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In it Together: Why the community skills of earth smarts are now a critical part of environmental and scientific education

Juntos nisso: Por que as habilidades da comunidade de "inteligência de terra" são agora uma parte crítica da educação ambiental e científica

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Abstract

This position paper uses the earth smarts framework as a basis to argue that a set of community-based skills, attuned to global and local contexts, have become important aspects of both scientific and environmental education. Regardless of where you live in the world, working together effectively is more important than ever, particularly on scales beyond our immediate families and local communities. Modern democracies require citizens that can manage multiple perspectives, communicate and collaborate in an increasingly connected world, resolve conflicts less violently, and navigate issues that often involve different and conflicting values. As the scale of the environmental challenges we face has become global, the solutions to many of them are beyond the scope of any individual or small group. In this context the themes of this issue, democracy, citizenship, and social justice, can be seen not simply as educational goals, but rather as tools to help us achieve more just, resilient communities in the face of accelerated environmental change.

Keywords: science; environmental literacy; perspectives; values, social skills

Resumo

Este artigo de posição usa o quadro da "inteligência da terra" como base para argumentar que um conjunto de competências baseadas na comunidade, que considera os contextos

globais e locais, tornaram-se importantes aspectos tanto da educação científica quanto da educação ambiental. Independentemente de onde vivemos no mundo, trabalhar efetivamente em conjunto nunca esteve tão importante, especialmente em escalas que vão para além das nossas famílias e comunidades locais. As democracias modernas exigem cidadãos que possam gerenciar múltiplas perspectivas, comunicar e colaborar em um mundo cada vez mais conectado, resolvendo conflitos com menos violência e gerenciando problemas que, muitas vezes, envolvem valores diferentes e conflitantes. Como a escala dos desafios ambientais que estamos enfrentando se tornou global, as soluções para muitos deles estão fora do alcance dos indivíduos ou de pequenos grupos. Neste contexto, os temas dessa edição especial: democracia, cidadania e justiça social, podem ser vistos não apenas como objetivos educacionais, mas como ferramentas para ajudar-nos a alcançar comunidades mais justas e resilientes, em face da rápida mudança ambiental.

Palavras-chave: Ciência, letramento ambiental, perspectivas, valores, competências sociais.

An Unprecedented Challenge

Environmental change is hardly a new challenge for individuals and communities across the planet; with varying degrees of success, we have been responding to environmental challenges throughout our evolutionary history. For example, advances in paleoclimatology and archeology suggest that periodic droughts throughout the Americas have challenged and destabilized societies here for thousands of years (MACDONALD, 2007; SCHIMMELMANN; LANGE; MEGGERS, 2003). The stakes are profound, and failure to anticipate and adapt to environmental challenges can lead to starvation, forced migration, wars over dwindling resources, and even the collapse of societies that had successfully maintained their culture for decades or centuries (DIAMOND, 2005). However, although environmental change is not a new challenge, for the last 12,000 years (the Holocene) we have been living in a relatively stable global climate. Two immensely significant, relatively recent changes make our current situation unprecedented in our lengthy existence.

The first is that our days of living on a warm and relatively stable planet may be numbered. Increasing numbers of scientists argue that we are entering the Anthropocene (ZALASIEWICZ et al., 2008), a time of more rapid changes that we ourselves are contributing to. The combined effects of our rising population, uneven and often excessive consumption rates, and breathtaking technological advances, have all given us unprecedented power to change our environments on scales far beyond the mostly local impacts of our ancestors. For example, about three quarters of the river discharge in North America and Europe has been altered by dams; there are over 40,000 large dams in the world now (www.internationalrivers.org). This power to alter the environment is a demonstrably double-edged sword, and science as we practice it, particularly in the contexts of capitalism and nationalism, can be considered a significant part of the problem, as well as a potential solution, to the challenges we face. Indeed, much of the classic environmental movement imagines some sort of preservation of, or return to, Eden-like environments of the past (MCCORMICK, 1991). However, romanticized views of societies living in “harmony” with nature fail to acknowledge new realizations that the balance of nature is largely a myth (KRICHER, 2009), or how much we have improved health and longevity for a significant percentage of humanity. We don't really want to go back to a Pleistocene existence, but the

increasing challenges of climate change indicate that we cannot continue to assume things will keep getting better without making some significant changes.

The second big change is where most of us live; for the first time ever, more than half of us now live in cities (UNITED NATIONS, 2006). Only 13 percent were city-dwellers in 1900, and for tens of thousands of years before that, we were largely farmers or hunter-gatherers. Most city dwellers are insulated, cognitively and spiritually, from resources our ancestors paid much more attention to. The degree of this loss of ecological knowledge and wisdom is considerable; it never ceases to amaze me how many of my 21st century college students have no real sense of where their water or power actually comes from, resources they use every single day. Many of us now live surrounded by steel and cement, eating foods transported from unfamiliar or even unknown ecosystems. Being cut off from natural systems can lead to ignorance and apathy for people and places, which in turn contributes to poor decisions and unnecessarily destructive lifestyles. However, because of the increasingly global scale of our impacts, even societies that remain intimately connected to their natural and built environments are vulnerable if they are not connected to global networks and information. For example, any coastal society would benefit from computer-based tsunami warning systems, hurricane forecasts, and models of rising sea level.

Education Can Help

Education could address these issues. Many children in developed nations spend 12 or more years regularly attending classes, which presents a tremendous opportunity to explore and strengthen our understand of, and connections to, the local and global systems that support us. We can nourish or rekindle our connections to the world, and teach ourselves to build more resilient and just communities. But do we? By most measures, our education systems have not been up to the task. We are failing to achieve scientific literacy; four decades after frantically developing the technology to quite literally fly to the moon and back, the United States had achieved a civic science literacy rate of less than 20 percent (MILLER, 2004). We are failing to achieve environmental literacy. More than ten years after Orr (ORR, 1992) warned us that our colleges were churning out ecologically illiterate graduates, Coyle (2005) found that less than 2 percent of the American public could be considered environmentally literate. In 2014, scientists have an increasingly sophisticated understanding of the human causes and potential effects of climate change, perhaps the greatest challenge that the next generation will face in communities worldwide, yet misconceptions, doubt, and ignorance are rife in the public, and as ineffective treaties and increasing carbon production indicates, there is presently little political will to take the steps we need to mitigate it.

Again, the stakes are high. The quality of life many of us take for granted, and many others strive for, is at risk of deteriorating. If social justice is to be achieved and sustained beyond a short economic boom or political surge, it must be accompanied by a transition to more sustainable socioeconomic policies created by communities that focus more of their energy and collective intelligence on wellbeing and resilience. Regardless of their developmental status, the political and economic systems of many societies have focused on short-term success for their elites. This often involves rapid depletion of natural resources – like fish, timber, minerals – and immense differences in opportunity, income, and lifestyles between the wealthy minority and the rest of the country. Examples of these sorts of colonial or class-based economies can be found throughout the world, from the millions of poor in oil-rich countries like Nigeria, to the local devastation and long-term toxicity that poor mining

practices have wrought in Africa and the Americas. Meeting the challenges of the Anthropocene will be easier if we learn to work together more effectively, both locally and globally. The planet is changing and shrinking; like it or not, we are in it together.

Common Ground

Scientific and environmental education have an interesting relationship. There can certainly be tension; scientists themselves are often uncomfortable with advocacy (LACKEY, 2007), which is the lifeblood of many environmental organizations and programs. The success of environmental education is patchy at best (BLUMSTEIN; SAYLAN, 2007), and it has occasionally been accused of demphasizing science, although this appears to happen in isolated situations. This is at least in part due to the wide range of programs that fall under the environmental education spectrum, many of which are unregulated, unstudied, and driven by the passion of individuals that come and go. In schools, "...students' exposure to environmental education depends on the luck of the draw and the amalgam of the interests of whichever teachers they happen to have throughout their school career" (WEILBACHER, 2009, p. 40). Nonetheless, the passion, behaviorism, perceived biases, alarmist tendencies, and more esoteric musings of the environmental movement, all of which contribute to backlash and polarization in the public, can also raise concerns from a nature of science perspective; the heated and often confusing debates over genetically modified foods are an unfortunate example. On the other hand, science and science education has often been accused of being too clinical, too dry, or too lacking in emotion, spirituality, values, or other affective characteristics (ZEIDLER et al., 2005) that can be harder to measure or break up into itemized, testable standards. While science does seek to reduce bias, science education presented as a barrage of dispassionate facts about the world has justly been accused of turning far too many students off of careers, or even further study, in the sciences (e.g., OSBORNE; SIMON; COLLINS, 2003).

Between these two edges, science and environmental education have long accompanied each other. Students have done transects, identified species, measured diameters and growth, and otherwise used the environment as big, fascinating inquiry lab. The growth of citizen science (DICKINSON; BONNEY, 2012), accelerated by the internet and the phone-based computers we carry in our pockets, is an interesting way to connect science and our environments, both built and natural, that will continue to expand. This overlap is expanding with science education reforms that incorporate values, character education, and skills beyond memorization. Science education in the context of socioscientific issues (ZEIDLER; BERKOWITZ; BENNETT, 2013) is an increasingly popular example that emphasizes controversy and values. Meanwhile, many scientists are recognizing the importance of getting more directly involved in policy. For example, the Union of Concerned Scientists (2013) boasts of effective advocacy as well as technical analysis, while the National Center for Science Education (ncse.com) advocates for effective evolution education; both organizations have become intimately involved in climate change education, communication, and policy. When it works, the relationship between science and environmental education might be considered as mutualism (GOUGH, 2002).

Education for sustainability, science education, and environmental education all share some goals that could help us face the challenges of a changing world, including topics like critical thinking and problem-solving. This is particularly true if we consider models of scientific

literacy that move beyond the confines of formal K-16 education, particularly when it is based on standardized tests, dubious STEM job shortages, or oversimplified measures of job readiness. Earth smarts (NICHOLS, 2013), a framework for socioecological literacy designed specifically to describe the qualities we need to maintain our wellbeing in a changing world, sits at the nexus of scientific, environmental, and civic literacy, and can therefore provide some useful guidance.

Earth Smarts for Everyone

Earth smarts was synthesized using a form of construct analysis (KRATHWOHL, 1993), a theoretical technique that systematically brings fuzzy concepts into sharper focus. The earth smarts construct analysis (NICHOLS, 2012) involved breaking numerous definitions into components, analyzing them with systems matrices to design an initial construct, and then refining the initial construct using qualitative data from conference presentations and interviews with experts as well as quantitative survey data. The building blocks included over 79 different definitions and constructs (see Figure 1); the framework itself is freely available and adaptable under Creative Commons licensing (at www.earthsmarts.info). The earth smarts framework avoids overly prescriptive components, recognizing that specific strategies may work in one cultural or ecological context, but not another. In addition to the community skills that we will look at in more detail, it includes two domains that are often not emphasized in formal education: sense of place and values.

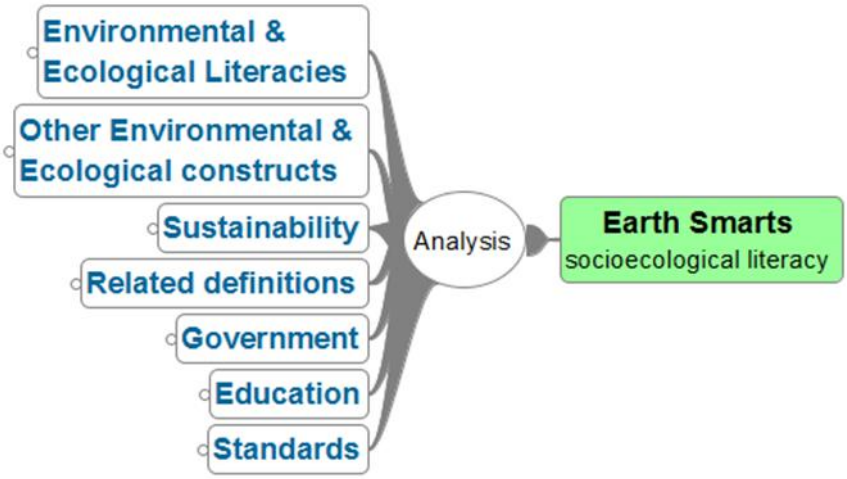

Figure 1: Categories representing the approximately 80 definitions, frameworks and constructs that went into the earth smarts construct analysis.

The sense of place domain captures some of the elements that influence how we think and feel about our environments, both local and global. It emphasizes attitudes and emotions, often called affective elements, which are aptly named, as this domain's components affect many of the other components. Sense of place includes our awareness of, and feelings toward, our local environments, whether they are built, natural, or the inevitable in-between, as well as our attitudes towards the global environments we share. The connection we feel to our various places has been called a lot of things, including an attachment to the land, biophilia (KELLERT; WILSON, 1993), and environmental sensitivity (CHAWLA, 1998). Whatever this connection is called, it is more difficult to maintain in many

modern, mobile, societies, particularly when they have been poorly or hastily designed. It is hard to appreciate your local landscape when it is obscured by urban blight, covered by cement and busy roads, or isolated by private, inaccessible lots. The final aspect of sense of place is how much impact we think we have on our environment, a form of self-efficacy. Powerlessness leads to fatalism, so understanding our power, whether to improve, sustain, or degrade our environments, is critical.

The second domain that is not well served by most formal education focuses on values. Earth smarts recognizes the importance of moral development, as environmental issues are typically complex, and involve stakeholders with different backgrounds and values. With a nod to research on systems and resilience, it focuses on respect for diversity in a range of contexts, including social, cultural, and biological. Finally, earth smarts incorporates justices as fairness (RAWLS; KELLY, 2001), recognizing that most routes to sustainability have to balance individual rights with community responsibilities, and account for modern views on equality and liberty. More details on the components, including critical concepts and competencies, are readily available online (www.earthsmarts.info).

Transcending Disciplines

One of the key areas of overlap that now exists between modern science and environmental education is what is categorized in earth smarts as community skills. This set of social skills occurs in the competencies domain, along with scientific reasoning, self-regulation, and systems thinking (Figure 2).

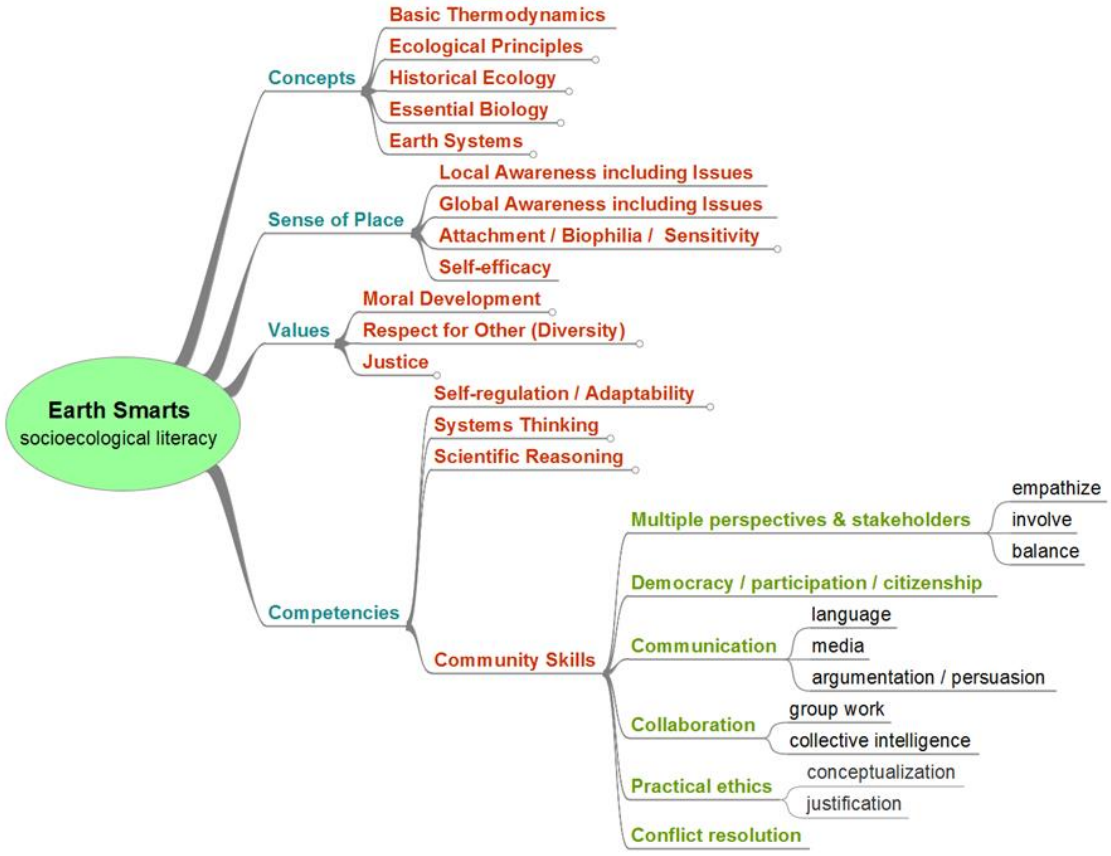

Figure 2: The four domains and primary components of earth smarts, with community skills expanded.

Community skills have become increasingly important for a variety of reasons, but three in particular stand out. The first is the loss of local socioecological knowledge and sense of community resulting from increasingly transient and isolated individuals. The second is the growth of global-scale challenges that endanger communities regardless of how good their local knowledge is. The third is the exponential growth of communications technologies – including the internet – which both facilitates and necessitates learning new modes of communication. This section includes a brief description of how the community skills components of earth smarts fit into the nexus of modern environmental and scientific education; secondary components appear as headings, while tertiary components are bolded in the text.

Multiple perspectives & stakeholders

Earth smarts is based on justly maintaining quality of life, so it requires skills that help us achieve just solutions to complicated environmental issues. In a diverse world, the ability to appreciate and utilize multiple perspectives & stakeholders, even when they have differing or conflicting values, is a skill that must be developed and practiced. Of particular concern is the ability to a) **empathize** with, b) **involve**, and c) **balance** different perspectives. In environmental education, this often relates to the consideration of widely varied stakeholders; in science, these skills are increasingly used to consider the potential contributions of indigenous communities and other cultures that are not rooted in traditional Western scientific tradition (e.g. LLOYD; BOYD, 2013).

Democracy/participation/citizenship

This component relates directly to self-efficacy, which appears in the sense of place domain. If we feel helpless to change our social or environmental situations, we give up and don't try; fatalism is destructive to environmental and political movements. On the other hand, science and scientists are often reviled for arrogance and even playing “God”, and have certainly crossed ethical boundaries in the past, including the nuclear destruction of entire reef communities in the Pacific. Participatory democracy, with the rights and freedoms that tend to accompany it, can help with both fatalism and scientific ethics. While there presently appears to be only a weak correlation between democracy and sustainability (WARD, 2008), there are indirect benefits to societies as well. For instance, a substantial percentage of global migration occurs not because people are directly fearful for their lives (starvation, war), but because they feel they cannot change anything for the better where they are; due to political factors like corruption or classism, there are no opportunities to improve their lot. Rather than investing in the wellbeing and resilience of their own communities – where they feel helpless to change anything – many people pay large amounts of money and take tremendous risks to move to places that they perceive to provide better opportunities to improve their lives. For example, by some counts (e.g., Fortress Europe), tens of thousands have died trying to reach southern Europe from African and the Middle East since the 1990's.

Communication

There has always been a communication aspect to science; traditionally it was through conferences and journal publications, but there is widespread recognition that this model is

now only part of the picture. Scientists have incorporated things like blogs and crowd-sourced models of peer review to their communication toolkit, while at the same time recognizing that their efforts to reach the general public have met with substantial failure. Denial of biological evolution is an obvious and ongoing example, but there are others, including alarming decreases in how much specific groups trust in science (GAUCHAT, 2012). Environmental education often includes a communication domain as well, and has also learned hard lessons about the complexities involved. Making people aware of environmental issues is no guarantee their attitudes or behavior will change, and theories that do attempt to find the right links often get increasingly complex and decreasingly helpful (HEIMLICH; ARDOIN, 2008).

Earth smarts recognizes that effective communication first requires proficiency with **languages**, but also there is also now a **media** component. Communicators need to become familiar with new, typically digital forms of communication, including film, video, and the various iterations of social media that have played an increasingly significant role in global affairs. Smart phones are achieving the global distribution that computers in classrooms never did, making digital media an increasingly critical aspect of communication. Of course, simple communication isn't enough; to mobilize communities and respond to environmental challenges, citizens will need to better understand **argumentation** and **persuasion**, both how to use them and how they might be used by others. Argumentation has been an interesting topic in science education for some time (JIMÉNEZ-ALEIXANDRE; ERDURAN, 2007), while persuasion has long played an important role in action-focused environmental education.

Collaboration

Much has been made in the environmental movement about how one person can make a difference. This is partly true; in some cases, the efforts of a single person have led to significant changes. In most cases, however, real change requires the efforts of far more than a single person. This is why **group work** is so important – for example, we wouldn't know nearly as much as we do about climate change if teams of scientists and technicians hadn't worked together to deploy and maintain earth-observing satellites. Science is increasingly being done in large teams, and even the public can get involved as technology facilitates citizen science projects like fish watching in REEF (www.reef.org) or Project BudBurst (www.budburst.org). **Collective intelligence**, a more subtle aspect of collaboration, is being accelerated and amplified at an unprecedented pace as both computer power and connectivity grow exponentially. The smart phones, tablets, and other portable computers we are carrying around provide easy access to the immense collections of museums, libraries, and governments from all over the world. What young students do with this collective intelligence, how their communities harness it to solve their problems, is something we can only speculate on.

Conflict resolution & practical ethics

Peaceful resolution of disputes can be difficult at the best of times; when it is appropriate to use violence is a highly contentious and constantly evolving question with context and culture as important factors. However, education can play a role in developing societies that can more effectively work through their differences without resorting to violence. Indeed, functioning participatory democracies can provide the political structure for peaceful conflict

resolution. Practical ethics (e.g. GERT, 2004) provides a framework for considering issues that involve multiple perspectives and values, and then making difficult decisions on what is the "right" thing to do. The details are beyond the scope of this paper, but they involve careful **conceptualization** of the potential actions, and **justification** of any harms they might produce. Like the other components of community skills in earth smarts, these competencies require learning and practice in a variety of contexts.

Implications

The community skills in earth smarts provide an interesting and potentially useful way for environmental and science educators to coordinate their efforts. In most modern forms, both scientific and environmental literacy now require communication and collaboration skills, something that employers often list as more important than technical knowledge. Both can also benefit from the deliberate and effective consideration of multiple perspectives. Set in a broader social context, scientific and environmental literacy have a mutualistic relationship with each other, and with vibrant democracies that can effectively negotiate challenges in peaceful ways. Each contributes to the existence of the other. Our world may be changing, but the changes need not be catastrophic. We really are in it together; using community skills as a place to begin, educators, curriculum designers, or researchers can use the earth smarts framework to flip the ideals of this special issue. Rather than seeing democracy, citizenship, and social justice as educational goals to work towards in the context of scientific or environmental education, they might better be conceived of as tools. Set in the context of earth smarts, democracy and social justice become sociopolitical tools that can help citizens of the world achieve more just, resilient, and happy communities in the face of accelerated environmental change.

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