

Bringing Sustainability Education into the High School

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Abstract:

American society does not recognize the importance of protecting the environment and creating sustainable development. There is a need for sustainability education at the high school level. Current Massachusetts' guidelines do not promote environmental education, but do allow a creative, committed teacher to implement sustainable ideas in his/her class. A wide variety of local and Internet resources are available to aid teachers and students in the quest to become more ecologically literate citizens. Some research has been done, but more is needed to provide educators with proven practices of including sustainability in their curriculum. The next step is for regulations to be put in place to require sustainability education as well as for colleges and universities to step up to the challenge of educating the communities around them.

Introduction:

Education in our society is meant to prepare us for our future. It gives us the tools we need to be successful in any endeavor we chose. Education also prepares us to be better citizens, by teaching values, morals, and social skills. We have discussed in class many times that education is needed to change the future. Ignorance allows many injustices in the world to occur. One area where this is very true is the environment. Many times the public has a blind eye when dealing with the environment because they are un-educated. One of the most important current aspects of environmental education is the goal of sustainable development. Sustainable development has many definitions, with the focus of meeting the current needs of society without compromising the future. For many people this is a good idea, but not a reality. Most Americans have limited environmental knowledge from public school education. In other words they are “ecologically illiterate.” Past and present industrial practices have caused harm to the environment at unimaginable rates. We need to develop sustainable practices to protect the world’s environment. To do this we need to educate the public and the future generations about the environment and sustainable practices. Currently the most progress in environmental education is at the collegiate level, but this is needed at every level of education. While all topics are not necessary at each level, there are aspects of environmental concern that could be addressed. There is a place for sustainability at the primary, elementary, middle and high school levels as well as collegiate. In this paper I will focus on the high school level, since I have particular interest in this area of

education. The addition of sustainability education would be positive for everyone involved and the future world. Creating ecologically literate citizens would benefit everyone. Environmental education is not solely facts and figures about the natural world. It also needs a deep understanding of the interconnectedness of life on the planet; how ecosystems work, how biodiversity impacts the world, and the human impact on other life. Most importantly environmental education needs critical thinking, new ideas, and problem solving. The benefits of environmental education stretch into other disciplines as well. In this paper I want to explore where environmental education is currently and where it can go. I will focus on high school education in the Pioneer Valley.

Methodology:

Current Education Guidelines

Research for this project is concentrated on Massachusetts' education guidelines and requirements set forth by the state Department of Education. I used the Science and Technology/Engineering Curriculum Frameworks from May 2001 as a basis of guidelines and requirements. I focused on the Biology/Life Science requirements because those are the only set of guidelines that mention ecology or the environment. I also used the National Science Education Standards published by the National Research Council (1996). While not published, I did look into the Massachusetts Comprehensive Assessment System (MCAS) to examine questions asked of students. The MCAS has become a major focus for many teachers in recent years. A main aspect I examined as I went through

these guidelines was the goals they set up for students and teachers and the actual results that would come out of teaching them. I also decided to look into the requirements teachers need to fulfill before getting certified to teach. Again I used the Massachusetts Department of Education as well as the Massachusetts Tests for Educator Licensure (MTEL) to understand the process of judging teachers.

Available Resources:

I wanted to locate resources for students and teachers to use in their quest to become ecologically literate. Colleges and universities have made the most progress in environmental education thus far and are available as role models and resources. Local resources could provide locations for field trips or as sources for information. The Internet has many sites for both teachers and students.

Looking at previous research:

Lastly I wanted to research what other's had done. I wanted to find studies that used environmental education, what they did and how it worked.

Results:

Current Educational Guidelines:

The Massachusetts Frameworks only mention Ecology and the Environment in the Biology/Life Sciences guidelines, and so I will focus my attention on these frameworks. There is no direct mention of sustainability education. The main topics of Life Science requirements are Chemistry of Life, Structure and Function of Cells, Genetics, Human Anatomy and Physiology, Evolution and Biodiversity,

and Ecology. The frameworks go on to describe what should be taught under each section and the weight the teacher should put on each topic.

The frameworks start with overall goals for Life Science throughout K-12. As a whole, their goals for Life Sciences encompass the main facts and ideas of biology as well as the thought process. The Massachusetts Frameworks state:

“The life sciences investigate the diversity, complexity, and interconnectedness of life on earth. Students are naturally drawn to examine living things, and as they progress through the grade levels, they become capable of understanding the theories and models that scientists use to explain the observations of nature.”(p.28)

The outline for the implementation does provide means to accomplish most goals for the younger grades, but in high school the focus is on the fine details. The theories and models take the majority of class time, while the bigger ideas like diversity, complexity and interconnectedness of life are overlooked. Of the six concepts outlined in the frameworks, the majority of the weight and sub-concepts are put on The Chemistry of Life, Structure and Function of Cells, and Genetics (see Figure 1).

Teachers and schools have worked more closely with the frameworks in recent years due to the focus on high-stakes assessments and funding stemming from the frameworks. Wheeler and Byrne (2003) agree that too much focus has been put on standards, assessments and accountability. Teaching is decreased to a narrow view of biology and too little attention is put on the bigger ideas and purposes.

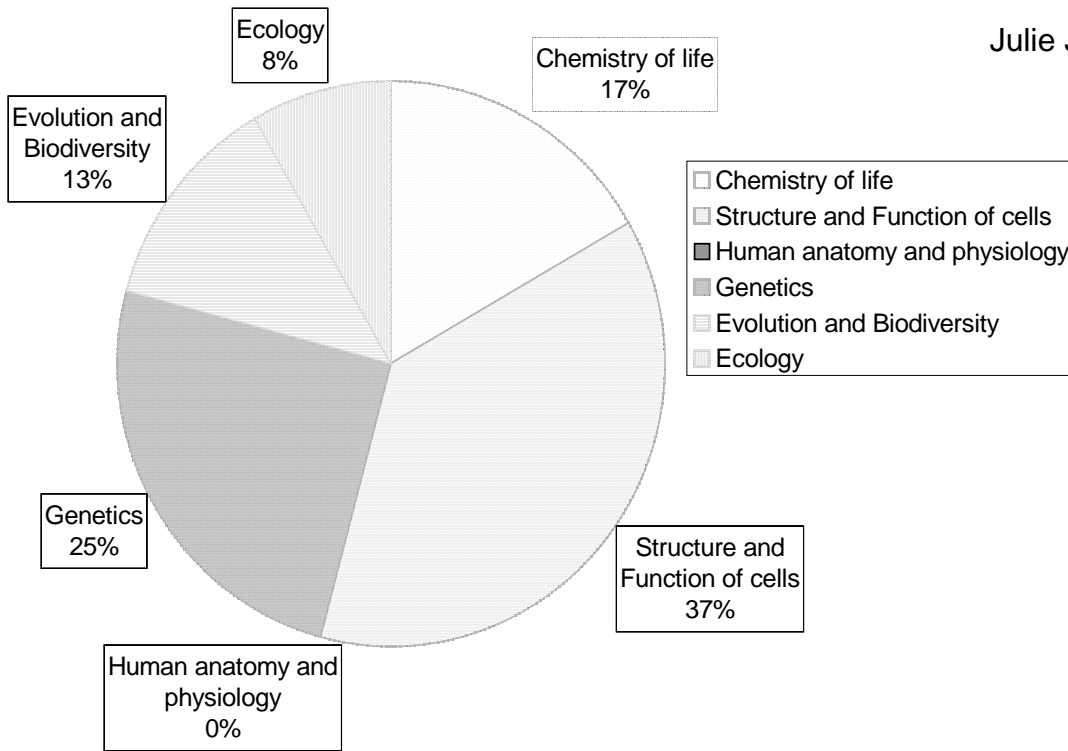


Figure 1 Graph of Frameworks

The science frameworks include Earth and Space Science, Life Science, Physical Science and Technology/Engineering. While the other sciences do not mention the environment, Technology/Engineering discusses the impact we as humans have had on the planet. The Technology/Engineering frameworks explore the historical and social context of the sciences. (p.102) Two of the suggestions for discussion are particularly environmentally centered.

“Unintended negative effects from uses of science and technology/engineering” and “how science and technology address negative effects from uses of science and technology/engineering” open discussions about sustainability. This is also an opportunity for teachers of different disciplines to work together to discuss sustainability and the environment. These discussion topics also open the door to discuss ethics and morality around science, which are often left out at the high school level.

The Massachusetts frameworks set the guidelines for teachers in this state though the outlines they give would not lead to the goals they set forth.

The National Science Standards (1996) direct teachers to use inquiry based science that enables students to think critically about the topics at hand. This fits well with the ideas of sustainability. Critical thinking and investigations are two main ways for students to develop problem-solving skills that are essential for a sustainable future.

The Massachusetts Comprehensive Assessment System (MCAS) has been a focus for many teachers in the state. It is a test each tenth grader takes in the spring. The results influence state funding through the “No Child Left Behind” Act and the school success. The science section of the test includes the same objectives as the state frameworks. The numbers of questions do not correlate to the weight the frameworks put on each area. (See Figure 2) The 2000 Life Science section had 10 questions out of 42 specifically about Life Science objectives. None of those questions concerned ecology. Open response questions were also asked and two of those questions pertained to Life Science, one of which asked about ecosystems.

<i>Topic</i>	<i>Number of Questions</i>
Chemistry of life	2
Structure and Function of Cells	4
Human Anatomy and Physiology	0
Genetics	2
Evolution and Biodiversity	2
Ecology	0

Figure 2 Table of MCAS multiple choice questions pertaining to Life Sciences

Another area I looked into was the requirements for teaching in the state of Massachusetts, specifically in the Life Sciences. Thirty-six hours of Biology course work are needed in addition to passing a degree program in Education. Teachers must also pass two tests (MTEL) to verify they have sufficient communication and literacy skills and biology knowledge to teach. Massachusetts Department of Education will then review their credentials for certification.

Available Resources:

Researching available resources for teachers and students unveiled that many opportunities are available locally, nationally and online. In the Pioneer Valley local resources include the Five Colleges as well as organizations focused on the environment. (See Figure 3) Smith College and the other local colleges should be available as role models and guides as well as resources for sustainability education. Teachers that are committed to teaching for ecological literacy could use the local resources as places to visit or places to get information from for class.

Ambassadors for the Environment	Amherst, MA
Green Network	Westfield, MA
Living Routes - Ecovillage Education Consortium	Shutesbury, MA
Massachusetts Turtle Rescue, Inc.	Springfield, MA
Northeast Sustainable Energy Association	Greenfield, MA
Pascommuck Conservation Trust	Easthampton, MA

Figure 3 - Local Resources about the Environment

The Internet is full of resources for both teachers and students. (See Appendix) Teachers can find curricula materials along with other sustainability materials.

Looking at previous research:

In search of understanding the current situation of Environmental Education for sustainability, I looked into the research of others. The work I found proved that more research needs to be done. Sustainability Education has just begun. Some initiatives have been setup, but little has taken hold. Some case studies are available, but more are needed to set up recommendations for teachers to implement Sustainability Education into their classrooms. I will discuss specific findings more in my discussion.

Discussion:

State level Changes

In light of my findings in the Massachusetts Frameworks, it is obvious that the Massachusetts Department of Education recommends little to no sustainability education. While inquiry based learning with a goal of critical thinking and problem solving is suggested, it is not put into environmental perspective. The National Science Standard's goals of independent work and thought closely resemble the goals of the Sustainability Education movement (Moore and Huber, 2001). The state does not seem to support those same ideals as represented by the Frameworks and MCAS, as well as the required testing for teachers (MTEL).

Haury (1999) reviews Sustainability Education and outlines a definition and current challenges. Many definitions of Sustainability Education exist, but I agree that it must include how development impacts economic, social and environmental elements. Haury discussed the President's Council on

Sustainable Development, which has since been dismantled. In 1994 the Council had a forum which developed the “Education for sustainability: An agenda for action” which is still available (see appendix). The “Agenda for Action” like other guidelines for environmental education promotes lifelong learning, interdisciplinary approaches, problem solving skills, partnerships with universities, multicultural perspectives, and empowerment of individuals and communities.

Wheeler and Byrne (2003) agree that there is not enough support for Sustainability Education, even though some progress has been made. They point out the lack of funding as a problem for many school districts. Teachers need to be committed to making their students ecologically literate. Teachers need support for administration and previous training in environmental studies. Teacher preparation programs need to be preparing teachers to teach Sustainability Education. “Effective teacher education is vital in producing an environmentally literate population that can advance the transition to sustainability” (Wheeler and Byrne, 2003). This leads to colleges and universities becoming role models of sustainability and sustainability education.

Herremans and Reid (2002) discuss the use of the sustainability triad as a framework for teaching sustainability. (See figure 3) They continue with a case study of implementing the triad in class through a national park activity. Many activities and lessons like this one are available for teachers on the Internet. (See appendix) The triad is an excellent way to compare economic, social and environmental values when discussing topics in class.

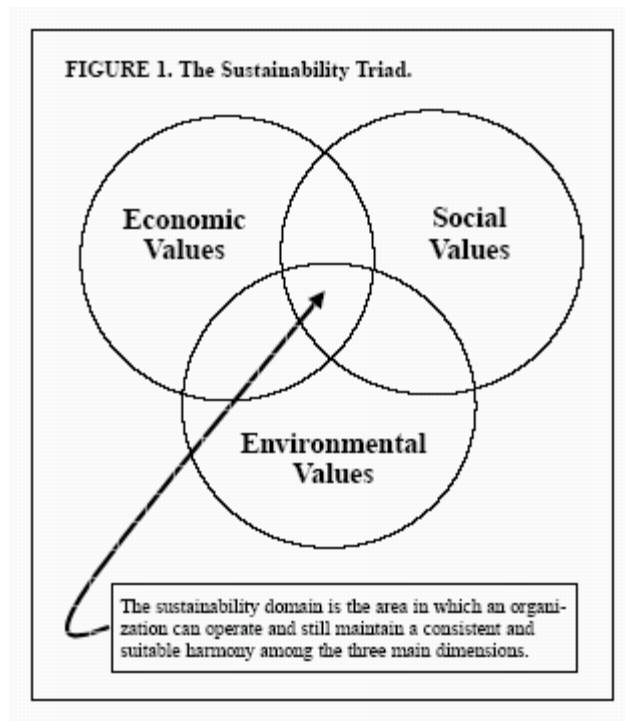


Figure 4 - Sustainability Triad (Herremans and Reid, 2003)

While I have mainly discussed American education, sustainability is an international issue. Barraza, Duque-Aristizabal, and Rebolledo (2003) bring up sustainability education issues from across the world. They focus on the “Environmental Education: from policy to practice” seminar from 2001 and the issues that arose there. An interesting aspect of their conclusions is other countries have other problems that prevent sustainable education and development that are not as big of issues in the United States. Politics and economics are large players for many countries which greatly differs from here (Barraza, Duque-Aristizabal, and Rebolledo, 2003). I do wish to focus on American education, but the rest of the world is an important aspect with the choices we make.

I have focused on high school education in this paper, but a goal is for sustainability to be in every grade in every discipline. We can also learn from

others, how they have tried to implement environmental education into their curriculum. Summers, Corney, and Childs (2003) did a study of sustainability in primary schools and faced issues that are common to all grades. Teacher education, motivation and commitment are needed for sustainability education to succeed in any grade. Their study proved that incorporating new goals into a curriculum are not always easy (Summers, Corney, and Childs, 2003) Reforms in education will not happen overnight, but this study shows that teachers need support.

Using Available Resources:

Teachers need support to begin adding Sustainability Education into their classrooms. As mentioned previously universities and colleges can provide role models and resources for teachers and students. In the Pioneer Valley we have the Five Colleges which can provide a variety of resources. We have discussed in class many opportunities that the colleges could provide for the community. Other local resources like the ones mentioned in the Results section could provide many learning experiences for students and teachers. Luckily this area of New England is rich in environmental education opportunities. Not only the organizations that I previously mentioned, but this area also has many state parks and farms including organic farms. Before researching this paper, I did not expect much from the Internet, but it actually has many sustainability education sites that could be of great use to teachers. (See Appendix) Many organizations have information available for teachers, including curricula, lessons and activities.

Recommendations:

My first recommendation for change would be state support of Sustainability Education for high school curricula, through the Frameworks and testing, using the goals established in programs like the “Agenda for Action.” Since this is the first step to including Sustainability Education in Massachusetts, I would not push for a paradigm shift by requesting an interdisciplinary route at this time. I would suggest that each of the sciences, especially biology and engineering; to include knowledge of environmental systems, problems solving and discussion of the impact humans have on the other species of the planet.

Teachers need the opportunity to become well educated in sustainability issues. Teacher prep programs need to at least make this an option for teachers to pursue. My second recommendation is for universities and colleges to take a more aggressive role in providing sustainability education opportunities. Higher education learning institutions have more educational freedoms to their students and the community.

Sustainability education has not been a priority for Americans. While a complete paradigm shift in society towards eco-friendly practices would be the best solution, I do not think that is possible immediately. Education is the best means to change society over the long-term. Adding sustainability education into the current education at the high school level is a definite possibility with committed, educated teachers. Some smaller changes like I mentioned above are possibilities in the short-term that would have large impacts. One of the goals of our education system should be to create ecologically literate citizens.

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<http://www.gcrio.org/edu/pcsd/toc.html>.

Appendix: Internet resources

Some of the available Internet resources for teachers and/or students. One problem with the web is that addresses change quickly.

“Education for Sustainability: An Agenda for Action” available at <http://www.gcrio.org/edu/pcsd/toc.html> is an excellent resource to help understand sustainability issues.

North American Association for Environment Education (NAAEE) available at <http://naaee.org> including their guidelines “Excellence in Environmental Education” offers a projects and activities for educators. They also offer another website <http://www.eelink.net/> that has professional and classroom resources.

Online Environmental Community available at <http://www.envirolink.org/> offers a wide variety of environmental topics to explore.

The Population Connection available at <http://www.populationconnection.org/> offers many activities and workshops on worldwide issues including environmental.

The National Science Standards are available online at <http://www.nap.edu/readingroom/books/nses/html> as a reference for teachers.

The Massachusetts Science and Technology/Engineering Frameworks are online at <http://www.doe.mass.edu/frameworks/current.html> as a reference for teachers.

The Globe program available at www.globe.gov is a well-established k-12 resource especially for students with links to other important sites.

The EPA offers a website for environmental education located at <http://epa.gov/enviroed> or <http://epa.gov/highschool>.