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ABSTRACT

Based on the life experiences of six prominent environmental voices – Fritjof Capra, David Quammen, Brian McLaren, Douglas Wood, Sylvia Earle, and Louise Chawla – I recommend changes in curriculum content for general science courses, specifically biology courses, to increase the ecological identity of our next generation. Experiences that allowed these individuals to develop an emotional connection to the natural world were an important component of their ecological identity. Coupling outdoor experiences with the development of systemic and ecological thinking skills was also crucial. Changing the science curriculum to reflect more holistic and systemic thinking by integrating with humanities and reflective practices is a necessary step to create a population with a highly developed ecological identity.

Key Words: Ecological identity; ecological literacy; environmental education; environmental literacy; K–12 education; biology education.

○ Educating to Increase Ecological Identity

There is little doubt that we are in ecological crisis. In response, there has been an incredible increase in the variety of environmental education offered to students. During my nearly 20 years of teaching life science, earth science, and ecology, there has been growing awareness of environmental issues as well as changes in behaviors, such as conserving of energy and recycling of waste by students, colleagues, and the general public. The “Minnesota Report Card on Environmental Literacy” supports this observation, reporting an increase in environmental activity during the 1990s and a correlation between environmental activity and environmental knowledge (Murphy, 2002).

It is a crisis of perception involving a lack of ecological or systemic thinking.

Counterintuitively, there has not been an appreciable increase in basic fundamental knowledge about the environment and the ecosystem among students. According to a report authored by Kevin Coyle (2005) and published by the National Environmental Education and Training Foundation, there was not much difference in the knowledge levels of students who graduated in 1970 versus 1990, even though the latter had received a great deal more environmental education. Moreover, Bruyere (2008) found that additional knowledge did not mediate attitudes and behaviors regarding environmental issues among the general public. And Mancl et al. (2003) found that those with lower literacy saw less need to avoid interfering with natural cycles and live harmoniously with nature, ultimately believing that humans were created to rule the environment and will therefore be able fix any environmental problems with new technologies.

A significant portion of the U.S. populace is improving in their collective environmental behavior, but the improvement is not as rapid in ecological and environmental literacy. This crisis is not just about environmental issues. It is also about how humans interact with the world. It is a crisis of perception involving a lack of ecological or systemic thinking; it is a crisis fueled by a lack of purposeful, philosophical thought. This deficiency in considered thought is not only present in the everyday lives of ordinary citizens, but also in education. This results in a general lack of understanding of one’s place in an ecological world. Many units and courses of environmental education have been added. Alone, this is not enough. There also needs to be a change in the paradigm of our general science courses – especially in elementary science, middle school life science, and high school biology – to focus more on outdoor experiences, an ecological approach, and a curriculum that connects the sciences to the other disciplines. In addition to new behaviors, living sustainably in relationship with nature requires an understanding of the ecology of a place. However, changing behaviors without

increasing ecological literacy means that those improvements in environmental behavior are only ephemeral.

○ Ecological Identity

Most are familiar with the terms *ecological literacy* and *environmental literacy*. Though they tend to be used interchangeably, there is a difference. According to David Orr (personal communication, July 7, 2008), “Ecological literacy I think is best applied to how nature works as a physical system . . . [and] environmental literacy to the broader human/environmental interactions. But the distinction has not always been clear.” I will add to this distinction offered by Orr by positing that *ecological literacy* more narrowly describes understanding of the workings of physical systems, whereas *environmental literacy* is a broader term involving how humans interact with their surrounding ecosystems (which requires ecological literacy). Orr continues: “An ecologically literate person would have at least a basic comprehension of ecology, human ecology, and the concepts of sustainability, as well as the wherewithal to solve problems.” When a student can identify ecological concepts, but then also begin to ask questions of what comes next in action, then they are becoming ecologically literate.

However, simple literacy is apparently not adequate. What is required is a well-developed *ecological identity*. This term was coined by Mitchell Thomashow and bridges the gap between the two previous terms, *environmental literacy* and *ecological literacy*. Ecological identity connects the understanding of physical systems with how humans in their society interact with the ecosystem, ultimately bringing it to a personal level. Thomashow (1995) explains that “ecological identity refers to all the different ways people construe themselves in relationship to the earth as manifested in personality, values, actions, and sense of self” (p. 3). In more detail, he stated that ecological identity “refers to how people perceive themselves in reference to nature, as living and breathing beings connected to the rhythms of the earth, the biogeochemical cycles, the grand and complex diversity of ecological systems.” Environmental literacy then describes how humans as a collective see themselves in relation to their environment, which is partially predicated on their ecological literacy, which describes their understanding of the ecosystem in which they live – leading to ecological identity, which describes how they fit as individuals into that ecological system and its biodiversity. This is more than simple behaviors; it is a shift in emotional, philosophical, and maybe even spiritual understanding of one’s place in the ecosystem in which one lives.

○ Prominent Environmental Voices

The completion of my dissertation (Goodwin, 2010) research involved interviewing six individuals I chose to interview as examples of prominent leaders in environmental or ecological literacy: Firtjof Capra, David Quammen, Brian McLaren, Sylvia Earle, Louise Chawla, and Douglas Wood. Within these interviews, I was looking for the significant life experiences that contributed to their development of ecological identity (involving high levels of ecological and environmental literacy) and the experiences that fostered their passion for environmental issues and their leadership skills.

During the interviews, the respondents were asked questions probing their significant life experiences and the influence on their

development of ecological identity in two categories: interiority and exteriority. They were asked to describe formative events, experiences, and influences on the development of their ecological identity and passion for environmental issues, and to describe their emotional connection to the natural world, intellectual habits, and the development of their attitudes and beliefs about their place in the ecological world.

○ Interview Questions

1. What is your greatest wisdom that you have gained over the years, and what influences contributed to that wisdom?
2. If you had not been passionate about the environment or natural world, would you have been passionate about something else?
3. Can you describe formative events, experiences, or influences that led to the development of your ecological identity?
4. How would you describe your current ecological consciousness?
5. I’d like you to think back to your earliest awareness of your natural world, or ecological world, if you will, and tell me a story of how it started.
6. Were there any particular heroines or heroes of any type (grandmother, author, environmentalist, fictional character) who positively influenced you?
7. How does your understanding of ecological concepts impact your understanding of environmental issues? How does that affect your daily life, if at all? How much are you thinking about your place in the ecosystem?
8. How does your understanding of biological evolution impact your understanding of your ecological identity?

All the individuals in this study had tremendous ability to see the “big picture” of a situation and think systemically. For some of them, this ability appears to have been awakened and developed at a young age through outdoor experiences of unstructured playtime, and then further developed through study of particular authors and literature. This ability is a crucial component of their prominence. It is just this type of thinker that Naess (1989) argued was needed by the ecological movement. An ability to think systemically or ecologically allows them to make observations about the natural world and then juxtapose those observations with societal issues. This gets integrated into their respective methods of understanding – scientific, artistic, emotional – and then they can speak knowledgeably, passionately, and eloquently about the environmental issues facing the United States and the entire world today.

The ability to think ecologically has either caused these individuals to develop a belief that all things are connected or, conversely, it could be that intuiting this has propelled them to think ecologically. This thinking has resulted in careers that propelled them to prominence in the field of environmental education and issues. They recognized that if all is connected on a biological level, with spiritual components to that connection, a sense of responsibility was a crucial part of their ecological identity.

The respondents all had many similar experiences. Most importantly for those of us teaching the life sciences, the paradigm from which they view their connection and responsibility to nature is somewhat different than might be the common paradigm for many

in Western culture. It was a common theme among the respondents that humans are not special. While nature may be sacred to them, humans are not awarded a special status in nature over the other life forms in the paradigm of these prominent environmental voices. This was a key component of their ecological identities.

○ Changing General Science Education

To develop an ecological identity similar to those of the individuals I interviewed, two things need to occur. First, there needs to be a paradigmatic shift in how individuals view their relationship to the world, from one of dominator and owner to mere part of a larger system. This is ecological thinking. Second, there need to be experiences that allow the formation of an emotional connection to the natural world.

Many practices are now being implemented within K–12 education that are intended to increase the knowledge base of students in the area of environmental issues and ecological systems in general. Although the success of these programs has been documented by some researchers as increasing students' concern for the environment, there has not been the necessary philosophical shift to sustain these changes in behavior. It is therefore quite easy to become disheartened and discouraged, in light of current trends in education, when making recommendations for educational reform to create more ecologically literate individuals. Whether it's No Child Left Behind (offered by a conservative president) or Race to the Top (offered by a liberal president), the trend is the same: there is still an emphasis on testing. Such emphasis on testing basic skills and core knowledge subjects as the main measure of success results in reductionist practices. The findings of this research indicate that developing systemic, ecological thinking is essential to solving environmental crises. This is increasingly difficult during times in education policy that further encourage specialization and separation of subjects, which is antithetical to more integration, holistic, systemic thinking. Failing to provide ecological perspectives in any of the subjects de-emphasizes the role of the ecosystem in which all students are a part (Orr, 1992).

All the respondents in my study had highly developed skills in the area of philosophical thinking, with an ability to think systemically and holistically about not just environmental issues, but also how those environmental issues interplay with societal issues. Therefore, it is necessary for K–12 education to embrace curricula and practices that develop these skills if we are to develop strong leaders with strong ecological identities (Naess, 1989).

One broad implication for K–12 curricula is a shift to practices that integrate subject matters as opposed to practices that continue to separate subject areas. While it is necessary to develop expertise through individual subjects and to then develop a disciplined mind, developing that disciplined mind in a curricular system that allows for connections between subjects allows for more interdisciplinary and, therefore, systemic thinking.

Another broad implication for the curriculum is to infuse more philosophy into the curriculum, especially into the environmental curriculum. This can allow for practice in thinking philosophically, but also add coherency to the curriculum by providing it with a solid foundation of application to the daily lives of students (Chapman, 2007). Additionally, this could allow for more relational and conceptual thinking to be developed, skills those I interviewed possessed strength

in. Such skills are essential to developing thinkers of tomorrow who have the ability to understand the role of humans as an integral part of ecosystems – not outside of ecosystems (Naess, 1989).

Two intellectual habits that can further the development of these desired intellectual skills are reflective practices and critical thinking. Practices that encourage, foster, and teach reflection on learning are essential components of the learning process (Badley, 2003). Students need the opportunity to reflect on their learning and incorporate it into their ongoing development. One simple reflective practice that can be implemented is to engage students in activities I call “sense-making.” One such strategy is, instead of simply marking items right or wrong on an exam, paper, or essay, to circle the items that need further exploration and then pose follow-up questions to the student to dig deeper into those ideas. And then require that they do this continued learning. Through this kind of metacognitive thinking and through exploration of environmental issues, students can hone these reflective practices and develop critical thinking by being placed in situations to make judgments and decisions on actions they should take. Participating in a curriculum that fosters these skills and requires these practices develops critical-thinking skills (Noddings, 2007). All these intellectual habits lead to systemic thinkers. Thinking systemically is a necessary component to a highly developed ecological identity.

A curriculum requiring students to explore and understand the interplay between personal, societal, and ecological systems and issues might best be created as a transdisciplinary curriculum in which all of the barriers between disciplines are eliminated. This would still require mastering of subject-area content to allow for adequate meta-understanding of the systemic issues being studied, and would ultimately require wholesale redesign of curriculum, pedagogy, and school structure. This is unlikely. Recognizing that such drastic reform is not likely, and is out of the control of individual classroom teachers, in the remainder of this article I will focus on a broad description of curricular reforms that might be within reach of individual teachers and/or individual teams of teachers.

In addition to outdoor experiences that allow for the development of knowledge about the natural world, students need to have a means to connect emotionally with the natural world if behaviors are to change (Kaplowitz & Levine, 2005). Making this connection is not a one-size-fits-all curriculum solution. For some, it may be a spiritual connection, for others it may be a personal connection due to a sense of loss of a special place. Others may connect through literature and adventure stories or the creation of art. Therefore, one recommendation cannot be made, except to change teaching practices to allow students the time to explore, contemplate, connect with, and then express that connection through a means that suits their learning style, personality, and family upbringing and values. This is not something that can be written in a textbook or measured by a standardized test. Providing students the time and space to do this kind of exploration involves a shift, most likely in assessment. Instead of using objective testing, require more writing by students that requires them to apply ecological concepts to their understanding of their place in the ecosystem.

It is essential to get students outside observing and collecting animals during the elementary years. The more unstructured this exploration can be, the better, thus allowing students the same type of unstructured exploration many of the respondents experienced

during their childhoods around their homes. It could be something as simple as taking elementary students on a “ramble” outside, with no curricular agenda except to encourage them to pick things up and explore and ask questions. This unstructured exploration should then be supported with the similar resources that the parents of the respondents provided for their children. For the most part this was books, magazines, and nature shows, which allow students to further explore the lives of plants and animals beyond the initial play and observation. This sounds simple and obvious, but with pressures to maintain math and reading test scores, there is often very little time afforded for this type of unstructured exploration, followed by guided research and exploration. Using an emergent curriculum built around student questions and inquiry can achieve both the requirements of standards and also develop the requisite thinking skills for a well-developed ecological identity.

By the time students reach middle and high school, their attitudes toward nature are often set. Nature is either something an individual enjoys and is not afraid of, or something scary, dirty, and icky – or just boring. More time getting dirty during elementary years may help to ameliorate these negative emotions as children grow older.

During the middle and high school years, life science education should shift focus more to understanding the ecological relationships among organisms, as well as organisms’ connections to other living systems as a whole. Currently, the focus of life science and biology education, which is the closest most students get to ecology, is on systems smaller than the actual organism. Many biology curricula are reductionist in design, beginning with basic chemistry, moving on to cells, then through the kingdoms, genetics, evolution (maybe), and (if there’s time) on to concepts of ecology. However, it is possible to complete a biology course and never actually consider the whole organism, but instead focus on the workings within an organism. This is a trend that reinforces reductionist thinking and does not support systemic, ecological thinking. At a minimum, the biology curriculum should be reexamined, with a shift in focus to support the development of ecological thinking. A typical high school biology course has grown to include potentially a year’s worth of study in genetics and cellular biology, plus the addition of a whole new field of ecological studies, yet the amount of time allotted for the study of biology in a traditional science scope and sequence has not changed. It is still a year-long course required by most states and state standards. Because of this, something has to change in biology instruction. Either a reprioritization of curriculum must occur, changing what is important for all citizens to know – the ecological systems – or more time has to be required for biology instruction. Developing a biology curriculum around ecological themes such as Matter and Energy, Ecosystems, Populations, Homeostasis, and Biodiversity would allow the instructor to cover all the standards in a traditional curriculum, but within a context that would require students to understand how the biology they are learning connects to living in an ecological world.

Another aspect of the biology curriculum that would appear crucial to developing a strong ecological identity is the understanding of biological evolution. Though many teachers avoid this subject in this country for political reasons, evolution is a necessary

part of environmental education, according to my respondents. For each of these prominent leaders, a strong understanding of evolution – and in particular Darwin’s theory of evolution by means of natural selection – was essential for them to fully intellectualize their understanding of the relationship among all creatures and their environment in a living system. The concepts of evolution simply cannot be avoided in a biology classroom. A student’s understanding of evolution is crucial to grasping his or her biological connection to all other life on the planet. This connection to other life is necessary to broaden students’ empathy to all life. It is not until they have empathy for other life that they will take action to mitigate their ecological impact on other species with whom they share an ecosystem.

Improvements in the biology curriculum, a shift to an ecological approach, more time in the natural world, and experiences that allow for connection are all changes that are necessary, quite doable, and will increase student knowledge and connection to the natural world. But more can be done. All the individuals I interviewed were philosophical about their place in the world. They supported this thinking with exploration of the workings of nature, integrating those findings with their understanding of the natural world, their emotional experiences in the natural world, and their understanding of their place as a human, an animal, and a social creature. They also showed the ability to make connections – not just thinking ecologically, but also thinking about things as interdisciplinary. By contrast, fragmented teaching and learning about one’s place in the world does not support the level of philosophical thinking necessary to become truly ecologically literate. While most teachers do not have the opportunity to develop a truly interdisciplinary curriculum within their setting, they can utilize a more thematic approach to organizing the curriculum, coupled with more time for students to explore their own lines of inquiry (around the biological concepts being taught), would allow students to make more interdisciplinary connections between the biology they are learning and how that biology informs their worldview.

All the interviewees have strong abilities in philosophical thought and systemic thinking, and literature may have been a crucial piece in the development of these skills during their childhood. All six referenced their predilection for great literature, the importance of books as sources of information, and authors as important mentors in their development. The importance of literacy is certainly not a new subject, and not under debate. Therefore, it is not necessary to provide evidence for the importance of continued efforts to improve literacy and expose students to literature. Increased exposure to literature, both nonfiction and fiction, is necessary to the development of students. If the goal is to change the paradigm in which students view the natural world and also change behavior, then increasing literacy can be one step toward this. A correlation has been found between literacy and views of nature that include the more enlightened view in which humans are a part of the ecosystem, not dominators over that ecosystem (Mancl et al., 2003). In addition to continued efforts toward improvements in general literacy, students should have access to archetypal environmental writers such as Muir, Carson, Leopold, and Thoreau. These environmental voices were essential to those studied in my research and are crucial pieces of the genealogy of environmental thinking.

If we want students to think ecologically, then these classic writers, along with new archetypes – maybe those honored here – should be routinely studied. Reading one of these authors could be a turning point for a future prominent environmental voice. As schools and teachers shift away from traditional textbooks as the source of content, more primary writings by these archetypal authors could be added.

Additionally, understanding the natural world in a more systemic fashion, in which humans are seen not as controllers but as participants in the natural cycles, can be aided by reading about individuals from other cultures, especially non-Western, traditional, indigenous cultures. Understanding the human condition and expanding that study to include non-Western cultures such as the Bushmen – not holding them up as the “noble savage” but studying them as a juxtaposition with Western peoples – can also be a key exercise in critical thinking, a necessary component to increasing reflective practices and philosophical thinking (Noddings, 2007). Understanding the comparison of various framing stories of how to live in the world is important to understanding directions to take with our own framing stories, be they personal, political, societal, or ecological (Caduto, 1998).

An exploration and understanding of such framing stories requires three crucial elements: ecological literacy, understanding social and political systems, and finally understanding the human condition. The K–12 education curriculum includes these, but in separate arenas. Students have access to classes that include ecology as a portion of the study. Students are required to take social studies courses to explore social and political issues. Literature and art classes are provided to explore the human condition. But a crucial intellectual skill of the individuals I studied was the ability to integrate these areas. The K–12 curriculum should do the same. This might include a shift from cellular and molecular biology to a science curriculum founded on environmental studies – by nature an integrated science – and thus focused on understanding how humans interact with the natural world (biological and physical). Such a curriculum would take a systems approach to understanding the relationships of humans and their institutions with each other and within ecological systems and, finally, would include a study of the human condition through literature. These topics should be explored together, not separately, because they are interdependent and interconnected.

The focus of K–12 schools and their students is often on simply completing the necessary requirements to build a transcript to meet one of these goals: simple graduation and getting a job, or acceptance to the higher-education institution of their choice so that they can pursue the career of their choice. What if the goal were more focused on learning and living as an adult in the interconnected world? Education could be about personal discovery of interactions with other people and environments (Caduto, 1998; Chapman, 2007). This doesn't preclude jobs, careers, or college. But what would be the implications for curriculum design, courses offered, and assessments used if the focus were not on achieving the test scores and GPA necessary for acceptance into college, but instead on preparing students to

answer this simple question: How ought you to live in the world ecologically, socially, politically, and personally?

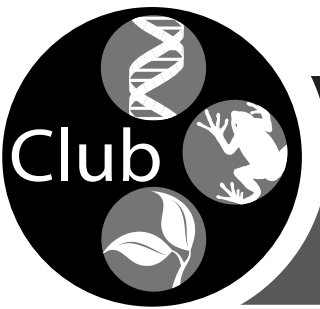
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