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Community Engagement in Climate Change: Models of Culturally Appropriate Citizen Science

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Abstract: Climate change is increasingly affecting people in rural and indigenous communities. This paper explores opportunities for adult educators to develop and support community programs related to environmental change and preservation.

Keywords: climate change, community education, environmental education

Although a majority of U.S. citizens believe global warming is a reality caused by human activities and support more funding for research and regulation of CO₂ emissions (Howe, Mildenerger, Marlon, & Leiserowitz, 2016), the Trump administration recommended a budget that cuts the Environmental Protection Agency's funding by 31%, with the intention to "eliminate climate change research and prevention programs" (Davenport, 2017, paragraph 3). The proposed budget would cut \$100 million dollars from climate change research and programs (EPA Hit Hardest, 2017). Given this radical reversal on national climate change policies, it is imperative that citizens unite and work together using indigenous and Freireian pedagogies, place-based learning, and citizen science to address local climate change issues. Politics is local and communities can share local climate change knowledge, employ Freireian methods of critical dialogue about climate change and engage in action. These local movements can spark regional and intra-state and interstate climate initiatives, including such activities as ambassadorship programs between states, that could mitigate the effect of national policies.

Communities in Alaska, particularly indigenous populations, are experiencing the effects of climate change, including disruptions in the patterns of everyday life. Changes in ice and wind patterns, including increased water temperatures, have affected the behaviors, locations, and populations of terrestrial and marine animals, resulting in poorer hunting and fishing seasons (Alaska Native Science Commission, n.d.). The thawing permafrost has threatened the availability of clean drinking water and created food insecurity as ice cellars thaw and food contamination occurs (Bennett et al., 2014). Reduced permafrost has also caused erosion, which damages villages' infrastructure and forces the relocation of indigenous peoples. Such damage and subsequent relocation come at major personal and economic expense and undermine the indigenous cultures that are strongly grounded in location and environment (Bennett et al., 2014).

Engaging local communities, including indigenous and rural peoples, is of utmost importance to understanding, mitigating, and preventing climate change. By involving those most affected by climate change in environmental science and advocacy, not only are they better positioned to understand and respond to change but to participate in governance around climate issues. It is therefore necessary to create programs through which indigenous and rural communities and outside agencies can exchange ideas about the science and politics of climate change.

The state government of Alaska has implemented several climate change programs. For example, the Alaska Climate Change Impact Mitigation Program (ACCIMP) identifies climate change impacts that are hazards for a community and predicts and recommends how to mitigate those and future hazards. The community may apply for community planning grants to address

these issues (Alaska Climate Change Impact Mitigation Program, 2016). A second program, the Alaska Community Coastal Protection Project, has focused its efforts on three villages in Western Alaska to "increase community resilience and sustainability to the impacts of natural hazards threatening these communities while protecting the natural coastal environment" (Alaska Community Coastal Protection Project, 2016).

While the State of Alaska claims to recognize the importance of including federal, state, regional, and local stakeholders in the decision-making processes regarding how best to address the effects of climate change on towns and villages, it is unknown how issues of power in these settings intersect with indigenous values and pedagogies. Typically, when indigenous issues are considered, assessments have been "about indigenous people, not by them" (Cochran, et al., 2013, p. 558). The purpose of this paper is to explore the intersections among Freirean liberatory philosophies on community development, teaching and learning, and Alaskan indigenous peoples' values and pedagogies to create possible frameworks for discussing climate change which can result in some culturally appropriate ways to teach and learn about climate change.

Conceptual Framework

The conceptual framework of the present paper derives from indigenous pedagogies and values, Freirean perspectives, place based learning, and the citizen scientist literature. Figure 1 presents each area that will be discussed.

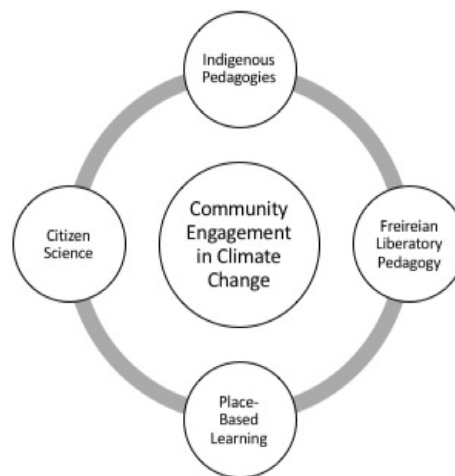


Figure 1: The concepts informing community engagement in climate change.

Indigenous Pedagogies

Typically, indigenous pedagogies, such as those used by the Yupiaq villagers in Alaska, include the concepts of passing down knowledge through stories and watching and copying elders to learn skills (Kawagley et al., 1998). Connecting knowledge to local needs and values is also important (Barnhardt & Kawagley, 2005) and interdependence is a key concept (Kawagley, et al., 1998). These ways of teaching are grounded in a worldview that believes knowledge is constructed by everyone, fields of knowledge are interconnected, and a more holistic view of science is promoted (Kawagley et al., 1998). General values of harmony, group needs over individual needs, patience, pragmatism, respect for elders, and indirect criticism are also indigenous values that shape instruction (Tippeconnic & Tippeconnic-Fox, 2012).

Teaching and learning are intertwined, so values brought to scholarly work and how the mind is seen are also important. Respecting local knowledge and approaching this knowledge with reverence is essential. Listening to advice and valuing oral traditions and stories is important in this type of teaching and learning (John, 2009). Each person's mind is unique; becoming more psychologically aware and conscious involves critical reflection and a realization

of the interconnection between humans, animals, and the sacred (John, 2009). The mind can be further developed through "education, creativity, exploration, experience, and trial and error" (p. 67).

Regarding indigenous methods concerning teaching about science, experiential learning, and having a spiritual connection with nature are important as well as "relational approach to science" (Iseke & Desmoulins, 2015, p. 44). Western ways of learning science can be combined with indigenous ways in what is called a "two-way street" type of learning (Barnhardt & Kawagley, 2005, as cited in Iseke & Desmoulins, 2015, p. 45). Other indigenous methods that enhance learning science include: making learning culturally relevant, the importance of learning within community and relationships, and the importance of apprenticeships with Elders in the learning process, and engaging all aspects of the self (i.e., emotional, physical, social, and mental) in the learning process (Iseke & Desmoulins, 2015).

Freireian Liberatory Pedagogy

Concepts from Freireian liberatory pedagogy are also appropriate in this teaching/learning context. Praxis is "simultaneous action and reflection of men and women upon their world in order to transform it" (Freire, 2000, p. 60). This action is grounded in a commitment to truth, respect, and the welfare of individuals (Carr & Kemmis, 1986). Praxis includes dialogue where participants teach and learn from each other. This dialogic approach means that teachers and learners are co-learners who engage in critical thought and they come to know, through dialogue, how "the socioeconomic, political, cultural, and historical context" affects individuals' personal lives (Wallerstein, 1987, p. 34).

Problem posing education involves listening, dialogue, discernment of themes, and action. Listening for themes from others' lives involves understanding what subjects elicit emotion. Some techniques to unearth themes include observation, interviewing others, and reviewing documentation (Wallerstein, 1987). Having individuals observe others in conversation, interviewing others, or analyzing documents of interest such as policy manuals may unearth problems or issues worthy of discussion and critical reflection. Having individuals bring objects from their homes to talk about them may also help reveal their concerns and this may allow participants to share information about their environments (Wallerstein, 1987). After an issue has been identified, a structured discussion must commence. The problem under discussion should be recognizable to the group, have many different perspectives so that there is not a "good" or "bad" point of view, the solutions to the issue should come from the group, and the problem needs to be small enough for action to be taken on it (Wallerstein, 1987). Last, a plan for action emerges from the group. Students may practice potential actions through role plays, write letters to the editor, or any number of other actions. If the action is not successful, community members can reflect, regroup, and try another action (Wallerstein, 1987).

Place-based Learning

Place-based learning occurs when individuals have experiences grounded in local contexts. Place-based writing exercises are an example of place-based learning. Researchers note that when individuals write stories about their identity as it relates to their experiences in their local environment, their writing improves (Donovan, 2016). Similarly, when place-based math, science, English/Language Arts, and social studies curriculums were implemented in elementary and middle schools, standardized scores improved and community partnerships with local colleges, the sheriff's office, Cooperative Extension, and the State Office of Forestry, among others, were formed (Emekauwa, 2004). Students got involved in their local environments and used their five senses to learn. Place-based education reconnects "the processes of education, enculturation and human development to the well-being of community life" (Gruenwald & Smith, 2008, p. xix).

Communication between individuals leads to new understandings and place-based education can lead to new intergenerational learning and relationships (Mannion & Adey, 2011). Since place-based learning occurs among teachers, learners and the community, place-based education is inherently intergenerational. "Places and intergenerational relationships co-evolve" and, particularly with issues concerning the environment, such as climate change, people must come together to share different perspectives and ideas on a common problem (Mannion & Adey, 2011, p. 39). Through an intergenerational focus on a shared concern, people with different interests regarding the community and the environment come together to address an issue, use intergenerational communication to generate "new intergenerational meanings, practices, and places that are held in common;" (p. 40), and generate willingness to reflect on implemented initiatives and change course if necessary.

Citizen Science

Last, understanding climate change takes time and money. For this reason, citizen scientists, or amateurs, may be helpful in collecting data as research funding decreases and challenges related to climate change increase (Gardiner et al., 2012). Programs include direct citizen science where data are reported without verification and verified citizen science where "only observations confirmed by trained experts are analyzed" (p. 471). Citizen scientists have been utilized to show changes in lady beetle populations (Gardiner et al., 2012), climate change shifts in desert reptile communities (Barrows et al., 2016), and observations of the Beluga whale near Anchorage, Alaska from 2008-2011 (Carlson, Sims, & Bruner, 2015). Understanding better how to train citizen scientists for accurate observations and persistent engagement is important as an increasing number of citizen scientists are needed.

Discussion, Conclusions, and Implications

Implications for the development of adult education theory and practice include, first and foremost, ways for individuals, communities, and industries to adapt to climate change in locations worldwide. Climate change is felt most acutely in arctic regions but scientists predict coastal regions will see increased flooding and increasingly extreme weather will affect those living inland. In response to these departures from expected patterns, communities around the world will increasingly be challenged to adjust to changing environmental circumstances. Education on the climate and natural environments, and human interaction with those natural environments, will necessitate culturally appropriate community involvement and education. Changes in climate will fundamentally affect indigenous livelihoods and habitats. Current related concerns include accommodation or prevention of new oil and gas pipelines, evolving political boundaries or circumstances, and natural disasters and emergencies associated with fluctuating or unpredictable weather. Adult educators have a unique and challenging opportunity to support indigenous and rural communities to understand, adapt, and thrive in a time of complex climates, both natural and political, with a view towards supports for broader and increasingly dire environmental change.

Adult education needs to engage in this conversation. This field has both the theoretical perspectives and the skillset to effectively facilitate conversations about climate change (working with climate scientists) and respect and support the skills and knowledge bases of indigenous populations. We can balance indigenous perspectives and community-based education with the technical academic science to create a learning/teaching environment that is learner and problem-centered, culturally sensitive, and comprehensible.

Despite overwhelming evidence of climate change, the current administration's proposed deep budget cuts to funding mean local action is imperative. Adult educators' facilitation of Freireian methods of problem-posing, dialogue, and praxis in addition to respecting indigenous customs and knowledge will help citizens engage in science and defend the integrity of their local environments. Second, locals may create a climate change resiliency network where

climate change ambassadors from different locales share issues and knowledge. This ambassadorship program has been proposed between Alaska coastal communities and those on the Texas coast (Baumgartner, Zarestky, & Cairnes, 2016). These networks may help offset damage caused by changes in national policy, agencies, and funding. The Freireian methods can help individuals learn political action and lobbying to protect their communities and local spaces.

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