

Sustainability Education in K-12 Classrooms

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Abstract

The national focus in K-12 education currently is on core subject mastery and testing; this is a tough environment in which to instill and expand sustainability education. Even those educators committed to sustainability education often have difficulty finding ways to incorporate what is considered by many to be ‘add-on’ material. Nevertheless our experience shows that educating for sustainability can be and is implemented effectively in virtually all kinds of K-12 classrooms by using one of four general approaches. This article includes descriptions and examples of these approaches, provides a summary of benefits of sustainability education, and gives an overview of sustainability education in the U.S. Included are results from several of our studies conducted on the use of sustainability education. A list of K-12 sustainability education resources is provided at the end of the article.

Keywords: K-12 education, global issues, sustainable solutions, sustainability education, critical thinking, systems thinking, student engagement

Over the last 10 years our organization, *Facing the Future*, has worked to help educators incorporate global issues and sustainability education into their K-12 classrooms. We’ve surveyed and interviewed thousands of educators and administrators around the country to learn what they need and how they incorporate sustainability education into their teaching. During this time we’ve launched and grown a global issues and sustainable solutions curricular effort that annually reaches over 1,500,000 K-12 students in all 50 states and around the world. We hope the following information that we’ve culled from over a decade of experience will highlight the importance of educating for sustainability and help educators simply and effectively incorporate sustainability education into their classrooms.

An Overview of Sustainability Education in the U.S.

Sustainability means different things to different people. For our purposes we define it broadly as the notion that a generation of people can consider sustaining themselves without inhibiting the ability of future generations to do so. While some people use the term “sustainability education” interchangeably with “environmental education”, sustainability differs from environmental education in that it necessarily includes environmental, social, and economic concerns (McMillan and Higgs 2003). We like to use the broader term “global sustainability” which refers to applying the sustainability concept on a global as well as local level, recognizing that at this time in human development we are all very much connected.

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The broad interconnected issues we often think about when talking about global sustainability are population, poverty, environment, consumption, conflict, and quality of life. Specific topics of current or historical interest, such as climate change, education or health, fall under the umbrella of these broad issues. In addition to these broad issues, there are several skills that many believe to be critical to global sustainability. These include (for a more in-depth discussion of this topic see Cloud, 2010 and Nolet, 2009):

1. Taking a global perspective, including a recognition that issues, people, and places are interconnected
2. Understanding how systems operate
3. Thinking critically and making informed decisions

A decade ago, the U. S. President's Council on Sustainable Development (1996) published *Education for Sustainability: An Agenda for Action*. This document articulated a clear vision and a Federal agenda for education for sustainability in formal and informal settings and was emphatic in calling for the presence of sustainability in the K-12 curriculum as well as in the preparation of teachers. Since that time, global sustainability has become increasingly prevalent in teaching. Some states have or are adopting education standards around sustainability (e.g., Vermont 2000, Washington 2009). In the private schools sector the national governing body, the National Association of Independent Schools (NAIS), has developed an emphasis on sustainability in schools according to what they are calling “global initiatives.” NAIS’ Global Initiative seeks to “...help students become global citizens and global leaders, and to assist schools and their students in making contributions across borders.”¹

Key support for the increase in sustainability education is provided by overlaps among sustainability and some universal educational standards, including critical thinking, systems thinking, and specific subject area standards. An example of where sustainability concerns overlap with the latter is the high school National Science Education Standard F: *Science in Personal & Social Perspectives*, which includes such topic areas as “personal and community health; natural resources; environmental quality; and natural and human-induced hazards (National Research Council 1996).”

We’ve observed global sustainability teaching occurring at all levels of K-12 education. At the classroom level, teachers are using sustainability as a context within which to teach core subjects, as well as teaching sustainability as its own subject. At the school level, a great variety of schools are focused on sustainability-centered learning themes. In some cases, school districts also have a stated emphasis on or ongoing commitment to sustainability.

Our data indicate that sustainability is being successfully integrated in every state, in every grade level, and in most subjects. We recently surveyed over 1,000 K-12 teachers who had incorporated teaching for global sustainability into their classrooms. These teachers self-selected to respond to an online survey conducted by *Facing the Future*; approximately 2/3 had used *Facing the Future* sustainability curriculum and 1/3 had not. Most of the respondents taught in

¹ National Association of Independent Schools, “Global Education,” <http://www.nais.org/sustainable/index.cfm?ItemNumber=146778&sn.ItemNumber=151259> (accessed February 5, 2010).

public schools (79%) and included a mix of high school (56%), middle school (40%), and elementary teachers (15%). The teachers surveyed represent varied classroom settings and communities: they teach in 48 different states, the classrooms of 50% of these teachers include a significant percentage of students on free and reduced lunch, and over 30% of the students in the classrooms involved are nonwhite. Among these teachers, global sustainability was used as a context within which to teach core subjects (32% total in math, science, reading, writing, social studies), as well as in its own right (61% taught sustainability as its own subject). In a number of cases sustainability was taught as an interdisciplinary unit. The teachers worked sustainability into their teaching using different methods, including:

- 1-2 day activities, from 1 to 25 lessons a year used as ‘hooks’ to engage students in a core subject (60%)
- 1-2 week intensive curriculum units, containing lessons and student readings (27%)
- supplemental reading for a unit (12%)
- supplemental reading to provide the thematic background for an entire semester, or to teach an entire course on sustainability (5%)

In addition to the incorporation of sustainability into K-12 classrooms, a very exciting development is the increased interest in incorporating global sustainability into colleges of education. An example of this is Washington State’s Professional Educator Standards Board, which recently adopted *Teacher Preparation Standard V* for colleges of education which seeks to ensure that, among other things, “All students are prepared to be responsible citizens for an environmentally sustainable, globally interconnected, and diverse society.” Inserting social issues programming into these colleges can help create new generations of teachers equipped and motivated to include sustainability issues in their teaching.

Benefits of Sustainability Education

Sustainability educators provide a variety of reasons why sustainability education is needed in K-12 education. However, not all educators are equally enthusiastic or willing to commit to sustainability education. Those educators wishing to incorporate sustainability concepts into their classrooms often face resistance from other teachers or administrators in their educational setting. The obstacle we hear most often mentioned by educators is a lack of time – time to learn something new, or the time to introduce an idea external to the curriculum. This is summed up in the following quote from a department head in a medium-sized public school: “*We’d love to integrate sustainability into our classrooms, but there is little to no room in the curriculum for add-ons.*”

An increasing number of K-12 teachers, schools, and districts are including elements of sustainability education into either specific classes or as a district or school-wide thematic focus (e.g., Schachter 2009). Here’s a summary of what we’ve heard as the primary reasons that these educators are choosing sustainability education. At the end of this section are the results of a survey *Facing the Future* conducted with science teachers about what specific benefits they observed from incorporating sustainability into their teaching.

Builds essential skills

Sustainability concepts can provide wonderful context for developing the skills of **critical thinking, systems thinking, collaboration, and communication**. One teacher who had incorporated sustainability lessons into his classroom told us: *“The nature of lessons on sustainability requires that students apply critical thinking skills and that they draw from their own experiences and world knowledge. The interactive characteristic of the activities invites the participation of all students.”*

Because sustainability discussions involve current affairs and often complex global connections, the material can be used as a starting point for critical thinking exercises as students consider the many facets of an issue. Climate change is a great example of this, as it involves both science and related complex social and economic issues. Below is a table of how the sustainability issue of climate change can be used to teach required high school science skills.

Table 1. Student Learning Objectives Mapped to Science Standards Using Climate Change as the Context

Sample Climate Change Learning Objectives	NSES A: Science as Inquiry e.g., Understanding of scientific concepts; an appreciation of "how we know" what we know in science.	NSES B: Physical Science e.g., Chemical reactions	NSES C: Life Science e.g., Interdependence of organisms; matter, energy, and organization in living systems	NSES D: Earth & Space Science e.g., Energy in the earth system	NSES E: Science & Technology e.g., Abilities of technological design; understanding about science and technology	NSES F: Science in Personal & Social Perspectives e.g., Personal and community health; natural resources; environmental quality; natural and human-induced hazards
Brainstorm and discuss personal and structural solutions to climate change	X	X	X	X	X	X
Debate climate change policy from multiple viewpoints						X
Understand the impacts of climate change on living communities			X			
Describe some economic solutions to					X	X

climate change						
Explore environmental justice issues related to climate change						X
Explain the science behind the greenhouse effect and rising global temperatures		X		X		
Understand the impacts of climate change on societies and environments in different parts of the world	X					
Analyze the benefits and consequences of using various fuel sources				X	X	

Improves student engagement in learning

Distracted students are non-learning students; student engagement in learning is a key to academic success (Bowen et al. 2003). We’ve seen that real-world sustainability issues can engage students in a way that other topics or contexts do not. While there is no hard data linking improved test scores to sustainability programming, there are reports that that link student engagement to improved academic performance. From *Using Student Engagement to Improve Adolescent Literacy* (Learning Point Institute 2005):

“As anyone who has spent time with middle and high school students can attest, attempting to build the skills of disengaged adolescents is a futile enterprise. Whether expressed as passive noncompliance or passive “checking out”, the student who refuses to learn will succeed in that effort.”

Readings and activities that enable students to grapple with real-life, real-world issues and combine them with opportunities for reflection and syntheses make learning authentic. A teacher of English language learners told us: *“The students who are in the achievement gap are engaged by the curriculum because it speaks to their truths. The curriculum doesn’t leave anyone out of the picture. All people are represented and an understanding of their lives is incorporated into the lessons.”*

Facing the Future annually surveys thousands of teachers around the country about their curriculum and professional development needs and habits. Year after year, teachers

overwhelmingly talk about improved student engagement when teaching real-world sustainability issues. In one survey of over 1,700 K-12 educators nationwide, more than 50% told us that their main motivation for using supplementary curricula in general was its “superior ability to engage students.” Even more compelling is that each year over 85% of teachers surveyed say that the use of global sustainability curriculum engages their students “more or as well as anything else” they use. A middle school social studies teacher noted how a lesson on depletion of natural resources helped engage all of her students: “*The hands-on activities brought in another dimension of learning and brought my tougher-to-reach kids into the lesson.*”

Connects students to their community and inspires active citizenship

In addition to our annual teacher surveys we’ve conducted a number of studies with students, assessing their knowledge, beliefs, and behavior before and after learning about global sustainability in their classrooms. The following quotes from 7th and 9th grade students made after participating in global sustainability programming in their classrooms show the kinds of changes in attitudes and worldviews that can occur when sustainability education is taught:

“I used to say I wanted to make a difference when I grow up. After this [global sustainability unit] I realize that I can make a difference right now.”

“I think more about the world and what my purpose is in it.”

“It made me think about what is happening in the world and how much the way I live is affecting it. This unit really changed my insight on life and it really makes me want to try to do something.”

It is important to note that sustainability education can be especially powerful when an action component, such as service learning, is included. Topics taught using sustainability as the context can be overwhelmingly complex or depressing to students who are not also learning about the positive steps being taken toward sustainability, or how they can work to create a future of their own making.

Prepares students for challenges of the 21st Century

One factor that can motivate sustainability educators is that global sustainability education prepares students for challenges of the 21st century. In fact, this is why many educators enter the teaching profession in the first place. Educators express that they feel there is a moral imperative to prepare students for a globally interconnected world in which we are seeing unprecedented population levels coupled with living systems and resources in decline. Many feel that we cannot simply let our children inherit problems such as climate change, resource depletion, and poverty without teaching them the knowledge and tools to create a more sustainable future. The overriding message that educators are conveying to students with sustainability education is that solutions exist and we can build healthier communities while addressing these challenges.

Study: Benefits of teaching global sustainability in science classrooms

We surveyed 55 science teachers who had incorporated a study of climate change into their high school classrooms using supplementary curriculum. These teachers used a 1-2 week comprehensive curricular unit about climate change.² These teachers worked in a variety of situations: they taught in 31 different states, 42 taught in public schools, the classrooms of 70% of these teachers included significant percentages of students on free and reduced lunch, and over 35% of the students in the classrooms were nonwhite.

Almost all (96%) of the teachers reported that the lessons taught using the contextual framework of climate change increased their students' critical thinking skills. Most (82%) saw increased engagement in the classroom with this context, and 79% said the units "increased students' belief that they can make a difference on global issues". After using the curriculum 88% of the teachers found their own knowledge of the subject and confidence in teaching it increased, and 87% thought it improved their teaching.

It's worthwhile to note that that 20 of these teachers (over 35%) were not particularly interested in teaching specifically about climate change, but used it solely as a means to engage their students in a core science topic.

Effective Strategies for Integrating Sustainability into Education

Global sustainability is currently incorporated in a wide variety of ways into classrooms, schools, districts, states, and in non-formal education settings. Some teachers are able to teach about sustainability as a stand-alone subject, either as part of a course or in some cases, full courses. Others work sustainability into their materials as the contextual basis for core subjects, or for various kinds of student projects. There are a small but growing number of schools and districts around the country who have developed their entire school-wide theme around sustainability; that is, sustainability provides a context for learning in all subject areas.

Below are descriptions of the four major approaches that we've seen educators use to incorporate sustainability into their learning environments, along with some examples taken from U.S. classrooms.

Strategy 1: Sustainability as its own subject

In some cases, teachers and schools may be able to teach sustainability as a stand-alone subject, not necessarily tied to particular core content learning standards. There are different variations on this approach: sustainability may be the subject of an entire course, it may be taught as a thematic unit within a core subject course, or it may be incorporated as a single lesson.

Supplemental curriculum, particularly activity-based lessons, is a great way to insert sustainability into classrooms. Described below are two sustainability-based lessons, followed by teachers' comments about these activities. We have seen these particular lessons

² This unit, "Climate Change: Connections and Solutions," is available free via download on *Facing the Future's* website: www.facingthefuture.org.

adopted for use by teachers in middle and high schools, as well as in interdisciplinary settings.

Example 1: Sustainable Fisheries, Migration, and Conflict

This lesson is in wide use, and presented in different forms by various curricula providers.

Students are divided into small groups, each with a bowl of M&M-type candies. The students are told that the bowls are their oceans, and the candies are the fish. Students are given straws with which to ‘fish’, and told that there will be several fishing seasons. The only rule is that students must each catch 2 ‘fish’ each season to feed their families and survive until the next season (see picture #1). After each fishing season, the ‘oceans’ are replenished on a 1:1 basis - students taking all of their ‘fish’ in the first season are faced with no replenishment, and an empty ocean. As the lesson goes on, a few students are given spoons with which to fish (instead of straws); this new ‘technology’ makes it much easier to ‘fish’.

What typically happens as this lesson progresses is that one or more groups of students empty their oceans. Because they haven’t been told they can’t, these students may then migrate to other students’ oceans and try to take their fish. This predictably leads to conflict, often with students wielding straws fending off their classmates with spoons. When the lesson is over the teacher can take the discussion and subsequent work in a number of directions; for example (s)he can talk about sustainable harvesting, or the effect of resource depletion on emigration and on conflict, all of which link to current global realities.

One high school history teacher had this to say after incorporating this activity into her classroom: *“Hands-on activities generate an experience that reaches many students who cannot connect with text. The ‘Fishing’ activity has supplemented my current unit and allowed students to visualize the impact on our oceans, rivers and streams.”*



Picture #1: Middle school students practicing sustainable ‘fishing’

Example 2: Ecological Footprint and Social Equity

In this activity-based lesson students are placed into groups of four or five and asked to think of something they use or enjoy in their everyday lives. The students draw a picture of the object on a large piece of paper (often using color). Once the students have done that, the teacher asks questions about the origins of the component parts; for example, if the students choose a hamburger, the teacher would ask them “Where does the meat come from?” Students might start out by saying “the store”. Additional questions lead the students to track back the ultimate origins of the product. For hamburger meat this would include cows, pastureland, and water. Students are then asked to identify the impacts of the various elements, for example, pollution resulting from transporting the meat from the butcher to the store.

The end result of this lesson is a map of all of the externalities associated with everyday objects that are familiar to students (see picture #2). This includes things like chemicals used to create the product and associated pollution (such as pesticides used in vegetable production), labor and associated human rights issues around production for athletic shoes, and fair trade issues around coffee and chocolate production and distribution. Some of the objects we’ve seen students choose to “map” include snowboards, SUV’s, toilet paper, and pizza.

This lesson grabs students’ attention as it starts with something that is interesting to them. Teachers see a real ‘aha’ moment as students grasp how choices in their everyday lives affect the world around them: What does it really take to create a hamburger? How does chocolate get from trees in Africa to stores in the U.S.?

One middle school language arts teacher shared the following observations with us about the impact of this activity on her classroom: *“Every one of my regular students was actively engaged in the “footprint” activity -- even those who rarely ever speak in class. The issues they find in this type of curriculum are things they feel directly connected to. It is very relevant to their lives today and what they are hearing and reading in the news and seeing in their own communities.”*



Picture 2: Student artifact mapping the ecological footprint of socks

Many educators create or use 1-2 week thematic units to bring sustainability issues into their classrooms. In most cases they build the units up from simple activities, such as those

presented above, by integrating the activities with readings and projects. We've seen the popularity of this approach rise as more teachers want to try to insert sustainability issues into their classes in concentrated segments. Popular topics include climate change, poverty, and sustainability as a whole.

Strategy 2: Sustainability as the context within which to teach core subjects

Global sustainability provides an authentic and engaging context for teaching core subjects. We've seen this approach taken in particular by science and social studies teachers. For example, when teaching about chemical bonds, a chemistry teacher might discuss how carbon's chemical structure is connected to global climate change. As noted above (Table 1), contextual and personal connections make up a portion of most educational science standards, and sustainability issues such as climate change provide a great backdrop for linking science to its compelling social issues.

We've also seen this approach taken in math classes. Below is an example of how one teacher used sustainability as the context within which to teach foundational algebra and geometry.

Example: Math: Area and Transformations - Wildlife Habitat

At the Community Learning Center East, an alternative school for at-risk 7-9th graders in Florida, a math lesson on area and transformations became a catalyst for a school-wide habitat project. The lesson introduced the students to the concepts of geometric figures and transformations by having them calculate the dimensions of snow leopard habitats in the Bronx Zoo, the Naltar Wildlife Sanctuary in Pakistan, and the Ajar Canyon wildlife preserve in Afghanistan. The students' interest was piqued as they learned about an endangered species they have never seen. After getting hooked on these math concepts through the lesson, students went outside their classroom to investigate their own 'habitat' around their school. What they found was a lot of weeds and very little "green stuff." Using their new-found math skills, the students determined the requirements and parameters for a school garden. They calculated the perimeter of the garden's planting area, the area of weed cloth required and the volume of mulch needed. As the project grew within the school it became interdisciplinary, involving the Language Arts teacher who worked with students on conducting research and persuasive writing on native plants and habitats. As a result of this project, community relationships were established, including connections with several related groups including the local native plant nursery, the National Wildlife Federation's backyard habitat resources, and the Florida Native Plant Society. Ultimately the school's garden became a showcase for the students and the schools, and they developed and conducted tours for the public which generated local publicity. As the lead teacher for this project reflected on the curriculum and the project, she said, "*Rather than using prescribed practice items, this provided real world skills. It wasn't an add-on, but just a replacement of less effective materials.*"

Strategy 3: Sustainability projects

Project-based learning is incorporated into many schools and the interest in this approach is growing, particularly for culminating/senior projects, 'Project Weeks', and to fulfill service learning requirements. Global sustainability provides an incredible platform from which to base a breathtaking array of projects. Below is an example of how the social justice element

of sustainability was used as the context in which students engaged in a service learning project.

Example: Service learning at Morris Brandon Elementary School in Atlanta, Georgia
In a 4th and 5th grade Connections class at Morris Brandon Elementary School, students went beyond merely learning content about some of the social justice issues involved in sustainability, and engaged in a service learning project to benefit CARE. To jumpstart this topic in her class, the Connections teacher invited a representative from CARE who had spent several years in Kenya as a refugee from Uganda to come in to speak to the class about refugees. After this first-person account of what it was like to be a refugee, students participated in a simulation-based lesson developed by *Facing the Future* called “Seeking Asylum” (the activity can be downloaded in its entirety from the *Facing the Future* website). Through this lesson students experienced the difficult choices and struggles facing refugees and internally displaced persons (IDPs). Students (in family groups) are told that civil war has broken out, forcing them to flee from their homes, and that they have two minutes to decide what they want to take with them. Students who remember to bring their ID cards become refugees, while the others end up in an IDP camp. Each group has to come up with a plan for what they will do to survive. In addition to the simulation, students researched refugee issues on select websites including The United National High Commissioner for Refugees, Anatomy of a Refugee Camp from CBC News, and Medecins Sans Frontieres.

After they did “Seeking Asylum” and read some articles about real refugee situations, the class did a ‘refugee walk’ to raise money for CARE. During the 40 minutes of class, everyone went out on the track and walked as many laps as possible. The students had gotten pledges for the amount of laps they could walk. The students and teacher carried backpacks, blankets and other household items to “empathize” with the refugee situation. This was a simple way to raise money that did not involve after school activities, parents permission forms, chaperones, or transportation (some of the many hurdles to implementing service learning projects).

Strategy 4: Sustainability at the school-wide or district level to guide institutional and curricular innovation - thematic

In a handful of schools and districts around the country, sustainability is becoming an integrating context for “greening” the facilities and curriculum across subjects and grades. One such example is the Gladstone School District in Oregon. Located about 15 miles south of Portland, the district educates about 2,000 students, 50% of whom are enrolled in the free and reduced lunch program. What ultimately is becoming a comprehensive sustainability initiative started with a \$40,000,000 bond measure that was passed in 2006 (Gladstone School District). As administrators began planning for facilities renovations in the district, some spurred their thinking on the advantages of greening their facilities, and as a result the school board developed a ‘sustainability goal’ for the district. The district has worked closely with the regional community as the work has progressed. As a result, they have reached out and developed new partnerships with higher education institutions, statewide sustainability groups, and the renewable energy community. The building renovations and improvements have served as a touch point for innovation in teaching and learning. A sustainable curriculum development team was formed to infuse sustainability themes into the

classroom, and student involvement on the campuses is increasing. A video of the some of the work going on at Gladstone is available on the district's webpage at: <http://www.gladstone.k12.or.us/Videos.html>.

Looking Ahead and Resources

The multitude of approaches to incorporating sustainability education into existing curricula and educational settings means that teachers from all different situations can teach sustainability in ways that are appropriate for their unique circumstances. From a single lesson to a district-wide theme, sustainability can be taught to all U.S. students. We have seen that even teachers resistant to adopting new things or accepting sustainability as a legitimate educational construct will put it into their classrooms when it meets their needs, which could be anything from covering core subject learning standards to meeting service learning requirements.

A number of sustainability education resources are available for curricula, programming, professional development, and consulting, whether it be for inserting a few lessons into the curricula or establishing sustainability as a thematic context for a district. All of these sites are good starting points as they all provide extensive lists of additional resources.

The Cloud Institute for Sustainability Education: <http://www.sustainabilityed.org/>

Facing the Future: <http://facingthefuture.org/>

Shelburne Farms: <http://www.shelburnefarms.org/index.htm>

U.S. Partnership for Education for Sustainable Development: <http://www.uspartnership>.

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