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**Unearthing the Roots of Climate Change Denial and Inaction: The Educational Necessities**

**Introduction**

In May of 2017 Chris Anderson, head curator of TED Talks (Technology, Engineering, Design) spoke with Elon Musk regarding his motives for pouring his passions into the development and advocacy of a renewable energy future. Musk responded quite plainly with the following: “sustainable energy will happen no matter what, it’s tautological.” As a student of Philosophy diving into my first coursework in Logic, this phrasing quickly caught my attention. Musk may have left a bit to the powers of inference, but I believe he would agree with this extension of his phrasing: sustainable, renewable energy is logically equivalent to actualizing the potential of human flourishing, that is to say, any world in which human kind will develop and thrive as a species is a world based first and foremost in renewable energy. The fact must be recognized that a future worth living in (a flourishing future) entails dramatically different consumer habits than the status quo. How people continue to respond as a global society to the realities of anthropogenic climate change will determine the quality of life for the vast majority of humans to come. The necessities of this logical equivalence—movement away from carbon-based fuel sources, a drastic remodeling of human consumption and disposal habits, a relearning of the place of non-human animals off the average dinner plate, the revaluation of existential necessities such as clean air and water, and a demolishing of the consumerist ideals engendered through a capitalist economy—are complex and far reaching—daunting, to be sure—and thus far none of these issues have been addressed in any way that allows for authentic hope of mitigating climate change.

The purpose of this essay is to propose a radical solution: public education, an education that must be a significant cornerstone of any solution to mitigate anthropogenic climate change and offset further consequences. Publicly adopted education at the K-12 levels has the capacity to change behavior for global mitigation. If persons are to play an agential role in their communities, countries, and as planetary citizens, they must be equipped with the knowledge-based skills to yield the best possible outcome for themselves and society as a whole. If we can agree that we owe our efforts to a flourishing contemporary and future humanity, then we must begin to envelope students in a learning environment that enables them to address, in their everyday lives and as an active member of said polity, one of the greatest issues in human history: anthropogenic climate change.

The answer to, “How do we adapt to climate change?” is, in short, a simple one: better education in critical thinking, science, and ethics. Only a climate change education based first and foremost in developing scientifically literate persons, a decent moral compass, and critical thinkers has the potential to mitigate anthropogenic climate change in a temporally efficacious fashion. This may seem like a statement of the obvious, but it has not been made part of the educational standards at the state level thus far. The goals of this paper are as follows: 1) to show that disparities exist amongst standards of climate change education at the state level. Indeed, it is the case that some states are making a concerted effort to educate their students, while others are making little to no effort of this nature. 2) The proposal of what these educational standards should strive for and how this may be integrated into the public education system at large, namely, a framework for what a good education in climate change must strive to portray to students and how said goals may be integrated into the public school system today.

**Acknowledging the Status Quo**

To provide suggestions for a meaningful incorporation of climate change education the current state of educational affairs must be addressed. To do this, I have conducted an informal analysis of the current educational standards of the following states: Alabama, California, and Colorado. Throughout this process the Principle of Charity has been utilized (Loar, 545-550). Applied to this case, I answer the following question through said principle: given the assumption that teachers within a given state system are meeting the educational standards of their home state, will it follow that students are being well-equipped to live their lives in a fashion that produces climate change mitigation? The states were chosen with the intent of representing likely extremes of the spectrum that is the demonstrable status quo of climate change education in K-12. To this end, the analysis can be used to draw general conclusions about the analyzed states but not necessarily to draw specific conclusions about the facets of other state’s program standards, given that states do vary. The conclusions, however, are clear: public education with respect to climate change is falling far short of meeting the necessary goals of an education for a flourishing future. Indeed, standardization across the board of state’s education systems must become an essential part of the mitigation process if we’re to avoid a future with potentially irreversible manifestations of climate change.

***Analysis of Alabama Science Standards***

The state of Alabama proposes a solid mission statement for the goals of their science education for, “all students to become scientifically literate… with the knowledge and skills necessary for the twenty-first century.” The standards also acknowledge the need to breakdown inaccurate predispositions; “Misconceptions concerning many scientific phenomena are also abundant at this age level. Teachers should work diligently to uncover these misconceptions and help students to recognize them as such… through the use of discrepant events and demonstrations that cause students to ask ‘why’ their logic or experiences do not always agree with scientific explanations.” The overall mission statements of Alabama’s core standards seem at least partially on par with educational goals to be later proposed, but unfortunately, it is entirely unlikely that students of Alabama would be receiving a sufficient climate change education based on a closer look at the standards.

Students of Alabama are required to take coursework in Biology along with coursework in one of following: Physical Science, Chemistry, or Physics. In addition, students are required to take two of the ten offered electives. Of the core requirements, Alabama’s Biology Core section is the only section to lightly wave a hand at climate change with the goal that students will, “Trace biogeochemical cycles through the environment, including water, carbon, oxygen, and nitrogen,” providing that possible examples for lessons could be in climate changes that result in, “changes in migratory patterns of birds,” and lessons in human activity that have resulted in, “habitat destruction resulting in reduction of biodiversity, conservation resulting in preservation of biodiversity.” This is the basic summation of the lack of climate change education within the core standards, as the physical science, chemistry, and physics requirements offer nothing as far as said standardization. The blatant lack of climate change education standards seems quite contradictory to the mission statement provided within the Biology Core providing that, “With the advent of anticipated breakthroughs in science and the personal, environmental, and societal issues that will accompany them, biological literacy for all Alabama citizens is essential.” The standards exemplify that it is a goal of the program to provide students with the ability to comprehend current and developing environmental issues (and the implications thereof) without exposure to a formalized climate change education: a wildly implausible pair of means and ends.

Within the ten elective choices the Environmental Science Elective is the only one that makes a coherent effort to begin creating the scientific basis for students to get a grasp on scientific knowledge. These standards have students learning and applying concepts such as carrying capacity, population size, evaluation of fossil fuel use (acid rain, GHG emission, particulate concentration, etc.), evaluation of alternative energy sources, impacts of pollutants (on atmosphere, water sources, ecological systems), sustainability and land-use practices, and more. The informative goals outlined in this elective are essential to fulfilling Alabama’s overall mission statement to equip students with the, “knowledge and skills necessary for the twenty-first century.” In any case, this is only one of ten offered electives, and students are only required to take two of the ten offered for graduation. It should not be left chance that students will begin grasping the body of scientific knowledge that has synthesized the consensus of anthropogenic climate change. It is also important to note that even in a best-case (and extremely unlikely) scenario wherein the majority of Alabama’s students would have taken the Environmental Science elective, the standards are ultimately missing the mention of entirely necessary components of a proper climate change education. Not only is a basis of the scientific knowledge necessary, but also exposure to ethics curricula and the critical thinking development needed to be able to adapt this knowledge base to ever-evolving facets of contemporary implications of the science should be explicit. It must be brought into the scope of relevancy that the likelihood of any given student electing to take Environmental Science as part of their course of study is only about eleven percent*.* Clearly, this would leave the vast majority of the public subject to the plague of denial and inaction present today (Alabama State Department of Education).The outlining of the above standards serves as the basis for exemplifying the extreme case where little chance of each citizen being exposed to a coherent anthropogenic climate change education is likely.

***Analysis of California Science Standards***

It became immediately obvious that the California standards place a large emphasis on the development of critical thinking skills in relation to science. In a subsection of each section of standards a *Connections to Nature of Science* goal is provided. For example, teachers are to guide students to the recognition of the values of science, “that include: logical thinking, precision, open-mindedness, objectivity, skepticism, replicability of results, and honest and ethical reporting of findings.” Another reads that students should be able to, “Plan and present an argument that: supports a precise claim; provides a logical sequence for claims, counterclaims, and evidence; uses rhetorical devices to support assertions (e.g., analogy, appeal to logic through reasoning, appeal to emotion or ethical belief); uses varied syntax to link major sections of the presentation to create cohesion and clarity.” These are just two of the many examples addressing the necessary aspect of critical thinking within a climate change education. Significantly more examples are standardized in sections that make a good case for the recognition that the state is likely making a concerted effort to engrain critical thinking capacities into students through the scope of climate change.

The California standards provide a well-rounded set of standards for the climate change science as well. Acknowledgements of the anthropogenic nature of the problem are available throughout with statements such as, “changes in the atmosphere due to human activity have increased carbon dioxide concentrations and thus affect climate,” as well as the need to address these issues in a concrete and practical fashion with statements such as, “humanity faces major global challenges today, such as the need for supplies of clean water and food or for energy sources that minimize pollution… these global challenges also may have manifestations in local communities.” In the section, *Interdependent Relationships in Ecosystems* students are expected to be able to demonstrate abilities to “Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.” It is apparent that important among these factors is human impacts, as students are also expected to be able to, “…refine a solution for reducing the impacts of human activities on the environment and biodiversity,” as well as, “create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.” The scientific nature and critical thinking development requirements are further explained in this section through the expectation of students to, “design, evaluate, and refine a solution to a complex, real-world problem,” “defend and critique claims and explanations,” and teachers are to guide their students to the conclusion that, “…anthropogenic climate changes in the environment—including habitat destruction, pollution, introduction of invasive species, overexploitation, and climate change—can disrupt an ecosystem and threaten the survival of some species.” The section titled *Human Sustainability* contains a concerted effort to provide a framework from which teachers may develop curricula around anthropogenic climate change and what students may do about it, providing a soft hand waving at the necessity to address the ethics within the educational material. For example, students are expected to create simulations to relate the “management of natural resources, the sustainability of human populations, and biodiversity,” taking into account practices of “resource extraction and waste management, per-capita consumption, and the development of new technologies.” This is the first mention of “per-capita” consumption, which is an entirely necessary issue to address in a well-formed climate change education. This topic can provide a direct link to causal chains of anthropogenic climate change (for example, emission rates through consumption patterns) and bring to the educational curriculum aspects of morality and social justice issues*.* A great educator may be able to spin standardizations of this nature into lesson plans invoking notions of ethics into the academic scope of the everyday student, but it would be dishonest to conclude that each educator within the California system is doing this without further standards being spelled out in a more explicative fashion (California Department of Education).

The California 9-12 science standards are quite extensive, and it would be possible to point out many more ways in which the standards seem to be making a coherent case for intensive learning of climate change science steeped in critical thinking. This is not to say, though, that the curriculum is not lacking. There are potential mentions of ethical issues to address academically, but no explicit standards that would allow for an honest conclusion that in any given lesson regarding anthropogenic climate change, including the science and critical thinking skills, topics in ethics will also be addressed.

At this point, a distinct conclusion may be drawn: it is likely that any given citizen within one state’s educational system may go through an educational system that makes a strong effort to address the educational needs of climate change (for example, California) while any given citizen within another state stands a statistically unlikely chance at being well-equipped to deal with the contemporary implications of a global world faced with climate change (for example, Alabama). The empirical evidence is clearly perceivable through a simple, yet charitable analysis of the state standards as shown above. This is the continuum that must be addressed through intense improvement of educational standards within every U.S. state educational system.

Readers that are sufficiently convinced of the above conclusions may find it most beneficial to skip to the section, “Necessary Components of the Education System.” The analysis of Colorado’s standards is provided below, and, though not necessary for the above claims, may serve as further evidence to outline the discrepancies within state standards. The remaining standards analysis will be provided in a less extensive form, for the sake of portraying the reality of the situation in a more concise fashion that is easily relatable to the analysis outlined above.

***Analysis of Colorado Science Standards***

The Colorado standards start out with a well-formed acknowledgement of the status quo, that which a good science education must readily address, by providing, “At a time when pseudo-scientific ideas and outright fraud are becoming more common place, developing the skepticism and critical thinking skills of science gives students vital skills needed to make informed decisions about their health, the environment, and other scientific issues facing society.” The Colorado standards place a large emphasis on climate change issues in general, but do a less extensive job overall of specifically outlining the necessary aspects of this education. This may perhaps be in part due to the fact that the climate change educational standards are laid out within the Physical Science, Life Science, and Earth Systems Science standards, whereas, for example, the California standards provided more clarity of the overall goals via sections such as Human Sustainability.

“Critical Thinking and Reasoning” take precedence at the top of Colorado’s Description of 21st Century Skills, which are outlined throughout, though no explicit outlining of the nature of logical reasoning, identifying fallacious arguments, logical entailment, rhetorical theory, etc. are provided (as is moreso the case within the California standards).

The outlining of the scientific nature of climate change is expressed in the Colorado standards in a similar fashion, where examples are provided throughout, but no entirely coherent series of standards seems to be in place.

Interestingly, the Colorado standards provide the best standardization of ethics curricula seen thus far, a topic that was not made entirely explicit in the California or Alabama science curriculum, providing many examples of how students must recognize their place as citizens bound to action, and these actions must be, if for a better future, informed by climate change learning. For example, emphasis is placed on discussion of various topics such as, “the implications of different types of funding and the ethical traditions of science,” asking questions such as, “how does modern agriculture affect biodiversity?” and asking students to, “debate the ethical and political issues,” associated with scientific breakthroughs. Unfortunately, this trend is not maintained throughout the Colorado standards, and this is the case in arguably the most important areas of climate change, such as when topics of dietary habit are addressed. For example, in the Life Science standards students are expected to, “Evaluate the potential ecological impacts of a plant-based diet or meat-based diet,” but are not asked to necessarily evaluate the ethical considerations of non-human animal body consumption and what this may imply for the everyday habits of the American consumer and the overall health of the national population (Colorado Department of Education). The process of evaluation without the goal of implementation, though not necessarily vacuous in all in its entirety (as it may potentiate change), is partially dishonest as a standard for educational outcomes. The pressing nature of climate change demands action, hence the necessity of ethical considerations throughout all science curriculum, even when it may bring culturally contentious ideas into the everyday classroom.

**Necessary Components of the Educational System**

Up to this point, we can see that there is much work left to develop a standardized set of objectives necessary for an education in climate change. The following section is dedicated to outlining a goal-oriented approach to this education, particularly with respect to the key components suggested earlier: science, ethics, and critical thinking curriculum taught in an age-appropriate fashion for the development of more environmentally responsible global citizens.

***Science Curriculum***

The overarching goal that must inform the science component of a climate change curricula can be stated as follows: students will be able to authentically acknowledge an understanding of the contemporary scientific consensus that anthropogenic climate change is a reality that necessitates adaptation. The notion of authenticity must not be undermined*:* the Latin root, *educere,* serves to exemplify the notion of authenticity, and is quite literally taken as, “to lead out of [ignorance/darkness]” (brackets added). It requires a keen interest and understanding of the scientific development that has lead to an accurate consensus among the scientific community that anthropogenic climate change is a pressing issue. This fundamental goal, though simple in form, has not adequately been addressed, though the science has been so well established that, despite this fact, educators may go forth in a meaningful fashion to bring students to a similar recognition of the science.

The EPA (Environmental Protection Agency) provides a list of terminology related to climate change that must become useable vocabulary if we’re going to understand the science and nature of climate change in any exhibitive way. This list includes teaching necessities that could find a place formally in the subjects of physics or chemistry such as understanding of chlorofluorocarbons (CFCs), greenhouse gases (GHGs), albedo, ozone depleting substance (ODS), methane, carbon dioxide, enteric fermentation, etc. It also includes material usable in climatology or oceanography coursework such as ocean acidification, coral bleaching, inundation, sea surface temperature, atmosphere, ozone, etc. Terminology applicable to learning in a civics, government, history, or English curriculum are also provided, such as learning of the development of Intergovernmental Panel on Climate Change (IPCC), alternative energy sources, etc. I believe it would be a feasible goal of a semester’s coursework to guide students to a practical level of fluency with this terminology (likely most appropriately this development would begin at the middle school and high school level, though more accessible versions could easily find a place in early childhood education through pedagogical tools). Resources of this nature are widespread and available for those in curriculum development, and, as we have seen, there are current state standards that have already begun a thorough development of curriculum oriented toward the scientific teachings of climate change (see, for example, California). Sources as such can satisfy the first portion of the goal I have stated above dealing with an authentic acknowledgement of the science.

The second portion of the scientific goal, that students will be guided to the realization that climate change mitigation necessitates adaptation, must be met through a different scientific approach: guiding students through the arduous task of the relational nature of cause and effect, that is to say, there are scientifically identified causes of climate change, and there are solutions to said causes. This is a simple notion that has inadequately been dealt with, but that certainly holds a key to mitigation strategies. Spelling out this relationship to students could come in a variety of forms, and must focus on the largest contributors to anthropogenic climate change. For example, analysis such as those done by the Oxford Martin Programme of the Future of Food, provide that between 29-70% of food-related greenhouse gas emissions can be eliminated by a transition from a meat-based diet to a plant-based diet while simultaneously benefitting the health of an abundantly obese and malnourished polity. For the global north (and for our purposes, the U.S.) that produces, sources, and consumes proteins nearly exclusively through animal factory farming, the per-capita mitigation rate is higher. Here, the proposed cause and effect relation is simple: when most people eat a diet heavy in animal proteins, it yields detrimental environmental damage (Springmann et al). Students, in this specific case, must be drawn to the realization that, as production methods stand, a plant-based diet is generally far less energy-intensive and environmentally damaging. This cause and effect relational model can be used for nearly all climate change issues grounded in the science. For example, students should be expected to analyze use of renewable versus non-renewable energy systems. This would include items such as a thorough examination of energy supply through hydraulic fracking, tar sands, offshore drilling, coal, etc. versus energy supply through solar, wind, nuclear, etc. Useful pedagogical tools are widespread and available for these purposes as well, along with the majority of scientific inquiry and learning regarding climate change.

The development of strategies for meeting the goal-oriented needs of the scientific education bring about an entirely pivotal point within our scope. Even still, the ever-growing body of scientific learning aimed at acknowledgement and understanding of the climate change and the recognition that mitigation necessitates adaptation must not be the single end at which we are aimed.

***Ethics Curriculum***

I come to the teaching Ethics with the Socratic notion of the trade in mind, where ethics is, “no small matter, but how we ought to live.” The import of authenticity, as seen with scientific learning, cannot be overstated: students must be guided to conclusions on actions they must take for the contemporary and future worlds they wish to live in. The goal of teaching ethics within the scope of climate change must strive to do the following: instill a sense of duty to the future and guide students to the existential recognition that there are better and worse actions for this future made manifest by individual and collective actions of today. Put more simply, ethics curricula must develop citizens that care about the quality of the world they live in.

The standard ethics curriculum in climate change education is, in a word, depressing (California, Colorado, and Alabama standards). A scientific recognition that non-human animal agriculture and energy extraction from carbon-based fuels are primary contributors to climate change means absolutely nothing more than wasted paper and ink if students are not faced with this question, “So, class, what *ought* we do about it?” In vain we will teach students the scientific nature of these issues without guiding to them the recognition that, as existential beings, we are bound to action, and our actions make a tangible difference.

In *Reason In a Dark Time,* a useful discussion of the failures of moral philosophy (ethics) is offered to aid in answering the above questions, as well as hope for future use of the trade, which Jamieson casts as a proposal of green virtues. I wish to adopt this view for our purposes but with hedging that will allow for adaptation to various educational settings. (Jamieson, pgs. 144-177)

Virtue ethics has its roots in ancient work dating back at least to Aristotle, wherein the good of man is determined through the development of virtuous character traits, all with the common aim of *eudaimonia*, often translated as a state of “human flourishing.” This flourishing, it must be maintained, is aimed at a state of flourishing for the present, but equally important is a state of flourishing for future beings. This will allow for the development of educational strategies that aid students in “going green” (for their future and all future peoples) without neglecting necessary and contemporary qualities of life (for themselves and all present persons), even if these at first will come across as supererogatory in nature (for example, transitioning to a plant-based diet). This modernized approach is consistent with the Aristotelian approach, where a virtuous character trait must be a qualified balance between extremes of rash action. (Rosalind, section 2.1)

Jamieson maintains that an ethical approach to climate change would, “rely on nourishing and cultivating particular character traits, dispositions, and emotions: what I shall call ‘virtues.’ These are mechanisms that provide motivation to act in our various roles from consumers to citizens in order to reduce GHG emissions…They also give us the resiliency to live meaningful lives even when our actions are not reciprocated.” This view melds quite well with the concepts of virtue ethics outlined above. So, for example, Jamieson suggests a redevelopment of temperance, which finds applicability in simple green virtue concepts such as moderation or using only a fair portion. The development of a green virtue, mindfulness, is also presented as holding potential. This virtue has been cast already in contemporary media use through the often-oxymoronic phrase, conscious consumerism. The purest form of this virtue, I add, means the recognition that we are existentially-bound beings, but that must not lead to a gutting and gluttonous approach to sustenance in our consumer-bound lives. (Jamieson, pgs. 178-200) Still, the pressing question remains, what do these concepts mean for an educational setting?

The teaching of ethics as key to climate change adaptation for the future can take many effective forms, and its benefit lies in the fact that intense learning of empirical and scientific knowledge is not grounds alone to believe individuals (and ultimately a nation state) will begin to regularly adopt environmentally responsible behavior. For example, while factory farming to support a diet based in nonhuman-animal proteins is not sustainable, this alone may not be enough to convince an eighth grader, likely more nervous about the weekend’s school dance than his future children’s’ environmental well-being, to adopt dietary changes and choose the veggie burger in the lunch line over the corpse patty (this analogy may be taken literally, but can extend to other realms of these issues). On the other hand, a reading of *Animal Liberation* or *Meatonomics*, supplemented by a visit to a large-scale slaughterhouse or broiler factory might bring home the message in a more concrete fashion and drive development of more virtuous actions. This would surely bring about the practice of a standard diet into question by asking, “Should we even consider it morally acceptable to eat non-human animals in the first place?” In the same regard, an analysis of energy forms (renewable versus non-renewable) would be more likely to find individuation if students are brought onto the development sites of pipeline construction, hydraulic fracking pads, etc., nearest their hometowns or favorite state park and lead to conformity to public transportation, carpooling, walking, or biking to school and a future workplace.

An ethics curriculum provides a unique and necessary approach to attempting to drive home the visceral aspects of human experience. Indeed, it is a necessary component of a climate change education to appeal to aspects of this experience that are often the most difficult to portray through an everyday lecture. This has been investigated through the lens of environmental education in general, more specifically within the scope of place attachment. For example, the connection of an individual back to nature (through outdoor recreation, community involvement, etc.) within their personal scope can increase likelihood of demonstration and conformity to environmentally responsible behavior (Vaske and Kobrin, 2001). For our purposes, knowledge of this sort serves as complimentary to educators within the ethics component of climate change curriculum. For example, the likelihood of Pennsylvania residents being passive citizens under the development of the Atlantic Sunrise Pipeline, causing destruction in direct proximity to areas such as Rickets Glenn State Park and acting in direct opposition to Chesapeake Bay restoration projects, would be reduced by appeal to place attachment through ethics curricula (Chesapeakecommons.org). Schools must encourage community development projects such as gardening within district land or within surrounding communities. The development of outing clubs (community gardens, beekeeping, rock climbing, hiking, biking, foraging, etc.) might also serve this purpose. It is paramount that the aim of said projects be towards the common goal of developing citizens that care. This goal must segue into social justice projects, student involvement at the community and governmental level, advocacy projects, and lifestyle changes.

The necessity of ethics curricula within climate change education must be embraced by the educational system in an age-appropriate fashion if we are to see effective mitigation. Indeed, there cannot be an honest and meaningful discussion about the environmental impacts of the faulty ideological systems, premised on raping the land for unsustainable satiation of consumer demand, of corporations such as *Nike* and *Wal-Mart* without considerations of human-rights violations. Nor can we teach about the atrocities and environmental degradation perpetuated by the United State’s addiction to nonhuman-animal proteins without addressing animal abuses, Ag-Gag laws, slaughterhouse day laborers’ rights, and corporate advocacy for diets perpetuating health crisis and disease (Simon, *Meatonomics*). We cannot discuss a cost-benefit analysis of corporate agribusiness projects without discussing resource allocation, avoidable world hunger, and increasing rates of farmer suicide. Furthermore, as writers Oreskes and Conway put it, we cannot discuss pseudo-scientific claims aimed at merchandizing doubt and denial without discussion of the rights of citizens to information that directly affects their everyday lives. (*Merchants of Doubt*, pgs. 10-35, 136-215)

***Critical Thinking Curriculum***

I have reserved suggestions for critical thinking curriculum development last as an acknowledgement of work for example, by Psychologist Daniel Willingham around the established difficulty in taking on the task of teaching critical thinking as a course subject. As I have made clear, the requirement of domain knowledge within the scope of climate change science and ethical considerations arising from climate change is paramount, but without the critical thinking capacities necessary to interpret the ever-evolving process of climate change mitigation the body of domain knowledge risks lying dormant and worthless. What is necessary within the educational system is a Venn diagram consisting of a qualification of the science, ethics, and critical thinking education to enact effective anthropogenic climate change mitigation.

Critical thinking development must be first rooted in basic logic and rhetorical strategies. Students must, for example, be able to identify the validity or invalidity of an argument before effectively analyzing the arguments premises as sound or unsound. Furthermore, students must develop a thorough understanding of the fallacious tools used by pseudo-scientists and corporate-funded climate change deniers. For example, a student able to identify *ad hominem* attacks or fallacious appeal to authority has a much better chance at analyzing the quality of a geopolitical opinion than one unarmed with said knowledge. Further more, and perhaps a far greater undertaking than the statement makes it seem, students must establish a thorough understanding of the nature of cause and effect phenomena. Without this understanding, the ability to understand both the scientific nature and moral mandates of necessary mitigation strategies will never be authentically recognized, adopted, and embraced by citizens at large. Equipped with a basic set of logical skills, students will effectively analyze the geopolitical environment surrounding anthropogenic climate change denial as unfounded.

The standardization of critical thinking development will not only allow students to identify and enact efficacious climate change mitigation strategies but also lead healthier and more meaningful lives. For example, the data-distortion, small sample, and for-corporate-profit ‘scientific’ claims made by the tobacco industry to hide the blatant fact that cigarette use is causally connected to a laundry list of health crisis are fundamentally the same fallacious tactics used by meat and dairy agribusinesses to keep the bellies of the world full of unsustainable protein sources that contribute wholesale to climate disaster. I contend that a critically thinking student will not only draw the factual conclusion that the addiction of the global North to consuming meat, dairy, and eggs is contributing to anthropogenic climate change in an unmatched fashion, but also the consumption of these products is effectively crippling the health of the fat and malnourished consumer. Furthermore, critically thinking students will not only be able to identify the oxymoronic claims of advertising campaigns such as, “Clean burning coal,” but to realize the existential necessity of a global renewable energy system.

**Conclusions**

I have internally debated and concerned myself to great lengths with the ordering of the necessary educational components that are science, ethics, and critical thinking. There is a sense in which it seems necessary, as a pragmatic matter, to decide what must be taught as priority over another given component. After much rumination, I have concluded that only with the three components at work together can one gain insight into necessary action for the global mitigation process, and to regard one component in higher standing than another is to create a sort of triage chicken/egg dilemma, which distracts from the problem at hand. One can regard scientific inquiry as the kingpin for mitigation development, but this leaves us with no moral mandate for contemporary or future persons. In the same manner, one can stew over moral considerations for only so long before spinning their wheels into a sort of moral paralysis. Finally, critical thinking is certainly the bedrock component necessary to draw valid conclusions for the mitigation process, but to regard the issue as residing entirely in the rational realm is potentially shortsighted. Only a mutual arising of mitigation solutions from the three educational components will yield a flourishing future.

The empirical evidence has been established that the public education system is in dire need of standardization of climate change education. According to the status quo, coming generations will be essentially left to their ignorant devices when facing personal and geopolitical consequences of local, national, and global manifestations of anthropogenic climate change. If students are not equipped to make sustainable decisions in their everyday lives as well as force pressure upon fascist government-corporate powerhouses to curb the world’s addiction to non-human animal products and carbon-based fuels, the manifestations of climate change are predicted to grow increasingly catastrophic. This educational system must house and nourish a polity cognizant and changed by a climate change education grounded in science, ethics, and critical thinking curriculum.

Outline below is a basic set of teaching tools for educators to use as guidance for curriculum development. This will allow an educator, even if working within a flawed state system, to properly educate students of their classrooms. Many of these resources were used in the writing of this piece, while others have been included simply as further source material for educational purposes. A competent educator of any grade level should be able to make use of this material in an age-appropriate fashion through the lens of any course subject; the development of climate change education cannot cease at the doors of a science classroom, but must percolate through the entire academy.

**Annotated Resources**

Simon, David Robinson. *Meatonomics: how the rigged economics of meat and dairy make you consume too much-how to eat better, live longer, and spend smarter.* San Francisco, Conari Press, 2013.

Meatonomics is a fabulous introduction for the general reader to the symbiotic relationship corporate powerhouses and career politicians have developed to keep non-human animal agriculture well in the black. Unfortunately, as Simon makes clear, this benefit comes at a painful price to the well being of people’s bodies, the environment, and citizen’s wallets. Simon takes an analytical approach to putting numbers and sound statistical analysis to the contemporary agricultural system and shows how there is potential for repair within the already existent economic system. Part I of the text is dedicated to setting a clear theoretical framework regarding how policy and fascist corporate-government interest is largely detrimental to the consumer body. Part II is dedicated outlining Simon’s proposed costs of the animal agriculture system paid by consumers and through environmental degradation. Appendixes A-D further outline externalized costs and how policy change and consumer choice may repair the flawed system.

This piece would be particularly useful to studies in civics and government as well as studies in statistics or economics. While I believe educators will find the material most appropriate for high school level curriculum, the fundamental concepts and conclusions (especially regarding dietary practice and consumer choice) can be made to fit any age-level given a reasonable amount of educator creativity.

Cavender, Nancy M. and Howard, Kahane. *Logic and Contemporary Rhetoric: the use of reason in everyday life.* Belmont, Wadsworth Cengage Learning, 2006.

Though not a necessary resource for studies of formal logic, this work makes use mostly of informal logic and sheds light on rhetorical strategies through contemporary examples. Diligent students and educators will be able to apply knowledge of linguistic tools learned throughout to identify sound reasoning within the context of climate change. For example, the fallacious nature of pseudo-scientific claims exposed in *Meatonomics, Merchants of Doubt, Reason in a Dark Time,* etc. can aid students and educators in identifying destructive industries and enacting social justice at the personal and legislative level.

Oreskes, Naomi and Conway, Erik M. *Merchants of Doubt: how a handful of scientists obscured the truth on issues from tobacco smoke to global warming.* New York/London, Bloomsbury Press, 2010.

Conway and Oreskes manage to provide one of the most useful educational tools to educators and students alike in *Merchants of Doubt* by drawing distinct analogies between the industry interests surrounding climate change denial and the historical case of industry interests surrounding tobacco habits as the causal link to various forms of cancer. They show the standard and fallacious methodologies used by corporate mongering entities to keep the public body ignorant or at least doubtful of sound scientific claims made by the rational majority of scientists and activists alike and the unfortunate success of the pseudo-scientific minority.

Jamieson, Dale. *Reason in a Dark Time: why the struggle against climate change failed-and what it means for our future.* New York, Oxford University Press, 2014.

Jamieson provides an in-depth look at the failures of the globe to address climate change in a meaningful way. Not only do I find Jamieson’s ethical considerations worthwhile, but also his work served as a personal breakthrough towards connecting the dots in a substantive way. This work is of utmost relevance in the fight to develop a polity that is willing to, as Jamieson adopts, “think globally, act locally.”

Singer, Peter. *Animal Liberation* New York, Random House, 2nd Ed. 1975.

Singer’s work is a great philosophical read with clear premises, conclusions, and core concepts that can be made understandable to all age groups. His Act Utilitarian approach to addressing animal body consumption and speciesism has become somewhat of a poster child for animal rights activist groups. The work could be read as a stand-alone ethical read or interestingly coupled with material such chapter eight of *Meatonomics* wherein Simon addresses cruelty as a measurable cost. Through proper educational experience with this work students will be forced to wrestle with questions such as, “What does it mean to be a sentient being?” “Is there a morally relevant difference between, for example, a pet dog and a broiler chicken, veal calf, or pig?” “Am I living a morally consistent or inconsistent life based on my *own* belief system?” Surely, Singer’s work has the potential to positively affect all willing to use it as an educational tool.

Ayers, William, Hunt, Jean Ann, and Quinn, Therese. *Teaching for Social Justice.* New York, The New Press and Teachers College Press, 1998.

*Teaching for Social Justice* can serve as not only a reference source for ways to integrate lessons oriented towards a goal of social justice but also as a guide for teachers themselves dealing with the hierarchical chastising often associated with taking a stance as an educator. Section two, “Human lives behind the labels: the global sweatshop, Nike, and the race to the bottom,” as well as section twelve, “History of my subversive teaching,” are more specifically useful to said goal.

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