

Social Change through Education for a Sustainable Future

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Abstract:

Environmental education is fundamental to a sustainable future. This study examines how transitioning to a concept-based learning system and introducing innovative teaching methods could provide the necessary moral accountability and ecological literacy for a sustainable future. The study aims at reviewing key theories and literature to provide recommendations on alternate educational strategies. A discussion of the Hudson Valley Materials Exchange shows how a concept-based curriculum can have an effective impact on a student's understanding of environmental issues. Additionally, the study suggests renovating the standardized New York State Regents testing system with a concept-based approach.

Social change begins with education. Creating a future that sustains and improves the standard of living requires that students understand how their individual actions and decisions impact the world around them. In addition, establishing moral accountability for environmental behavior will help to develop the next generation into responsible supporters of sustainability. This paper suggests that comprehensive concept-based environmental education programs be mandatory at all science education levels to ensure adequate knowledge of environmental issues.

Environmental issues have become broadly defined to include deforestation, soil degradation, overpopulation, climate change, greenhouse gas emissions, pollution, over fishing, population extinction, environmental racism, suburban sprawl and more (EPA, 2007). For the purposes of this paper, ‘environmental issues’ will refer to these topics collectively, in the educational context of their causation and potential resolutions through human activities.

Environmental Ethics and Education

Environmental ethics are a fundamental component of effective environmental education. According to Paul Ehrlich (2002), “we cannot look to our genes to either explain or modify most of our behavior” (p. 32). Since it seems that knowledge of environmental value is not intrinsic to human genetic makeup, it must be assumed that it only develops through learning. Human behavior and participation in civilization are developed based on an individual’s particular environment (Ehrlich, 2002). This is reflective of the teachings of Jean-Jacques Rousseau, who believed that a higher level of

understanding of nature must be learned through experience and teachings (Kontio, 2003).

Ehrlich (2002) provides historical background on knowledge of conservation. He identifies Native Americans and aboriginal Australians among those who have had a historical respect for nature. He attributes this respect to their hunter-gatherer lifestyle, which ties them more closely to nature than the lifestyle of an industrialist. If one applies Rousseau's theory of learning the value of nature through experience and teachings, it is understandable that the hunter-gatherer lifestyle would be more conducive to understanding and valuing nature. Industrialized societies may place more educational emphasis and value on non-nature related endeavors, as understanding of nature today is much less of a survival necessity.

Ehrlich identifies that there still exists a broad knowledge gap and lack of public consensus regarding the current environmental state. Ehrlich states "the seriousness of the environmental dimensions of the human predicament is still unknown to the vast majority of the general public and decision-makers worldwide" (Ehrlich, 2002, p. 31). Within the past few years, this gap has been closing. Increased education based outreach and media coverage of environmental issues have increased citizen awareness. One problem with media coverage is that the issues can become muddled with conflicting or unsubstantiated media reports of scientific evidence and environmental policy development (Plater, 2006). For example, the news typically sensationalizes a topic with catchy sound bites to attract and hold a viewers attention. However, environmental issues are often too complex for this type of distilled news programming. In order to truly communicate environmental concepts to the public, news broadcasters should

provide scientific background and details regarding the many contributing causes. This may exceed the attention span of the average news watcher. Without a pressing and immediate crisis to report on, it may not make for good news (Plater, 2006).

Environmental Governance and Education

Environmental issues have quickly been added to the political docket, and will continue to grow in importance through the 2008 elections. Terms such as “carbon footprint” and “greenhouse gases” are becoming more widely discussed and of concern to citizens. Carbon footprint is defined by CarbonFootprint.com as “a measure of the impact human activities have on the environment in terms of the amount of green house gases produced, measured in units of carbon dioxide” (Carbonfootprint.com, 2007). This website provides a tool for individuals and organizations to measure the amount of greenhouse gases they produce as a result of everyday behavior and ideas on how to reduce individual carbon dioxide emissions. As a result of this growing public awareness and concern, environmental issues must be examined more closely from a political perspective (Bell, 2004). Citizen education has resulted from a demand by both citizens and the scientific community for governing bodies to address issues of environmental protection.

Derek Bell states that educational politics dictate staying away from ethical, religious and moral issues in schools. The state should be more focused on “peace, freedom, equality, opportunity and economic conditions of its citizens.” (Bell 2004) This issue comes to light when considering environmental ethics and the future of a sustainable earth. In a classroom setting, environmental ethics can become a personal and moral issue, potentially threatening individual beliefs, understanding and learned

behaviors. Bell succinctly identifies the dilemma presented, that education is believed to be the catalyst by which environmental issues are solved.

“It is commonly argued that major environmental problems can only be solved by radical transformation of the attitudes, preferences and lifestyles of the citizens of contemporary liberal democracies. It is only by creating ‘green citizens’ and ‘green consumers’ that we can alter the patterns of demand that are driving environmental degradation” (Bell, 2004, p. 38).

Reversing environmental degradation is not an endeavor that can be solved by policy or technology advances alone. A real turnaround will require modifications to individual behavior.

Bell is a strong proponent of concept-based learning techniques, where learning is active and engaged (Bell, 2004). He argues that environmental education not only teaches students, for example, that recycling is good, but teaches them the background of why it is good. This method of teaching would include all of the historical and scientific background of the environmental issue. Bell believes that environmental education curriculum should be mandatory in all schools, and should provide students with both pro-environmental and anti-environmental ideas to provide a better perspective for students (Bell, 2004).

Concept-based learning and constructivist learning have become widely accepted education theories. DiEnno and Hilton (2005) defined the constructivist theory as an

“understanding that each student comes to class with his or her own assumptions about how the world works; for knowledge to be retained, it needs to be presented in a way that fits this new knowledge into the student’s existing worldview” (p. 14).

The constructivist approach takes a look at what the student already understands and attempts to integrate new realities. The older one grows, the less receptive he is to new information and concepts which does not fit into his understanding of the world

(Kollmuss & Agyeman, 2002). In the case of environmental knowledge, one educational approach would be an attempt to create a concept-based curriculum which allows students to see environmental issues first hand. This will allow them to integrate environmental concepts into their existing knowledge based on visual, tactile and emotional experiences. Some examples include field trips, discussions about personal experiences with regard to environmental issues and hands on learning.

Environmental Education Challenges

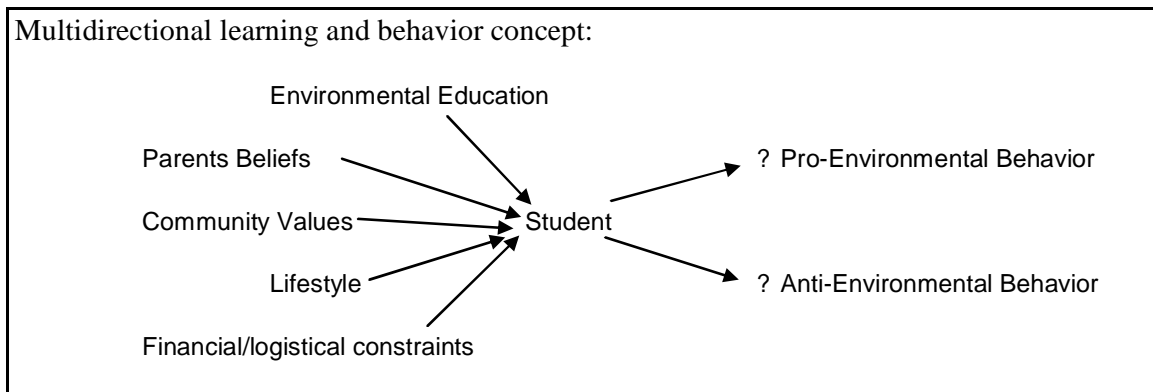
Researchers of environmental education acknowledge that education is only one factor in creating pro-environmental behavior. Kollmuss and Agyeman (2002) identify that environmental education will not necessarily lead to environmental behavior. Early linear thought models determine that acquiring environmental knowledge would lead to a more positive environmental attitude, and linearly yield pro-environmental behavior.

Linear learning and behavior concept:

$$\mathbf{Student + Environmental Education = Environmental Behavior}$$

(Interpreted from Kollmuss & Agyeman, 2002)

The authors dispel the idea by discussing the complexity of the motivation behind pro-environmental behavior. There are a number factors contributing to pro or anti-environmental behavior which are not necessarily linked to education level. For example, culture, values, convenience, personal comfort and lifestyle may dictate whether or not sustainable behavior occurs. Many factors will contribute in the ultimate decision-making process regarding whether or not to exhibit pro or anti-environmental behavior.



(Interpreted from Kollmuss & Agyeman, 2002)

Kollmuss & Agyeman acknowledge that certain types of learning events may contribute more greatly towards environmental understanding and accountability.

“direct experiences have a stronger influence on people’s behavior than indirect experiences...learning about an environmental problem in school as opposed to directly experiencing it (e.g. seeing the dead fish in a river) will lead to weaker correlation between attitude and behavior” (p. 242).

Clearly the authors are suggesting that a more concept-based learning experience, such as seeing the dead fish, will have a greater impact for students than simply hearing about dead fish in a classroom. It is up to educators to effectively integrate concept-based learning in a classroom setting to achieve maximum educational impact with regard to environmental issues.

Kollmuss and Agyeman (2002) analyzed studies comparing pro-environmental behavior between wealthy countries and poor countries. While developing countries tend to leave a smaller ecological footprint, the authors found that it is the result of minimal resources, and not a desire to act in favor of the environment. Individuals surveyed in poor nations do see environmental issues as important, but they fall behind economic issues (Kollmuss & Agyeman, 2002). The authors state that “people who have satisfied their personal needs are more likely to act ecologically because they have more resources

(time, money, energy) to care about bigger, less personal social and pro-environmental issues” (Kollmuss & Agyeman, 2002, p. 244). Once people have been able to provide for themselves financially, they may have more time and energy to devote to thinking about problems larger than themselves.

In thinking about pro-environmental behavior, one can also consider the ‘actively caring’ hypothesis by Geller (Kollmuss & Agyeman, 2002, p. 245). While an individual is struggling to ensure the survival and comfort of his own family, it is difficult for him to actively care about larger social issues with no immediate concern to him. Geller hypothesized that an individual cannot actively care unless “the need for self-esteem, belonging, personal control, self-efficacy and optimism have been satisfied” (Kollmuss & Agyeman, 2002, p. 245).

Kollmuss and Agyeman’s (2002) hypothesis dovetails Maslow’s hierarchy of needs and indicates that without achieving the highest level of self actualization, a person cannot look outside themselves to help solve greater sociological problems (Maslow, 1970). It is difficult to focus energy or financial resources on broad social issues if an individual is suffering financially, medically or emotionally. Once a person has become fully self-aware, or self fulfilled; he may be capable of looking beyond himself to decrease the suffering of others. This idea leads into the theory of altruism, proposed by Schwartz in 1977, which identifies a personal desire to alleviate suffering of others (Kollmuss & Agyeman, 2002).

Thus, thinking about pro-environmental behavior cannot be seen as a linear function; ($X+Y=Z$). Environmental knowledge does not necessarily lead directly to pro-environmental behavior. Instead, there are many contributing factor and obstacles

preventing pro-environmental behavior as previously detailed in the multidirectional model. Further, the motivation to overcome these obstacles is often hindered by a lack of emotional involvement (Kollmuss & Agyeman, 2002).

Kollmuss and Agyeman, (2002) discussed the slow nature of environment destruction as a contributing factor to an overall lack of motivation. They refer to the famous experiment where a frog is placed in boiling hot water, and immediately jumps out. When the frog is placed in cold water, and heated slowly, the frog remains and boils to death. This experiment is commonly used as a metaphor in psychology for human behavior. The authors here apply the experiment's outcome to the inability for people to perceive the growing threat of climate change. When presented with the slow deterioration of the environment, people are much less likely to perceive the threat (Kollmuss & Agyeman, 2002). It is only through immediate threats, such as disastrous hurricanes, tsunamis, droughts and other natural disasters that climate change is perceived as a threat. This may be indicative of a lack of environmental education and media coverage of environmental issues, coupled with human nature.

Kollmuss and Agyeman, (2002) argued that a main hindrance to pro-environmental behavior is an "individual's perception of whether or not he or she has the ability to bring about change through his or her own behavior" (p. 255). If an individual believes that his small actions will fail to contribute to the solution, he will forego the pro-environmental behavior in favor of his own comfort and convenience. As an example, the authors argued that a person may choose to drive to work instead of riding a bike due to time, distance or weather which makes driving more desirable. Individuals need to learn that each solitary action collaborates with the actions of others towards the

resolution of the issue. Hence, there are no efforts too small in environmental conservation.

Ultimately, changes to environmental education may not be enough to promote pro-environmental behavior. Further research in environmental psychology is necessary around convenience and comfort based decisions. Kollmuss and Agyeman (2002) do not see a linear relationship between environmental education and environmental actions. The authors stated that they “see environmental knowledge, values and attitudes; together with emotional involvement as making up a complex we call ‘pro-environmental consciousness’. This complex, in turn is embedded in broader personal values and shaped by personality traits and other internal as well as external factors” (p. 256). Environmental consciousness is personal and has been shaped by a variety of experiences, values and teachings for each individual. Further, it is through free will that an individual makes behavioral choices, which may or may not be pro-environmental, depending on competing values.

One method of modifying behavior with regard to environmental decisions discussed by Kollmuss & Agyeman’s, (2002) study is financial deterrents. Through policymaking, some cities have had success in pushing financial responsibility for waste production onto citizens. For example, the “pay per bag” concept, which requires that prepaid bags be used for garbage to ensure pickup. This has been effective in reducing the amount of waste produced (Kollmuss & Agyeman, 2002). Another tactic is increasing taxes on gas and fuel to increase conservation and minimize carbon emissions from personal transportation. Applying financial pressure can be an effective way to steer environmental behavior (Kollmuss & Agyeman, 2002).

There are a great number of hindrances to pro-environmental behavior, such as culture, values, convenience, personal comfort and lifestyle. Kontio (2003) discusses Rousseau's ideas on education in the context of human nature and development of autarchy. The author argued that autarchy is defined as equality between a man's desires and ability to fulfill those desires (Kontio, 2003). Autarchy brings into question whether or not the desires and goals of individuals and organizations are in line with environmentally based principles, such as conserving environmental resources to ensure a sustainable way of life for this generation and generations to come.

Kontio (2003) argued that "the task of education is to turn man into a social being and so to turn the absolute being of nature into the proportional being of society" (p. 3). Considering that Rousseau's educational philosophies focused largely on citizenship, this brings reason to man about nature and society, which can be a motivating factor towards action for the common good (Kontio, 2003). Rousseau identified that aside from self preservation, unhappiness from the suffering of other sentient beings is a motivating factor in human nature. While environmental disasters and climate change cannot be seen as sentient beings, they will undoubtedly continue to be a growing threat to individual self preservation. Rousseau's principles of natural education through concept-based learning are still relevant today. Application in environmental education may be a key to creating more awareness and sensitivity amongst the next generation of citizens and policymakers.

Kollmuss & Agyeman (2002) have shown through studies that standard classroom education alone is ineffective in generating pro-environmental behavior. It is likely that

the authors would agree with Ehrlich's ideas about strategically inserting moral accountability through a concept-based educational curriculum of environmental issues.

A Closer Look at Concept-Based Learning

Concept-based learning looks beyond textbooks to incorporate everyday experiences into a student's education. This approach may be an effective tool in preparing the next generation of policymakers for the immense challenge of sustainability. Concept-based applications in environmental education were studied by Vaughn & Gack (2003) and Simpson & Daly (2005), revealing positive learning benefits for both the students and communities. Kontio (2003) further supports a hypothesis about the positive impact of concept-based learning by arguing the need for an educational system that promotes the common good of society.

Based on current studies, it is apparent that students need to be encouraged to become more engaged in the democratic process to enact social change. Student interest and participating in democratic governance has suffered in recent years. Hart (2004) conducted a study of college student's attitudes showing that only 30 percent would consider working in a public service or government position. The study revealed a decrease of 9 percent since a similar study in 2002 (p. 22). This decrease indicates a significant decline in government and public service interest in an era when engaged democratic citizens are greatly needed. Bell argued,

“education should prepare children for citizenship in a society of free and equal citizens each with the capacity to form, revise and pursue their own doctrines and the ability to live by principles of justice appropriate for such a society. More specifically, [John] Rawls expects education to promote ‘freedom’ by teaching

children that they have the right to choose how to live their lives (within the limits of justice) and by ensuring that they have the necessary skills to support themselves in a modern society” (p. 39).

Without a strong spirit of democracy instilled in today’s youth, we cannot expect a cohesive environmental movement to be successful. All great movements of the past were driven by democracy and the collective force of concerned citizens. It was the people who banded together to change minds in great movements of the past, such as the woman’s suffrage and civil rights movements. Students must understand their responsibility as citizens to actively participate into the democratic process to solve environmental issues. Learning to become active participants in the democratic process is important, as our planet continues to be challenged with considerable environmental issues.

Environmental Education Concept-Based Curriculum

A concept-based learning approach to environmental issues would allow students to experience the big picture and observe solutions in action. It is important to delve deep enough into the technical aspects and science behind these issues, while continuing to examine the placement of the concept in the larger picture. One of the best methods of teaching about environmental concepts, according the New York State teacher Jessica Mauer, is to provide a hands on and visual learning experience that allows students to relate to the problem (personal communication, January 11, 2006). Some examples of effective concept-based strategies include:

- Helping students to measure their carbon footprint and discuss ways to decrease carbon dioxide emissions.

- Problem solving exercises that challenge students to think critically about themselves and their environment.
- Hands on field trips to develop an understanding of human impact to ecological systems.
- Educational videos about environmental concepts, such as oil spills, overpopulation, recycling and waste management, coupled with engaging group discussions.
- Research projects on environmental issues in the context of globalization and international affairs, including sustainable development.
- Discussions about how human behavior has led to climate change, population extinctions, and other changes to the ecosystem.
- Discussion of local environmental problems and letter writing to politicians, to instill activism.

Clearly, for different age groups, different modifications would be necessary in implementation. These may range from educational games and coloring books for younger students to case study analysis, research papers, educational videos and field trips for older students.

An example of creative concept-based learning curricula development and environmental stewardship is the action by BP of creating the A+ for Energy program. BP originally launched the program in California and Texas, challenging teachers to develop creative and innovative methods of teaching environmental concepts. The program has proven to be popular and successful. “A+ for Energy grants are presented directly to teachers who submit creative classroom, after-school, extra-curricular or

summer activities focused on energy education and/or energy conservation, in increments of \$5,000 or \$10,000” (Yahoo News, 2005). Due to the success of the program, BP expanded the program further in 2007 to include Alabama, Canada, Illinois, New Mexico, Indiana, and Ohio. Since its inception, 6.5 million dollars in scholarships and grants were awarded to participating teachers (BP, 2007).

Stakeholders from the nonprofit sector have also been active in developing concept-based curriculums. NEED (National Energy Education Development) for example, focuses its expertise on energy education. NEED has extensive experience in developing curricula and providing training for educators. Their mission is “to promote an energy conscious and educated society by creating effective networks of students, educators, business, government and community leaders to design and deliver objective, multi-sided energy education programs” (NEED, 2006).

NEED is an organization which has established a number of successful collaborations with schools, government agencies and other non-profits. According to program director, Mary Spruill, NEED works on a daily basis receiving funding and programmatic support from agencies such as the Department of Energy, State Energy Offices, Department of the Interior, Environmental Protection Agency and Department of Agriculture (personal communication, January 19, 2006).

The Environmental Protection Agency is a key stakeholder and Federal expert on environmental concepts. The EPA’s Education Department has worked hard to develop interesting and creative teaching tools for teachers, which are available on the EPA’s website (EPA, 2007). In addition, the EPA can provide funding and grants to school districts or states looking to improve curricula in environmental education.

Concept-based Learning Case Study - The Hudson Valley Materials Exchange

The Hudson Valley Materials Exchange (HVME) is an organization which has sought to promote environmental education through concept-based teaching about material consumption and re-use. This non-profit organization collects materials salvaged from the industrial waste stream, and uses them as a tool to communicate conservation concepts to students. In addition to the education component, HVME has a community warehouse of reclaimed building materials open to the public for sale.

HVME instructors travel to area schools in the “Reuse-a-Bus” loaded with bottle caps, cardboard paper towel rolls, fabric and leather scraps, straws, and more. Through creative programming, students engage in a craft project using the reclaimed materials, while learning about the resources that go into making the materials, as well as what happens to them after they are discarded. The ultimate goal of the program is to reduce waste by inspiring creative use of existing resources.

Executive Director, Jill Gruber sees HVME as a leader of sustainability in the community. HVME provides a valuable service to the community, both by promoting education and awareness of the need for greater reuse of everyday materials, and by making available salvaged materials for local artists, teachers and builders (personal communication, J. Gruber, March, 2007). Communicating a message of reuse and conservation to the public will continue to grow more important as global environmental challenges are faced everyday.

Curriculum Integration –A case study of the New York State Regents system

The New York State Board of Regents is an integral part of the New York State Education Department. The Board of Regents is “responsible for setting educational policy, standards, and rules – and are legally required to ensure that the entities we oversee carry them out” (NYSED, 2005). Part of the Regents program in New York is the administering of standardized tests for all core topics such as math, science, social studies, and language (NYSED, 2005). Standardized testing is an integral part of the New York State education system.

Environmental education programs are generally lacking in practice in the New York State school system. They are buried within the existing standardized Regents science system for commencement level (grades 9-12). Environmental education is only available as a science elective course. The New York State Living Environment Regents contains a small section on ecology, and includes understanding energy cycling and human actions, recycling and alternate resources.

While this may seem comprehensive, the problem arises in that teachers are not able to spend any significant amount of time on environmental concepts, as they are not heavily represented in the standardized Regents examination. Jessica Mauer, a New York State Regents Living Environment teacher discussed that each student is required to pass these examinations for graduation. As a result, teachers spend most of their efforts teaching to the test, and cannot devote time to topics not appearing on the test (personal communication, January 11, 2006). Further, individual teacher’s performance reviews are based on student test scores, providing greater incentive to teach heavily to the test.

Currently, less than five percent of the test questions are on ecology, energy conservation, sustainable development and other environmental issues (NYSED, 2005). Since ecology and environmental concepts are a small representation of this exam, teachers cannot devote the necessary time or energy to effectively instilling environmental literacy in students. While these tests are comprehensive, they fail to adequately address environmental education. J. Mauer (personal communication, January 11, 2006).

The preface to the Living Environment curriculum is contradictory to the ultimate administration of the standardized exam. The preface (NYSED, 2006) reads “It is essential that instruction focus on understanding important relationships, processes, mechanisms, and applications of concepts. Far less important is the memorization of specialized terminology and technical details. Future assessments will test students’ ability to explain, analyze, and interpret biological processes and phenomena more than their ability to recall specific facts” (p. 7). This statement, as well as the rest of the preface indicates that New York State educators condone a more concept-based approach to teaching the material. This type of teaching has not been implemented, as the Living Environment Regents standardized examinations still rely on fact and process memorization.

Educator Training

Before the New York State Board of Regents could abolish the standardized test, teachers must be properly educated on how to implement a thorough concept-based curriculum. This is a significant change from the traditional textbook based instruction. The training for the teachers should involve a hands-on introduction to concept-based

learning, as well as specific instruction on the details of the curriculum concepts and case studies related to environmental concepts.

Further study

The area of study linking environmental education and moral accountability is open for further research. Delving deeper into the possible linear connection between ethical environmental behavior, and concept-based environmental education could provide valuable information for educators and policymakers. As we have seen, there is currently literature around the topic both supporting and refuting the benefit of education in creating pro-environmental behavior.

More assurance in concept-based learning on environmental concepts will be needed to test new curricula before state education departments begin to promote such programs. Additionally, environmental education will need to become a priority for the New York State Board of Regents before any action will be taken. Regardless, it will be essential that newly developed curricula are effectively tested and qualified to meet academic standards. Collaboration of existing nonprofit and private sector partners from the community will help support the development and testing of innovative concept-based curriculum. Spruill, program director of NEED confirmed the need for collaboration by arguing “I don’t like to do anything without partners – from creating new curriculum to planning new training efforts – without partners and collaborators, we would be spinning in our seats” (personal communication, January 19, 2006). Spruill indicates that collaboration is essential today in crossing boundaries and enacting social change. Taking expertise and power from various sectors is an effective way to create widespread social change. The Hudson Valley Materials Exchange has also been seen

crossing sector boundaries by creating a “teach the teachers” series of workshops to further promote environmental education.

Our nation’s leaders are struggling to develop programs for sustainability, which should have been established decades ago. However, our culture and education have not prepared us to be held morally accountable for meeting the needs of future generations, while meeting our current needs. It is time to move away from a culture of memorization and standardized testing, and encourage students to think critically and problem solve. The promotion of concept-based learning in environmental education may be a key to promoting social change and leadership towards a sustainable future.

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