ETHICS AND SCIENCE EDUCATION IN A WICKED WORLD

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Wicked socioecological issues pose challenging ethical dilemmas related to both human and nonhuman life on this planet. This paper makes the case that science education must enable students to understand environmental issues not just in terms of science content but also from appropriate ethical standpoints. Some ethical frameworks for understanding environmental issues have been proposed in the field of science and environmental education. However, these ethical frameworks were developed in an era in which technology seemed to power limitless economic growth, environmental sustainability was not considered mutually exclusive with such growth, and we had not yet entered the new age of unprecedented ecological catastrophes. In this paper, therefore, I also make the plea for a critical examination of the relevance of the current ethical frameworks for informing the role of science education in the new Anthropocene epoch.

INTRODUCTION

The latest report of the Intergovernmental Panel on Climate Change (IPCC, 2018) makes it abundantly clear that unless prompt, far-reaching, and unparalleled changes are undertaken to transform the relationship humans have with the rest of the world, our planet is headed for a catastrophic future much earlier than expected. I believe that science education has an important role to play in preparing future citizens to mitigate and cope with the disastrous effects of climate change and other environmental crises of the Anthropocene epoch; crises that our current generation of leadership have utterly failed to address. This paper makes the case that an important step in this direction would be to enable students to understand environmental issues not just in terms of science content but also and equally importantly from appropriate ethical standpoints. As I argue in this paper this is because environmental issues are quintessential *wicked problems*, which are "defined by high complexity, uncertainty, and contested social values" (Miller, 2003, p. 279). Thus, environmental issues pose challenging ethical dilemmas related to both human and nonhuman life on this planet with profound justice and equity implications of environmental problems for poor and marginalized people. Though we see promising efforts in the United Kingdom, New Zealand a few other countries, unfortunately, in the rest of the world there currently appears to be little movement towards inclusion of ethics as a component in the intended official science curricula (Reiss, 2008; Jones, et. al, 2007).

Of course, this is not to say that official science curricula are devoid of implicit or explicit ethical dimensions. But research (Bazzul, 2016; Sharma & Buxton, 2018) appears to indicate that the ethical standpoints tacitly implicated in the intended and enacted science curricula hinder rather than help students both in understand-

ing and in taking ethically just actions towards ameliorating environmental problems. Some ethical frameworks have been proposed in the field of environmental ethics and environmental education for understanding environmental issues from an ethical standpoint (Palmer, 2013; Saunders and Rennie, 2013). Most of these ethical frameworks were developed in an era where technology powered limitless economic growth and environmental sustainability were not considered mutually exclusive (WCED, 1987). Therefore, in this paper I assert that it is important to (a) critically examine the relevance of these ethical frameworks in the current Anthropocene epoch, and (b) explore the meta-ethical foundations of alternative ethical frameworks that might be better suited for inclusion as components of science education for this new era of unprecedented wicked environmental problems. I believe that this examination is an important step toward the development of the philosophical foundations of ethical reasoning that needs to become a critical part of science education in the current era of ecological catastrophes.

THE WICKED ETHICAL DILEMMAS OF ENVIRONMENTAL ISSUES

Ethics is about answering the question: "What is the right thing to do"? Unfortunately, we live in an extremely complex and interconnected world where it is often not easy to decide what is the right thing to do, especially regarding socioecological issues. Let me illustrate this challenge with an example from the United States, where I currently live and work. Imagine that a student in the United States learns in her science classroom one day that bananas, the most consumed fruit in the United States, come from plantations that have caused massive destruction of rainforests in South and Central America (Clay, 2013). This student may decide that a boycott of bananas would be an ethical response to save rainforests from these plantations. In fact, many mainstream environmental groups, such as *Rainforest Relief,* do urge customers to "avoid purchasing bananas altogether and instead opt for fruit grown locally, such as apples, peaches, cherries or pears" ("Banana Industry's Impact on Rainforests", 2010). Alternately, some environmental groups, *Rainforest Trust* for example, may try to save rainforests by buying land in these regions so that they can be restored to their pristine ecological health (Butler, 2014). But as Vandermeer and Perfecto (2005) explain such actions alone may hurt the rainforests more than save them. The closure of banana plantations can result in loss of jobs for many plantation workers who often end up converting forests into subsistence farmlands in order to survive.

This student may instead decide that buying organic bananas might be the best option to help save the rain forests. However, the world currently is not in a position to feed all the people on the planet through organic farming (Seufert, Ramankutty & Foley, 2012). Organic bananas can be grown in only very specific conditions that severely limits the amount of land available for growing them. So even if there was a 10% percent drop in supply of regular bananas, the potential of growing organic bananas will not be able to meet the demand (Loza, 2016). The cost of production for organic bananas is much higher too. So, if only organically grown bananas were available in the grocery stores, it could mean that bananas would go back to being the exotic fruit for the rich like they were back in the 19th century. Again, higher prices may decrease demand, laying off plantation workers who return to unsustainable subsistence farming practices. Similar outcomes may result if our student adopts the strategy of raising money to buy up land for conservation and restoration. This is not likely to work either and may only lead to an ecological landscape marked by "isolated islands of

tropical rain forest surrounded by a sea of pesticide-drenched modern agriculture, underpaid rural workers, and masses of landless peasants looking for some way to support their families" (Vandermeer & Perfecto, 2005, p. 13).

A seemingly simple question of whether to consume or boycott bananas ends up revealing a complex global assemblage of relations and entanglements involving local and distant human, non-human, material, social and cultural actors, and ethical-political dimensions. Simple actions such as a product boycott can indeed be counterproductive in resolving environmental issues because when we affect one strand of the complex web of causality inherent in these assemblages, the effects reverberate through the web in unanticipated ways to yield all kinds of desirable and undesirable outcomes. Thus, we find that an issue that on the surface looks very simple when unraveled reveals serious ethical quandaries that deserve to be acknowledged and tackled. This turns out to be the case for most environmental issues. Unsurprisingly, therefore, researchers have come to recognize environmental issues as a classic example of wicked problems (Brown, 2001; Camilus, 2008). Socioecological problems are wicked because they are "defined by high complexity, uncertainty, and contested social values" (Miller, 2013, p. 279). They arise from "the functioning and evolution of interconnected and complexly interacting socio-ecological systems" and defy solutions because "they are multicausal, intertwined with other problems, and value-laden" (Metzger & Curren, 2017, p. 94). As a result, environmental issues pose such difficult ethical dilemmas that unless one is equipped with appropriate ethical frameworks it becomes very hard to answer the question "what is the right thing to do?"

Unfortunately, wicked socioecological problems define our existence in the Anthropocene epoch, the geologic time period in which humans now substantially alter the Earth's geology and ecosystems. These challenges have long been known to affect the poor and marginalized sections of society disproportionately, and their impact on nonhuman life has been nothing short of disastrous (Walker, 2012). Any attempts to resolve such problems are also likely to create additional complex equity and socioecological justice implications for all kinds of life on this planet. As a result, as we saw in the examples above ethical dimensions are critical for both understanding and acting upon socioecological challenges (Brown, 2001).

ETHICAL LITERACY: WHAT DOES IT HAVE TO DO WITH SCIENCE EDUCATION?

Therefore, if we wish to remain hopeful about our future, we need to prepare our students as citizens who not only understand the 'wicked' nature of socioecological issues facing our planet but who are also deeply cognizant of the ethical implications of action as well as inaction on these challenges. Unfortunately, research (Sharma & Buxton, 2018) indicates that the implicit ethical stance in the school science curricula in the United States is problematic on several counts. Based on my past association with the Hoshangabad Science Teaching Program in Madhya Pradesh in the nineties and continued collaboration in science curriculum work with erstwhile colleagues in Eklavya in Bhopal and Hoshangabad, I am not sure if the situation is any better in India. In the United States for instance, school science curricula typically exhibit a strong belief in human exceptionalism. This view partitions the world into distinct social and natural domains, with human concerns at the center and issues related to nonhuman existence and survival at the periphery in deliberations on issues of resource allocation, survival and sustainability. This ethical stance is predicated on instrumental reasoning

that, in concert with human exceptionalism, supports the commodification of the nonhuman aspects of our world. Research also shows that the ethical standpoint embedded in science curricula is neither explicitly articulated nor challenged in the science classrooms, thereby facilitating its uncritical reception by the students (Bazzul, 2016; Sharma & Buxton, 2018). In agreement with Poole et al. (2013) I find the absence of ethical learning to be "particularly problematic regarding environmental issues as management decisions must integrate ecological, social, and cultural dimensions, and a comprehension of the values underlying those decisions" (p. 349). It is hardly surprising, then, that when young adults in the United States are quizzed on the ethical implications of climate change, a clear majority is either unsure or does not see climate change as representing any moral or ethical issues (Markowitz, 2012).

It is therefore imperative that instruction on ethical implications becomes an explicit and critical component of science education not just in the United States and India, but in all nations of the world. Unfortunately, a number of powerful factors continue to frustrate inclusion of ethics in science education, including the naïve belief in value-free science, fears of indoctrination and relativism if ethics become part of school curricula, and the hegemony of neoliberal logic that insists on transmuting all non-economic and social values into economic values (Poole et al., 2013). However, in recent years, a strong case for inclusion of ethics in science curricula has been made by several science educators from different parts of the world (Reiss, 1999, 2011; Zeidler and Sadler, 2008). These calls for including ethics in science education have been made on the grounds of better understanding the nature of science, improvements in the ethical sensitivity, knowledge and judgement of students, and broadening participation of students who might otherwise show limited interest towards science learning. Science educators and researchers engaged in research and instruction on socio-scientific Issues in science education in particular have been a redoubtable votary of the inclusion of moral and ethical issues as critical components of scientific literacy (Sadler, 2004; Saunders and Rennie, 2013; Zeidler and Keefer, 2003).

CURRENT ETHICAL FRAMEWORKS IN SCIENCE EDUCATION

As things stand there is no dominant or preferred ethical framework in science and environmental education for instruction on environmental or socioscientific issues. Usually, proponents of inclusion of ethical literacy make the case for viewing scientific and environmental issues from a few dominant perspectives that constitute the scholarly canon on ethics in western societies (Reiss, 2003; Zeidler and Sadler, 2008; Beauchamp and Childress, 2001). Though these scholars articulate their frameworks differently, broadly speaking the different ethical frameworks articulated by them can be clubbed under *consequentialism*, *deontology* and *virtue ethics*.

Consequentialism: Ethical theories categorized under consequentialism make the case that only the consequences determine whether an action is ethically right or wrong. That is, if we wish to be ethical we should aim to bring about best outcomes. (Brennan and Lo, 2002).

Deontology: In contrast, deontological ethical theories maintain that it is in the context of our moral rules and duties that we decide what is the ethical thing to do. According to Palmer (2013), "Deontological theories

in environmental ethics emphasize rules, principles, duties, rights or some combination of these. The basic idea is that we should adopt certain principles or respect certain rights, rather than that we are required always to maximize the good" (p. 199).

Virtue Ethics: In distinction with both consequentialism and deontology, virtue ethics conceptualizes ethical action in terms of virtues, like "kindness", "honesty", "sincerity" and "justice" (Brennan and Lo, 2002). In an environmental context, therefore, virtue ethics centers on "our attitudes and dispositions with respect to the environment" (Palmer, 2013 p. 200).

Unfortunately, indigenous and nonwestern ethical perspectives find themselves on the margins of scholarly conversations on ethical literacy in science and environmental education. Though, it is encouraging to note that a few scholars have argued for ethics of caring or feminist care ethics as important for inclusion in science education, or have advocated for pluralism in recognizing diverse ethical standpoints and values of different social groups (Lloro-Bidart, and Semenko, 2017; Reiss, 2003; Saunders and Rennie, 2013).

The ethical frameworks that dominate the conversation for inclusion of ethical literacy in science education are mostly the products of the age of enlightenment and modernity in the western world. They have been critiqued by environmental ethics scholars on theoretical grounds as well as for being out-of-step with the realities of life in the Anthropocene on several grounds. the main critiques of these modernist ethical frameworks can be summarized as follows:

1. They are based on a strong belief in human exceptionalism that leads students to partition the world in two distinct social and natural realms. This belief positions human concerns at the center and issues related to nonhuman existence and survival at the periphery (Sharma and Buxton, 2018).

2. Humans are reified as autonomous, rational, responsibilized individuals who can freely exercise their ethical agency independent of the socio-material context. Further, in any consideration of the situatedness of human ethical action, the environmental, nonhuman world is simply treated as a passive background (Whatmore, 1997).

3. Modernist ethical frameworks adhere to a material essentialism that characterizes the entities in the world with "a set of immutable properties that are relatively or absolutely autonomous from those of other entities and relatively enduring" (Castree, 2003, p. 4). Environmental ethicists are increasingly considering this material essentialism as untenable in the Anthropocene epoch that teems with "myriad part-human, part-organic, part-machinic entities that resist being represented within the conventional *taxon*", and owe their ontological properties to the varied discursive-material networks they are embedded in (Castree, 2003, p. 8).

4. These frameworks are anthropocentric in that they assume "capacity for reason as the definitive basis of a distinctively human ethical standing" (Whatmore, 1997, p. 38). This elevates the moral significance of humans vis-à-vis the nonhuman world, and serves to deprive the nonhuman world, such as birds, animals and trees, of an independent *ethical standing*, and visibility in any ethical calculus based on these frameworks (Valentine, 2004).

5. By consigning ethical consideration to instrumental logic (consequentialism), individual rights and responsibilities (deontology) and personal virtues (virtue ethics), these ethical frameworks work to depoliticize environmental ethical dilemmas. This depoliticization severely impoverishes the public sphere and diminishes the much-needed space for democratic contestation and decision-making on wicked environmental issues (Douglas, 2018).

In a way, therefore, these modernists ethical frameworks align well with the *Dominant Social Paradigm* of our times that has valorized low evaluation of the natural world for its own sake, compassion mainly for those near and dear, limitless economic growth and maximization of wealth, and instrumental, technocratic rationality (Harper and Snowden, 2017). It is hardly surprising, therefore, that the dominant pro-environment ideology continues to be *environmentalism*, which promotes the understanding that environmental dangers to the planet can be tackled within the existing political, economic and cultural order (Harrison and Boyd, 2018).

CONCLUSION

It is high time that we clearly recognize that we are in a new age of unprecedented ecological catastrophes. The scale of these crises has made it quite impossible to be confident about the planet's future without sounding naïve and out-of-touch. According to the newest report of the Intergovernmental Panel on Climate Change (IPCC, 2018) we only have a little more than a decade to undertake rapid and far-reaching transitions in our socioeconomic and industrial systems to limit the global mean temperature rise to 1.5^0C. That is, we have scarcely any time left to undertake actions designed to partially mitigate the impending threat to all life on earth. This is especially true for disadvantaged and vulnerable populations, including indigenous people and communities in poorer parts of the world, who are dependent upon agriculture or coastal livelihoods. As the already existing robust critique of modernist ethical frameworks indicates, it is quite likely that in the coming dystopian age in which "business as usual" approaches to science education as well as education in general might not work, we may need more radical ethical frameworks to guide our intended and enacted science curricula in schools all over the world (Sharma & Buxton, 2018; Whatmore, 1997). In addition to indigenous and feminist ethical perspectives, there are a range of ethical standpoints that have been proposed in response to the call for alternative frameworks that are immune from the aforementioned critiques of modernist frameworks. At one end we find frameworks like *non-centered democratic ecologism* that discards the nature-social dualism and encourages us to see the world as consisting of networks of nature-culture collectives (Latour, 2012). In these nature-culture collectives, non-humans are no longer relegated as objects with no ethical standing. Instead, they are included as constituent members of the social with the understanding that we extend equivalent (if not equal) ethical obligations to them as accorded to humans (Whatmore, 1997). At the other end, there exist standpoints like *post-environmentalism* that argues that we need not place any limits on economic activity to save our planet. We just need to unleash human creativity and ingenuity to find technological solutions for current environmental crises (Shellenberger and Nordhaus, 2011).

Unfortunately, however, there has been little discussion among science educators and researchers on the appropriate ethical frameworks for ethical literacy as part of K-12 science instruction. The only progress we

have had so far is a recognition amongst a small group spread across different parts of the world that students need ethical literacy in order to better understand and be agential about socioscientific issues in science education. That is not enough. It is critically important that more members of the international science education community join this conversation by (a) recognizing the need to include ethical literacy as a part of science education; and (b) examining the philosophical foundations of current as well as alternative ethical frameworks to assess their adequacy for informing the role of science education in the new Anthropocene epoch. In the United States and a few other nations this conversation has already begun. It is my hope and plea that science educators in India too heed the call of the global socioecological moment we currently find ourselves in.

REFERENCES

Banana industry's impact on Rainforests. (2010). *Business Ethics*. Retrieved from http://business-ethics.com/2010/06/19/2440-banana-industrys-impact-on-rainforests/

Bazzul, J. (2016). *Ethics and science education: How subjectivity matters*: Springer.

Beauchamp, T. L., & Childress, J. F. (2001). *Principles of biomedical ethics*: Oxford University Press, USA.

Brennan, A., & Lo, Y.-S. (2002, Sep 22, 2019). Environmental ethics. *Stanford Encyclopedia of Philosophy*. Retrieved from https://plato.stanford.edu/entries/ethics-environmental/

Brown, D. A. (2001). The ethical dimensions of global environmental issues. *Daedalus, 130*(4), 59-76.

Butler, R. (2014). Saving rainforests by buying them. *Mongabay*. Retrieved from Mongabay website: https://news.mongabay.com/2014/04/saving-rainforests-by-buying-them/

Camillus, J. C. (2008). Strategy as a wicked problem. *Harvard Business Review, 86*(5), 98.

Castree, N. (2003). A post-environmental ethics? *Ethics, Place & Environment, 6*(1), 3-12.

Clay, J. (2013). *World agriculture and the environment: A commodity-by-commodity guide to impacts and practices*: Island Press.

Douglas, M. (2018). The depoliticization of risk. In *Culture matters* (pp. 121-132): Routledge.

Harper, C., & Snowden, M. (2017). *Environment and Society: Human Perspectives on Environmental Issues*: Taylor & Francis.

Harrison, K., & Boyd, T. (2018). Environmentalism and ecologism. In *Understanding political ideas and movements*: Manchester University Press.

Intergovernmental Panel on Climate Change (IPCC). (2018). *Global warming of 1.5 C*. Retrieved from http: //www.ipcc.ch/report/sr15/ .

Jones, A., McKim, A., Reiss, M., Ryan, B., Buntting, C., Saunders, K., . . . Conner, L. (2007). Research and development of classroom-based resources for bioethics education in New Zealand. *Hamilton, NZ, Wilf Malcolm Institute of Educational Research, School of Education, University of Waikato.*

Latour, B. (2012). *We have never been modern*: Harvard University Press.

Lloro-Bidart, T., & Semenko, K. (2017). Toward a feminist ethic of self-care for environmental educators. *The Journal of Environmental Education, 48*(1), 18-25.

Loza, A. (2016). There are only few places where organic bananas can be grown. *Fresh Plaza*. Retrieved from http://www.freshplaza.com/article/158803/There-are-only-few-places-where-organic-bananas-can-be-grown.

Markowitz, E. M. (2012). Is climate change an ethical issue? Examining young adults' beliefs about climate and morality. *Climatic Change, 114*(3-4), 479-495.

Metzger, E. P., & Curren, R. R. (2017). Sustainability: Why the Language and Ethics of Sustainability Matter in the Geoscience Classroom. *Journal of Geoscience Education, 65*(2), 93-100.

Miller, T. R. (2013). Constructing sustainability science: emerging perspectives and research trajectories. *Sustainability Science, 8*(2), 279-293. doi:10.1007/s11625-012-0180-6.

Palmer, C. (2013). Contested frameworks in environmental ethics. In R. Rozzi, S. T. A. Pickett, C. Palmer, J. J. Armesto, & J. B. Callicott (Eds.), *Linking ecology and ethics for a changing world: values, philosophy, and action* (pp. 191-206). Dordrecht: Springer Netherlands.

Poole, A. K., Hargrove, E. C., Day, P., Forbes, W., Berkowitz, A. R., Feinsinger, P., & Rozzi, R. (2013). A call for ethics literacy in environmental education. In R. Rozzi, S. T. A. Pickett, C. Palmer, J. J. Armesto, & J. B. Callicott (Eds.), *Linking ecology and ethics for a changing world: values, philosophy, and action* (pp. 349-371). Dordrecht: Springer Netherlands.

Reiss, M. J. (1999). Teaching ethics in science. *Studies in Science Education, 34*(1), 115-140.

Reiss, M. (2003). How we reach ethical conclusions. In R. Levinson & M. Reiss (Eds.), *Key issues in bioethics: A guide for teachers* (pp. 14-24). London, UK: Routledge.

Reiss, M. (2008). The Use of Ethical Frameworks by Students Following a New Science Course for 16-18 Year-Olds. *Science & Education, 17*(8), 889-902.

Sadler, T. D. (2004). *Moral and ethical dimensions of socioscientific decision-making as integral components of scientific literacy.* Paper presented at the Hoosier Association of Science Teachers, Indianapolis, IN. https://files.eric.ed.gov/fulltext/ED481210.pdf

Saunders, K. J., & Rennie, L. J. (2013). A pedagogical model for ethical inquiry into socioscientific issues in science. *Research in Science Education, 43*(1), 253-274.

Seufert, V., Ramankutty, N., & Foley, J. A. (2012). Comparing the yields of organic and conventional agriculture. *Nature, 485*, 229. doi:10.1038/nature11069

Sharma, A., & Buxton, C. (2018). *The natural world and science education in the United States*: Springer.

Tilman, D., Socolow, R., Foley, J. A., Hill, J., Larson, E., Lynd, L., . . . Somerville, C. (2009). Beneficial biofuels—the food, energy, and environment trilemma. *Science, 325*(5938), 270-271.

Valentine, G. (2004). Geography and ethics: questions of considerability and activism in environmental ethics. *Progress in Human Geography, 28*(2), 258-263.

Vandermeer, J. H., & Perfecto, I. (2005). *Breakfast of biodiversity: The political ecology of rain forest destruction*. Oakland, Calif.; New York: Food First Books.

Walker, G. (2012). *Environmental Justice: Concepts, Evidence and Politics*: Taylor & Francis.

Whatmore, S. (1997). Dissecting the autonomous self: hybrid cartographies for a relational ethics. *Environment and planning D: Society and Space, 15*(1), 37-53.

World Commission on Environment and Development (WCED). (1987). *Our common future*. Oxford; New York: Oxford University Press.

Zeidler, D. L., & Keefer, M. (2003). The Role of moral reasoning and the status of socioscientific issues in science education. In D. L. Zeidler (Ed.), *The role of moral reasoning on socioscientific issues and discourse in science education* (pp. 7-38). Dordrecht: Springer Netherlands.

Zeidler, D. L., & Sadler, T. D. (2008). Social and ethical issues in science education: A prelude to action. *Science & Education, 17*(8-9), 799-803. Cambridge, MA: Harvard University Press.