

Environmental Discourses in Science Education

Volume 2

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Animals and Science Education

Ethics, Curriculum and Pedagogy

 Springer

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ISSN 2352-7307 ISSN 2352-7315 (electronic)
Environmental Discourses in Science Education
ISBN 978-3-319-56374-9 ISBN 978-3-319-56375-6 (eBook)
DOI 10.1007/978-3-319-56375-6

Library of Congress Control Number: 2017941718

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Printed on acid-free paper

This Springer imprint is published by Springer Nature
The registered company is Springer International Publishing AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Wild Awakeness and Animalistic Inquiry: Introducing a Book on the Role of Animals with/in Science Education

Welcome to the one of the few books in science education that addresses the roles of animals with/in science education! We hope you will enjoy the character of the conversations led by diverse authors as they guide topical explorations with faculty, students, and colleagues across multiple disciplines in science education. Animals have interesting yet tenable positions in science that have yet to be explored. Fish, insects, amphibians, and small mammals are often kept in K-6 classrooms as pets for their calming effects or for teaching young children about personal responsibility. Some teachers do animal-rescue projects with their students and keep foster cats and dogs in the classroom. Service animals, too, may accompany teachers or children to school. Animals such as daphnids, earthworms, sow bugs, midge larvae, fish, or turtles often are studied in the classroom. Animals also may be discussed in the classroom to help analyze relationships between animals and infectious diseases, animals used in entertainment, effects of climate change, or topics such as genetic modification, cloning, invasive species, extinction, environmental conservation, stocking wildlife, farming, animal slaughter, antibiotic use, the Endangered Species Act of 1973, and organizations that make statements about animals, such as People for the Ethical Treatment of Animals (PETA) or the American Society for the Prevention of Cruelty to Animals (ASPCA). Animals also are dissected in biology or anatomy courses, and specimen collections have long served education focused on Earth's natural history. Many large metropolitan areas have museums, zoos, aquariums, conservation centers, and wildlife rehabilitation centers. In short, animals play a large role in the sciences and science education, and yet they remain one of the least visible topics in educational literature.

Animals and the Ancient Greeks

To understand why animals are de-emphasized, we need to go back about 2000 years to the ancient Greeks. The Greek legacy largely shapes the ways in which animals have been thought about and intimately associated with in academic

disciplines. Socrates and his student, Plato, had little to do with animals other than to consider their subservience to humans, assigning them largely to the servitude and welfare of their masters’ hand. This subjugation is not unlike what is found in the Bible, where many Biblical stories use analogies or metaphors describing animals in largely anthropomorphic ways in relation to human strengths, weaknesses, desires, and passions. The worth of animals was described in terms of the ways in which they served humans. Ancient Greeks placed animals and nature at the lowest level in the hierarchy of how society might be organized, and humans were considered apart from animals in every way. More specifically, the ancient Greeks organized their societal hierarchy in this way:

- Man
- Woman
- Slaves
- Children
- Nature

Man	Woman
Culture (Human) (human)	Nature (animal)
Rational (categorized)	Irrational (wild)
Productive (work)	Reproductive (home)
Mind (intellect)	Body (emotion)

Men were considered the brokers of culture, rationality, intellect, and productive work, whereas women were considered the brokers of the home, body, and reproductive processes of society. The characteristics traditionally associated with women over time have historically limited their participation in the sciences and constrained what they could do as teachers. Carolyn Merchant, Karen Warren, and other ecofeminists provide outstanding studies of this history and show how it was exacerbated by the scientific revolution, industrialization, and capitalism – forces that further separated humans from nature and animals as they began urbanizing. Indeed, Francis Bacon used female metaphors to discuss the exploitation and domination of nature in his accounts of science. These ideas have very strong residuals in science even today.

It is worth talking a bit more about the ancient Greek philosopher, Aristotle. Aristotle was largely associated with reinforcing the hierarchy that still subjugates animals and the earth beneath human concerns and issues (or anthropocentrism). He was also responsible for the current trajectory of the more animal-centered ethics stemming from those who are concerned with the well-being and livelihoods of animals, for Aristotle’s biology emerged not only through careful naturalistic studies of organisms in the environment but also through considering the intimate relationships of humans with animals in industries such as fishing, beekeeping, and animal husbandry. Some of his observations about animals in biology are still relevant.

Animals and Indigenous Epistemology: Lost Dialogues

For many indigenous societies, both far before and far later than the ancient Greeks, the relation of animals and their role with/in education is paramount for understanding our place in the world. There are always exceptions. However, much has been written about native peoples' relations with animals and their embodied epistemologies around the significance of animal ethics – so much, in fact, that we do not need to rehash that literature here. Even with this vast literature and understanding of indigenous ways of knowing, native epistemologies have had very little influence on the topic of animal well-being in relation to science. This marginalization of indigenous epistemology points to the lack of their voice in the conversation around animals with/in science education. Native epistemologies have been largely discounted in relation to more popular notions of science, which emphasize exploitation and domination of the natural world and the animals and plants in it. Rather, extreme forces of anthropocentrism and capitalism reinforce economic models that are based on animal exploitation for food, agriculture, pharmaceuticals, cosmetics, pets, exotic animal trade, and fashion.

Neoliberalism and the Economic Rationalization of Animals

Neoliberalism, the twentieth-century perspective driving economic rationalization, stemmed largely from the philosophy of the ancient Greek society. The irrationalities or imperfections of “wild” nature, including animals (and women), were refined through scientific inquiry and technologies designed to take advantage of animals and manipulate their lives for ours. This hegemonic mindset firmly established animals as subjects of the humans, and their animalistic natures were thus “approved” for a more desirable future. Yet even as corporations are now genetically modifying organisms to withstand the harsh realities of the farm, other scientists are engineering methods for growing meat and other foods in the laboratory. Interestingly, with education and growing acknowledgment of the pain and suffering of animals involved in conventional agriculture, society is turning toward organic and responsibly nurtured foods and better ways to protect wild game and fisheries. However, very few people know how to grow their own food, and even fewer know how to hunt and fish. So even with a transition from conventional agriculture, there is still a heightened dependence on the market to meet the food needs of humans on Earth. In short, we may need to shift to an education for and with animals, rather than against them. Such shift will involve engaging students in experiences centered on gathering, hunting, and fishing wild foods. We will describe this trend as cultivating *wild awakenedness* and *animalistic inquiry* in the next section.

Toward Wild Awakenedness and Animalistic Inquiry

How might we bring into greater attention the significance of animals with/in science education? Reclaiming the conversations of native peoples and women is one way to start. We've done that above by noting the vast literature on the importance of indigenous epistemology and the acknowledgment of the ecofeminists and others who have helped catalyze wild awakenedness and the animalistic inquiry of the human species in relation to more than human. The chapters in this book go further to heighten our attention for animals in science education. Hopefully, these chapters will stimulate ways to prepare teachers, or work with teachers in schools, or talk with faculty colleagues, or discuss the importance of animals with community members. For the ideas of wild awakenedness and animalistic inquiry to mature, they will need to be used with youth, as well. These conversations are the beginnings of much-needed dialogue in environmental discourse. They should help us to see our relationships as animals with animals in more nuanced ways.

Wildly Awakened Vision of Animalistic Inquiry

Is it wild to think that we might embrace our animalistic nature rather than treat "her" as an object to be exploited and manipulated? We are critically dependent on the natural world for our survival. But have we deeply experienced and thought about the ways in which we are absolutely inseparable? Humans have interacted with animals for millions of years, primarily by harvesting them for food. But through evolutionary time, our relationships with some animals have evolved. Consider, for example, the evolution of our relationships with dogs: unlike some animals, domesticated dogs will sometimes stare "longingly" at their human owners, and through this extended gaze, they can induce serotonin production in the human who stares back. By this means, through gaze alone, dog-human interactions trigger a chemically mediated sense of well-being and trust (Grimm 2015). Dogs, in this case, seem to have hijacked the human hormone system, and some dogs, at least, can use it to better their lot in life. How wonderful is that?

Other examples of fine-tuned adjustments in human-animal interactions have also been discovered. In Africa, wild honeyguide birds will come to human calls and willingly lead their human caller to an active bee tree. The birds are then rewarded for their help by being allowed to eat the honeycomb wax as their portion of the prize. How wonderful is that?

Further, through science, the line between humans and animals is likely to become increasingly blurrier, adding to ethical dilemmas. The National Institutes of Health, for example, is opening the door now for developing chimeras (animals containing human genes) (Stein 2016). We have difficulties now – or at least, plenty of variation – in the ways in which we think about interacting with animals. Difficulties in determining the appropriate ethical standards seem to be greater,

somehow, for larger so-called charismatic megafauna than for smaller, out-of-site, out-of-mind invertebrates. When we have chimeras to contend with – or only slightly more futuristically, when we have companion animals that are genetically modified to contain some of our own genes – then, our current framework for thinking about ethics and how we engage animals in an ethical context may fly right out the window. To adjust an old Chinese saying, we may yet live in an ethically interesting time!

With the broad array of topics covered in this book, even more surprising is how many topics simply could not be covered due to limitations of space. Not directly addressed, for example, is how much our understanding of evolution has been fueled by thousands of scientific studies involving literally thousands of kinds of animals, starting, most notably, with measurements of beak length, beak width, and body size of finches on the Galapagos Islands. Birds, bats, and butterflies, fossilized remains of *Archaeopteryx*, woolly mammoths (Mayell 2001), pigs (Giuffra, Kijas, Amarger, Carlborg et al. 2000), whales (http://evolution.berkeley.edu/evolibrary/article/evograms_03), turtles (Rieppel and Reisz 1999), and the social evolution of ants (Bourke and Franks 1995) – we know a lot now about how animals came about, compared to what we knew just a few hundred years ago. And in so doing, *we've learned a lot about ourselves as well* – physiologically, socially, morphologically, and behaviorally, by studying animals, ethically or not. In our various considerations of how we can or do or should interact with animals, we must not forget that we, too, can be considered as animals – just naked apes (Morris 1967).

In this book, several chapters provide clear guidance as to how some kinds of animals can be used in the science classroom to help students learn about animals. Missing are several tens of thousands of other chapters focusing similarly on this topic. Much K-12 science teaching is constrained largely to classroom environments, where teachers can find it very difficult to expose students to meaningful encounters with animals in any kind of systematic or rigorous manner due to constraints imposed by resources, time, testing schedule, and syllabus. In this context, we risk missing even simple opportunities to encourage students to experience, firsthand, many kinds of animals they might be vaguely aware of but know next to nothing about. We have strong and storied relationships with charismatic mesofauna and megafauna, such as wolves, salmon, and bears, and students need to understand such relationships because they are important. But we have strong and non-storied relationships with tens of thousands of “little species,” too, and students need to understand these relationships, because these relationships, too, are important.

Teachers and their students can justifiably celebrate when a water flea, housed in a gallon jar of pond water in a classroom, sheds her exoskeleton and releases, into her little environment, a dozen babies. In the world of little, there's opportunity aplenty to consider what the water flea babies will require for food, how they eat, and where, outside the jar, they might survive and why.

Teachers and their students can justifiably mourn the death of a single member of a roly-poly community, set up in a shoebox-sized plastic container in the back of a classroom. In that world of little, there's opportunity aplenty to consider what that small loss can mean, to larger-scale processes such as decomposition and to the

other roly-polys that survive. Freshwater aquatic snails are much smaller than salmon, but snails and salmon both have fascinating life histories, unique features, and important ecological roles. In short, life's magic does not scale as a simple function of animal size. Rather, every living thing is important, and every living thing has a deep and wonderful story it can tell. Teachers and their students can respectfully gather around, settle, observe, and listen. It is in these nuances for teachers and their students that a wild awakenedness will emerge and then catalyze a vision for their animalistic inquiry of the future. It is through this metaphorical way of thinking about science and the role of animals that serves ecojustice and, in turn, influences behaviors around a more enhanced vision of science work.

The Nuances of This Book

Not surprisingly, there has been very little attention for the role of animals with/in science education beyond the ethical treatment of specimens used for scientific research.

The most visible organization has been the National Science Teachers Association (NSTA). Most universities and corporate institutions have an ethical board of review for studies that involve animals in scientific research. However, the NSTA and these university and institutional ethical review boards are often limited in scope to vertebrate animals, and rarely consider ethics around the use of invertebrates or plant specimens used in the classroom or laboratory. The closer that animals appear as specimens related to humans (such as chimpanzees or dolphins), the more scrutiny they receive, to the point where some organizations, such as PETA, protest any role for animals with/in science. Yet, from a contradictory perspective, without the lives of animals that contributed to the well-being of the very mindset underpinning our scientific society, there would be a conflict for values, which inhibits too particular a cementing of roles for animals. If there is one thing that children learn about animals in school, it is the ways in which they provide countless contributions to the health, beauty, and lifestyles comprising the status quo.

The topic of animals with/in science education is at best a compromised conversation. The mere mention of ethics pushes the boundaries of traditional scientific work that has fed our human population and cured its diseases. The human dimensions of scientific inquiry dominate the landscape of science education at the expense of a richly dynamic and polysemic animalistic inquiry and wild awakenedness. Now, more than ever, we need this enlarged conversation to pave the way for thinking about the unthinkable – animals with human genes or culturally desired human traits. A surprisingly broad array of topics are explored in this book. There are straightforward talks about the use of animals as devices for teaching in the classroom, to complex considerations of ethical and moral relationships between humans and animals, those wild, and those for food.

In this book, we take on the logic of domination and symbolic violence embodied within the scientific enterprise that has systematically subjugated women and

nature and emboldened the thrusting androcentric tendencies and exploitative expressions for the future role of animals. We share part of the responsibility for setting these things right in light of the changes for our climate and planet that are the result of the very same influences that sidelined animals. With a wild awakeness and thriving animalistic inquiry, we might:

1. Better understand the ways of the invertebrate worm (Chap. 1 on silkworm) or honeybee (Chap. 2 on honeybees)
 2. Foster new engineering solutions that contribute to ecosystems (Chap. 3 on managing fish waste)
 3. Relate with the experiences of animals under our care (Chap. 4 on the deployment of animals, and Chaps. 5 and 6 on the pedagogical opportunities within the context of farming)
 4. Integrate aesthetic and contemplative practices alongside science (Chap. 7 on poetic inquiry)
 5. Provoke ethical dialogue among youth (Chap. 8 on the ethics of biomedical research in school)
 6. Reorient nature study for promoting inquiry around sustainability (Chap. 9 on live specimens)
 7. Challenge the perspective that nonhuman animals need to be used for science whatsoever (Chap. 10), and
 8. Reconceptualize the study of dead animal specimens (Chaps. 11 and 12)
- Becoming more wide awakened to the wild and animalistic inquiry requires a shift toward forms of science education that better cultivate epistemic practice (Chap. 13 on socioscientific issues) grounded in cultural integrity and connected habitats (Chap. 14 on Hawaiian citizen science). Science education for animals and the role of animals with/in science education becomes more enlivened with interspecies interweavings of curricular wild awakeness and animalistic inquiry, which reclaims the care and nurturance of gender-balanced curriculum choices for science education (see Chap. 15). The final chapters focus on the theoretical conversations around cultivating critical thinking skills (Chap. 16) and the ethical role of animals (Chap. 17).

We are not advocating for neologisms around wild awakeness and animalistic inquiry, but rather suggest that such conversations should begin with imagined possibilities and heightened consideration of perspectives encased in this book. We hope, too, that this book will additionally create diversions from more traditional scientific concepts that place us at the center of things.

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References

- Bourke, A. F. G., & Franks, N. R. (1995). *Social evolution in ants*. Princeton: Princeton University Press Princeton.
- Giuffra, E., Kijas, J. M. H., Amarger, V., Carlborg, Ö, Jeon, J.-T., & Andersson, L. (2000). The Origin of the domestic pig: Independent domestication and subsequent introgression. *Genetics*, *154*, 1785–1791.
- Grimm, D. (2015). *How dogs stole our hearts*. Retrieved on August 6, 2016, from <http://www.sciencemag.org/news/2015/04/how-dogs-stole-our-hearts>
- Mayell, H. (2001). *Woolly mammoth study shows complexity of evolution*. Retrieved on August 6, 2016, from http://news.nationalgeographic.com/news/2001/11/1101_WoollyMammoth.html
- Morris, D. (1967). *The naked ape: A zoologist's study of the human animal*. New York: McGraw-Hill Company.
- Rieppel, O., & Reisz, R. R. (1999). The origin and early evolution of turtles. *Annual Review of Ecology, Evolution, and Systematics*, *30*, 1–22.
- Stein, R. (2016). *NIH plans to lift ban on research funds for part-human, part-animal embryos*. Retrieved on August 6, 2016, from <http://www.geneticsandsociety.org/article.php?id=9611>

Animals and Science Education

Ethics, Curriculum, and Pedagogy

Full Book Abstract

Animals have an interesting relationship in science education that has yet to be explored in a meaningful and significant way. This book will explore the vital role of animals in science education, specimens, protected species, and other associated issues with regard to the role of animals in science. The most visible issue of course is the ethical treatment of specimens used for scientific research, and this category of animals is so important that it is an essential standard for science teacher preparation for the National Science Teachers Association. Most universities employ an ethical board of review for projects that involve animals in scientific research. However, these reviews are often limited to vertebrate animals rather than invertebrates, and there are numerous other issues that come up with specimens. The closer that animals as specimens are related to humans (such as chimpanzees), the more scrutiny they receive to the point where some organizations such as PETA protest animals used in science work. Yet we know animals have provided innumerable contributions to the health and lifestyles we all enjoy.

The authors of this book hope to elicit conversations around the relationship between animals and infectious disease, animals used in entertainment (e.g., circus), analysis of the Endangered Species Act of 1973, and analysis of PETA, ASPCA, and others that make statements about the use of animals in science. We explore the topic of keeping animals as pets, particularly issues around “dangerous” animals in the classroom, care for animals in the classroom, and the release of animal pets into the wild. We examine high-profile issues in the media such as climate change, bees and pollinators, colony collapse, and pollinator education. Likewise, the topic of collecting and studying organisms from nature, the role of natural history museums and specimen collections, the use of genetically modified organisms in school science, invasive species, cloning, genetics, antibiotic use, and toxic chemicals are explorations that stem from this book. Still other chapters may stimulate conversations around science connected with habitat restoration, extirpation, rare species conservation, stocking wildlife, farming, animal slaughter, and raising and harvesting animals in school. Some cultural perspectives on animals and

specimens will surely play a role in this book, including views on dissection, animal housing, zoos, aquariums, wildlife conservation centers, rehabilitation, and so on.

This book emphasizes theory, research, and practice around animals and specimens in school science. In particular, we are interested in theory and pedagogy associated with ecojustice philosophy, socioscientific frameworks, citizen science, school programs, and education policy orbiting the role of animals in science education. Finally, authors hope to catalyze conversations around specific animals – snails, daphnids, earthworms, sow bugs, midge larvae, fish, and turtles often found in the classroom, for example – or animal therapy programs used specifically in science education.

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About the Editors



Michael P. Mueller is a professor of secondary education with expertise in environmental and science education in the College of Education at the University of Alaska Anchorage. His philosophy focuses on how privileged cultural thinking frames our relationships with others, including nonhuman species and physical environments. He works with teachers to understand the significance of cultural diversity, biodiversity, and nature's harmony.

He is the coeditor in chief of *Cultural Studies of Science Education*.



Arthur J. Stewart of Lenoir City, Tennessee, is a scientist, science educator, and poet. He earned his Ph.D. at Michigan State University in aquatic ecology and worked at the Department of Energy's Oak Ridge National Laboratory for 17 years as an ecologist and ecotoxicologist before becoming a science education project manager for Oak Ridge Associated Universities. In addition to publishing over a hundred scientific articles, book chapters, and technical reports, his poetry has been published in numerous literary magazines and in more than a dozen anthologies.



Deborah J. Tippins is currently a professor in the Department of Mathematics and Science Education at the University of Georgia. Her scholarly work focuses on encouraging meaningful discourses around environmental justice and sociocultural issues in science education.