Interdisciplinary education in sustainability: links in secondary and higher education

The Northampton Legacy Program

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Abstract Describes The Northampton Environmental Legacy Program, which links studies of the historic culture of Eastern Shore life with an awareness and understanding for the importance of environmental quality in this region. Over the six years’ duration of this pilot program, instructors have found that when this unique environmental/cultural instruction process is superimposed on an interdisciplinary blend of traditional high school teaching (math, science, language, literature, history, etc.), the students’ learning experiences are put into a context much more aligned to their life experiences. Program results have been significant. Because of the success of this program, a strong message is being sent to institutions of higher education. In preparation of future teachers, college/university curricula will need to offer an opportunity for developing exceptional skills in interdisciplinary teaching, so that new teachers can move seamlessly into high school programs already developed along the lines of the sustainable education model described here, and equally important will be the training of future teachers who can develop these new programs of education in sustainability at the high school level, where they do not yet exist.

Introduction
In our quickly advancing technology and information age, it is imperative that education focus upon encouraging students to “think outside the traditional box” if they are to fit into the technological society of tomorrow, be successful as adults, and have the ability to achieve a sustainable future through informed and effective decision-making (Orr, 1994). In particular, with all the pressures placed on education by a highly technological world, it becomes extremely difficult to address the needs of students not receptive to traditional educational approaches. Likewise, students capable of taking advantage of an advanced technological education process often gloss-over basic principles important to their real life, and its sustainability, in the ever increasing demand for new knowledge. As a result, these young adults are either left out of the “mainstream” or left unaware of interconnections between society and the natural world (Flint, 1999). Alternative ways must be found for both “kids at risk” and those on a fast-track to a technological future to relate their education
to the place they call home and the environments that ultimately support their future, irrespective of technology potential.

Environmental education techniques offer a good model upon which to mold curricula that are interdisciplinary and afford the student the ability to learn critical thinking, problem-solving, and effective decision-making skills toward achieving sustainability in a multi-issue atmosphere that replicates real world situations (Cortese, 1992). This multi-dimensional approach is founded upon a combination of cultural, environmental, and traditional learning. Our experience on the US Virginia Eastern Shore over the last several years has demonstrated that if we can present young adults with a meaningful education that relates their cultural heritage and the special features of the environment in which they live to traditional, as well as evolving, methods of teaching high school disciplines, then our success of achieving a literate, well-informed population knowledgeable of sustainability issues is significantly increased (Flint, 1996).

**Sustainability education model**

As more of society becomes focused on sustainability and its philosophical foundation, new dimensions are called for in education (Lubchenko, 1998). Consider the great shifts over recent years in public attitudes about diet, exercise, fitness, preventive health, and wellness; or about pollution, global warming, and atmospheric ozone depletion (Flint, 1999). Such agendas have begun to sink in. Tough issues remain, however, that are going to require a new way of preparing the public at large as well as the graduates of our educational institutions that have to deal with complex, interconnected issues.

To-date, a lack of recognition for the connectedness of things has been partially responsible for adverse environmental impacts, economic failures, social programs that do not work, and difficulties in achieving world-wide sustainable societies (Orr, 1994). In order to find solutions to complex, multifaceted problems related to living sustainably, today’s students must be exposed to techniques of teaching that directly involve them in diverse interdisciplinary collaboration, the creative process, advanced technology, cross-cultural communication, economic development, and environmental ethics and values, to name a few (Jenks-Jay, 1995). This integrative approach will also result in the production of a new generation of scientists that are both sensitive to the intrinsic value and inherent worth of the natural environment and responsive to the fact that science and technology should be used for nature’s sake and not simply as a means to exploit nature for society’s continued use (Jacobson, 1995).

Science for example, is a valuable tool to examine the understanding of our place in nature and the utilization of natural phenomena for human purposes (Orr, 1992). We can and should design curricula, however, that will provide opportunities for the student to place science in the proper perspective. The goal is to teach the future professional the real need for continued examination of linkages among economic, social, cultural, technological, and environmental issues in achieving a sustainable, global society through the use of science
(Lubchenko, 1998). Students should also be taught to realize that issues involve moral choices and that information from several disciplines enables them to make more informed decisions.

Our students live and will work in a world where information from several disciplines must be integrated. Obviously, individuals cannot have all the specialized knowledge relevant to a decision in their private, work, or civic life. They must realize, however, that such information is relevant and available. We need to prepare a “new” graduate that is able to feel comfortable in a multi-disciplinary framework (Flint, 1999). Such an approach would enable graduates to apply their learning to the needs of real world problems and real people. Cross-disciplinary education enlarges the students’ awareness of issues and methods beyond their own disciplinary enquiry, enabling them to explore the interrelations of these issues and methods, and encouraging students to regard their own studies in a broader social and ecological perspective.

Curricula can be “packaged” to emphasize the connectivity among scientific, social, economic, technological, and cultural experiences, demonstrating the relationship between high quality environments and the other aspects of people’s lives. Through this approach, students also become much more aware of and sensitive to the obstacles to a sustainable future for our global society by grounding the “stuff” of science education in real life and real problems (Cortese, 1992). Likewise, an urgency exists for innovative interdisciplinary education approaches that “mimic” life in the community and the natural environment so that the boundaries between education and community life become less defined and therefore, more integrated (Orr, 1992).

By using sustainability as an integrating force, especially in science education, we can improve and facilitate academic and community relationships. If sustainability and its foundation in science, math, technology, and socio-economic learning is to become a paradigm for analysis, decision-making, planning, and action, it is essential that it be incorporated into the instructional practices of our educational institutions, which in turn can also strongly influence programs for community education (Flint, 1999).

As a litmus test for the ability of our educational institutions to produce students able to envision a sustainable future, high school graduates should possess:

1. the knowledge to comprehend linkages among all living things, and their dependency on each other as well as the physical environment;

2. the understanding for basic principles that govern natural systems and the ability to apply this knowledge to the limits to, and major factors associated with, earth’s capacity to sustain life;

3. the ability to cross the boundaries of very diverse disciplines, including the understanding for cultural, economic, and political forces – both past and present – that affect environmental attitudes and decision-making based upon science and technology understanding;
the skills to better understand connections between science/technology and the natural/cultural environments;

(5) the talent for seeing “the big picture” in employing scientific method and technology as organizing tools to enhance a community’s capacity for using local assets to build sustainable communities;

(6) the competence to think at a level where one can integrate scientific knowledge, economic and political realities, historical and cultural experiences, and moral, philosophical, and aesthetic values;

(7) the skills to engage in scientifically, socially, and culturally informed dialogue on environmental issues in communities in which the person works and lives;

(8) the respect for the “public way of knowing” as well as the “expert way of knowing”; and

(9) the understanding for how people organize as family, community, etc., and how activities used to meet needs affect societal health, environment, and quality of life for present and future generations.

Value of sustainability education on Virginia’s Eastern Shore
Socio-economic conditions and quality of life on the Virginia (USA) Eastern Shore (which includes the two poorest counties in the state, Accomack and Northampton) have continued to decline over the last several decades (Smutko, 1995). Ironically, although this rural coastal region possesses a wealth of natural resources, many of the Shore’s population, especially the minority population, is poor. More than 20 percent of Northampton County, Virginia households are considered below the poverty level in contrast to 10 percent for the Commonwealth of Virginia as a whole. At least 15 percent of Northampton households do not possess indoor plumbing.

A generation ago, the opportunities for young Eastern Shore men and women were in agriculture and the seafood industry (Durham, et al., 1997). It was quite possible and acceptable for a young person with the ability to “sign clams,” work “crabpots”, or build “fishtraps” to make a life and a livelihood on the water. It was equally viable for that same young person with a background in agriculture to make a comfortable career, afford a home, and live their life in the respectable simplicity the area offered. Today, the clams are big business and the independent waterman is nearly a memory. Those same young people who made their living “signing clams” and “pulling crabpots” 20 years ago are now security guards and store clerks making half what they did on the water. And the family farm has become more valuable as a real estate venture and subdivision.

Thus, the Eastern Shore is typical of many other rural, poor areas in that young people with ambition find they must leave in order to have a career and support a family. This eventually can become a crippling tragedy to a region. Any community which cannot sustain its youth cannot sustain itself for very long. Regional demographics now indicate that the young are moving away and retirement communities are growing as suburban sprawl. This revolving
door invites the loss of culture and the loss of natural connection between a
place, its people, and its past. Those who knew the skills, the art, the
craftsmanship, and the nuances of living on a pristine peninsula are
disappearing and no new generation is taking their place.

In response to the needs of many “kids at risk” from these quickly changing
communities, Northampton County High School staff developed an
Environmental Legacy education pilot program in 1993 to reach out to students
with special learning needs. This program adopted a methodology for
integrating environmental and cultural issues into a high school educational
protocol that addressed the needs of culturally, socially, and economically
deprived, under-motivated students in a manner that literally gets these kids
“excited to learn”, because of the context within which this learning is placed. In
essence, this pilot program introduced students to learning relevant in their
daily life struggles.

African-Americans represent more than 50 percent of the Northampton
County population and numerous surveys in recent years have illustrated their
lack of awareness and appreciation for environmental and cultural issues that
not only are the foundation of their heritage but also represent a means for
improving their quality of life through new and innovative job opportunities
(Durham, et al., 1997). By carrying out the Legacy Program in a rural school
district that represents a large population of poor, minority people, and is also a
US Department of Agriculture and US Housing & Urban Dev. designated
Empowerment Zone/Enterprise Community area, the School District is offering
an understanding concerning the importance of sustainability and
environmental quality to sectors of society that do not always connect this
importance with their socio-economic well-being. By its focus on poor, minority
groups and its methodological approach, in essence, this program also makes
significant advances in the area of student learning and awareness with
regards to environmental justice.

**Legacy Program philosophy**
The Northampton County School District, which operates under the motto of
“Educating Today for our Children’s Tomorrow”, has a student population of
approximately 2,500 and has received a number of awards in the last several
years regarding its innovative and successful approaches to education. As one
of these approaches, Northampton High School developed the Environmental
Legacy Education Program in 1993.

Legacy was not originally conceived as a vehicle for sustainability. Instead,
the Legacy Program, in its pilot stage, was designed to reach a student audience
not always assisted by traditional educational approaches. It grew out of a
grassroots, community request for an academic program that would highlight
the history and culture of the Eastern Shore. The program focused upon the
objectives of researching, recording, and saving the rich cultural and natural
heritage of the region. Of course, it did not make sense to tackle the past and
neglect the present. So Legacy evolved into an environmental program as well.
The third branch of this trilogy was the students themselves, who are the most critically sustainable element in any community. What emerged quite naturally from this combination was a curriculum of connectivity, a program that literally and figuratively leaves the confines of the school and creates much of its subject matter from the collective memory and experience of the community itself. The partnerships that have resulted from this process are numerous. In the course of their Legacy studies students become involved with dozens, maybe hundreds of people, businesses, and organizations.

This program improved upon generic approaches to environmental education because it linked accepted environmental teaching methods with a student’s learning about culture, heritage, and traditional disciplines (Orr, 1992). The approach followed a community-based, multi-disciplinary curricula, patterned after the highly successful Foxfire effort used in the rural mountains of Georgia (Dewey, 1963). Unlike many “add-on” environmental curricula, the Legacy Program was designed to integrate within the normal teaching package, which would be attractive to administrators and faculty of most high schools. Heterogeneous groupings of students, through facilitated instruction, tackled the Commonwealth of Virginia’s “Standards of Learning” for biology, English, and local objectives of an Eastern Shore-based social studies elective. The program facilitators included English, social studies, and biology instructors, who team taught the program during a three block day. This arrangement not only allowed students to learn from teachers, but students to learn from students and teachers to learn from teachers.

**Curriculum strategy**

The Northampton Environmental Legacy Program links studies of the historic culture of Eastern Shore life with an awareness and understanding for the importance of environmental quality in this region. Legacy students are given the team task of building their own boats (kayaks and canoes), and then are provided the opportunity to use the boats they have built to explore and scientifically measure the coastal marine environment that surrounds them, as well as to learn about the historical culture that depended upon this environment.

Over the six-year duration of this program, instructors have found that when this unique environmental/cultural instruction process is superimposed on an interdisciplinary blend of traditional high school teaching (math, science, language, literature, history, etc.), then the student’s learning experiences are put into a context that is much more aligned to their life experiences. Through their participation in this curriculum, students find themselves in a culturally significant boat not only analyzing and evaluating their relationship to the aquatic environment, but also learning about a past culture extremely important to Virginia’s Eastern Shore, which is unfortunately now disappearing. This experience offers students both an aesthetic and functional appreciation of their environment and the place they call home.

The principal instructional methods used in the Northampton Legacy Program are the “experiential learning” concept advocated by John Dewey, and
modeled in the “Foxfire Program”, and the Socratic techniques used in the “Paideia Seminar” method (Dewey, 1963). Many teachers, when faced with classes of reluctant learners, typically resort to a control method of instruction which mirrors the “sit and listen” or “worksheet” approach. With reluctant learners, such as those exemplified in many at-risk groups, these methods result in either total apathy or additional behavioral problems. They are far removed from outcomes, such as problem-solving, development of team work, confidence building, and accomplishment. In addition, these “control methods” usually serve to widen the gulf between the community and the educational system. Community members are seldom invited to speak to “these students”. What teacher wants to showcase their reluctant learners?

Mrs Clinton, wife of the US President, says it takes a community to raise a child. In the Legacy concept, the community also takes part in that child’s education. Legacy students often are found learning conservation from a conservationist; marine biology from marine biologists or college professors; and about life and living from those with whom they share a community.

The Northampton Legacy Program, however, is not about becoming a boat-builder. Students build boats and the boats are a tool that functions to make the local waters a community in which they belong and an activity around which they build team work and leadership skills. The building of the boat is not an end in itself. The boat is a vehicle to create a relationship between the builder and the environment. By involving the builder in the environment from the paddles of a boat that he or she constructed, an appreciation for that environment is evolved. Using these links, an existing environmental curricula is used to stimulate understanding of relationships between humans and their surroundings. Selected curricula highlight the balances and imbalances inherent in an ecosystem. Students are given the opportunity to understand the needs environmentally, economically, and aesthetically for a healthy ecosystem. They also become aware of obstacles to a healthy ecosystem. All of this is then placed in the context of their general high school curriculum, which causes them to much more appreciate their basic learning needs.

For example, as part of their English studies, Legacy students are required to write letters to businesses and individuals requesting donations of materials, tools, or money for the boat-building program. Students are also required to help draft any grant proposals that might be needed to support parts of the program. As a result, the writing becomes real work as opposed to just school work. The students receive tangible rewards for their efforts, first in the mail and then in their own hands as they construct their boats.

The study of grammar is also reinforced by the example of boat construction. The class creates a working analogy to demonstrate how the boat parts are assembled in the same way a sentence is assembled. The analogy works further to demonstrate how these parts have similar functions. For example, a verb functions like a paddle, an adverb like a rudder or keel, a conjunction like screws and nails, and the preposition like a compass or chart. Clearly, as the class progresses, the learning and the boat-building become mutually sustaining activities.
Six years of results

It is disheartening to face a classroom of students whose cultural heritage is deeply dependent on agriculture and seafood and find that they feel no particular connection to this culture, nor do they have an understanding of many of its more practical components. Sadly, many students from the Virginia Eastern Shore area have never been on a boat, never caught a fish or a crab, and cannot even swim. The Legacy Program is designed to address this lack of cultural identity. Not only do students build boats, but they use them in a setting where the boats are a cultural, historical, and ecological component of their own past.

Because of its unique approaches to education, from its start the Legacy Program was well-publicized and highly-regarded. The first couple of years (1993-1995) included the construction of canoes and kayaks by Legacy students and the actual use of these boats on a local creek. This boat-building project was praised by many in the private sector as “what education should be” and has become the centerpiece of the program. The instructors use the boat and its construction to teach team work, math, grammar, writing, biology, and history. An indication of the value that others have placed in this program design is suggested by the more than 200 inquiries from other school districts and the media coverage from more than 15 magazine and newspaper articles over the first three years.

Typically, the boat explorations center on the salt marsh, tidal flat, and barrier island ecosystems. Following a winding gut through the marsh, these young explorers might find themselves on a tidal flat in a broad lagoonal bay. The instructors can use this opportunity to give a lesson in the biology of a clam. After having instruction in one particular “clam sign” (a figure-eight shaped key-hole on the exposed flat), students prowl the mud and sand with bent back on hands and knees. When repeated attempts fail to expose the elusive clam, they return for more detailed instruction until one or two acquire the knack and then they become instructors. And soon a seemingly barren expanse of mud and sand, something to be religiously avoided by most recreational boaters, has become a gold mine of learning and life forms.

Experiences such as these lead to a natural connection between multiple academic disciplines. It becomes the fodder for reading and writing, the touchstone for historical understanding, and the genesis for scientific curiosity. These experiences have also evolved into more elaborate activities, such as our more recently evolved oyster project. Legacy students are now cultivating oysters in an effort to understand their physiology, learn how this beleaguered neighbor can be restored in its natural habitat, and discover how improving water conditions in the Chesapeake Bay will lead to enhanced oyster populations.

Legacy students take their boats, or their boats take them, to other places as well. Operation of the county landfill, the building of a new span to the 17-mile Chesapeake Bay Bridge-Tunnel, or the construction of a golf course can be tangibly related to the plight of the ecosystem and to the economic importance and role of development. The answers to the questions are real, and they are...
connected by the boat to the clam, to a parent, to a job, to the future. They relate to the necessities of daily life and the difficulty in making trade offs in order to preserve and protect.

But it does not stop there. The students visit a school board meeting and make an unrehearsed presentation of their program of study. They are invited to educational and environmental conferences to assemble boats and explain the connection between boat building and the larger issues of education, environment, and culture. They help conduct a summer program for other teachers who want to begin a Legacy Program in other schools and communities. They design and implement a separate program to share their work with elementary school students and then make that presentation on over two dozen occasions to more than 700 first, second, and third graders. Back in the classroom, students write letters to individuals and local businesses and organizations soliciting contributions for material and equipment. If they want a boat, they have to raise the money. It is a fundamental connection between academics and the larger world.

But the connection does not stop there. Invariably, a contributor is intrigued and shows up to observe the work. They might later join the class for a paddle around Raccoon Island. Others have purchased their own materials and built a boat alongside the students. Still others have commissioned the class to build boats for their personal use or as presents for others. The list goes on, succeeding simply because it makes sense. And the community at-large is involved in the educational process.

As a result of the pilot program’s successful first two years, and because of the regional US Fish and Wildlife Service’s desire to offer educational opportunities to a local school, the Virginia Eastern Shore National Wildlife Refuge agreed to provide the Legacy Program an off-campus location for the 1995-1996, 1996-1997, 1997-1998, and 1998-1999 school years. Students were provided with a lab, museum/classroom, workshop, and free access to all areas of the refuge.

The results from this program expansion have been significant. In the initial years of the program, students took the Iowa Standardized tests in reading comprehension, science, and social studies. They had also taken this test in the eighth grade. So we were able to measure their improvement from eighth grade to tenth grade compared with the improvement of the entire Northampton High School student body in that same time period. Legacy students fared better across the board, despite the fact that they were not a representative cross section of the school as a whole. In reading comprehension Legacy students were 5.8 percent better than their classmates, in science 4.7 percent better, and in social studies 6.4 percent better.

In 1996-1997, the state of Virginia went to the SOL (Standards of Learning) testing process. The first set of Legacy test scores available for comparison was for the 1998-1999 school year. The results were remarkable. A total of 14 Legacy students took the biology end of course test. Of these, six were special education students; the remaining eight students had a cumulative high school grade point average of 1.9 or a D+. Despite this obvious handicap, 13 of the 14
Legacy students – 93 percent – passed the test. This was much higher than either the school or the state average. The one student who did not pass only missed by two questions. During the same testing cycle, two of the Legacy students were juniors and took the multiple end-of-course tests for English 11. They passed three of the four tests, which, again, was better than the school or the state average.

Evaluation of the Legacy Program after six years also included a comparison of milestones reached with the listing of nine criteria presented earlier in this paper regarding the “litmus test” for producing students literate in issues of sustainability. The Program was judged to address six of the nine criteria. For example, the design of the program was intended to offer students a better understanding about linkages in the natural world and their dependency upon healthy environments (criteria No. 1). This was measured as successfully achieved from the assessment of awareness students demonstrated in their carrying out of different class team projects. The oyster project proved to be a good measuring stick for determining that students were understanding the basic principles that govern natural systems (criteria No. 2), including concepts of limits and carrying capacity. The fact that instructors were able to associate boat-building exercises with teaching in math and English for example, provided evidence that students were crossing boundaries in their learning experiences (criteria No. 3). Reference by students in numerous class activities to information they obtained from field trips and discussions of regional development projects, and their impact on the environment, demonstrated their ability to connect science and technology as well as environmental protection and cultural needs (criteria No. 4). The team presentations by students to regional groups, including the County Board of Supervisors, illustrated their learning and ability to connect environmental issues to the science, politics, and culture of community concerns (criteria No. 7). And finally, the students realization through class reports and essays that the changing regional landscape has significantly changed the culture of their ancestors was found to be an important feedback loop in the students connecting the importance of their heritage to their present lives (criteria No. 9).

Most impressive of all evaluation statistics, however, included influences on high school graduation rates. Since 1993 110 students have taken the Legacy Program. Approximately 50 percent of these students were designated “at-risk.” Nationwide, almost 40 percent of “at-risk” students do not graduate. Here again the Legacy Program bucks the trend. Of the 110 students who have completed the Legacy Program, only three have subsequently dropped out of school.

Conclusions
As a pilot effort, the Northampton Legacy Program started out to address the educational needs of “kids at risk.” As the program has evolved and had significantly increasing success at reaching this segment of the student population with the teaching approach of education targeting sustainability in the student’s life experience context, the program has been attracting the
attention and demand of “mainstream” students. This further speaks to the pilot program’s design worthiness in approaching sustainability education, both at the high school level and beyond.

While these results are significant, it is important to realize that Legacy is neither magic nor miraculous. The problems that plague conventional classrooms are present in Legacy as well. Too many students continue to fail one or more classes. Absenteeism is a problem. Chronically low expectations are a problem. Apathy is a problem, even when a boat is on the line. Luckily, the Legacy Program already has in place the necessary tools to address these conditions. It is the continuing challenge of the teachers, the administrators, and the community to better use these tools so that we reach more students and so that we impact their lives as well as their test scores.

A large portion of our global population has the notion that environmental protection is an albatross designed to cripple economic and social advancement (Cortese, 1992). Anyone with limited experience and limited or selective education is vulnerable to these ideas. In most education settings the students offered the advantages of environmental experiences are typically those from higher socio-economic backgrounds for several reasons:

• they are generally not behavioral problems;
• they are usually more willing to attempt something new, because they have had prior favorable experiences;
• they have the disposable income to take part in different opportunities; and
• they already have an identity that includes certain environmental aesthetics.

The method that Northampton High School has designed and tested, while certainly appropriate for the above individuals, is also intended for others. By empowering economically depressed and/or at-risk individuals to control their education, we develop a self-confident, decision-maker of a new order. By further wrapping this around high priority environmental issues that historically have determined the livelihood of these same individuals, we are creating a new breed of environmentally and sustainably literate citizen.

Because of the success of this pilot program at the secondary school level, a strong message is being sent to institutions of higher education (i.e. colleges and universities). In preparation of future teachers, college/university curricula will need to offer an opportunity for obtaining exceptional skills in interdisciplinary teaching. In this way, new teachers can move seamlessly into high school programs already developed along the lines of the sustainable education model described here. Equally important for institutions of higher learning, however, will be the training of students to develop these new programs of education in sustainability at the high school level, where they do not yet exist, so that the momentum developed by this demonstration project can grow. Only then will significantly more high school students be able to benefit from these new approaches, influenced by new college/university trained teachers.
By providing students with the tools necessary to participate as active members of their communities, having the creative problem-solving skills, social literacy, and commitment to engage in responsible individual and cooperative actions that will lead to ecologically viable, socially just, and economically secure societies for present and future generations, results from the pilot program suggest that we can instill in them a caring for the environment as citizens and perhaps one day as science professionals, trained to protect and restore their birthright and their legacy.

References