claim. Others would argue that, even if the ecopedagogy movement that grew out of the Rio Earth Summit in 1992—influenced first and foremost by Freire’s philosophy—has resulted in international forums on ecopedagogy as well as key docu-

56 Kopnina and Gjerris, “Are Some Animals More Equal than Others?”, 119.

57 Kopnina and Gjerris, “Are Some Animals More Equal than Others?”, 118.

ments like the Ecopedagogy Charter⁵⁸, the challenge remains. Indeed, “the field of critical pedagogy has tended to remain historically silent on environmental matters”⁵⁹ and “critical pedagogical theory may not only be insufficient to fully grasp planetary ecocrises in all its complexity, but could also unconsciously reproduce unsustainable harms in its struggle for human freedom and equity.”⁶⁰ According to Kahn, a northern ecopedagogy is surrounded by a “larger hidden curriculum of unsustainable life.”⁶¹

The question that follows would then be: How enclosed are we today in a market and growth ideology, and is this ideal of growth not just a social bounty, something that characterizes politics and institutions, but also something embodied in every human being as a way of thinking? Since ideas often are rooted in experience, it is difficult to arrive at something utopian that is also realistic. Even the IPCC base their models, trajectories, predictions—and warnings—on degrees of change (literally) within the current economic system of production, demands and markets.

Foucault’s concept of “biopower” is relevant here: that is, a way of controlling and regulating human bodies through “an explosion of numerous and diverse techniques for achieving the subjugations of bodies and the control of populations.”⁶² These expectations of social order and social practices seem to regulate human behaviour, be it for better or worse, as, according to Foucault, biopolitics is the political rationality needed in a society: “biopolitics is deployed to manage populations; for example, to ensure a healthy workforce”.⁶³ Today the question could be framed as this; how determined are we by the new “sustainability power” and how open to fundamental power critique and self-reflections is this paradigm?

Concluding remarks—imagining an education for the future?

While writing this article, we experienced not only that we met across the disciplines of biology and philosophy of pedagogy, and articulated somewhat different ideals, histories and theories of our disciplines, even though we started from a more or less common grounding in the critical thinking informed by deep ecology, but that one of the most interesting and relevant findings of the article was the process itself. Having to explain and argue for common norms of objectivity, we became increasingly aware of the demanding aims of gaining ecological knowledge and insight and that the very ideal of critical reflection and norms of objectivity ended up as the most profound tool for starting to care for the environment. The way we articulated the relation between knowledge of nature and

58 María de los Ángeles Vilches Norat, Alfonso Fernández Herrería, Francisco Miguel Martínez Rodríguez, Ecopedagogy, “A Movement between Critical Dialogue and Complexity: Proposal for a Categories System” *Journal of Education for Sustainable Development*, 10, nr 1 (2016): 178-195. Doi.org/10.1177/0973408215625552

59 Richard Kahn, *Critical Pedagogy, Ecoliteracy, and Planetary crises* (London: Peter Lang, 2016), 20.

60 Kahn, *Critical Pedagogy*, 20, here referring to C.A. Bowers.

61 Kahn, *Critical Pedagogy*, 20.

62 Michel Foucault, *The History of Sexuality*, Vol. 1: The Will to Knowledge (London: Penguin, 1998).

63 Foucault, “Society Must Be Defended.” *Lectures at the College de France, 1975-1976*. (New York: Picador, 2003), 239–64.

knowledge from *within* nature, was itself the most interesting challenge for defining a position of caring for nature while stimulating curiosity, reasoning and ethical reflection.

As we see it, three challenges still remains, each one of them demonstrates the need for science education in school to clarify and not cover, the intimate relationship between experiences of belonging to nature and knowledge of it.

As discussed in Bostad and Fischer,⁶⁴ the first of these challenges are the *supplement–replacement dilemma* (also called the paradox of *bildung*); How can we contribute to ecological awareness through formal education when it is not possible to completely control classroom outcomes, let alone broader educational ones? The second is the *instrumental–pluralist dilemma*: How can an open pluralism include, and not reduce, basic ecological information while encouraging debate and reflection? And lastly, the *short versus long-term dilemma*; How can we accommodate holistic, reflexive approaches to education within existing curricula based on separate, discrete subject areas and the educational system? These dilemmas will most certainly continue to exist, but they may be bridged or overcome partly by accepting a wider definition of critical thinking, informed by some of the basic norms and methodology of deep ecology.

Clearly education at all levels should embrace a basic, scientific approach, as well as promoting curiosity and motivate passion, yet with somewhat different emphasis on these three educational elements at different levels. The curiosity and passion components are important in primary school, which at the university levels the scientific approach should be in front, yet still supplemented with a strong motivation of curiosity and passion.

The increased interest in ecological pedagogy and environmental education today⁶⁵ gives hope—hope that the words of Marcuse will be recognized as a description of the past, when he writes that “education is a cultural activity, and that in Western history such culture has systematically defined itself against nature in both a hierarchically dominating and repressive manner.”⁶⁶ Even greater hope lies in the fact that the younger generations, with the Swedish Greta Thunberg as a role model, will be forced to strengthen their engagement in environmental issues, and engage in the political struggle. As Thunberg herself frames it, “it was my teacher in school who opened my eyes to the climate crisis.”⁶⁷

64 Inga Bostad and Aled Dilwyn Fisher, “Curriculum and social change in education for a sustainable future? Ecophilosophy, critical inquiry and moral dilemmas”, in *Human rights in language and STEM education: science, technology, engineering and mathematics*, ed. Zehlia Babaci-Wilhite (Sense Publishers, 2016), 71–90.

65 Helen Koppina, “Education for Sustainable Development (ESD): The turn Away from “Environment” in “Environmental Education”?”, *Environmental Education Research* 18, no. 5 (2012): 699–717. DOI: 10.1080/13504622.2012.658028, Bostad and Fisher, “Curriculum and social change in education for a sustainable future”.

66 Kahn, *Critical Pedagogy*, 138.

67 Jonathan Watts, “Greta Thunberg, schoolgirl climate change warrior: ‘Some people can let things go. I can’t,’” *The Guardian*, March 11, 2019, <https://www.theguardian.com/world/2019/mar/11/greta-thunberg-schoolgirl-climate-change-warrior-some-people-can-let-things-go-i-cant>.