

Environmental Education in U.S. Public Schools: Fostering a Culture of Sustainability

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Combating the Status Quo

As society has begun to see the importance of environmental issues and the need for sustainable alternatives to current practices, the U.S. has struggled to make necessary changes in the face of well-established, but environmentally naïve, infrastructures. While special environmental education programs have become more and more common, general environmental education in public schools has been neglected in favor of more traditional subjects and an orientation toward standardized tests and entrance requirements for higher education. This lack of environmentally focused education in public education ignores the fact that the root of most environmental problems, which are ultimately human problems, is ignorance of ecological systems, their impact on human populations, and their vulnerability to human interference

The myriad environmental problems facing our world today make the need for comprehensive and motivating environmental education ever clearer. In the world of school administrators who encourage teachers to emphasize material that will be covered on standardized tests, environmental education is hardly seen as a priority, and the majority of the environmental education that does exist is provided by outside experts in a hierarchical, instructor-to-student, fashion. Because of the urgency of many of the environmental problems facing both local and global communities, environmental education which engages all members of society – children, parents, and community members – in identifying

environmental problems and solutions will be necessary in order to foster the culture of sustainability which we desperately need.

In this paper, I explore the current status of environmental education as part of public education in the state of Minnesota, and present a comprehensive and detailed report identifying my reform aspirations, accompanied by a strategic plan of action. My reform initiative addresses the three major areas of needed improvements which are suggested in my assessment of current environmental education in U.S. public education. These areas are: 1) Teaching and learning structure; 2) Curriculum; and, 3) Evaluation.

No Room for Questions

The current teaching and learning structure for environmental education is similar to that of most kinds of formal education in the U.S. today. That is to say that the basic framework relies on top down instruction, in which experts (school teachers or outside instructors) relay information (in the form of discrete facts) on to students. With this in mind, it follows then that the emphasis in public education would be product (what information has been memorized) rather than process (how children are learning to learn, think and ask questions). In the current structure, there is little space for student engagement or inquisition, and even less opportunity for parent or community involvement. Regarding environmental education specifically, most programs exist outside of the public school system, and as such, tend to be optional, limited in scope and short term. Programs that are integrated in the public schools are generally based mainly in environmental science and are usually limited and sporadic, not to mention expensive.

The urgency of most environmental issues demands more than just an investment in the environmental literacy and values of young people, something which currently goes largely unaddressed in most public schools. Environmental education must aim beyond the traditional education of students and must work to reach older generations as well if these problems are going to begin being addressed now. With major problems like climate change, limited natural resources, habitat destruction and environmental pollution, we don't have the time for potentially eco-literate children to grow up and make changes. Changes must be made now, which means that environmental education must foster intergenerational and intercommunal learning. Although students are becoming more environmentally literate and concerned, most adults rely on the media for their limited environmental education (Ballantyne, Fien & Packer, 2000).

The environmental education that is available to students does not generally encourage engagement or experimentation, and often, ironic as it may be, students do not spend any time outside of the classroom. These are major drawbacks of the current system and illustrate a broader trend in public education which stifles creativity and inquiry in the name of teaching material that will be covered on standardized tests in the most efficient manner possible. Fostering a culture of inquisitive learning is one of the most important services that good environmental education has to offer. By getting students engaged in real-world examples and supporting a synthetic understanding of complex and pertinent issues, environmental education has the potential to inspire a shift in the way that students engage with their education.

More than Just the Facts

The curricula of current environmental education programs fall into two categories.

Programs which are outside of the public school system may provide out of classroom experiences but they tend to be limited in scope, and if they are commissioned by a school to come into classrooms, their lessons tend to focus on passing on as much information as possible while expending as little time (and money) as possible. Programs within public schools, on the other hand, are generally embedded in one subject, usually science, making their focus unnecessarily narrow, and provide little, if any, out of classroom experiences. Again, the emphasis is usually on passing on discrete facts rather than engaging students in inquisitive learning.

A major problem with environmental education curricula in public schools is the fact that the material covered is usually constrained by state and federal standardized tests. The fact that very little regarding environmental knowledge is covered on such tests means that teachers and other proponents of environmental education have less leverage to argue what should be included in the curricula. This is compounded by the fact that teachers are already struggling to cover the topics encouraged by state academic standards, as they find it more and more necessary to “teach to the test”. This focus on testing is also especially unfortunate when we know that studies have shown that emphasizing local environmental problems significantly increases students' emotional investment and participation (Ballantyne, Fien & Packer, 2000 and Barnett, Lord, Strauss, Rosca, Langford, Chavez & Deni, 2006). Questions about local environments and environmental problems, however, are never asked on the tests that schools and teachers must cater to.

Another major problem with current environmental education within public schools is the lack of out of classroom experience and experimentation. This is in part due to a lack of funding for these kinds of programs which often prevents renting buses to transport students to field sites and limits access to equipment that students might need in order carry out experiments or testing. Another reason for the lack of outdoor instruction, however, is due not to resource constraint, but rather to teacher discomfort and apprehension about teaching outside (Barnett, Lord, Strauss, Rosca, Langford, Chavez & Deni, 2006). Especially in schools serving students more prone to behavioral problems, teachers often harbor fears about behavior management that deter them from taking students outside of the classroom.

Incorporating a consistent environmental education program into the current public school system would use resources more efficiently and would cost schools less than bringing in outside programs for sporadic and small-scale lessons, which is ultimately an unsustainable means of bringing environmental education to school-aged children.

Beyond Standardized Testing

Evaluation and assessment are contested issues across the spectrum of public education, not just in environmental education programs. As the reliance on standardized testing has increased and such tests have become the primary means for evaluating students, other kinds of evaluation have been sacrificed or abandoned. This is an issue for all subjects, but standardized tests are particularly unsuited for evaluating environmental education programs because the aim of these programs should be not only to impart discrete facts, but also to teach students how to find information they don't have and how to make connections

between their behavior and the subsequent consequences in the natural environment. These are not concepts which are easily assessed through a standardized test.

Additionally, if the role of environmental education is to engage students in their local environments and foster the development of environmental values, a more personal kind of evaluation seems to be in order -- one that takes into account input not only from students, but also from teachers, parents and community members. Such forms of more qualitative evaluation are nearly unheard of in any part of public education, let alone in an area as undervalued as environmental education.

The Future of Environmental Education

In order to address the limitations of the current system of environmental education in U.S. public schools significant changes must be made in the areas of teaching and learning structure, curriculum, and evaluation. It is not enough for outside environmental education programs to provide sporadic lessons. It is not enough for teachers to present students with environmental facts without engaging them in participatory learning. It is not enough for students to read about the environment in their textbooks without experiencing it first hand. And it is not enough for schools to simply pat themselves on the back for having any environmental education at all rather than taking the time to evaluate the effectiveness of such a program.

In this reform initiative I present a three-part plan with several strategies suggested in each part. Throughout, I try to acknowledge the potential obstacles that such a comprehensive

initiative may face, although it is difficult to predict all of the possible challenges that future environmental programs might come up against. I propose that effective environmental education will engage students not only with their natural environments, but also with themselves and with each other. It will provide them with a space to ask questions and perform experiments. Comprehensive environmental education will also manifest itself in the everyday practices of schools and will extend far enough to touch parents and community members. Finally, this vastly improved environmental education will acknowledge that there is always room for more improvement and will include both quantitative and qualitative forms of evaluation to measure success, in the many ways that it is defined.

Fostering Engaged Learning

I propose that the teaching and learning structure of environmental education requires some drastic changes. First, a gift-exchange model of learning, which acknowledges the contributions of all participants in the learning process, needs to be embraced in the stead of the current top-down structure. Additionally, students should be directly involved in identifying environmental problems and solutions, not just absorbing and memorizing facts. This shift would also address the larger need to begin fostering a culture of inquisitive and engaged learning in public schools which would emphasize the process of learning (asking questions, developing creative solutions, working in teams, etc) over the product (acquiring discrete knowledge which can be regurgitated on a standardized test). Finally, and perhaps most importantly, parents and community members need to be brought into the learning

process, particularly considering that environmental literacy is something that all citizens should be striving for, not just children.

Below I offer a more in depth look at each of the previous shifts I have called for, along with specific steps that each party (teachers, students, parents, community members and school administrators) might take in order to begin moving in these directions.

Shift to Gift-Exchange Model of Learning

The concept of a market economy describes the relationships and exchanges of more than just corporations and countries. Public schools are also modeled, however inadvertently, on the market economy system, where “attempts to produce, accumulate, and apply knowledge for personal advancement or material gain are generally valued more highly than attempts to teach, share, or apply knowledge in order to sustain the physical, emotional, social, and spiritual well-being of the community” (Kurth-Schai,1992).

With the current underlying system in mind, we can more directly take on the challenge of transitioning to a more effective system which is simultaneously more personal and more communal. Extending the analogy of the current market economy system, environmental ethicist Jim Cheney "poses an *economy of gift exchange* as a promising alternative to the prevailing market economy model" (Kurth-Schai, 1992). Such a model assumes that all parties involved in the learning process -- teachers, students, and even parents and community members -- have something valuable to contribute. Kurth-Schai notes that the felicitous paradox of the gift-exchange model, in sharp contrast to the market economy model, is that "once the gift is passed on, its value to the individual releasing it and to the

community-at-large actually increases" (Kurth-Schai, 1992). In her paper, "Ecology and Equity: Toward the Rational Reenchantment of Schools and Society", Kurth-Schai describes two tactics used in a classroom setting to facilitate the shift toward a gift-exchange model of learning. These tactics have been adopted here as part of this reform initiative.

1. Conduct Gift Assessment

In order to introduce the idea of a gift-exchange model of learning, Kurth-Schai suggests that students first be encouraged to identify the gifts that they feel they have to share as well as those they hope to receive in the process of both teaching and learning. By beginning this process alone, students are encouraged to think outside of traditional expectations, but later brainstorming together as a group can help to expand the list of potential gifts. It is important to find ways to address not only traditionally recognized and rewarded attributes like content knowledge, academic skills, and individual leadership, but other dimensions as well, such as experiential, intuitive, aesthetic, emotional, and social contributions. Often students lack the vocabulary to describe these generally undervalued gifts, so it may be necessary to create new terminology. The list of gifts can be revised and expanded over the course of the semester or year by getting insight from others especially those people who are traditionally excluded from education policy (Kurth-Schai, 1992).

2. Develop Personal Gift Exchange Profiles

Because a system modeled on gift exchange is dependent on everyone involved both giving and receiving, it is crucial to balance the potential needs and contributions of students by having them develop personal profiles outlining what they feel they have to contribute to the learning process and what they hope to gain. Such profiles cannot be permanent or static,

however, as the goal of education must be to grow and learn as both individuals and as a group. Personal gift exchange profiles could be part of a reflection journal that students keep, writing down their goals, questions, and insights throughout the year.

Foster Culture of Inquisitive Learning

Giving and receiving cannot be merely passive endeavors. Students must also be taught how to ask questions and engage critically with material, even at a young age. In fact early childhood education is perhaps the most important time to stress the value of inquisitiveness and investigation so as to combat the prevailing trend of students, and later adults, to be passive consumers of the information they are fed rather than active participants in the learning process. In this sense, the scientific method provides a useful model which can be adopted across disciplines to encourage questioning and experimentation. In their study of field-based urban ecology, Barnett, Lord, Strauss, Rosca, Langford, Chavez & Deni demonstrated that field-based urban ecology science programs can engage traditionally under-represented groups, such as minorities and women, in real-world science.

Such programs improve students' interest in science, support students in developing a better understanding of scientific methodologies, and increase students' sense of environmental stewardship. They also increase student interest in and engagement with science through interaction with their local environment. The model program in the study engages students in the scientific process by combining the immediate relevancy of their own urban ecosystem with basic scientific research. Built on the educational process of inquiry, each study within the program is framed around a question, "what is the health of this area's urban ecosystem?", which drives the focus of the study for both teacher and students.

1. Ask Questions

As detailed in the exploration of the gift-exchange model of teaching and learning, we, as a society, must begin shifting our thinking to acknowledge the contributions that all people, regardless of age, race, gender, class, education or any other factor have to offer. Teachers can support the understanding and acceptance of this truth by asking students for their input. Their differing opinions, experiences and backgrounds provide not only improved understanding for both teacher and students, but also reaffirm the idea that students have something valuable to contribute to the learning process, a revelation which is both engaging and empowering.

2. Invite Questions

Public education, particularly with the ever increasing emphasis on standardized test preparation, often focuses on relaying as much information as possible with as little deviation as possible. This is hardly engaging to students in the short term, and does them, and the rest of society, a great disservice in the long run by producing citizens who do not question information that is presented to them. Environmental educators can serve as models in this area by encouraging students to engage with and question the material presented. Suggesting that each child ask at least one thoughtful question per week could begin this process. To accommodate the personalities and comfort levels of all students, questions might be asked in class, on homework assignments, by note to the teacher, or written on the board. Just as with questions posed by the teacher, students should be encouraged to engage with and answer the questions of their peers.

Relay Findings to Parents and Community

In order to facilitate the process of intergenerational communication and extend the effect of school environmental education programs beyond the boundaries of the classroom, Ballantyne, Fien & Packer suggest that three questions must be answered when developing environmental education reform. 1) How effective are environmental education programs in promoting intergenerational communication about the environment? 2) What kinds of environmental education experiences tend to motivate students to share their school learning with parents? And, 3) What steps can environmental educators take to encourage or assist their students in sharing their learning (knowledge, attitudes and behavior) at home?

There are several ways that school environmental educators can encourage discussion of environmental issues at home. Programs can be designed which involve parents in activities such as homework assignments, research activities, and class presentations. Parents and community members can also be involved by conducting surveys and interviews to identify people's perceptions of environmental issues, presenting project reports and research findings in a public forum, having the program reported in a local newspaper, asking local industries to demonstrate their environmental management strategies, and involving local business and community groups in environmental action projects (Ballantyne, Fien & Packer, 2000).

In order to facilitate this kind of intergenerational and intercommunal learning, teachers must actively work to widen their audience to include parents and community members by consciously considering them when planning environmental education lessons. In cases where teachers have incorporated material that encourages discussion at home, many parents

have confirmed that they have been challenged to change their attitudes or household practices (Ballantyne, Fien & Packer, 2000). Research findings also demonstrate that students can and do share their learning and environmental attitudes with their parents and that they can and do bring about positive changes in household practices when what is learned at school initiates a dialogue at home.

1. Homework, Projects, Presentations

Ballantyne, Fien & Packer provide strong evidence that teachers can do several things to encourage meaningful exchanges between students and parents around environmental topics. Their study found that dialogue was often initiated as a result of projects that students were required to do as homework or presentations that the students were giving at school or in the community. Some discussion had also arisen as a result of students' participation in uncommon or particularly enjoyable activities or experiences (in most cases such activities were out of the classroom), but these discussions tended to be more focused on the activity itself, rather than the environmental issue or possible actions. Environmental education programs of longer duration were also more likely to incite conversation than those that were shorter. These findings suggest that incorporating homework assignments, and long term projects and presentations which encourage parent and community participation could be extremely effective in promoting broad-based environmental literacy and behavioral change.

2. End-of-Semester/End-of-Year Student Showcase

Based on a 2006 study done by Barnett, Lord, Strauss, Rosca, Langford, Chavez & Deni, another tactic which increases the transfer of environmental knowledge to parents and

community members is to include an event at the end of each semester or each school year gathering teachers, students, parents and community members together to celebrate student work around environmental issues. Such an assembly provides a public forum for recognition and reward of school and individual achievement and also offers students the opportunity to showcase their commitment and knowledge gained through their semester-long or year-long studies.

Taking it Outside

One of the biggest challenges in developing effective environmental education programs is determining which information to cover. Many current programs focus heavily on environmental science, neglecting other important aspects of environmental issues and missing out on the opportunity to use environmental education as a common thread unifying many different subjects. The Urban Stewards and City Connections programs of Eco Education based in the Twin Cities, demonstrate that environmental education can be incorporated into all academic subjects, and in such a way that state academic requirements are met – something which should bolster support for and limit objections to the inclusion of environmental education in public education.

In their 2000 study, Ballantyne, Fien & Packer suggest that there are four types of experience that contribute to environmental education programs' success in achieving goals for student learning. First, the opportunity to perform tests on the quality of environmental components such as water or air in students' neighborhood or community fosters a relationship between students and their immediate environment. Second, the presentation

or discussion of information about environmental issues, especially focusing class discussion on environmental problems that students are able to observe in their homes or local areas, seems to arouse student enthusiasm and commitment to the topic, while enabling teacher input and direction. Third, environmental experiences such as planting trees, cleaning creeks, canoeing, and taking forest walks help to raise awareness and influence environmental attitudes among students. Finally, involvement in individual and group projects – especially those requiring data collection (from organizations or internet searches) or field research (like surveys or car counting) – can have a major influence on the degree of engaged learning. Often such projects can be done as homework with the results then presented to the class. When creating environmental education curricula these four kinds of experience should be kept in mind if the resulting lessons are to be not only comprehensive, but also engaging.

Incorporate Environmental Education into Many Subjects

Eco Education, a nonprofit organization located in Minnesota, has been able to develop a curriculum that not only incorporates environmental education into all subjects, but also addresses many state academic requirements, something which should put teachers and administrators alike at ease. Looking specifically at the state of Minnesota, the academic requirements which Eco Education addresses, and which might be consulted when developing environmental education curricula, can be found at the end of this report in Appendix A.

1. Use Environmental Education as a Common Theme

Environmental education is simultaneously blessed and cursed by the fact that it is not considered to be, on its own, a subject equal to the other subjects which are traditionally studied in public schools. This can be a drawback as it means that responsibility to cover environmental material is often diffused among many teachers and each teacher's expertise is in another area other than environmental education. Looked at from another perspective, however, environmental topics, which span from science to social studies, have the ability to provide a common theme uniting each of the separate subjects. Finding ways to tie environmental education into science, math, social studies and language arts curricula emphasizes its importance, while reinforcing the real-world significance of those subjects to the students who study them

Include Location Specific as well as Universal Components

Numerous studies have shown that finding ways to make environmental education specific to the local environment that students live in and have a personal relationship with is not only more engaging for students by providing real-world examples, but also provides opportunities for meaningful out of classroom experiences and fosters responsibility for environmental issues. There are also many national and international environmental issues such as climate change, natural resource depletion, habitat destruction and pollution that all children should have some exposure to. This report therefore suggests that both local and universal components be included in environmental education programs.

1. Location Specific Component

In a 2006 study conducted by Barnett, Lord, Strauss, Rosca, Langford, Chavez & Deni, schools that participated in an environmental education program were expected to conduct research at a local ecologically rich study site within the city, located near the school, ideally within walking distance. In this case, the same sites were used each year to provide long-term comparative data. A similar location specific component could be included in most, if not all, environmental education programs to provide students with hands on applications of the material they learn about in class. Location specificity has been cited again and again as an integral component of effective environmental education which engages students not only in the learning process, but also in their communities. Additionally, school sites needn't be traditionally "environmental" or "natural" to provide opportunities for engagement. Urban environmental education looks at the ecology of neighborhood parks, community gardens, and other green spaces that are relevant to students in their everyday lives.

2. Universal Component

It would be quite difficult to create an entirely location specific curriculum for every school. This would also be unnecessarily limiting as there are a plethora of national and global environmental issues and phenomena which all students should be exposed to. These topics include environmental concerns such as climate change, natural resource depletion, habitat destruction and environmental pollution, as well as environmental concepts like atmospheric cycling and ecosystem diversity.

Provide Outside of Classroom Experiences and Hands-on Experimentation

Good environmental education necessarily requires going outside – into the environment. This can be intimidating for teachers who are not used to teaching outside of the classroom, so it is not hard to believe that many environmental curricula are taught entirely within the classroom. It is unfortunate that lack of experience teaching outside, compounded by a fear of unmanageable students, restricts this integral component of effective environmental education. Improved teacher training would obviously directly affect, and improve, this situation. In the absence of special training, however, other tactics can be employed to allow students first-hand exposure to the natural environment.

1. Field Trips

Field trip proposals are often rejected because schools lack the funding necessary to pay for buses and equipment. This is of course a legitimate concern, but as mentioned in the section of this paper that addresses location-specific environmental education, field trips do not necessarily need to be to far away places or require expensive equipment. Just getting students outside, even if it is just a block away at the neighborhood park, or a few feet away at the school garden, is crucial to providing effective environmental education. Numerous studies have shown that getting students outside is one of the surest ways to not only engage students in what they are learning about, but also encourage them to foster environmentally minded values and behaviors.

2. Service Learning Projects

Service learning projects provide benefits for students and their community. Just as student showcases can provide an opportunity for community members to learn about what

students are doing with regards to the environment, service learning projects can give students a first hand glimpse at what adults in their community are doing to address environmental issues. Projects can range from helping out at an environmentally minded nonprofit to assisting a local business with their efforts to recycle and save energy. Seeing grown-ups making an effort to protect the environment sends a strong message to students that such efforts are important, while student enthusiasm reminds community members that they are making a difference.

Integrate Environmental Education into School Practices

Environmental education is not simply a set of theories which can be studied from afar. In addition to facilitating student engagement with the environment outside of the classroom, comprehensive environmental education must also address the relationship between humans and the natural world as part of everyday life. This includes school policies and everyday practices. Classroom learning can be greatly enhanced by the adoption of environmentally conscious practices on school campuses, which indicate to students that what they are learning about is both important and relevant, and that their actions, and the actions of their peers, teachers, parents and community members, have a direct impact on the world around them.

1. Get Administrators On Board

In order for any project to be successful, school administrators must be at least receptive, and ideally enthusiastic, about its adoption. School administrators can make a huge difference in the success of environmental education programs by providing them institutional support in the form of school-wide recycling programs, waste reduction

initiatives, cafeteria composting, school gardens, and energy efficiency campaigns. Such programs are generally beneficial to the school as a whole because they reduce costs, not to mention that most schools relish the prestige and increased funding that come from serving as an exemplary model in their district or state.

2. Encourage Student Led Initiatives

Administrators are not the only ones capable of initiating environmental programs, however. Individual classes and groups of students can have immense power in starting up new programs at school and encouraging their peers to change their behavior. Often, student-led projects are even more successful than projects that have been introduced from the top down, as they indicate to other students that the initiative is self-motivated, not imposed. Student-led projects, if given sufficient support, have the opportunity to thrive -- simultaneously empowering students and improving school practices.

Asking the Right Questions

Evaluation is an area where public education in general needs some major changes, but environmental education needs special attention, as it is often seen as a luxury and the prevailing tendency to think that “anything is better than nothing” often discourages thoughtful evaluation. This report proposes that both quantitative and qualitative forms of evaluation be included in any environmental education program to gain information about the knowledge, values, behavioral changes and intergenerational exchanges that result from the program.

Quantitative

1. Before and After Tests

Before and after tests can be used to measure both discrete facts and general concepts learned through an environmental education program as well as to measure environmental values and concern (Ballantyne, Fien & Packer, 2000). Several case studies recommend providing both students and parents with a before test at the beginning of each year or semester in order to measure environmental knowledge and values going into the program. The same test should then be administered at the end of the program to measure improvements in all areas. Such evaluation can inform educators about which areas of the curriculum have been effectively communicated as well as which areas need more attention.

Qualitative

1. Surveys and Interviews

Interviews and surveys with teachers, students, parents, community members and school administrators can also be extremely useful in evaluating the effectiveness of environmental education programs. Such forms of qualitative evaluation can analyze which parts of a program have been most effective, most fun or most resource intensive. Surveys can also question both students and parents about what they learned, whether and in what ways the information they learned was useful to their lives, and whether and in what ways the program made them want to change their behavior. Teachers should also be interviewed to understand their perspectives regarding how participation influenced their students' thinking toward the environment, their ability to conduct investigations and actively engage with material, and if they observed a change in their students' interest in learning in general (Barnett, Lord, Strauss, Rosca, Langford, Chavez & Deni, 2006).

Surveys and interviews can also provide insight into the extent to which students shared information they learned with parents and community members. Students can be questioned about whether they discussed at home what they had learned during the program, how much they had talked about it, and what sorts of topics they may have discussed (Ballantyne, Fien & Packer, 2000). Parents can be asked many of the same questions as students, such as what effect, if any, the environmental education program had on their children's behavior or attitudes, whether their child had talked about the program and what was discussed, and which factors might have triggered any discussion with their child about the environmental education program.

Moving Forward

Environmental education which engages students and encourages the development of environmentally sympathetic values and behavior is desperately needed in order to combat the many environmental problems we now face, locally, nationally, and globally. Providing effective environmental education, however, will require more than just a shift in educational priorities – it will require a shift in the way that educators and school administrators view the role of education, and the roles of those who are affected by it. Solving environmental problems is possible, but only if the collective contributions of students, teachers, parents and community members are acknowledged and encouraged. Just as ecosystems depend on the active involvement of different organisms and environmental forces, so too does the process of education require that all members of the learning community be active participants.

Appendix A
MN State Academic Standards Addressed by Eco Education Programs

1. Language Arts

- IA Student will decode unfamiliar words using phonetic and structural analysis and will read with fluency and expression
- IB Student will use a variety of strategies to expand reading, listening and speaking vocabularies
- IC Student will understand the meaning of informational, expository or persuasive texts, using a variety of strategies, and will demonstrate literal, interpretive, inferential, and evaluative comprehension
- IIA Student will create informative, expressive and persuasive writing/write in narrative, expository, descriptive, persuasive and critical modes
- IIB Student will engage in writing with attention to audience, organization, focus, purpose and quality of ideas
- IID Student will locate and use information in reference materials
- IIIA Student will demonstrate understanding and communicate effectively through listening and speaking
- IIIC Student will critically analyze information found in electronic and print media, and will use a variety of these sources to learn about a topic and represent ideas

2. Social Studies (Geography)

- VA Student will identify and locate major physical and cultural features that played an important role in the history of Minnesota
- VB Student will make and use maps to acquire, process and report on the spatial organization of people and places on Earth
- VC Student will use basic terminology describing basic physical and cultural features of continents studied
- VD Student will give examples that demonstrate how people are connected to each other and the environment
- VD Student will identify examples of the changing relationships between the patterns of settlement and land use in Minnesota
- VD Student will describe how humans influence the environment and in turn are influenced by it
- VE Student will use maps, globes, geographic information systems and other sources of information to analyze the nature of places/answer geographic questions at a variety of scales from local to global

3. Social Studies (Government and Citizenship)

- VIIA Student will recognize the importance of individual action and character in shaping civic life
- VIIA Student will understand the importance of participation in civic life and demonstrate effective civic skills
- VIIA Student will analyze various methods of civic engagement needed to fulfill responsibilities of a citizen of a republic

4. Mathematics

- I Student will apply skills of mathematical representation, communication and reasoning throughout the remaining four content strands
- IIA Student will represent fractions, decimals and whole numbers in a variety of ways, to quantify information and solve real-world and mathematical problems. Understand the concept of negative numbers
- IIA Student will use positive and negative rational numbers, represented in a variety of ways, to quantify information and to solve real-world and mathematical problems
- IIB Student will compute fluently and make reasonable estimates with whole numbers in real-world and mathematical problems, Understand the meanings of arithmetic operations and how they relate to one another
- IIIA Student will understand and describe patterns in numbers, shapes, tables and graphs
- IVA Student will represent data and use various measures associated with data to draw conclusions and identify trends
- VC Student will measure and calculate length, area and capacity using appropriate tools and units to solve real-world and mathematical problems
- VC Student will make calculations of time, length, area and volume within standard measuring systems, using good judgment in choice of units

5. Science

- IB Student will understand the process, design and conduct scientific investigations
- IB Student will understand that scientific inquiry is used in systematic ways to investigate the natural world
- IIIA Student will investigate the impact humans have on the environment
- IIIA Student will identify Earth's composition, structure and processes
- IIIB Student will explain the causes and effects of the Earth's atmospheric and hydrologic processes
- IVC Student will describe how the environment and interactions between organisms can affect the number of species and the diversity of species in an ecosystem
- IVF Student will understand how the flow of energy and the recycling of matter contribute to a stable ecosystem

Annotated Resources

Ballantyne, R., Fien, J., & Packer, J. (2000). Program effectiveness in facilitating intergenerational influence in environmental education: Lessons from the field. *The Journal of Environmental Education*, 32(4), 8-15.

This reading introduced me to the concept of intergenerational learning, and made clear the need its inclusion as a part of environmental education. Because of the urgency of environmental issues, it is not realistic to wait for the current generation of school children to grow up and implement what they have learned about human-nonhuman interactions and sustainable behavior. Environmental education must therefore facilitate increased eco-literacy of adults as well as children, and this paper makes that case very successfully. I found it extremely useful and would highly recommend it to those interested in delving deeper into the topic of intergenerational influence in education, particularly environmental education.

Barnett, M., Lord, C., Strauss, E., Rosca, C., Langford, H., Chavez, D. & Deni, L. (2006). Using the urban environment to engage youths in urban ecology field studies. *The Journal of Environmental Education*, 37(2), 3-11.

This study focuses on urban environmental education in Boston and greatly informed the section of my paper which looks at location-specific environmental education. The results of the study were fairly significant, demonstrating the extent to which urban environmental education which is location specific greatly improves student engagement in the subject of science, particularly female and minority students who are generally less interested and/or successful in the study of science. This article also provided evidence supporting the use of the scientific method in other subjects as a way of engaging student interest and participation.

Duvall, J. & Zint, M. (2007). A review of research on the effectiveness of environmental education in promoting intergenerational learning. *The Journal of Environmental Education*, 38(4), 14-24.

This article also looks at the promotion of intergenerational learning through environmental education programs. I found the article extremely easy to navigate as its structure is bullet-based, providing the reader with easy access to the main points. I came away from the article with some general suspicions confirmed, such as the fact that longer environmental education programs are more effective than shorter ones, but not a lot of new information. If you are looking for an introduction to the utility of environmental education to facilitate intergenerational learning, this article provides you with a good foundation.

Engels, C.A. & Jacobson, S.K. (2007). Evaluating long-term effects of the golden lion tamarin environmental education program in Brazil. *The Journal of Environmental Education, 38*(3), 3-14.

This article looked at community environmental education in Brazil. I found it particularly useful for the model it provided for different kinds of evaluation, both quantitative and qualitative, of environmental education programs. It also provided valuable information about potential community reactions to environmental education, and suggested tactics for getting communities more involved in environmental stewardship such as by focusing on local environmental issues, highlighting a flagship species that community members care about, and fostering pride in the local environment.

Hart, R. (1994). Children's role in primary environmental care. *Childhood, 2*, 92-102.

This reading highlights the important role that children have to play in environmental stewardship. I found the discussion of community participation and social mobilization particularly enlightening. I also took a great deal away from the section that looked at teaching civic engagement in the classroom as a way of cultivating concerned and engaged citizens who ask questions and seek solutions. Finally, this paper provided solid support for the effectiveness of environmental education programs which support children in fostering personal and intimate relationships with their environments.

Kurth-Schai, R. (1992). Ecology and equity: Toward the rational reenchantment of schools and society. *Educational Theory, 42*(2), 147-163.

I primarily looked at the section of this article which contrasts the economic-market and gift-exchange models of education. I personally find the concept of the gift-exchange model of learning extremely compelling, so I enjoyed this article immensely and cited it extensively in the section of my paper that looks at strategies for shifting to a gift-exchange model in the context of environmental education.

Legault, L. & Pelletier, L.G. (2000). Impact of an environmental education program on students' and parents' attitudes, motivation, and behaviours. *Canadian Journal of Behavioural Science, 32*(4), 243-250.

This article emphasizes the ability of environmental education to foster not only intergenerational learning of discrete environmental facts and concepts, but also the adoption of more environmentally sympathetic attitudes and behaviors among students and their parents. I find this argument extremely encouraging as it indicates that environmental values and behaviors can be altered even in adulthood, and it acknowledges the power that children have in influencing their parents to make changes to their everyday lives that positively affect their relationship with and understanding of the environment.

Vaughan, C., Gack, J., Solorazano, H. & Ray, R. (2003). The effect of environmental education on schoolchildren, their parents, and community members: A study of intergenerational and intercommunity learning. *The Journal of Environmental Education*, 34(3), 12-21.

This study looks at the intergenerational and intercommunal learning resulting from environmental education in a rural community in Costa Rica. I found this article particularly helpful and it synthesizes a lot of the different arguments made by various other articles into one cohesive paper, and it uses the case study in Costa Rica to provide real-world examples of how certain strategies might be implemented. The recommendations for effective environmental education at the end of the article are succinct and insightful, providing a jumping off point for further research or the implementation of an environmental education pilot program.

Additional Resources

- Ballantyne, R., Connell, S., & Fien, J. (1998a). Students as catalysts of environmental change: A framework for researching intergenerational influence through environmental education. *Environmental Education Research*, 4(3), 285-298.
- Ballantyne, R., Connell, S., & Fien, J. (1998b). Factors contributing to intergenerational communication regarding environmental programs: Preliminary research findings. *Australian Journal of Environmental Education*, 14, 1-10.
- Berkowitz, A.R., Nilon, C.H., & Hollweg, K. (Eds.). (2003). *Understanding urban ecosystems: A new frontier for science and education*. New York: Springer.
- Bybee, R.W. (2003). Integrating urban ecosystem education into education reform. In A.R. Berkowitz, C.H. Nilon, & K. Hollweg (Eds.), *Understanding urban ecosystems: A new frontier for science and education*. (pp. 430-449). New York: Springer.
- Fusco, D. (2001). Creating relevant science through urban planning and gardening. *Journal of Research in Science Teaching*, 38, 860-877.
- Hollweg, K., Pea, C.H., & Berkowitz, A.R. (2003). Why is understanding urban ecosystems an important frontier for education and educators? In A.R. Berkowitz, C.H. Nilon, & K. Hollweg (Eds.), *Understanding urban ecosystems: A new frontier for science and education*. (pp. 19-38). New York: Springer.
- Kahle, J.B., Meece, J., & Scantlebury, K. (2000). Urban African-American middle school science students: Does standards-based teaching make a difference. *Journal of Research in Science Teaching*, 37, 1019-1041.
- Kim, C., & Fortner, R.W. (2006). Issue-specific barriers to addressing environmental issues in the classroom: An exploratory study. *The Journal of Environmental Education*, 37(3), 15-22.
- Lane, J., & Wilke, R. (1995). Strengths and weaknesses of teacher environmental education preparation in Wisconsin. *The Journal of Environmental Education*, 27(1), 36-47.
- Nieto, S. (1994). Lessons from students on creating a chance to dream. *Harvard Educational Review*, 64, 392-426.
- Orion, N., & Hofstein, A. (1994). Factors that influence learning during a scientific field trip in a natural environment. *Journal of Research in Science Teaching*, 31, 1097-1119.
- Strom, R. (1988). Intergeneration learning and curriculum development. *Educational Gerontology*, 14, 165-181.
- Sumner, J. (2003). Environmental adult education and community sustainability. *New Directions for Adult and Continuing Education*, 99, 39-45.

Uzzell, D. (1994). *Children as catalysts of environmental change* (Final report) London: European Commission Directorate General for Science Research and Development Joint Research Centre.