ABSTRACT

Title of the Dissertation: A CASE STUDY OF THE DEVELOPMENT OF ENVIRONMENTAL ACTION PROJECTS FROM THE FRAMEWORK OF PARTICIPATORY ACTION RESEARCH WITHIN TWO MIDDLE SCHOOL CLASSROOMS

Kim Charmatz, Doctor of Philosophy, 2007

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The purpose of this study was to understand student and teacher empowerment through a socially critical environmental education perspective. The main research question guiding this study was: How do participants make sense of a learning experience in which students design and carry out an environmental action project in their community?

This study used participatory action research and critical theory as practical and theoretical frameworks. These frameworks were relevant as this study sought to examine social change, power, and relationships through participants' experiences.

The context of this study was within one seventh and one eighth grade classroom participating in environmental projects. The study was conducted in spring 2005 with an additional follow-up data collection period during spring 2006. The school was located in a densely populated metropolitan suburb. Fifty-three students, a teacher researcher, and three science teachers participated. Data sources were written surveys, scores on Middle School Environmental Literacy Survey Instrument (MSELI), observations, interviews, and student work.

This study used a mixed methodological approach. Quantitative data analysis involved dependent samples t-test scores on the MSELI before and after the completion of the projects. Qualitative data were analyzed using an inductive analysis approach.

This study has implications for educators interested in democratic education. Environmental action projects provide a context for students and teachers to learn interdisciplinary content knowledge, develop personal beliefs, and learn ways to take action in their communities. This pedagogy has the potential to increase cooperation, communication, and tensions within school communities. Students' participation in the development of environmental action projects may lead to feelings of empowerment or being able to make a difference in their community, as an individual or member of a group.

Future research is needed to discern why participants experience this type of educational experience differently, for example, how does the type of environmental action project influence individual and group empowerment?

A CASE STUDY OF THE DEVELOPMENT OF ENVIRONMENTAL ACTION PROJECTS FROM THE FRAMEWORK OF PARTICIPATORY ACTION RESEARCH WITHIN TWO MIDDLE SCHOOL CLASSROOMS

By

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Dissertation submitted to the Faculty of the Graduate School of the
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DEDICATION

To My Parents
Betty Charmatz and Marc Charmatz

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A true team of people has helped guide me to the completion of this dissertation, and I greatly appreciate all their support.

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CHAPTER ONE: INTRODUCTION

Overview and Purpose

Environmental action projects are one context in which students can make choices and act on ways they can personally make a difference in the world. This study is about teaching and learning practices that ask students to formulate and study their own questions concerning environmental issues and take action to improve these issues. Hungerford and Volk (1990) studied the influence of environmental education on learners' actions and more broadly argued that the "ultimate aim of education is shaping human behavior" (p. 8). More specifically, Mordock and Krasny (2001) suggested that students should be involved in "real-life research" with the goal of "enhancing students' critical thinking and problem-solving skills, feeling of empowerment, and understanding of science content" within an environmental context (p. 15). One aspect of this study will explore whether the type of pedagogy suggested by Mordock and Krasny possibly leads to environmental empowerment for students and leads to changes in their behavior in the local community. This study also examines science curriculum in practice by teachers and students that involves critical thinking around science-society problems, and work designing action-based projects. In this way, this study explores curriculum choices that support a science-technology-society connection, as well as being authentic, interdisciplinary, promoting social responsibility, and having practical applications.

The development of environmental action projects in a classroom is one way to work toward and study goals of science education, and to look at the significance of power roles in the classroom and community through a critical theory perspective.

This study also examines how the framework of "place-based education", as described by Sobel (2004), can be situated or realized in an environmental action pedagogy. Sobel argued that place-based education "moves beyond environmental education. . . to look at how landscape, community infrastructure, watersheds, and cultural traditions all interact and shape each other" (pp. 8-9). This study will follow the tradition of case study research while also using the framework of participatory action research. Please see Figure 1for an overview and a conceptual map of the study.

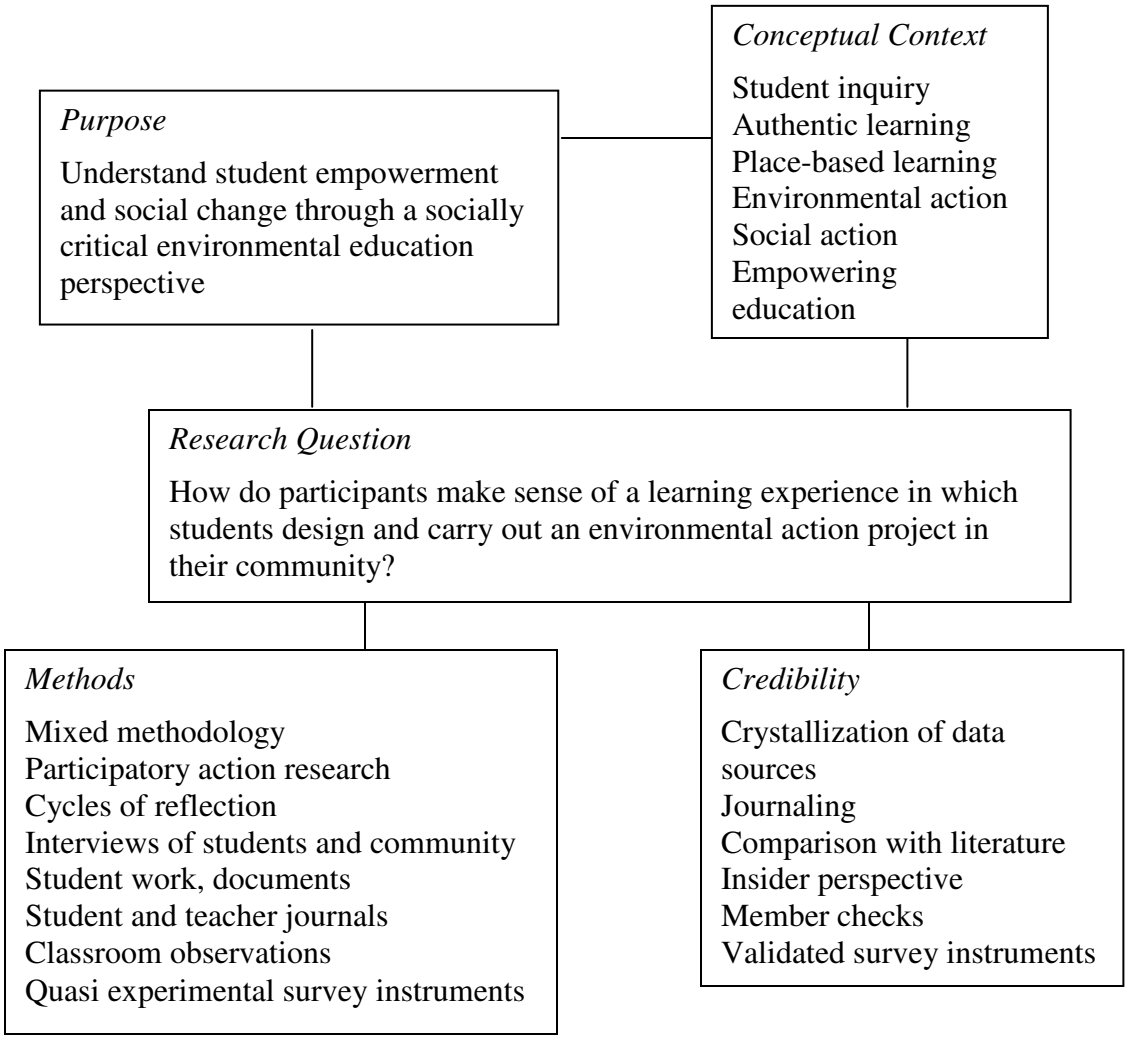

Figure 1: Study Overview

While this study pertains to a wide variety of purposes, my central purpose is to understand student empowerment and social change through a socially critical environmental education perspective.

Framework of Participatory Action Research and General Research Questions

Participatory Action Research

Various forms of action research are conducted across many professions, such as health care, social work, and education. In the field of education, Cochran-Smith and Lytle (1993) define action research as "systematic intentional inquiry by teachers about their own school and classroom work" (pp. 23-24). Other terms that describe action research by teachers include teacher research, practitioner research, and classroom action research, albeit with some variations among these terms. For example, some distinguish between classroom research and practitioner research by placing emphasis on the teacher as professional with myriad responsibilities beyond classroom practice, only.

Zeichner and Noffke (2001) look historically in the last century to define five traditions of action research: 1.) "action research tradition", 2.) "teacher-as-researcher movement", 3.) "contemporary teacher researcher movement", 4.) "self-study", and 5.) "participatory research" (p. 301). In the 1950s, Corey (1953) defined the methodology of action research in "cycles of planning, acting, observing, and reflection" within the United States (p. 301). In the 1960s, the "teacher-as-researcher movement" came about in Britain and Australia (p. 302). The Australian movement, led by Kemmis and McTaggart (1988), was one based in critical theory and the involvement of participants to enact change. They stated that, in the 1980s, a more "contemporary teacher researcher movement" began in North America as a result of such factors as increased qualitative

research and attention to action research in teacher education (p. 303). Cochran-Smith and Lytle (1993) identified two types of teacher research during this movement including "conceptual research, which is theoretical and philosophical," and "empirical research, which involves the collection, analysis, and interpretation of data gathered from teachers, schools, and classrooms" (p. 304). At the same time, a tradition of "self-study research" emerged in which university faculty began to study their own teaching practices in teacher education (p. 304). Finally, a tradition of "participatory action research" (PAR), as described by Kemmis and McTaggart, emerged that sought to give voice to people that traditionally have been oppressed or powerless and often has social action as its goal (p. 305).

Kemmis and McTaggart (2000) describe PAR as research that brings together the "practical and theoretical" while involving the participants in the study (p. 567). A defining feature of action research in general is the practical nature and applications it seeks to produce. PAR takes this a step further by involving participants, often students, in the actual design of the research. PAR strives for research that seeks to change social structures and organization as well as that is practical and meaningful for participants.

Community-based action research similarly seeks to make practical improvements in local communities. Stringer (1999) defines community-based action research as "a collaborative approach to inquiry or investigation that provides people with the means to take systematic action to resolve problems" (p. 17). Stringer suggests several areas in education where community-based education can "make a difference" including "curriculum development, classroom processes, class projects, and special programs" (p. 14). These areas in community-based action research, along with the theoretical

framework of PAR, are particularly relevant for science and environmental education, and relate to the conceptual framework of my proposed study in environmental education through their participatory and action components.

Mordock and Krasny (2001) argue that PAR can provide a "theoretical and practical framework" for the study of environmental education, particularly as it relates to students' research about their communities and action to improve them. Community-based or place-based student research complements the North American Association for Environmental Education (NAAEE, 1997) guidelines which "emphasize in-depth understanding based on accurate information, critical thinking, and research skills, as well as taking action to enhance the environment" (p. 15). The theory guiding PAR, based in action to create social change, can provide a foundation for methodologies of environmental education research. Mordock and Krasny therefore identify PAR as a framework to examine studies in environmental education. Their focus is on "participatory research in community development" which could also include action research by teachers focused on community issues (p. 16).

A dilemma for teachers who might decide to conduct PAR is "allowing students to determine the direction of their research" while also "providing opportunities for youth to learn new science and skills" (p. 19). Students often choose topics they are most familiar with when given a choice. The teacher therefore has to provide opportunities for students to explore new topics, while at the same time allowing students to make their own choices in this process. This study will review this dilemma in detail through the description of the environmental action project development. Mordock and Krasny provide case study examples that show how student choice while allowing for new

opportunities is possible in classrooms. For example, "the *Aerial Perspectives* program enabled youth to learn new skills and science concepts regarding nonpoint pollution, the epidemiology of lead poisoning, changes in land use over time, air-photo and map interpretation, GIS, interviewing, document analysis, and synthesizing and communicating results" (p. 19). A teacher involved in this program said about the program, "If you give middle school students the opportunity to do hands-on research, you will facilitate students' learning through problem solving, set the groundwork for further science education at the high school level and beyond, and empower students to be change agents on environmental issues" (p. 19). In the case of this middle school, students collaborated with a local garden club to purchase and use water-sampling equipment at the school. Other student research projects have increased media attention about the negative impacts of vacant lots in the community, and the impact of salt leaching into a local stream.

Therefore, I believe that PAR provides a feasible framework to meet the many objectives of environmental education, including inquiry and action. In fact, it may provide a model for student inquiry that guides students from designing inquiry projects to action, and involves students in all aspects of the research process. Both qualitative and quantitative methodologies can inform a PAR study.

Kemmis and McTaggart also suggest that PAR can take a "reflexive/dialectical view of relationships between subjective-objective and individual-social" that can lead to "critical-emancipatory knowledge" (p. 587). This approach is considered "critical" in that the knowledge created is practical and intended to lead to social change. It is reflexive and dialectical in attempting to bring together various forms of knowledge and

participants that are often kept separate in research. This breaking down of dichotomies can allow participants to understand how their "system" and "life world" interact (p. 588). This is particularly important in the field of education in which individuals' life worlds are guided and played out according to the system in which they live. Participatory research that attempts to address these overarching constructs will be stronger in identifying why problems exist as they are and what structures are available to enact change. The credibility of PAR may lie in the idea that researchers are participants in the research and that they "must live with the consequences of the transformations they make" and therefore enact a "reality check" (p. 592). A reality check could be done by a participant (such as the researcher), or an outsider, by looking at the question--how did the research enact a "transformation" in the setting, or not (p. 592)?

Stringer, as well as Kemmis and McTaggart, identify the spiraling nature of community-based action research, PAR, and action research in general. Stringer defines community-based action research as a spiraling process of "look-think-act" that includes components of "observation, reflection, and action" (p. 19). In addition, at the end of each cycle of look-think-act, researchers will "review (look again), reflect (reanalyze), and re-act (modify) their actions" (p. 19). But this makes action research perhaps sound simpler than it is in practice. This structure simply provides a guideline which researchers may use as an organizational framework for looking at the steps in their study. They may work backwards at times or think ahead in the spirals.

Kemmis and McTaggart present a framework of a similar spiral with steps of "planning, acting and observing, and reflecting" (p. 595). They also recognize the actual steps of PAR will not be so orderly, but may "overlap" and become more "fluid" (p.

595). In addition, they suggest seven other principles guiding PAR that they argue are at least as important as the spiraling nature: 1.) "PAR is a social process." As in the reflective-dialectical model, PAR attempts to look at the interplay between individual and social realities. 2) "PAR is participatory." This seems obvious, but also relates back to the reflective-dialectical model in that individuals are trying to identify their place in the larger social world. 3.) "PAR is practical and collaborative." The aim of PAR is to improve society. 4.) "PAR is emancipatory." This involves breaking down traditional structures that oppress people in society. 5.) "PAR is critical." PAR examines how people view and are affected by "relationships of power." 6.) "PAR is recursive (reflexive, dialectical)." This involves researchers examining dichotomies in order to enact change. 7.) "PAR aims to transform both theory and practice" (pp. 597-599). This is an important point, related to how Mordock and Krasny approached PAR as a theoretical and practical framework for environmental education. There is not a need to separate the theoretical and practical in PAR. Through working together, they can have greater pedagogical meaning.

PAR is usually, and in the case of this study, presented in the tradition of a case study. I choose the tradition of case study to richly describe and explore how change can be enacted through environmental action projects in one context.

Research Question

Through this study I wish to question how environmental education can serve as one context of democratic education that empowers students and allows students to experience social responsibility. The research question guiding this study is: How do participants make sense of a learning experience in which students design and carry out

an environmental action project in their community? To answer this question, the following information is necessary to examine or obtain:

- What are the experiences and processes involved for teachers and students in designing an action project?
    - How do my values and students' values play out in this process?
    - What are the points of difficulty when completing a community action project and what helps students and teachers overcome them?
    - What is student empowerment and how does it develop?
    - What are the connections between student empowerment and student ownership?
    - What is the teacher's role in empowering students and leading them toward socially responsible actions?
    - How did the experience of developing environmental action projects influence students' participation in the rest of the school day?
- What literacy or other content skills did students use or develop?
    - What connections do/can an environmental action project make across disciplines?
    - How is environmental literacy situated within a science-technology-society (STS) perspective?
    - How is environmental literacy situated within a critical thinking perspective?
    - How are STS, critical thinking, and environmental literacy connected?

- How are action and place-based learning connected to required curricula for students in public middle school setting?
    - How are students assessed in their understanding of environmental issues?
    - In what ways do environmental action projects connect with curricular and/or cultural norms in a particular context?
- How does the development of an environmental action project influence relationships in the classroom community?
    - What types of power and roles are present in a classroom in this setting?
    - How do issues of power play out through relationships in the classroom community?

Through this critical study, I will address some theoretical questions, such as:

- What are contemporary goals of environmental education?
- What does it mean to be environmentally literate?

I will continue the ideas of future research suggested in the literature (Volk and Cheak, 2003; Greenall Gough and Robottom, 1993) such as:

- Does students' involvement in this type of learning experience create a "consciousness of empowerment" (and what does this look like?)
- How can a socially critical curriculum fit into today's educational system?
- How do students develop an internal locus of control?
- How does students' involvement in this type of environmental pedagogy impact their various forms of literacy (e.g environmental, general, technological)?

It is my hope that this research will add to the literature by looking more deeply at the actual process of students' participation in environmental action projects, and their possible development of empowerment.

Critical Theory Paradigm

Although this study attempts to incorporate multi-perspectives of positivistic and even more so interpretivistic views of research, I believe it to be most strongly grounded in critical theory. As Greenall Gough and Robottom (1993) describe in their study, I want to also examine environmental education that is socially critical. They provide a framework for socially critical education that fits my context as well. Within this framework, students are engaged in critical thinking and action, the curriculum is "action oriented," the teachers, students, and community work together as a "focus for expression," and a major theme involves students' development of "working knowledge and critical perspectives on society" (p. 306). To further this context, through socially critical education, students in this study will also be involved in a type of "social praxis" as described by Freire. Teachers and students themselves are working toward changes in the community through using socially constructed knowledge in connection with action strategies to enact change.

Tripp (1992) suggests several principles of socially critical research that I can address in the context of my study. First, the participants of my study will be from the "mutually supporting groups" of students, teachers, school community, and local community. However, although these groups are connected and intend to be mutually supporting, part of the research will address the actual support of these groups in practice. I will consider such questions as: What is my role, as teacher and researcher, in the

community? How does the community support the students and their ideas? How do the groups interact?

The intent for this pedagogy is for it to be student-directed in context and content. The students will decide on an environmental issue and action that they think is relevant in their community to investigate. Therefore, the direction of this study would be different in different contexts. I am also hoping for students and myself to explore a "consciousness of empowerment" such as Greenall Gough and Robottom (1993) suggest. This could involve being open to different perspectives, developing critical thinking skills, developing an internal locus of control, and enacting changes in their community. The meaning of the knowledge as socially constructed and having different viewpoints will also be important to consider as a part of critical theory.

Finally, the constraints and outcomes of this study can be examined in the critical theory framework. In one sense, as a public school teacher, I need to work within the constraints of the system and what is deemed "educative" by the school district I am working for. In another sense, I am seeking to explore ways to change teachers' and students' roles of power and voice in the community. As Greenall Gough and Robottom suggest, many people write about the benefits of critical pedagogy, but few are actually doing it. I am hoping to look at power relationships within the local community in this context and show ways of giving voice to people who usually have little. The outcomes of the study will be related to this constraint of power in the community, in that the environmental program will attempt to lead students to action in the community. The audience for this study is intended to be broad and include students, parents, teachers, community members, and researchers.

From a theoretical perspective, I am looking at the data through critical theory because of the issues of power, justice, and privilege in this study (Kincheloe & McLaren, 2000). Issues of power and empowerment are also a part of critical theory specifically in terms of "social transformation" and equality (Lincoln & Guba, 2000, p. 172), which I look at in this study. I also draw from constructivist models in that the participants, including myself, are working towards actions or the construction of a product (Lincoln & Guba, 2000, p. 172).

I use a narrative approach (Silverman, 2000, p. 823) including the use of metaphor. I, consider the act of writing as a "method of inquiry" and "way of 'knowing'" as Richardson (2000) describes (p. 923). Taking Richardson's description of writing further, this study falls into the context of poststructuralism through the linkage of "language, subjectivity, social organization, and power" (p. 929). Again, although this study is a case study about the students and myself designing an environmental action project, I am looking at the overall structure of language, power, empowerment, and ownership within an educational system.

Mixed Methodology

Through a mixed methodology, I am attempting to look at my research context through different lenses. In an article on educational paradigms, Reeves (1996) suggests an "eclectic-mixed methods-pragmatic paradigm" that incorporates an "openness" to all of the methodologies, as well as the necessity of using different perspectives to "triangulate" data, and a practical approach that has educational improvement as a goal. This mixed paradigm is appealing to me because I believe it allows researchers and

audiences of research to look at my study in different ways and from a practical standpoint.

Within this mixed methodology approach, I will enact my commitment to understand student empowerment and social change through a socially critical environmental education perspective. I will do this by engaging as many people as possible in the research process and in the research audience. This study is based in critical theory because I seek to understand how all students and teachers can change their positions of power within a classroom, school setting, and community. Broadly, I will challenge what educators and others consider the goals of education, particularly of environmental education. Again, what does it mean to be an environmentally literate citizen? What are the goals of environmental education? Who decides what knowledge has power in the curriculum and classrooms? How do socially critical experiences in education shape students' lives and their community? Can students develop a sense of "conscious empowerment" through school experiences? Through critical questions such as these, I will explore the place of environmentally critical education in society and within students' lives.

Personal Biography

Maxine Greene says, "Looking back, I find myself seeing past experiences in new ways—and I realize what it means to say that I have lived one possible life among many—and that there are openings even today to untapped possibilities" (Ayers & Miller, 1998, p. 1). As a participant in this study, the views, values, and beliefs I have developed through my life experiences will play a significant role in the development and findings of this study. My own personal biography has drawn me to this study in a

number of ways. From a young age, I enjoyed being outdoors and playing outside, and was especially interested in animals—both wild and companion. I held this interest in animals and the outdoors throughout elementary school and middle school, but I don't remember very many experiences in these grades that furthered or developed this interest. The most interesting related activities I remember were field trips—to an outdoor center and a planetarium. I don't remember learning about local places or the local schoolyard in a way that was connected to the rest of the day-to-day content we were studying. In other words, activities that related to the outdoors in elementary and middle school seemed to be separate or a one-time field trip type of setting.

In high school, I went to a science and technology magnet school and focused on studying biology in the hopes that I would go to veterinary school and help animals in some way. For my senior year in high school, I completed an internship at Patuxent Wildlife Research Center in Laurel, Maryland, working with a wildlife veterinarian in the endangered species center on a project to help whooping cranes who were suffering kidney problems from non-steroidal anti-inflammatory drugs used to ease leg pain. This experience continued and increased my interests in helping animals and my appreciation for wildlife and wild places. I then went to Virginia Tech as a biology major, with the plan to take courses which would lead to veterinary school.

During my time at Virginia Tech, two courses in my sophomore year were especially influential in my developing interest in environmental studies and education. The first course was Literature and Ecology offered through the English department. The course provided a multidisciplinary introduction to a variety of literature on the environment from poetry by Gary Synder to descriptive first person texts by Edward

Abbey and Al Gore's book *Earth in Balance*. The following semester I took a small honors course in the history department called Wildlife in American Culture. This course also gave me access to a variety of multidisciplinary literature on the environment, including many written from a historical and cultural perspective. I particularly remember a paper we read deconstructing the influence the movie Bambi had on American culture. In this course, I wrote a paper on the topic of the interactions between wildlife, American culture, and DDT before Rachel Carson's book *Silent Spring* was published in 1962. I believe the interdisciplinary nature of these courses along with the other science courses I was learning from continued to help shape my beliefs and values especially regarding animals and the environment. Interestingly, neither of these courses was in my major department, and I do think that the interdisciplinary nature of the courses was particularly important to both my learning and the continuing development of my belief systems.

Virginia Tech was also a place—a real lived-in environment—for me to physically explore these new philosophies and ideas related to the environment that I was developing. In the mountains of southwest Virginia, when I wasn't studying for a biology test or writing a paper, I was immersed in the outdoor physical environment--in the mountains or local neighborhoods hiking, swimming, running or bike riding.

Also during my sophomore year at Virginia Tech, I began volunteering at a local Natural History museum organizing environmental activities for local elementary age students, and volunteering in a local elementary school helping fourth graders in reading and math. I thoroughly enjoyed these experiences working with elementary age students

and remember thinking that education might be another area I could make a difference, particularly in the connections between students and their local environment.

During my junior year of undergraduate work, I participated in the National Student Exchange program and studied at California Polytechnic University in Pomona, California. I drove cross country from Maryland to California and visited many national parks and other natural areas that I had not been to before. Through these experiences, as well as my experiences outdoors as a child and at Virginia Tech, I believe I was developing not only my interest in environmental issues, but also my appreciation for natural places and wildlife. One course of interest I took at Cal Poly was marine biology which required several field trips to outdoor sites to examine wildlife living in the Pacific Ocean and inlets, and again be immersed in a "real-life" physical environment.

Perhaps the thing that stands out most to me though in my experience at Cal Poly was the effect of pollution and smog on everyday life. On one of the gym buildings one day I noticed a sign that read "Smog Alert—Outdoor Activities and Sport Classes canceled today." I was shocked that the apparent (or in my mind at the time—supposed) "smog" could actually cancel a course meeting or activity. I remember the day that I first saw the sign in particular because I was planning on going for a jog around campus that afternoon. (The campus itself is beautiful and included many gardens, a citrus grove, a variety of trees, and even pomegranate bushes.) I decided to take my jog anyway, thinking that the smog warning was an exaggeration and that I was in a good enough physical condition for any smog not to really affect me. The day on the jog, and for many other days while I was there, I had to stop several times and went noticeably slowly because I felt like my lungs were not able to take in the same amount of air that they

usually did. My legs also cramped up. I think that this may have been one of my first truly negative and personal/physical experiences with an environmental problem. Up until this point, my personal and physical experience with the environment and the outdoors had been positive in the sense that it was mostly about viewing wild things, going to parks, and hiking in pristine environments. My experiences in urban areas outside had also been positive. I do not remember a time when pollution or another problem had physically interfered with me doing an activity that I wanted to do.

When I went back to Virginia Tech for one semester my senior year, I continued to finish the requirements for my biology degree and for hopeful admission to veterinary school. However, I carried with me the recent years' experiences in volunteer educational work, multidisciplinary environmental courses, and environmental experiences—both negative and positive. The last semester, I decided to take an education theory course as well. I applied to both veterinary school and the masters' certification program at the University of Maryland. I graduated a semester early and decided to explore education further by taking an internship at a nature center in Maryland, where I would teach environmental programs to a variety of age groups. After completing the internship, I felt that education was the area I truly wanted to explore further. However, I was accepted into veterinary school but not the education program I applied for. At the last minute, I decided to go to veterinary school because I thought that perhaps I should try it because I had been working towards this goal for a long time and was not completely certain if it was or wasn't a field I would be happy in. As it turned out, I did not feel that veterinary school was a good match for me after all,

and reapplied to the masters program in education during this year. This time I was accepted, and started my studies there the following year.

As I had felt relevance in the interdisciplinary environmental courses I took at Virginia Tech, I also felt relevance in the education courses I took at the University of Maryland. I enjoyed this program thoroughly and felt the year was a tremendous year of personal growth for me.

During the student teaching component of this program, we were required to complete an action research project related to a question we developed about our teaching experience. For this project, I studied the development of environmental action projects in a fourth grade classroom. The major finding of this study was the tremendous influence the development of these projects had on the classroom community and my relationships with the students. As the student teacher, I played an obviously different role than that of the classroom teacher. I asked the students if they would like to participate in an environmental club that would meet at recess and work on projects that helped the environment around the school. Almost all of the students signed up and we met at least once a week to do different projects outside. I had anticipated that I would study what projects we actually completed—making bird feeders, etc.—but what I ended up finding was that both the student and my participation in these projects influenced our interactions in the rest of the school day. I found that the environmental action projects we did a class transferred into a stronger classroom community through stronger relationships. I theorize that this occurred because of the experiences we had working towards common goals and our perceived joint successes making a difference. This

project continues to be relevant to me as I further describe the current study presented here, which in a sense is an extension of what I learned in this previous study.

Through my own experiences teaching as well, I have discovered that environmental action projects can bring students in the classroom together in common goals, as well as lead to positive changes and increased performance. In my first year teaching seventh grade science, the district I worked in had a curriculum in which the environment was the integrating theme—much as I had learned about environmental issues in my studies at Virginia Tech. There were three units—waste management, endangerment, and oceanography. Within each of these units, we discussed and completed environmental actions—e.g. we composted all of the waste we got from lunch, we set up recycling centers, students completed independent research projects on an environmental topic of their choice. Through this experience, I became interested in learning more about research on these types of programs and so I applied for the doctoral program at the University of Maryland in science education.

I began the program the fall following my first year teaching and continued teaching full time during my first two years in the program (and then part-time during this study). Most of my studies in my coursework involved the study of environmental action projects both with third grade students and with fourth-sixth grade students (both elementary school settings; the later being at a Montessori charter school).

In a fourth-sixth grade classroom, as a teacher researcher, I examined a classroom context when students designed their own environmental action projects. Students choose a variety of projects to complete in groups. I met with the groups individually and collectively. The culminating activity for the study was an Environmental World

Day activity that the students in my class held for the other classes to visit. The students developed stations related to their different action projects, and the other classes came to visit the stations and participate in various activities (e.g. composting, planting, bird feeders). In this way, students chose projects they wanted to work on, but the class as a whole had a similar end goal—to educate other students at the school on their topic.

Through examining issues of power relationships between students, myself, the class, the school, and larger community in this context, I looked at the development of these action projects through a critical perspective. Using multiple data sources, I developed three assertions around the relationship of power. First, the teacher's role of power in the classroom is meaningful even when one goal is for students to take more responsibility for their learning. Second, students develop complex power structures among their peers in cooperative groups and in the classroom. Finally, students are empowered to help their community through designing environmental action projects. Key implications from this study were the importance of teacher's awareness of power roles in the classroom and teachers need to use strategies to ensure that all students' participation is seen as important in the classroom community. Questions for future research include how students come to understand that they can make a difference in the community.

The following year, in another study with the same students, I asked the questions: How do students apply prior experiences in environmental action projects to their own lives? How do students apply prior knowledge and experiences to think critically about environmental dilemmas in their community? How do students construct plans of taking action in their community, and do they feel empowered to do so? Through

this brief and preliminary study on students' critical thinking and action to solve environmental problems, I reported some tentative findings. First, this study provided evidence that fifth-seventh grade students can apply both "school" knowledge and personal knowledge to analyze environmental dilemmas. However, more research is needed as to what students believe scientific ("school") knowledge to entail. Second, this study provided an example of how students can apply previous experiences in environmental action projects to their own lives and can begin to feel empowered to make a difference in the community. The actual experience of taking action through school projects seems important in developing this sense of empowerment. Finally, these fifth-seventh grade students were able to identify when they were lacking enough information to solve a problem or come to a conclusion, and were then able to formulate sophisticated questions that they would need to know to answer the original problem.

An interesting, important, and unexpected finding of this study was the absence of students' reported personal experiences in their written work. As the discussion and written portion of this activity were intertwined and connected, I was surprised to find a lack of personal experience in the written work after it had been rich in the discussion. A question arising from this finding is what do students constitute as being "scientific knowledge." Perhaps, they did not consider their own personal experiences as science and did not deem it worthy enough to include in a written format. However, the fact that these experiences came up through discussion, points to the importance of context to activate students' various resources.

Students in this study did have some hesitancy that their voices would matter as part of larger society as indicated by "write to someone who people would listen to" and

"talk to the governor. . and he might answer." However, this point makes an argument to continue this project through with student actions. I argue that this process of participating in environmental action is crucial for students' development of social responsibility and empowerment that they will need to be active and responsible citizens in the future.

This study left me with a number of questions and ideas for possible future research. One question this study raised is what is the purpose of environmental education? Is it to educate future citizens who can analyze environmental problems and ask the necessary questions to make informed decisions? Is it to educate students in how they can take informed action in their community? Also, what does it mean to be environmentally literate? Then, if we can decide on the goals of environmental education, how should they really influence instruction? How should students be assessed in environmental science? What is the role of critical questioning and sources of knowledge in assessment? Finally, how can education be more empowering to students in a way that is relevant to their lives, learning, and place in the world? I attempt to address some of these questions through the research presented in this paper.

I believe that each of these conclusions from my previous studies working with students on environmental action projects speaks to the importance of context. The contexts of these studies were each unique; for example, in the last study I described, I had previously taught the students involved in the discussions, and had tried to develop a sense of science as inquiry through my year with them as their general classroom teacher. Through this particular study, I would argue that students are able to use sophisticated

reasoning and critical thinking in science when they are in a context that allows them to activate the appropriate epistemological resources.

All of these selective past experiences I described here in my personal biography have influenced the development, the experience, and the writing of this current study. In retrospect, I have come to understand that my experiences in a tree house as a child through my experiences in interdisciplinary courses in college, my physical experiences in the outdoors, my development in understanding what it means to be a participatory action researcher through a combination of teaching and coursework, and numerous experiences teaching elementary-middle school students, have all led to the current writing and carrying out of this research work. In this current study, I explore these personal understandings in a more systematic way that I hope others can learn from as well.

Metaphor

Other researchers suggest the power of using metaphor in describing qualitative research (Janesick, 2000; Richardson, 2000). Richardson suggests that "metaphor is the backbone of social science writing" (p. 926). I would like to suggest a metaphor for my study. For this study, the students and I have embarked on a hiking trip in the mountains. On this trip, I am the leader and the guide. I have a rough map of where we will be heading, but in the wilderness, we know that we could come across unexpected events or detours. I have also marked on my map where I think the terrain will be especially rough or steep and where it will level off and let us walk a little easier. I believe before starting our journey, that the first mile or so should be level as we think about where we will be going on our hike and on our individual ideas for an environmental action project. Then,

I expect the path to get steeper and maybe even go in different directions as we try to make decisions and come up with one general direction, that allows for everyone to see and do what they are interested in. This will be the hard part. *How can we allow everyone's voices to be heard in the woods?* I expect that some students are going to be interested in looking closer at the trees in the forest, while others what to see flowers, and still others want to study the animals or the soil. Can we design a hike and project where everyone can live out their desired experience? Whose voices will we hear loudest along the way? How will I make decisions about where to go next? How will I know when to provide the students with the needed guidance to help them finish our journey?

My concerns in this metaphor of teaching and learning through hiking in the woods bring up many ideas from my past, present, and future. I am concerned with hearing everyone's voice in the classroom. I believe that an environmental action project is a type of pedagogy in which all students can contribute, learn, and act in meaningful ways. From my own experiences described in my personal biography, I feel it is important that all students feel a part of a classroom community that works together to accomplish common goals. I believe that individual students can each contribute what they are capable of when given these expectations. But again, it is important to me that all voices are heard. How I work through this in the classroom is part of a research process for me, as well as what my past experiences bring to it.

Limitations

This research study has some limitations. As a case study, I look at the development of environmental action projects in one context (within two classrooms in which I am the teacher). I do this in order to thoroughly describe and explore this one

context, and hope that others can learn from this in order to apply the findings to their own settings. However, as this case study seeks to look at change, it can only look at the influence and development of local change within this specific context or setting. I argue that there is a need for more systematic, large-scale change in education to include more relevant teaching and learning in students' communities. This larger scale change would need to be explored through further study. I believe that this study will allow others to think about what it would mean for more students to participate in environmental action projects that are place-based and designed to enact positive change.

My role in this study is one of an active participant and teacher researcher. My role in the study is both a benefit and a limitation. It is a benefit because I can describe my own thinking in this process, and I do not have to infer thinking based on my own actions. However, a study involving myself can be limiting because there are a small number of participants, and it can be difficult to see yourself accurately (Feldman, 2003, p. 27). As Feldman describes, I aim for a study of myself that provides "clear and detailed descriptions of how [I] constructed the representation from [my] data" and also gives "evidence of the value of the changes in [my] ways of being [a] teacher educator" (Feldman, 2003, pp. 27-28).

Significance

The contribution to the field this study makes is an empirically-rich, in-situ exploration of how environmental education can serve as one context of democratic education that empowers students and allows students to experience social responsibility. Through this study, I have explored closely how both student and teacher participants experience an environmental action-based learning context that aims for student and

teacher empowerment, as well as learning and retention of content knowledge. The study reveals how students and teachers perceive this action-based learning model while in its development, as well as reviews limitations in current schooling systems and provides suggestions for future directions.

Therefore, this research specifically seeks to add to the science education field's understanding by providing: 1.) an example of an exploratory action research study in which participants develop environmental action projects related to required curricular topics, 2.) an analysis of ideas related to student empowerment and social change through a socially critical environmental education perspective, and 3.) implications for practice.

Summary and Foreshadowing

Through this chapter, I have reviewed the overview and purpose of the study, framework and general research questions, participatory action research as a theoretical and practical model, the theoretical paradigm of critical theory, an overview of the mixed methodological approach, how my personal biography has informed the study, the limitations and possible significance of the study.

The main purpose of the study is to understand student empowerment and social change through a socially critical environmental education perspective. The research question guiding the study is: How do participants make sense of a learning experience in which students design and carry out an environmental action project in their community?

This study uses both participatory action research and critical theory as practical and theoretical frameworks. These frameworks are particularly relevant for an environmental education research study that seeks to examine social change, social structure, and relationships through the actions of its participants. Issues of power and

empowerment are also a part of critical theory specifically in terms of "social transformation" and equality (Lincoln & Guba, 2000, p. 172), which I look at in this study.

This research is also a case study presented using a mixed methodological approach that includes both qualitative and quantitative data. I chose the mixed methodological approach in order to understand data from many view points, in a type of data crystallization.

As a participant in the study as well as the researcher, my perspective and personal background is a part of the study. I have described selective experiences in my personal biography, including findings from studies I have completed related to environmental action projects. These previous studies have revealed new understandings to me related students' development of content skills, action skills, empowerment, and relationships within a classroom community.

Limitations in the study mostly relate to the idea that this is a small case study in one specific context. I hope to contribute to the field specifically by adding a rich description of an example of the development of environmental action project within classroom communities, an analysis of ideas related to student empowerment and social change, and implications for practice in the science education field.

In Chapter Two, I review literature related to the study specifically as the research literature is situated within the research question. Specifically, this will include an analysis of literature related to critical pedagogy, knowledge constructs, goals of environmental education, research and curricular models for environmental action projects, analysis of environmental literacy, general and technological literacy related to

environmental action projects, and a review of curriculum documents that support environmental action projects. In Chapter Three, I review the design and methodology grounding the research. In Chapter Four, I present data and emerging insights. In Chapter Five, I discuss the implications, conclusions, and future research possibilities related to the study.

CHAPTER TWO: REVIEW OF RELATED LITERATURE

In this chapter, I review research and literature specifically related to the central research question and information needed to inform that question. Related topics include critical pedagogy, knowledge and power within a classroom setting, goals of environmental education, research and curricular models for environmental action projects, environmental literacy, reading and technical literacy, and national and state curriculum models and standards as related to environmental action projects. I have presented original quotes from literature because I hold the belief that it is important to represent and portray multiple voices in the literature and the field.

Critical Pedagogy

Developing environmental education projects is rooted in critical pedagogy and seeks to change and empower individuals and communities involved. I will first review literature related to critical pedagogy and its relationship with the environmental action projects described in this study. Next, I will discuss the role of knowledge and power in a critical pedagogy setting.

The Impossibilities and Possibilities of Critical Pedagogy

In this study, I present my understanding of what I envision to be the tensions and possibilities of critical pedagogy in a middle school science community where I am the teacher. Why critical pedagogy? First, there is no one definition of what critical pedagogy looks like. Maxine Greene (2003) quotes a poem by Adrienne Rich that speaks to a general ideology of hope that I believe critical pedagogy suggests:

A clear night in which two planets

seem to clasp each other in which the earthly grasses

shift like silk in starlight

If the mind were clear

and if the mind were simple you could take this mind

this particular state and say

This is how I would live if I could choose:

this is what is possible

For me, this is an especially powerful poem. Critical pedagogy, teaching and learning, in which students are empowered to make differences in their own lives and others, has come to be a personal ideology. It is how I wish to live. But as the poem also suggests, our lives are not so simple that we can choose our exact paths or enact things so simply. The question then becomes, how can I live out what I believe in, within the system that we live? Again, what might critical pedagogy look like within our current system of schooling and society?

Finding Hope within the Tensions of Critical Pedagogy

There are a number of tensions and contradictions that I must not only live with, but also need to embrace, in critical pedagogy. Recognizing the tension between impossibility and possibility that Rich and Greene (2003) allude to in the poem above has been both a realization as well as a relief for me. It has helped me to recognize that while my own personal ideal of critical pedagogy may in fact be impossible in reality, this tension between impossibility and possibility creates an opening for me to explore my passions and hopes. Lather (2001) speaks to this tension as well from a poststructural perspective:

> I am entirely persuaded by poststructural theory that it is what seems impossible from the vantage point of our present regimes of meaning that is the between space of any knowing that will make a difference in the expansion in social justice and the canons of value toward which we aspire. Implementing critical pedagogy in the field of schooling *is* impossible. That is precisely the task: to situate the experience of impossibility as an enabling site for working through aporias. (p. 189)

Lather's (2001) particular claim that critical pedagogy "is impossible" is particularly revealing. Recognizing this, and acting in spite of it, is an empowering idea to me. It no longer means that I am doing something wrong, but that I am a part of a system that is so complex that no one can ever completely act purely or "rightly" within it. There are so many other contradictions and tensions that are a part of this impossibility/possibility construct as well. The point is that there may be no all encompassing solutions to these tensions, only power in their recognition and action within. For instance, how do I balance my role of authority as the teacher and the freedom that I wish to instill in students? Where is the space between structure and choice (that Dewey also talks about as well) (Dewey, 1938/1963)? What about the complex nature of my authority as a non-tenured young white woman teacher who is working within a system that tells me I have little/no choice in what I teach? Where is the space between my desires as an individual and the demands of the systems and institutions that make policy? Further, what about the relations of myself as an individual within both the teaching system and the society that I am a part of? Where do the identities of students and their families fit within these systems and society? What about

the tensions between each of our multiple identities in our professional and personal lives?

My point here is not that I know the answers to any of these questions. Nor do I want to suggest that the deconstruction of all these tensions is especially meaningful. As Hill Collins (2000) suggests, postmodernism can be powerful for us in the recognition that it is a continuum. At one end of the continuum, we can deconstruct ideas to the point that they are unhelpful. But at the other end, we can reconstruct what we have to create new meaning (p. 62). I further argue that the recognition of tensions and contradictions in our lives can be an empowering place to start.

Greene (2003) asks the crucial questions: "How can we awaken others to possibility and the need for action in the name of possibility? How can we communicate the importance of opening spaces in the imagination where persons can reach beyond where they are" (p. 100)? These questions speak to the power of possibility and hope. We cannot simply sit back and say, our hopes for change are impossible in the complex system we live in, or this is just "the way it is." I believe in the possibility of hope and action in an imperfect world. It is this hope that Freire (1998) states is part of what makes us human:

> Hope is something shared between teachers and students. The hope that we can learn together, produce something together, and resist together the obstacles that prevent the flowering of our joy. In truth, from the point of view of the human condition, hope is an essential component and not an intruder. It would be a serious contradiction of what we are if, aware of our unfinishedness, we were not

disposed to participate in a constant movement of search, which in its very nature is an expression of hope. (p. 69)

So, our incompleteness is not fatalistic, but rather the very thing that makes us human and gives us hope for the future. Our ability to transfer this into the classroom with students will not only create a critical pedagogy, but I believe, a humanizing pedagogy that attends to each of our human qualities, as well. Other researchers have also identified a humanizing pedagogy that expands on our current understandings of critical pedagogy (Price & Osborne, 2000; Ng, 1995). From a humanizing perspective, I am concerned not only with students' development in environmental social action, but in the development of who they are as "whole" people. This perspective also questions what "humanness" means and how our whole selves develop and "transform" through working in systems of hierarchical power relations (Price & Osborne). In this way, critical pedagogy is "not only for the oppressed. . . it is for us as human beings, to help us liberate ourselves from the shackles of our own learning" (Ng, p. 150). I have found this idea of humanizing pedagogy to allow for a more global and encompassing perspective for critical pedagogy. It is for all of us; it does not claim that we or anyone else has the power to "rescue" another from their "oppression." We are in this together because we are humans who are learning, growing, and teaching together.

Taking these tensions and hopes into consideration, I now turn to explore the possibilities in my own research and life context.

How Critical Pedagogy is Situated in the Current Study

Critical pedagogy provides a theoretical framework for my research of students' development of environmental action projects. As a framework, it guides my

understanding of the development of projects designed from the perspectives of the participants and community members. Specifically, ideas in this study related to critical pedagogy include:

- How is action and place-based learning situated within traditional required curricula in public school?
- What are the "dangers" of a socially critical pedagogy (Osborne, 1998)?
- How do my values play out in the process?
- What is student empowerment and how does it develop (or not)?
- What are the connections between student empowerment and student ownership?
- What is the teacher's role in opening a space for the possibility of empowerment?
- What types of power and roles are present in a classroom in this setting?
- How do issues of power play out through relationships in the classroom community?
- What are the processes involved for teachers and students in designing an action project?
- What are the points of difficulty when completing a community action project and what helps students overcome them?
- How did this experience of developing environmental action projects influence relationships in the classroom and school community?

Also, questions suggested as future research areas in the literature also apply to the current study and critical pedagogy (Volk & Cheak, 2003; Greenall Gough & Robottom, 1993):

- Do students' involvement in this type of environmental pedagogy inspire a "consciousness of empowerment" (and what does this look like?)
- How can a socially critical curriculum fit into today's educational system?
- How do students develop an internal locus of control?
- How do students' involvement in this type of pedagogy impact their various forms of literacy (e.g. environmental, general, technological) and overall "way of being" in the classroom?

Kincheloe (2004) describes the connection between curriculum and critical pedagogy that I am attempting to explore:

> [T]he school curriculum should in part be shaped by problems that face teachers and students in their effort to live just and ethical lives. Such a curriculum promotes students as researchers (Steinberg and Kincheloe, 1998) who engage in critical analysis of the forces that shape the world. Such critical analysis engenders a healthy and creative skepticism on the part of students. It moves them to problem-pose, to be suspicious of neutrality claims in textbooks; it induces them to look askance at, for example, oil companies claims in their TV commercials that they are and have always been environmentally friendly organizations. (p. 16)

The authority of the teacher engaged in curriculum of this type changes from the authority of teachers in more traditional models. Teachers of critical pedagogy are part of a more complex "dialectical authority" in which they use their position of power to support students in their research and ideas (Kincheloe, 1998, p. 17). This tension of authority of the teacher and freedom for the students is one of many tensions that teachers

are faced with in critical pedagogy. How do teachers and students work with this tension in a classroom?

In the type of socially critical environmental education I am suggesting, students often work within and on problems in their own local community, while also having broader global ideas in mind. This type of experience is often referred to as "place-based education" (Sobel, 2004), which I will describe further later in this literature review.

Development and Perspectives of Knowledge and Power in Critical Classroom Setting

Feminist and Education for All Perspectives

Through my own teaching experiences and action research in classrooms, I developed an interest in knowledge and power in the classroom. Questions such as what knowledge counts in the classroom, who creates knowledge, and who decides what knowledge students should know or engage in, have guided some of my personal questioning of teaching and action research in environmental education. In this study, I also further examine my questions of knowledge and power in broader contexts of action research by teachers, larger institutions, and their effects on teachers and classroom practice. I examine these ideas of knowledge and power through two related frameworks—one from the perspective of feminist pedagogy and "women's' ways of knowing" (Maher & Tetreault, 1997), and the other from a discussion on teacher education for all students (Gore, 2001). The feminist framework is based on knowledge that is socially constructed and will situate knowledge and power in what it means to have mastery, voice, authority, and positionality in a classroom context. I argue that Gore's framework is related to these themes and includes intellectual quality, relevance,

supportive environment and recognition of difference. Inherent in these discussions will be issues of social justice, change, and empowerment.

I also want to suggest that these themes and frameworks are one way to organize ideas and a discussion around knowledge and power. I have found this to be a very complex topic and these themes are in no way final or existing in isolation. Gore (2001) cautions that the generality of categories cause people to accept them as already in practice. She asks that individuals look very closely at specific instances in which these themes are actually enacted in their programs. These categories are overlapping and just one way to approach this topic. However, I hope, as well as Gore, that these might at least allow for more coherent discussions and programs.

Mastery and Intellectual Quality

Within this theme, Maher and Tetreault (1997) question "what it is that students are supposed to know" (p. 158). In a traditional sense, students are expected to "comprehend" a curriculum as designed by the "expert" in the field. Traditional types of knowing include "received knowing" and "procedural knowledge" (p. 166, 168). Maher and Tetreault argue that this is really a type of assimilation to mainstream culture, not based on students' individual identities. From this feminist perspective, mastery should be about more than an individual's understanding of what an expert deems valuable; it should involves interpretation of relationships and discussions within varying contexts.

Gore (2001) also describes a more complex view of knowledge that is "problematic" and "socially constructed rather than simply accepting knowledge as a body of facts" (p. 128). She suggests a variety of ways in which this type of "high intellectual quality" can be experienced in classroom contexts, including learning through

critical thinking, "deep understanding" of topics, and classroom discourse (p. 128). Tarule (1997) also argues for dialogue as "a way of knowing" and "making knowledge" that is socially constructed (p. 279).

Therefore, both of these frameworks argue for knowledge that is socially constructed in the classroom where students and teachers are the creators of knowledge, and where students and teachers have power through their construction. This knowledge would then be different depending upon who was involved and in what context. This still leaves questions such as what is it that students should know, and how should they learn it. Next, I will discuss how voice and relevance also fit into the frameworks of feminist pedagogy and teacher education for all.

Voice and Relevance

Maher and Tetreault (1997) describe voice in two different ways, as being about a "new form of personal student expression" and "the construction of communities of discourse as teachers' and students' voices interact with, influence, and construct each other" (p. 159). Voice then is closely connected with the theme of mastery through student construction: voice is a lens through which the construction of knowledge can be understood. Tarule furthers the metaphor of "developing a voice" that includes the interconnections of "voice, mind, and self" (p. 275). She argues that Vygotsky's research on child development supports the "connected knowing" people come to understand through dialogue (p. 277). Developing voice then is about developing individual and group meaning. Students that do not have a voice in classrooms do not develop the same types of knowledge as students and teachers that do. This implies the importance of

opportunities for student discourse in which all students feel comfortable participating, both within K-12 classrooms and in higher education settings.

Gore (2001) argues for a dimension of relevance in school and teacher education programs that I argue is related to voice. Within all types of learning, there needs to be "links" between students' background or prior knowledge and their future experiences. These links should be made explicit to students and be presented in a coherent way in programs. In order for voice to develop, the conversation and topic need to be relevant to all students in the classroom. When students are able to develop voice, perceive learning as relevant, and can even act on this knowledge in their own lives, they can become empowered. The types of conversation, topic, voice, and relevance are going to be different in every classroom, and even for each individual student. In this lies one of the greatest challenges of curriculum development.

Authority and Supportive Classroom Environments

Authority can be a problematic construct in classrooms. What are teachers' and professors' authorities in relation to "their disciplines, their students, and the institutions in which they work" (p. 159)? Maher and Tetreault (1997) suggest that in traditional contexts authority is "hierarchical" through "expert to teacher to student" and is "enforced" by the institution (p. 160). However, in situations where knowledge is socially constructed through the voices and relationships between students and teachers, authority, too, becomes something that can be constructed and not pre-eminent. Within a feminist classroom, knowledge, relationships, voice, and authority are being evolved. However, a context of a feminist classroom is not free from the institutional authority. In order to be really a part of a situation with evolving authority, the entire program needs to

have the same coherent ideal. There will probably always be institutional authorities to work through, but if a program has a strong coherence, students and teachers can have more power in the knowledge they deem meaningful.

Related to the importance of evolving authority, is the dimension of a "supportive classroom environment" (Gore, 2001, p. 127). Again this is important for all types of classrooms. Developing a supportive classroom environment is a complex task for teachers. They need to experience it first, and I believe, explicitly discuss its formation for their own teaching. Gore alludes to a number of things that can help teachers achieve this type of an environment, such as helping students "self-regulate" their learning, giving students "control" or power over their learning, and explicitly identifying what is "expected of students" (p. 128).

Tarule (1997) also calls for "discourse or interpretative communities" as places where knowledge is "produced, reproduced, and contested" (p. 286). Again, knowledge in the classroom is something that is evolving and that is the "common property of the community" (p. 286). From my action research on students engaged in environmental action projects as a class, I have found students to be more empowered when they feel part of a group working towards common goals. This "common property" idea is one that can really strengthen relationships, empowerment, and knowledge, from my own perspective.

Positionality and the Recognition of Difference

Maher and Tetreault (1997) view this theme of positionality as a theme that can only be examined relationally. That is, no one has an individual positionality without relation to anything else. Constructs of black cannot exist without white or male without

female. Therefore, positionalities are different from identities in that peoples' positionalities are more likely to change depending on the context they are in. For example, a student's positionality in a classroom with a feminist philosophy would be different than her positionality in the larger society (pp. 160-161). It is also important to mention that students and teachers can have multiple identities and positionalities within the same context that need to be considered.

Gore (2001) also argues for the importance of positionality in terms of "recognition of differences" that can be seen through different perspectives. For a classroom in which all people feel empowered and included, teachers need to ensure that perspectives outside of the mainstream culture are "included and legitimated" and that all students are given opportunities to participate in the active construction of knowledge within the community (p. 128). Through explicit attention to positionalities and difference within the classroom, more students can develop knowledge that is empowering to them. One way to give explicit attention to these differences is through open types of dialogue and a community that is respectful, caring, and open.

Finally, I would like to note the power of multiple positionalities for bringing more people to common understandings. In thinking about my own position, as a white woman teacher from a middle-class background, I realize that I will not be able to put myself in all others' positions, but I can recognize commonalties as starting points and be willing and open to appreciate others' perspectives. Maher and Tetreault (1997) give an example of one of their students writing on this topic: ". . .the attempt of a non-Black reader to write about the Black woman writer will be far more dangerous, if not impossible—at least to write from a Black perspective. Perhaps it would be less

presumptuous and less offensive for the White women writer to try to comprehend the 'feminist' or 'lesbian' issues within Black women's literature" (p. 161). The construct of people having multiple positionalities within different contexts creates a more open space for people to develop dialogue and understanding of each other through their commonalties first, and their differences later. This is understanding that applies in all types of classrooms.

Power Roles

O'Hair and Blasé (1992) identify five types of power that teachers use in a classroom: "expert, referent, legitimate, reward, and coercive" (p. 12). Expert and referent power has been shown to be associated with student learning (Richmond & McCroskey, 1984). Students perceive teachers as having expert power when they appear "competent and knowledgeable" (O'Hair & Blasé, p. 13). Referent power involves the power of relationships in the classroom and can be broken down into three types: "feedback monitor, role model, and personal advocate" (O'Hair & Blasé, p. 13). These types include communication with students to best meet their needs, students' perceptions of the teacher as "approachable," and teachers supporting the students as advocates for their learning and development (O'Hair & Blasé, p. 13). In this study, I focus on my use of expert and, especially, referent power, in the classroom. I will refer back to these types of power in the discussion section of this study.

Goals of Environmental Education

Before reviewing the possibilities and frameworks for development of environmental action projects, I will briefly review literature concerning the overall goals of environmental education. What are the goals of environmental education? Research

literature gives many definitions, with responsible student action often cited as the final outcome. For instance, Stapp et al. (1969) wrote, "Environmental education is aimed at producing a citizenry that is knowledgeable concerning the biophysical environment and its associated problems, aware of how to help solve these problems, and motivated to work toward their solution" (cited in: Gigliotti, 1990, p. 9). Hines et al. (1986) also state that "the development of environmentally responsible and active citizens has become the ultimate goal of environmental education" (p. 1). The Western Regional Environmental Education Council defines the goal of environmental education in their curriculum guide Project WILD: "The goal . . . is to assist learners of any age in developing awareness, knowledge, and commitment to result in informed decisions, responsible behavior, and constructive actions concerning wildlife and the environment upon which all life depends" (WREEC, 1983).

What exactly is meant by "environmental action" and "responsible environmental behavior"? Hungerford and Volk (1990) give specific qualities of an "environmentally responsible citizen":

> (1) an awareness and sensitivity to the total environment and its problems [and/or issues], (2) a basic understanding of the environment and its allied problems [and/or issues], (3) feelings or concern for the environment and motivation for actively participating in environmental improvement and protection, (4) skills for identifying and solving problems [and/or issues], (5) active involvement at all levels in working toward the resolution of environmental problems [and/or issues]. (p. 9)

In other words, environmentally responsible citizens use their knowledge to determine and carry out the appropriate actions to solve environmental problems or issues in society.

Environmental action projects, such as those developed by students in Hungerford and Volk's (1990) "Issue Investigation and Action Training" Model (IIAT), are one way to allow students to participate in the process of environmental action. (p. 16). In this model, students complete a report on their own chosen environmental issues, develop action plans, and carry out their plans with their teachers' assistance.

Environmental literacy is also a goal of environmental education that I will describe in further detail in a later section in this chapter.

Before continuing, I would also like to clarify some other terms commonly associated with environmental action projects and place-based education. First, I have defined above some perspectives on the goals of environmental education. Sobel (2004) argues that place-based education goes beyond these goals of environmental education to "look at how landscape, community infrastructure, watersheds, and cultural traditions all interact and shape each other" (p. 9). In this way, place-based education takes an integrated curricular approach similar to environmental education, but perhaps more culturally based. Another term that is frequently associated with these is community-based education. In Wals et al.'s (1990) description of an education model called "action research and community problem-solving" they describe goals that include students' development of environmental action projects in their community. They identify this model as a "form of community-based environmental education" (p. 15). Sobel clarifies that the term community-based education is used to "elaborate" on place-based education

by giving "equal emphasis to cultural and natural contexts for learning" (p. 61). Another term that appears in the literature is "locally-focused teaching" (Walker Leslie, 1999; Tallmadge, 1999). This term is specifically linked to connections between local nature journaling and writing. It therefore is also a part of place-based education.

To summarize, environmental action projects are a specific example of place-based education, which is also linked to community-based and locally-focused teaching. For the purposes of this paper, I will use the terms environmental action projects and place-based education.

Frameworks for Environmental Action Projects: Research and Curricular Education Models for Environmental Action Projects

I now review research and curricular models that are appropriate to studying the development of environmental action projects to further examine the framework of this type of pedagogy. Although some models may be considered both research and curricular, for the purposes of this discussion, research models include action research, participatory action research (PAR), and "action-research and community problem-solving" (ARCPS). Curricular models include the "5E" (engage, explore, explain, extend, evaluate) science education model, place-based education, and "investigating and evaluating environmental issues and actions" (IEEIA) (based on IIAT). I start with reviewing the models that are of the broadest scope and progressively work to describe the most specific models for research and curricula on the development of environmental action projects.

Research Models

Action Research in Science Education

Through inquiring into their own teaching, teachers can learn more about effective practices as well as learn a method of inquiry. Akerson and McDuffie (2002) argue that this is an important point as "most elementary teachers have never conducted a science inquiry, yet they are being asked to teach science as inquiry" (p. 1). They argue that an experience in conducting an action research project can give teachers an experience of inquiry into their own teaching. Elementary education preservice teachers might also be encouraged to engage in research on their science teaching, as this tends to be an area where elementary teachers have less background.

Merkle (1994) suggests that by allowing preservice teachers to do action research in their methods courses they will be more likely to conduct action research themselves as teachers. In this way, action research can provide another way for preservice and inservice teachers to learn about effective teaching strategies and inquiry. The inquiry involved in action research can provide a model for inquiry activities with students.

Lin (2001) conducted a study to investigate how eight elementary science teachers' practices changed as a result of engaging in collaborative action research with a researcher. She found that teachers developed "constructivist" teaching behaviors through their studies, action research encouraged teachers to reflect on their teaching, and "seven of the teachers building classroom climate was as good or more positive than before on seven scales of the questionnaire" (p. 1). In this context "constructivist" teaching was defined as teaching that involved students more in the process of what they were learning.

Feldman and Capobianco (2000) also review other instances when action research has been conducted in science education, through teacher education, professional

development, and curriculum development. For example, Hewson et. al. (1999) had preservice teachers in science education do action research on "what it means to teach for conceptual change" (p. 1). Science FEAT (For Early Adolescence Teachers) is a project described by Speigel and funded by the National Science Foundation, in which practicing middle school science teachers conduct action research. The teachers take classes in research methods and meet regularly to talk about their research. Many of the research projects have also been published.

Action research is important to the study described here as a method for conducting case study research that is participatory and seeks to explore changes within the specific context of environmental action projects in a middle school community.

Participatory Action Research (PAR)

Mordock and Krasny (2001) describe PAR as a framework that both teachers and researchers can use to better understand and situate environmental education, specifically environmental education that empowers students. Mordock and Krasny argue that PAR can provide a "theoretical and practical framework" for the study of environmental education, particularly as it relates to students' research about their communities and action to improve them. They cite the National American Association for Environmental Education (NAAEE, 1997) guidelines which "emphasize in-depth understanding based on accurate information, critical thinking, and research skills, as well as taking action to enhance the environment" (p. 15). The theory guiding PAR, based in action to create social change, can provide a grounding for methodologies of environmental education research. Mordock and Krasny therefore identify PAR as a framework to examine studies about environmental action in education. Their focus is on "participatory

research in community development" which could also include action research by teachers focused on community issues (p. 16).

Mordock and Krasny (2001) provide case study examples that show how this is possible in classrooms. For example, "the *Aerial Perspectives* program enabled youth to learn new skills and science concepts regarding nonpoint pollution, the epidemiology of lead poisoning, changes in land use over time, air-photo and map interpretation, GIS, interviewing, document analysis, and synthesizing and communicating results" (p. 19). A teacher involved in this program said about the program, "If you give middle school students the opportunity to do hands-on research, you will facilitate students' learning through problem solving, set the groundwork for further science education at the high school level and beyond, and empower students to be change agents on environmental issues" (p. 19). In the case of this middle school, students collaborated with a local garden club to purchase and use water-sampling equipment at the school. Other student research projects have increased media attention about the negative impacts of vacant lots in the community, and the impact of salt leaching into a local stream (p. 19).

Therefore, PAR provides a framework to meet the many goals of environmental education, including inquiry and action. In fact, it may provide a model for student inquiry, which guides students from designing inquiry projects to action, and involves students in all aspects of the research process. PAR can be approached from both qualitative and quantitative methodologies (Mordock & Krasny, 2001, p. 20).

Action Research and Community Problem-solving (ARCPS)

Wals et al. (1990) developed a model called Action Research and Community Problem-Solving (ARCPS) for environmental education that is similar to PAR, or a further specific subset or example of PAR. This model can be considered both an

educational model and an (action) research model. ARCPS can be broken down into two parts: action research conducted in a classroom, and community problem-solving as the context for the action research and environmental education. Action research is described as a process that includes both teachers and students in cycles of planning, implementing, and evaluating progress. Participants (teachers and students) are expected to reflect on their learning and action throughout the study, involving periods of "discussion, negotiation, and exploration" (p. 14). Problem solving in the context of schools' communities is meant to connect students' learning with their outside lives. Several steps of community problem solving are identified as "recognizing a problem; collecting, organizing, and analyzing information; defining the problem from a variety of perspectives; identifying, considering, and selecting alternative actions to take; developing and carrying out a plan of action; and evaluating the outcome and the entire process" (p. 14). I argue that ARCPS is an example of PAR, with a detailed plan for how to enact PAR within community problem solving.

Wals et al. (1990) also present steps of the process of ARCPS as a whole. The first step is for school systems, administrators, and teachers to plan the process that ARCPS can take within their schools. This can involve workshops, cooperative consultations, being comfortable with a localized open-ended curriculum, and framing the time periods. The next step asks teachers to assess their students' skills in "information gathering, communication, and group processing skills" (p. 16). Based on the teacher's assessment, teachers can scaffold instruction accordingly with help from workshops or other training modules. The third step involves students choosing a project topic of something that they wish to improve in their community. Particular attention is

given to both the "natural and social environment of their community" and students often brainstorm topics after taking a walk through their community (p 16). Students negotiate criteria for their decision through class discussion and come to a consensus. For the fourth step, students research the topic they have chosen with the teacher's help as project facilitator. Next, students determine what action is appropriate for them to take to improve the problem. Action research is particularly apparent in this step as the teacher and students can continually reflect on and refine their plan of action. Journaling is one instrument for recording this process. The last step of ARCPS is evaluation, although this should also be considered in an ongoing way throughout the process. Evaluation can take the process of log books, individual journals of teachers and students, teachers' observations, and student sheets on their opinions of positive, negative, and parts they would change about the project. As this type of project seeks to empower students, students' written work and verbal statements can be evaluated by teachers for feelings of empowerment. Teachers are encouraged to evaluate students in productive ways by giving feedback on students' journal writing, reports, class participation, work in small groups, oral reports, and self-evaluations (p. 18-19). The goal of this whole process is for students to be the center of "constructive change" and for teachers and students to reflect on and research this process (p. 19).

Curricular Models

The 5E Model

The 5E model is a science education model that is applicable to all grade levels (Bybee et al., 2006). Both of the districts I have taught in use this model as a guide for science teaching in the elementary and middle school grades. Other districts across the country use it as well. It is a general science education model that is intended to be

flexible and engage students in learning. There are five phases, that can occur cyclically or throughout (they are not intended to be a rigid step by step process). The five phases are engage, explore, explain, extend, and evaluate. I have created an outline of a possible environmental action project on local stream restoration using this model. Stream restoration can incorporate several of the examples of place-based education that Sobel (2004) suggests, including water quality monitoring, schoolyard naturalization, habitat restoration, natural areas interpretation, and invasive species control. Please see Appendix A for a possible project outline of stream restoration using the 5E model as a framework.

Place-based Education

Environmental action projects are more broadly situated in the context of place-based education. Place-based education is a model of education that is receiving increased attention in recent years. The field of environmental education particularly has been linked to place-based education. Sobel (2004) specifically describes how environmental education can be situated within a place-based model. He defines place-based education as:

> [T]he process of using the local community and environment as a starting point to teach concepts in language arts, mathematics, social studies, science, and other subjects across the curriculum. Emphasizing hands-on, real-world learning experiences, this approach to education increases academic achievement, helps students develop stronger ties to their community, enhances students' appreciation for the natural world, and creates a heightened commitment to serving as active, contributing citizens. Community vitality and environmental quality are

improved through the active engagement of local citizens, community organizations, and environmental resources in the life of the school. (p. 7)

Environmental action projects are specific examples of place-based education, and are usually interdisciplinary, as the above definition suggests. Examples of place-based environmental action projects that Sobel (2004) describes include "water quality monitoring, school recycling, schoolyard naturalization, habitat restoration, natural areas interpretation [as related to conservation], aquaponics and waste management, toxins reduction, energy conservation, green buildings, and invasive species control" (p. 42). One purpose of this study is to examine how environmental action projects within the framework of place-based education are linked with literacy development for students.

Investigating and Evaluating Environmental Issues and Actions (IEEIA)

A curricular model that has been used to develop environmental education programs is the IEEIA curriculum model, based on the IIAT Model first developed by Hungerford and Volk (1990). Volk and Cheak (2003) describe IEEIA as a "skill development program, designed to help learners take an in-depth look at environmental issues in their community, to make data-based decisions about those issues, and to participate in issue resolution" (p. 12). Forms of this model have been used with students in elementary through college. The development and research concerning this model is discussed further in the section on literacy below.

Environmental Literacy

Definitions of Environmental Literacy

The definition of environmental literacy and goals of environmental education are not clearly defined across research and curriculum (Disinger & Roth, 2003). However, I analyze what literature does say about environmental literacy, particularly how it is

defined from frameworks of "Science-Technology-Society (STS)" and "critical thinking" perspectives. First, I will review how environmental literacy has been defined and used in research studies, and then I will give my own operational definition of environmental literacy within the context of this study.

Charles Roth has been credited as the first to use the term environmental literacy in 1968. He has argued that "environmental literacy should be defined. . .in terms of observable behaviors. That is, people should be able to demonstrate in some observable form what they have learned—their knowledge of key concepts, skills required, disposition toward issues, and the like" (Roth, 1992, p. 5). As stated previously, though, Disinger and Roth (2003) recently suggested that environmental literacy "continues to lack precise definition" (p. 1). However, Roth has attempted to identify characteristics of environmental literacy, including how it can exist on a continuum of three levels, as well as what distinguishes it from other types of literacy. This continuum of environmental literacy includes "nominal, functional, and operational" levels where nominal literacy is the lowest level indicating an "ability to recognize many of the basic terms used in communicating about the environment and to provide rough, if unsophisticated, working definitions of their meanings;" functional literacy indicates "a broader knowledge and understanding of the nature and interactions between human social systems and other natural systems;" and operational literacy indicates "progress beyond functional literacy in both the breadth and depth of understandings and skills" (p. 2). The main characteristic Disinger and Roth argue distinguishes environmental literacy is its "action" perspective or its goal of "responsible behavior" (p. 3). They also argue that environmental literacy is not simply a subset of science literacy, but has issues that

function outside the scope of science literacy, including "the interrelationships between natural and social systems; the unity of humankind with nature; technology and the making of choices; and developmental learning throughout the human life cycle" (p. 3). This allows for six major areas of literacy, including "environmental sensitivity, knowledge, skills, attitudes and values, personal investment and responsibility, and active involvement" and four strands including "knowledge, skills, affect, and behavior" (p. 3). Other researchers and environmentalists have expanded this framework of the literacy continuum, major areas, and strands.

Educational researchers, in particular, have added to the environmental literacy continuum through examining Orr's (1992) work on ecological literacy. Ecological literacy is often used synonymously with environmental literacy, although it originated after the term environmental literacy and can imply a more cultural perspective. Orr, who first used the term ecological literacy, has been criticized for not differentiating it more from environmental literacy (Cutter-Mackenzie & Smith, 2003, p. 502). At any rate, Orr defines "knowledge, caring, and practices" as the "basis of ecological literacy" (p. 92). This relates similarly to the major areas of environmental literacy given by Disinger and Roth (2003), namely knowledge, attitudes and values, and active involvement.

Cutter Mackenzie and Smith (2003) further identify the term "eco-literacy" to connect what they describe as "ecological literacy and environmental philosophy" which combines "complex knowledge and beliefs about the environment" (p. 502). Using the framework of Roth and Disinger (2003) and Orr (1992), they expand further on the levels and continuum of environmental literacy, and again what they term "eco-literacy." In

their continuum, people can be ecological illiterate, nominal ecological literate, functional/operational literate, or highly evolved ecological literate. In this way, they expand the continuum given by Roth to include "highly evolved ecological literacy" (p. 502). According to Cutter-Mackenzie and Smith, a person with "highly evolved ecological literacy. . possesses a thorough understanding of how people and societies relate to each other and to natural systems, and how they might do so sustainability" (p. 503). This might be thought of as a goal for environmental literacy as well. For the purposes of this study, I will use the term environmental literacy (and consider it to have similar goals as ecological literacy and eco-literacy).

How is Environmental Literacy Situated within a Science-Technology-Society (STS) Perspective?

STS advocates student learning about science and technology in the context of societal issues. DeBoer (1991) argues that environmental education deserves "special attention as part of STS" and credits it as "perhaps one of the greatest driving forces toward a STS approach" (p. 179, 182). The goals of environmental literacy place it naturally within STS perspectives, especially in terms of its focus on solving practical issues and problems in society through an action focus. As Mackenzie and Smith (2003) have suggested, an environmentally literate person is one who understands "how people and societies relate to each other and to natural systems, and how they might do so sustainability" (p. 503). Therefore, environmental literacy is at least partly about connecting knowledge in scientific ecological concepts with practical applications in society.

The National Science Education Standards (NSES) (1996) also make a connection between the goals of environmental literacy and science in society. As part of Content Standard F: Science in Personal and Social Perspectives, students in grades K-4 should understand "characteristics and changes in populations, types of resources, and changes in environments" (p. 138). The standard further states that "central ideas related to health, populations, resources, and environments provide the foundations for students' eventual understandings and actions as citizens" (pp. 138-139). NSES also state that students in grades 5-8 can "undertake sophisticated study of personal and societal challenges" and "expand their study of health and establish linkages among populations, resources, and environments" (p. 167). This provides further support for environmental literacy's focus on the application of knowledge to action and responsible behavior.

Gayford (2002) studied teachers' views of the meaning environmental literacy, which further supports the connection between environmental literacy and society. Through a participatory action research model, seventeen secondary science teachers explored the meaning of environmental literacy and how it fits the goals of science education. These teachers concluded that:

> The important purpose of environmental literacy is to serve both the individual and society. To give the individual the ability to apply concepts, processes, and skills to the life, work, and culture of their society. . . Within the process of development of environmental literacy is the need to identify issues of special importance for personal, local, and national development. . . Environmental literacy has a significant science component, since most environmental problems require this dimension in order that citizens fully appreciate the issue. . .The aim

> is to use environmental literacy to guide change, leading towards a better world and sustainable lifestyles. (p. 106)

Therefore, instruction that is guided by an environmental literacy focus would apply scientific concepts to societal issues to create positive change.

Perspectives about technology within STS are also related to environmental literacy. Disinger and Roth (2003) suggested that one issue of environmental literacy involves "technology and the making of choices" (p. 3). Decisions involving technology are related to applying science to environmental issues in society. McLaughlin (1994) describes how technology education is a context to further students' development in environmental literacy. He specifically suggests that "environmental themes studied within technology education allow the student to apply integrated skills and knowledge to the solution of environmental problems associated with technology and industry. Students can study technology as the origin and solution of environmental problems in the integrated program" (p. 32). Students' understanding of technology is another piece of environmental literacy because it is part of the choices and actions people take regarding environmental issues in society.

STS is one perspective with which to understand and situate the goals of environmental literacy. An environmentally literate person can apply concepts of science and technology to environmental issues in society, and take action to improve these issues. Critical thinking skills are needed in these decision making processes, which I will talk about in the next section.

How is Environmental Literacy Situated within a Critical Thinking Perspective?

Applying ideas in science and technology to act on environmental issues requires critical thinking. Howe and Disinger (1990) in cooperation with the Eric Science, Mathematics, and Environmental Education Clearinghouse and the Center for Science and Mathematics Education Ohio State University provided an Environmental Education Information Report that specifically addresses critical thinking in environmental education contexts. Howe and Disinger suggest a twelve step approach to critical thinking in classrooms that includes three essential types of skills: 1) "defining and clarifying the problem, 2) judging information related to the problem, and 3) solving problems/drawing conclusions" (p. 3). Within this approach, students' "ability to formulate questions that will lead to a deeper and clearer understanding of an issue or situation" and students' "ability to decide whether the information provided is sufficient in quality and quantity to justify a conclusion, decision, generalization, or plausible hypothesis" seem particularly important for environmental literacy (p. 3). I argue that these abilities to formulate appropriate questions about environmental dilemmas and to recognize the adequacy of data are crucial in students' learning to become socially responsible citizens. Understanding how to ask questions about environmental issues as well as evaluating existing and discovered data is a foundation for students to actively participate in solving environmental problems. Suggested approaches that develop critical thinking as related to environmental issues include "library research and analysis of information, interviewing and analysis of information obtained through interviews, debates, simulations and role playing, analyzing speeches and presentations, case studies, critical writing for community action, planning alternative actions, and evaluating

alternative actions" (p. 5). These approaches for critical thinking need to be based on students' understanding of science concepts as well.

Two studies that involve students taking action to solve environmental problems provide examples of how critical thinking is a perspective of environmental literacy (Volk & Cheak, 2003; Greenall Gough & Robottom, 1993). Keeping in mind the goals of responsible behavior and action as a major part of environmental literacy, these studies show how critical thinking is involved in decision making about appropriate action and how involvement in this type of pedagogy increases critical thinking skills.

Greenall Gough and Robottom (1993) analyze an environmental education project in Australia that fits within a socially critical framework. They claim that "both environmental education and socially critical pedagogy seek to empower students to participate in a democratic transformation of society" (p. 301). Five schools in Australia participated in this project in unique ways, but with a focus on three dimensions: 1) students' study of fresh and marine water environments, 2) computer conferences with about 100 schools overseas participating in similar kinds of studies, and 3) teachers and students engage in a type of "participant research" on education issues (p. 302). This study focuses particularly on one school, Queenscliff High School, which is located in a coastal holiday resort town. The students at this school conducted a "critical study" of sewage pollution at their local beaches (p. 303). They found bacteria levels in the ocean to be above the levels deemed healthy by the Victorian Environmental Protection Agency and approached the local Water Board concerning what they found, but were turned away. They then took their findings to a local newspaper that published the results, leading to a heightened community interest in the problem. In the end, the state's

minister for the environment requested that the Water Board make improvements to their facility of more than five million dollars in cost.

Greenall Gough and Robottom (1993) argue that although much as has been written on the critical goals of education, few schools have been involved in education that is "socially transformative" (p. 307). They present a framework for "dominant concerns" in socially critical curriculum based on the work of Kemmis, Cole, and Suggett (1983). Aligned with environmental literacy, the dominant curriculum concerns are "critical theory and group processes or action oriented;" the school concerns are the "engagement of students in critical thinking and action;" the themes of concern are "developing working knowledge and critical perspective on society" (p. 306). Critical thinking skills are a major part of students' action concerning environmental issues and therefore also of their development in environmental literacy.

Volk and Cheak (2003) evaluated the impact of an environmental education program on fifth and sixth grade students, parents, and the community in Molokai, Hawaii. The program, based on the curriculum "Investigating and Evaluating Environmental Issues and Actions (IEEIA)," had been used for five years in this school. Students select a local environmental issue to investigate. They make recommendations based on their investigation and take an active role in resolving the issue. For the quantitative portion of the study, the researchers compared scores of students in the IEEIA program and students in a traditional program on the Critical Thinking Test of Environmental Education (CTEE).

The CTEE focuses on three types of critical thinking skills believed to be associated with environmental education including "making conclusions," "making

inferences," and "identifying bias" (p. 13). (These skills are in line with the three essential types of skills suggested by Howe and Disinger (1990) as well.) The instrument was developed by Cheak (Volk & Cheak, 2003) and has been field tested with sixth grade through college students. The researchers found that IEEIA students scored significantly higher on the CTTEE than non-IEEIA students in each of these areas. These results suggest that students' involvement in programs designed to impact environmental literacy also involve and therefore increased skills in critical thinking.

How are STS, Critical Thinking, and Environmental Literacy Connected?

One way to describe environmental literacy is the understanding of and the active role of living in an environmentally sustainable way in society. In developing pedagogy to meet these goals, a connection to both STS and critical thinking perspectives are present. Although these perspectives are not always connected to each other in literature, in the case of environmental literacy, they seem very much intertwined. Students involved in environmental education programs that deal with societal issues through science and technology are developing the goals of environmental literacy to understand and act in environmentally sustainable ways. In order to understand environmental issues, to ask questions, to make choices, and to ultimately take action, students must engage in critical thinking. In this way, critical thinking is a necessary part of the process of engaging in critical social action as suggested by STS. Therefore, both perspectives of STS and critical thinking support goals of environmental literacy. As a result of my review, I operationally define environmental literacy as understanding the knowledge and skills needed to make informed decisions and actions related to environmental issues in society.

Reading, Writing, Science, and Technological Literacy—Meaning and Development as Related to Environmental Action Projects

Why is it important now to show that environmental action projects are related to literacy development? Environmental education and place-based education have been described as interdisciplinary and consisting of integrated curriculum. In the current national climate concerning high stakes tests in reading and writing, it is important to clearly define these connections. What are the actual descriptions of students doing reading and writing in the educational models? What does research say about the development of reading and writing skills through the process of environmental action projects? Again, research on how environmental education and place-based education are truly interdisciplinary is greatly needed. There have been relatively few research studies linking these areas clearly. There have been more descriptions of case studies in which literacy is described as embedded in environmental action projects. First, I will examine the model of PAR to show examples of how literacy skills are embedded in the environmental action programs. Next, I will describe research studies relating the success of environmental action projects and place-based education in increasing students' literacy development.

Development of Literacy Activities in the Context of PAR

Within the context of PAR, Mordock and Krasny (2001) sought to describe case studies of environmental education programs that were connected with community development. Their purpose was simply to "discuss four exemplary programs based on two criteria: 1) the program included an investigative component that could be interpreted within the PAR framework, and 2) programs represented diverse educational settings and

audiences" (p. 17). Within these case studies, elements of literacy are present, but a detailed development is not described. In the first case study, students at a community center in New York City wrote a "campaign report" for legislators and community members on the usability of open space in the area. In Brooklyn, New York, high school students wrote letters and newspaper articles about their findings on lead poisoning in their community. In upstate New York, high school students wrote a report and a newspaper published their findings concerning their findings of run-off coming from a salt shelter shed. In Armonk, NY, middle school students designed signs that explained the problems associated with feeding local waterfowl (pp. 17-18).

In summary, I would like to point out the purposes of these case studies were not to show how environmental action projects are connected to literacy. However, literacy activities are so much embedded in the programs that I choose to use these as examples to show how the projects inherently involve literacy skills. In the book *The New Science Literacy*, Their (2002) quotes a teacher emphasizing this point: "Teachers don't have to make a connection to literacy because the connection is embedded in science. Teachers are already doing it. They just need to recognize it" (pp. 116-117). In the same way, place-based environmental action projects inherently incorporate literacy. More research needs to be done to recognize these processes and effects.

Research on the Development of Literacy Skills through Environmental Action Projects

To further the case on environmental action projects or place-based education leading to developments in students' literacy skills, a few research studies have been completed. Sobel (2004) describes two fairly large national studies incorporating large numbers of schools. Volk and Cheak (2003) use a case study to examine the effects of a

particular place-based environmental education program (IEEIA) on students, with literacy being one area of development.

The State Education and Environment Roundtable (SEER) Report

SEER is made up of education agencies in sixteen states that look at how the environment is integrated into K-12 curricula. As an assessment of these types of educational programs, SEER studied behavior and standardized test performance for students in forty "model public school programs" in twelve different states (Sobel, 2004, p. 23). The authors of the study indicated that the schools studied were using the "environment as an integrating context (EIC)" across the curricula. They found that EIC "improves student achievement in social studies, science, language arts, and math" as well as leads to "gains in summative measures of educational achievement such as standardized test scores and grade point average" (Lieberman & Hoody, 1998, as cited in Sobel, p. 23). More specifically, "seventeen comparisons of reading scores on standardized tests indicated that students in EIC programs outperform their peers in traditional programs" (Sobel, p. 26). As an example of one school in Dallas, Texas, Lieberman and Hoody wrote:

> The passing rates of fourth graders from the 1996-1997 class, the first to learn through EIC approaches, surpassed by 13 percent those of students in the 1995-96 class. According to staff members in the Texas Education Agency's Division of Student Assessment, Hotchkiss' gains were 'extremely significant' when compared to the statewide average gain of one percent during the same period. (cited in Sobel, p. 27)

Researchers attested to real-world applications, such as writing grant applications, to improving writing skills. Overall, they claimed that students had improved skills in

reading for "understanding," used more variety in "writing genres, styles, and strategies," synthesized "complex ideas more effectively," and created a "greater volume of higher quality work" (Sobel, 2004, p. 27). This led the researchers to claim that students improved in ways that spanned the "spectrum of language arts assessment" (Sobel, p. 27).

Study Conducted by National Environmental Education and Training Foundation

A study conducted by National Environmental and Training Foundation (NEETF) found similar results as the SEER study. This study looked at five schools each in Texas, North Carolina, Wisconsin, and Florida involved in model school programs, as well as a statewide program in Kentucky. The researchers noted that many of these schools were in urban areas with high percentages of students receiving free or reduced lunches. Standardized testing indicated students improved scores in all subject areas after participating in place-based environmental programs. An example of one elementary school in North Carolina is given. At this school, "environmental education with a service learning focus" was a strategy the school used to meet state standards (Sobel, 2004, p. 28). Three projects the school participated in were "a gardening and science club, the MAGIC program (Mountain Area Gardens in Community), which involved school and community gardening and food preparation, and the re-establishment of a schoolyard nature trail" (Sobel, p. 29). The researchers cited improved scores in reading, math, and writing skills on state achievement tests. This improvement was 9.1 points above the expected growth. Similar results were found at other schools in other states, across all subject areas (Glenn, 2000, as cited in Sobel, 2004).

Both the SEER and NEETF study indicate the effects of using place-based education that has environmental action components on students' performance on standardized tests. Although many people might argue for and against the validity of

these tests, in the reality of the current political climate, student success is often measured by standardized tests. Therefore, these statistics are important to consider for program funding and acceptance in broader political terms.

Development of Literacy and Technology Skills through IEEIA

Volk and Cheak (2003) evaluated the impact of an environmental education program on fifth and sixth grade students, parents, and the community in Molokai, Hawaii. The program, based on the curriculum "Investigating and Evaluating Environmental Issues and Actions (IEEIA)," had been used for five years in this school. The students make recommendations based on an investigation and take an active role in resolving the issue. The researchers approach this study using quantitative and qualitative methodologies. For the quantitative portion of the study, the researchers compared scores of students in the IEEIA program and students in a traditional program on both the Critical Thinking Test of Environmental Education (CTEE) and the Middle School Environmental Literacy Instrument (MSELI). Four students in an IEEIA class also conducted research on differences in opinion, behavior, and knowledge between IEEIA students and students in a traditional setting. For the qualitative data source, researchers conducted 34 open-ended interviews of students, parents, community members, and school personnel.

The researchers found that IEEIA students scored significantly higher on the CTTEE than non-IEEIA students. IEEIA students scored significantly higher than non-IEEIA students on four of eight subtests of the MSELI, including: "knowledge of issues, ecological foundations, issue analysis, and self-reported environmental action" (Volk & Cheak, 2003, p. 15). IEEIA students scored higher, although not statistically significantly, on the following subtests of the MSELI: "issue identification, action

planning, perceived knowledge of action, and perceived skill in action" (p. 15). The research by students indicated that "88% of IEEIA students and 25% on non-IEEIA students consider themselves knowledgeable about the environment" and "75% of IEEIA students and 43% of non-IEEIA students reported that they had taken an environmental action" (p. 16). The researchers conclude that the while the quantitative data about environmental action were inconclusive, IEEIA students used higher levels of critical thinking skills and other cognitive skills than non-IEEIA students.

The qualitative portion of the study was particularly telling as related to literacy development. Through coding comments in the interview data, researchers developed nine major concepts mentioned in the interviews: "participatory environmental citizenship in the community, improved reading and writing, improved oral communication, effective use of technology, student characteristics, teacher-related items, Molokai community viewpoints, IEEIA program characteristics, and IEEIA program importance" (Volk & Cheak, 2003, p. 15). From this data, they argue that students' literacy improved in multi-dimensions including "general literacy, environmental literacy, and technological literacy" (p. 23).

The researchers provide detailed accounts of how the program improved students' general literacy or reading and writing skills. They define "three conceptual threads" of general literacy including "the variety of text types students read, the difficulty level of the texts, and the improvement of students' writing skills" (Volk & Cheak, 2003, p. 18).

Students' involvement in community issues allowed them to access both more varied types of texts and sources of text material. Types of texts included "books, encyclopedias, pamphlets, articles, magazines, permits, minutes of public hearings, and

transcripts of expert testimony from the state legislature" (Volk & Cheak, 2003, p. 18). Sources of text material included "the library, the Internet, newspapers, community public records, and agency experts," as well as texts "authored by present and former students of the IEEIA program" (p. 18). Since the students' projects involved the local community, students often needed to go to "authentic texts," as well as their local newspaper, where they both read and published articles. One parent noted of her child that "[IEEIA] differs in that [she] reads much more technical information type of material. She has not done this before. It is different in that she reads for a purpose for real world problems" (p. 19).

In terms of text difficulty, students noted that they read more difficult material then they would normally. One teacher expressed why there is a need for students to read more difficult material: "The materials . . are all written for adults. There is no children's text for how much water there is on Molokai, or what kind of chemicals remain in the soil from years of use on pineapples" (Volk & Cheak, 2003, p. 19). Students' high interest in the material, as well as their development of specific strategies, led to their success in reading more difficult text. Strategies included "rereading, seeking help from a capable peer, and taking notes" as well as working as a group and going back to difficult sections later (p. 19). An important point is that the students' reading was for a different purpose than traditional reading in science. In this context, they were reading to understand a concept and "apply that knowledge" versus reading for "verbal recall or memory of details" from a textbook (p. 19).

The students' improvement in writing skills seemed to be related to the variety of authentic purposes for writing. These purposes included writing for:

> assigned school projects; as a strategy to understand difficult reading material; to develop instruments for the collection of primary research data; for personal pleasure (journal); to inform the public (newspaper articles); to submit testimony at local and state hearings; to make reports at public meetings; to shape presentations at local, state, national, and international meetings and conferences; and for contractual purposes. (Volk & Cheak, 2003, p. 19-20)

This wide array of purposes also included a wide variety of audiences for the students' writing. The students come to see their writing as a way to have a voice both in the school and wider community. Community members that did not even have students in the program came to look at the students' writing seriously. One community member said:

> We [the Native Hawaiian Education Council] have contracted them with…the teachers and students…so at the present they do two things for us. They council reports in our local newspapers. They do interviews and of course, they use what they learn in class and they write up the stories and send it to the local newspapers for them to print in their weekly paper. (Volk & Cheak, 2003, p. 20)

All of these ideas in terms of the students' writing indicate that improvements were related to variety or purposes and audiences, as well as the development of authentic voice in the community.

The researchers also note higher student achievement for students with a variety of academic abilities and cultural backgrounds. They conclude that future research is needed in a variety of areas including communities of learners, long-term effects on

students' learning, and impacts of this type of environmental program in other schools and their community.

Nature Journaling, Writing, and Action Projects

Nature journaling and writing are specific activities that some writers have devoted their attention to, specifically in the context of place-based education. It can be a reflective process that is used both at the beginning and throughout the development of action projects. In terms of stages toward positive environmental actions, it can provide an initial awareness as well as personally connect people with the environment and influence their locus of control (feelings that they can make a difference). Therefore, I will describe what some writers in the field have written about the impacts and process of nature journaling and writing. I will also briefly summarize what one national environmental education curriculum project, Project Wild, says about environmental action projects and literacy.

Tallmadge (1999) describes writing as "a window into nature" and as a "means for expression" and also as a way of "exploration and discovery" (p. 5). He describes several exercises in description, interpretation, and speculation that can be done with students in the outdoors around their school and community. Exercises in description include four progressive activities: 1.) The exercise "colors" in which students learn to describe the "particularity of color" through simile and metaphor, 2.) The exercise "shifting the frame" in which students describe an object or thing without "reference to appearance," 3.) The exercise "simple to complex" in which students go from describing simple, familiar objects, to more complex objects to describing "behavior, change, and movement" as well as "changes over time," and 4.) The exercise "giving voice to the

voiceless" in which students find something that speaks to them, and then write as though they were that thing, sharing this voice with others (pp. 18-19).

Tallmadge (1999) similarly describes exercises students can do for interpretation and speculation which include "reading the land," "ecological role playing," "ecological powers of ten," and "combined exercise: power spot" (pp. 19-22). "Reading the land" involves students in interpreting the landscape and looking more critically at place. In ecological role playing, students describe themselves as another creature in a particular landscape and what a typical day what be like for them. "Ecological powers of ten" asks students to imagine places after varying amounts of changes in time. The "combined exercise: power spot" has students combine phases of writing to visit and revisit a particular place over many times and write about what they see. Therefore, in the combined exercise students are describing, interpreting, and speculating about what they see. This last exercise especially could be a potential starting point for asking students to critically examine their community and in what ways it could be improved.

The most crucial element of Tallmadge's (1999) description of nature writing is its ties to place. Students can read other nature writers that have tried to describe, interpret, and speculate about place; writers that have written near their own environment are particularly useful. Tallmadge further suggests that students describe the places they have discovered and interpreted by writing stories, in which they bring alive the place and "reveal unseen mysteries and riches of their home place" (p. 29). He suggests that this type of writing "offers a promising path toward the intimacy we seek, by deepening perception and understanding, by throwing the light of attentive imagination upon the green world we normally take for granted" (p. 30). These words offer a powerful

suggestion for the importance of writing for discovering and making personal connections that may lead into significant changes in thinking and action for students.

Walker Leslie (1999) describes the many benefits of nature journaling as allowing students the opportunity to make a "one-on-one connection with their own immediate environment" as well as integrating disciplines, and providing activities that are differentiated and individualized for various learning styles. She suggests simple exercises for writing in journals around the schoolyard as well as kinds of thematic nature journals students can use. Kinds of journals include a "garden journal; a drawn/written study of local birds, mammals, fish, reptiles, amphibians, etc. through the year; seasonal accounts; and a journal of a trip" (pp. 51-53). Other writing and drawing of nature might also include "plotting the flora, fauna, land topography, or historical changes on the school campus," mapping "historical, social, or geological" changes in your town, writing a trail guide for the school property, and creating "illustrated classroom newsletters describing studies of local places" (p. 53).

Walker Leslie (1999) also describes the connection between journaling and environmental awareness. She gives one example of a class of fourth graders who had been journaling around their school. They often listened for and wrote about the sounds of wood frogs in a pond as an "indicator of healthy vernal pools" (p. 54). When they heard that this part of woods and property was to become a new housing development, the students were able to discuss this dilemma because they were familiar with the land. They began showing their drawings and journals to their parents and local conservation commission. They were using their journals as a starting point to "make the town aware of what lived so precariously in the future path of the bulldozer" (p. 55). This example

provides a clear description of how journaling can be the starting point for community action.

Critical Pedagogy, Socially Critical Contexts, and Skills Learned

Greenall Gough and Robottom (1993), as described above, analyze an environmental education project in Australia that fits within a socially critical pedagogy framework. They claim that "both environmental education and socially critical pedagogy seek to empower students to participate in a democratic transformation of society" (p. 301). Greenall Gough and Robottom argue that although much has been written on the critical goals of education, few schools have been involved in education that is "socially transformative" (p. 307). The authors analyze the practice of the environmental project at Queenscliff High School within the framework theory of socially critical pedagogy using the following categorical views: 1) view of knowledge, 2) roles of teachers and learners, 3) broad curriculum organization, 4) school-community liaison, and 5) the role of consultants (p. 308).

The view of knowledge by participants in the project was that of "working knowledge" that the students constructed themselves within the context of their chosen research problems (Greenall Gough & Robottom, 1993, p. 308). Working knowledge has the characteristics of "transactional rather than transmissional, generative rather than preordinate, opportunistic rather than systematic, and idiosyncratic rather than generalizable" (p. 309). This view of knowledge seems to focus on the idea of the students as makers of knowledge and indicated that the students have a place of power in the school and community. The role of the students was that of generating knowledge through interacting and collaborating with others. Teachers were responsible for

organizing these collaborative activities within student groups and the community. Teachers were also responsible for ensuring working knowledge was the prominent form of knowledge in the classroom and developing a "project perspective" (p. 310).

A socially critical curriculum is designed through collaboration and "negotiation between community, teachers and students" (Greenall Gough & Robottom, 1993, p. 310). In this study, each of the schools in the region chose a different project focus that was of interest to their particular school and community. Each of the schools had a curriculum that evolved differently. The liaisons between community and school were important in developing the curriculum. The view of this curriculum was to involve students in community change as a preparation for participation in society. There was also the idea that the schools and the community were "mutually supportive:" the community depended on the school for scientific data, and the school depended on the community for funding and voice. The connection between the school and the media was especially interesting in that they provided the schools a voice in the local paper, but at the same time held on to existing power structures through their "policy of evenhanded reporting" (p. 311). The role of consultants was also important on the projects in that they provided methodological assistance for such things as bacterial testing and telecommunication specialization, as well as forming new avenues for communication between teachers, students, university personnel, and community agencies. The authors bring up several questions based in critical theory around communication: "Communication between which parties? Through communication channels designed by whom? Who controls the substantive messages that form the communicated discourse?" (p. 311).

Finally, Greenall Gough & Robottom (1993) conclude that the practice at Queenscliff High School provides an example of education that led to social and environmental change. The work at this school raised consciousness of environmental issues in the community while also allowing for a redistribution of resources for environmental activities. The researchers bring up several questions for future study in critical environmental education, including "whether students possess a consciousness of empowerment through involvement in curriculum work of this kind" and the challenge of developing emergent working knowledge and socially critical education in the face of conventional courses that include set texts and curriculum. In my own research, I am very interested in these future directions—what does a "consciousness of empowerment" mean for students; and how can socially critical education develop in the context of today's educational system?

Ramsey and Hungerford (1989) ask "can issue investigation and action training (IIAT) improve responsible environmental behavior of middle school students" and "can variables identified as critical contributors to responsible adult environmental behavior be enhanced in middle school students as a function of issue investigation and action training?" (p. 29). This study does not take the critical theory approach of the Greenall Gough and Robottom (1993), and is more positivistic in its research methodology. However, several of the variables they investigated are related to issues of student empowerment, although this is not explicitly discussed. Specifically, they examine variables that have been linked to responsible environmental behavior in previous studies, including: "1. Knowledge of environmental issues, 2.) beliefs concerning environmental issues, 3.) values related to the environment, 4) individual and group locus of control, 5)

environmental sensitivity, 6) knowledge of, and skills in, environmental action strategies, and 7) knowledge of ecological concepts" (p. 29). The individual and group loci of control are particularly related to empowerment in that they involve the perception of control individuals and individuals within a group have over enacting change in a situation. Individuals with an internal locus of control feel that they can impact or influence a given situation. Individuals with an external locus of control believe that factors other than their own actions determine the outcome of a situation. In this way, students that have an internal locus of control either individually or as member of a group would feel empowered that they can make a difference in their community.

Ramsey and Hungerford (1989) consider their research design to be "quasi-experimental" in that they administer questionnaires to students in treatment and control groups before and after experimental IIAT instruction and traditional instruction. The instruction period is 18 weeks long, where 4 seventh grade groups "received" IIAT instruction and 4 seventh grade groups "received" traditional instruction. The IIAT program included six modules that incorporate problem solving, writing research questions, gathering and interpreting information, investigating an environmental issue, and learning environmental action strategies. The questionnaires include Likert-scale data and phenomenological data related to the seven variables thought to influence environmental behavior.

The results of the study indicated statistically significant differences between the control group and the treatment group in the following variables: "overt environmental behavior, individual locus of control, group locus of control, knowledge of environmental action skills, perceived knowledge of environmental action skills, and perceived skill in

the use of environmental action skills" (Ramsey & Hungerford, 1989, p. 31). The variable of "environmental sensitivity" was not found to have a statistically significant difference between groups (p. 31). The researchers conclude that students who "participated" in the IIAT training used environmental behaviors more often than students in the control group. Included in this finding is the idea that students receiving the training felt they had more control in resolving environmental issues. The authors do acknowledge that there are threats to validity in their study, including different teachers, school settings, and learner characteristics. However, they believe that the consistency in findings for the variables support the validity of the findings. They conclude that instruction such as IIAT can lead to the goal of responsible citizenship participation in environmental issues. I continue this study of what types of instruction led to responsible environmental participation in a community.

Volk and Cheak (2003) evaluated the impact of an environmental education program on fifth and sixth grade students, parents, and the community in Molokai, Hawaii, as described earlier. The program, based on the curriculum "Investigating and Evaluating Environmental Issues and Actions (IEEIA)," had been used for five years in this school. It is similar to IIAT described in the study by Ramsey and Hungerford (1989). Students select a local environmental issue to investigate. They make recommendations based on their investigation and take an active role in resolving the issue. The researchers approach this study using quantitative and qualitative methodologies. For the quantitative portion of the study, the researchers compared scores of students in the IEEIA program and students in a traditional program on both the Critical Thinking Test of Environmental Education (CTTEE) and the Middle School

Environmental Literacy Instrument (MSELI). Four students in an IEEIA class also conducted research on differences in opinion, behavior, and knowledge between IEEIA students and students in a traditional setting. For the qualitative data source, researchers conducted 34 open-ended interviews of students, parents, community members, and school personnel.

Volk and Cheak (2003) found that IEEIA students scored significantly higher on the CTTEE than non-IEEIA students. IEEIA students scored significantly higher than non-IEEIA students on four of eight subtests of the MSELI, including: "knowledge of issues, ecological foundations, issue analysis, and self-reported environmental action" (p. 15). IEEIA students scored higher, although not statistically significantly, on the following subtests of the MSELI: "issue identification, action planning, perceived knowledge of action, and perceived skill in action" (p. 15). The research by students indicated that "88% of IEEIA students and 25% of non-IEEIA students consider themselves knowledgeable about the environment" and "75% of IEEIA students and 43% of non-IEEIA students reported that they had taken an environmental action" (p. 16). The researchers conclude that the while the quantitative data about environmental action were inconclusive, IEEIA students used higher levels of critical thinking skills and other cognitive skills than non-IEEIA students.

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Cheak, 2003, p. 15). From this data, they argue that students' literacy improved in multi-dimensions including "general literacy, environmental literacy, and technological literacy" (p. 23). The researchers also note higher student achievement for students with a variety of academic abilities and cultural backgrounds. They conclude that future research is needed in a variety of areas including communities of learners, long-term effects on students' learning, and impacts of this type of environmental program in other schools and their community.

Possible Environmental Science Content Infused in Environmental Action Projects

I merged science content that is a part of the curriculum standards with the interest of students and their specific setting. An example of a project that could be adapted with students in this context is a stream restoration project in the students' community. This model incorporates many Maryland and National Standards that include science as well as other disciplines. The National Science Education Standards (1996) include a standard on "science in personal and social perspectives" in which they explicitly suggest that "students in grades 5-8 can undertake sophisticated study of personal and societal challenges" and that these "societal challenges often inspire questions for scientific research" (p. 167). The Maryland Learning Outcomes also support a critical approach to environmental science through its outcomes in critical thinking, applications of science, scientific inquiry, and environmental science. Outcomes in critical thinking and applications of science are especially relevant and include indicators such as that students should be able to "provide supporting evidence when forming conclusions, devising a plan, or solving a practical problem" and "use the knowledge of science and available scientific equipment to devise a plan to solve a

local/global problem." In the context of this study, students will work to resolve an environmental problem using supporting evidence, and suggested ways to improve the problem or take action in their community. For a review of NSES see Appendix A. In this Appendix, I reviewed standards to evaluate how a stream restoration project in particular (as an example of an environmental action project), fulfill national and state outcomes. I designed this particular example through my involvement in environmental education workshops and a teacher-as-researcher internship experience with the Maryland Department of Natural Resources.

Very generally, a stream restoration study can create learning opportunities for students in an integrated environmental science field that includes objectives in biology, chemistry, physics, and earth science. Content students would gain knowledge about include watersheds and impacts of humans on local and global scales, stream habitat, biodiversity of plant and animal life, weathering effects such as erosion and flooding, impact and importance of exotic and native species, water chemistry and movement, and the interconnections of scientific systems (i.e. how water chemistry or movement affects biological life). This type of study would provide students with an in-depth focus on a habitat in the community, how they affect it, how they can improve it, and why this is important. I argue that this study will take an interdisciplinary approach with a particular focus on student development in science, literacy, and communication. See Appendix B for an outline of a proposed stream restoration project. I developed this example of a stream restoration project using the 5-E Model because this is the pedagogical framework for science teaching that is used in Sienna County schools. My decision to use this model is not research-based but because it is the county's recommended activity model. The 5-

E model is a generic model that describes a pedagogy where students and teachers engage, explore, explain, extend, and evaluate their learning.

One tension in this study is the connection between student interest and curriculum requirements. Community action is not typically a part of required curriculum but can provide a valuable context in which to study science content as well as develop knowledge in other areas, such as communication and literacy. This study explores how students participate, react, and develop within this pedagogy.

How National and State Standards Support Environmental Action Projects

I will now briefly review how the National Science Education Standards (1996) and the Maryland Learning Outcomes support environmental action projects. As environmental action projects are intended to be interdisciplinary, standards support several content areas, including literacy development. The national science standards include a standard on "science in personal and social perspectives" in which they explicitly suggest that "students in grades 5-8 can undertake sophisticated study of personal and societal challenges" and that these "societal challenges often inspire questions for scientific research" (p. 167). The Maryland Learning Outcomes also support a critical approach to environmental education through its outcomes in critical thinking, applications of science, scientific inquiry, and environmental science. Outcomes in critical thinking and applications of science are especially relevant and include indicators such as students should be able to "provide supporting evidence when forming conclusions, devising a plan, or solving a practical problem" and "use the knowledge of science and available scientific equipment to devise a plan to solve a local/global problem." In the context of environmental action projects, students work to

resolve an environmental problem using supporting evidence, and suggest ways to improve the problem or take action in their community. For a review of the NSES and Maryland Learning Outcomes see Appendix B and C.

National Environmental Education Curriculum Materials Support of Action Projects and Literacy Skills: Project Wild

Project Wild is a national K-12 curriculum project administered by the Council for Environmental Education and cosponsored by the Western Association of Fish and Wildlife Agencies. The authors of the curriculum guide provide the goal of Project Wild as to "assist students of any age in developing awareness, knowledge, skills, and commitment to result in informed decisions, responsible behavior, and constructive actions concerning wildlife and the environment" (p. vi). The activities in the guide are designed to be interdisciplinary. Appendixes indicate what skills each activity focuses on, including science, math, social studies, language arts, environmental education, and expressive arts. They also identify both "cross-discipline skills" and science "topics" that the activities include. Activities are organized into three sections, including "ecological knowledge, social and political knowledge, and sustaining fish and wildlife resources" (p. ix-x). These sections are further broken down into subsections. For example, section three includes activities about "attitudes and awareness, human impacts, issues and trends, wildlife management, and responsible action and service" (p. x). This section on responsible action is the last section of the guide, representing the culmination of activities.

The guide includes a separate appendix on "taking action-involving students in environmental action projects" (Western Regional Environmental Education Council, p.

487). In this appendix, the authors define environmental action projects as "any activities that get students involved in tackling an environmental issue or problem, or that aim at improving an environmental setting" (p. 487). They cite IEEIA by Hungerford et al. (1992) as a source for "suggested approaches to environmental action" (pp. 488-489). "Seven steps to action" as well as assessment suggestions are also included in the guide. The seven steps include: "1.) Get informed, 2.) Create a list of possibilities, 3.) Narrow the choices, 4.) Select a project, 5.) Create an action plan, 6.) Put the plan into action, and 7.) Assess, generalize, and apply" (pp. 489-491). Within each of these steps is the possibility and often necessity for students to critically reflect on reading and written material. Assessment strategies include the use of journals, essays, and portfolios. Journals might include students' "feelings about the project, its progress, and its setbacks" (p. 491). Essays might ask students to think about "whether they've changed their thinking or behaviors as a result of the project" and to describe "what those changes are and what students think prompted them" (p. 491). Students might also ask for feedback from community members, as well as publishing their thoughts and others in a community newsletter.

Other national curriculum projects provide examples of how environmental education can be interdisciplinary as well as place-based and lead to action in the community. These curriculum projects include Project Learning Tree, Project Wild (Aquatic), Wonders of Wetlands, and Ecological Concepts.

Summary and Foreshadowing

In this chapter, I reviewed an analysis of literature related to critical pedagogy, knowledge constructs, goals of environmental education, research and curricular models

for environmental action projects, analysis of environmental literacy, general and technological literacy related to environmental action projects, and a review of curricula documents that support environmental action projects.

Critical pedagogy is particularly relevant and important in this research study as the development of environmental education projects is rooted in critical pedagogy and seeks to change and empower individuals and communities involved. I review literature related to critical pedagogy's perspective of hope within a world that makes its realization both possible and impossible. I develop ideas around critical pedagogy as way to understand my position of power in the classroom—one of dialectical authority—as well as my own and students' varying positionalities within different contexts. I further examine critical pedagogy through a feminist perspective and relate specific research questions to these ideas.

I also described other researchers' interpretations of the goals of environmental education and the research and educational models for completing environmental action projects. A common goal often sited related to environmental education is one of responsible action. This makes it unique related to other content areas and aligns it with principles of democratic education. I described practical research models that can be used to study environmental action in increasing specificity—action research, participatory action research, and action-research and community-problem solving model. Curricular models that environmental action is situated in include the 5E model, place-based education, and Investigating and Evaluating Environmental Issues and Actions.

Next, I described environmental, general, and technological literacy as related to environmental action projects. First, I reviewed definitions of environmental literacy as there is some variation in the literature as to how this type of literacy is defined. Related to goals given for environmental education, definitions of literacy often include the major areas of knowledge of issues, attitudes and values, and active involvement. Because of its broad focus related to knowledge and action, environmental literacy can also be situated within science-technology-society perspectives and critical thinking perspectives (as well as a combination of each of these). Also, because environmental literacy and then environmental action projects are interdisciplinary in nature, there is a potential for students to develop new understandings both related to general and technological literacy. I have reviewed some previous studies that have shown improved skills in these areas. I also connect development of understanding in content skills to critical pedagogy and links between various literacy skills and socially critical based learning activities.

Finally, I reviewed my interpretations of how environmental action projects can be situated into current curriculum and standards. I examined an example of a local project, through local, national, and state standards using the 5E curriculum approach used in the district this study takes place in.

In Chapter Three, I examine the design and research methodology for the study. This will include a review of a summary description of context (a more detailed description will be given in Chapter Four), the overall approach and rationale for the research methodology, data-gathering and analysis procedures for qualitative and quantitative data, philosophical assumptions and trustworthiness issues related to the study, and ethical and political considerations.

CHAPTER THREE: DESIGN AND METHODOLOGY

In this chapter, I review the research design and methodology, including a summary of the context, the overall research approach and rationale, data-gathering and analysis procedures, trustworthiness, and ethical and political considerations.

Description of the Context

The context of this study is within one seventh and one eighth grade middle school classroom participating in an environmental project that is decided and designed by the class of students and requires social action in the community. The project took place at Humana Middle School in Sienna County, in late spring 2005, from May 11—June 10, 2005, with an additional one-year follow-up data collection period during May 2006. The middle school was located in a metropolitan suburb in the Northeast USA, one of the largest middle schools (approximately 1300 students) in the largest district (by population) in the area. Fifty-three students (from one seventh grade class and one eighth grade class), myself as the classroom teacher, and three additional science teachers in the school (for grades six, seven, and eight) participated. The seventh grade class had 29 students total, including 13 girls and 16 boys. The eighth grade class had 24 students total, including 10 girls and 14 boys. The three science teachers who participated (other than myself) were veteran teachers—each grade level team leaders—and were female.

Students researched environmental topics, designed and completed action projects, and reported on them in both classes. Observations, student work, presentations, and student and teacher journals provided data sources. Three students and three teachers were also interviewed on their views about the projects and where they fit into curricular frameworks. Five students were interviewed approximately one year after

completing the environmental action projects, in May 2006. A more detailed description of the context is presented in Chapter Four.

In looking at the context of the study, Strauss and Corbin's (1998) conditional/consequential matrix also provides an important model to situate this study. This model shows that relationships between individuals, groups, and their larger community are not isolated. It shows the interplay between ideas and that conditions and consequences are not independent. For this study, I found it useful to look at the various categories spiraling out in the matrix. It starts in the center with the individual. In my case, this is the individual teacher and individual student. From there it moves out to group and family. What is the child's family structure and what group of other students do they associate with? Clearly, these structures play roles into who they are in the classroom. The suborganization is how I structure the classroom. Organizational and institutional structures are the school's structure and culture and the school system's organization. Regional, national, and global refer to regional, national, and global educational systems. In my context, I am most struck by the fit of the "community." In this study, I think this has multiple meanings, most importantly, the community and culture of the class. This is related to the suborganization, but is more about the relationships and how people in the class communicate with each other. As the word "community" is in the outer part of the matrix, I think it has other connotations as well, including the community of the school, neighborhood, and district (Strauss & Corbin, pp. 183-184).

Research Approach and Rationale

The research approach in this study is similar to those described by Volk and Cheak (2003) and Greenall Gough and Robottom (1993). Both of these studies provided examples of how students can engage in critical environmental social action in their community. Volk and Cheak reported on the positive impacts of an action-based curriculum called "Investigating and Evaluating Environmental Issues and Actions (IEEIA)" on students' learning as well as impacts on other community members (p. 12). Greenall Gough and Robottom described how middle school and high schoolers were able to change public policies on water pollution in their community by providing research data to government officials.

I argue that this study is participatory in that I was involved with, observing, constructing the project with the participants in this class, and reporting the lived-in experiences of the participants over time. It is also practitioner research in that I was the students' teacher for this project. Within the tradition of action or practitioner research, I consider this study to be within PAR as described by Zeichner and Noffke (2001) in that it addresses students' participation in the "social production of knowledge" (p. 305). The study also examines how students are empowered to "take effective actions toward improving the conditions in their own lives" (p. 306). Within the context of the study, I am a researcher, practitioner and a participant. That is, my role as a teacher in this study allows me to be both a practitioner and a participant.

My study is a case study in which I conduct classroom action research according to the model of reflexive-dialectical participatory action research given by Kemmis and McTaggart (2000). It is a case study because I am studying two classrooms of students,

the teacher (in this case myself) and three other teachers in the school (Stake, 2000). As one of the participants in the study, I am studying my own teaching and reactions in the process of this study. As action research, the study is reflective-dialectical in nature, in that I am trying to understand the "life-worlds" of the participants within the system of the classroom, school, and district. The school can be seen as the agency; the class is the structure; the students and I participating in a social order as it leads to social movement. Within this model of action research, the biographies of the individual as well as the previous history and context of our class and school are also important components (Kemmis & McTaggart, 2000, p. 588).

Furthermore, my study is an "instrumental case study" in that this case study is "instrumental to accomplishing something other than understanding this particular teacher" (Stake, 1995, p. 3). To reiterate, my study is about my two middle school science classes' development of environmental action projects. I use this context to "provide insight into an issue" such as power roles, equality, and empowerment of students in a classroom setting (Stake, 2000, p. 437). In another sense, my case study can be seen as "intrinsic" because as the teacher researcher, I am looking for a "better understanding of a particular case" (Stake, 2000, p. 437). This particular case is trying to understand my teaching and students' development of learning and experience in new ways.

The study is also critical action research in that I am attempting to combine "the self-reflective collective self-study of practice, the way language is used, organization and power in a local situation, and action to improve things" (Kemmis & McTaggart,

2000, p. 568). I focus particularly on student action, and power issues in the classroom and how they affect structure.

Data Gathering and Analysis Procedures

Using a theoretical framework of critical theory as described in Chapter One, I included both qualitative and quantitative analyzes in this study, similar to those used in the study by Volk and Cheak (2003). Qualitative and quantitative analysis allow different perspectives to be seen from the data, as one way to crystallize the data from different viewpoints. As my data sources come from different perspectives, I use data crystallization. Richardson (2000) describes crystallization as a postmodern way of thinking in that the data is complex and changing, depending on how you look at it (p. 934). Interestingly, in crystallization, she says, "we know more and doubt what we know" because of its complexity (p. 934).

I blend the data as Greene (2001) suggests in an "integrated mixed-method design" so that the different types of data can inform each other and create a richer type of analysis (p. 255). The different types of data include pre-post written surveys, pre-post scores on environmental critical thinking and literacy instruments, observations, interviews, and student work, described in more detail below. Using an integrated mixed method design, I look for ways to synthesize the meaning of the different types of data.

For one experimental measure, I compare students' scores on the Middle School Environmental Literacy Instrument (MSELI) before and after instruction (Volk and Cheak, 2003). I selected the use of this instrument as it is relevant in understanding both students' perceptions of their knowledge and students' conceptions related to environmental issue content inherent in environmental action projects. The MSELI was

designed to “measure a variety of components of environmental literacy” and includes eight subtests including “knowledge of issues, ecological foundations, issue identification, issue analysis, action planning, perceived knowledge of action, perceived skill in action, and self-reported action” (p. 14). The MSELI has been used with students from fifth to eighth grade and has been “validated as a representative of environmental literacy framework by a 19-member panel of U.S. professional environmental educators” (p. 14). Scores are analyzed using dependent samples t-test comparisons. The designers of the survey, a statistician working on this particular study, and other researchers recommend dependent t-test scores as an analysis technique for the study (Wilke et al.; Volk & Cheak; Hungerford & Ramsey). Additionally, I choose to use dependent t-test scores because they allowed me to review the data from both parts of the test inclusively and look for overall significant changes in the scores as related to the overall nominal data. This part of the study uses an experimental group to compare pretests-posttests. I used Part 2 of the MSELI survey which has two subsections. The first subsection asked students to describe their perceived knowledge and actions related to environmental issues. The second subsection asked students to complete an issue analysis of a particular environmental issue. See Chapter Four and Appendix for additional details related to the survey as well as the text of the survey.

Qualitative data include observations, interviews, student work, and surveys. Approximately ten observations occurred in which the students participating in the environmental project were audiotaped and the audiotapes were transcribed. Audiotapes will be kept at the researcher’s home for three years and then destroyed. Eleven semi-

structured open-ended interviews of students and school staff were conducted and transcribed, with consent given.

Protocol and examples of interview questions include:

How has the class' environmental project influenced the community?

What actions do you participate in to help the environment?

Do you participate in any environmental activities in your life related to the school project?

Students' classwork are also analyzed for environmental action content. This qualitative data are analyzed for common patterns and themes related to the students' participation in the action projects. The overall qualitative data (interviews, observations, student work) were analyzed using an interpretive means. I used inductive analysis to develop assertions related to the data with the construct of power as a filter to analyze the data. Ideas related to categories specifically included student empowerment, teacher leadership, student ownership, and student action. I describe the properties and dimensions of these categories in the findings and discussion section of the paper. Text was considered data from transcribed discussion and interviews, as well as written pieces including planning papers, journals, and student written work.

I compared qualitative survey data of the students participating in an environmental action project before and after the development of the environmental action project. The survey questions are related to environmental variables shown to impact behavior (Ramsey & Hungerford, 1989), including written responses such as what students know about environmental issues in their community, how students could take action to help problems in their community, and what actions students have taken or are

taking to help the community. Surveys are analyzed based on students' written responses (See Appendix F). (All students in the class participated in the surveys and other classwork; data comes from students whose parents have signed consent. Please see the Appendix E.)

Student classwork is also analyzed for environmental action content, according to criteria related to action in the MSELI. This qualitative data is analyzed for common patterns and insights related to the students' participation in the action projects. The overall qualitative data (interviews, observations, student work, journals, and other documents) is analyzed using an inductive and interpretive approach. The data is further analyzed through looking at power as a filter for analysis of data.

See Appendix E for interview protocol and consent forms as outlined in the Internal Review Board documents.

See Table 1 for details of how I address philosophical assumptions in methodology as described by Creswell (1998). See Appendix C and D for a data matrix and timeline for the qualitative portion of the study. See Appendix E for internal review board application for data collection.

Table 1: Philosophical assumptions of study

Assumption	How do I address?
Ontological	There are multiple realities, so I attempt to understand various viewpoints around environmental action projects: • Student interviews, written work, oral discussion • Community member discussions—parents, local officials • Other professional interviews and surveys—teachers, administrators
Epistemological	I have a collaborative relationship with the students in facilitating their design of a project that improves their community. I am interested in our relationships in this process, and issues of power in the classroom.
Axiological	This research is value-laden in that I approach the study with

	the orientation that there is a need for environmental action by students in the community. I have to work through issues of my own values and their impact on my relationship with others in the study and the research as a whole. Students, community members, and other educational professionals also have value perspectives that are included in the study.
Rhetorical	Since this involves research on my own teaching, my own voice is an important part of the study, and includes narrative about my experiences within the study. I kept a researcher/teacher journal that including narrative and personal writing.
Methodological	As a case study of critical participatory action research, I begin the process of the research with broad questions about what it means for students and community members to participate in environmental action. As the study proceeds, my questions become more specific depending on the emergent data. I develop theories from the data in an inductive way.

Trustworthiness

The viability of action research lies in its ability to be accessible to teachers and lead to real and practical changes in education. For example, the project Science FEAT leads to teachers' publication of their research that can have a real impact on classroom instruction. Many of the researchers that advocate for the viability of action research include a section in their articles or books on the "validity" of action research.

Zeichner and Noffke (2000) include a lengthy section on "practitioner research as a trustworthy way of knowing" in their handbook chapter on practitioner research (pp. 314-323). They cite Lather and Anderson et al. as developing criteria to access practitioner research including the idea of "research-as-praxis" which draws from Freire's ideas that research should be emancipatory. Lather emphasizes the ideas of a "self-critical attitude" and "self-scrutiny" on the part of researchers (p. 318). Anderson et al. include some of Lather's ideas in their criteria for validity in practitioner research:

- "Democratic validity" in which "multiple perspectives" are included.

- "Outcome validity" in which the research "results in action."
- "Process validity" that includes attention to the processes and research methods.
- "Catalytic validity" that addresses Lather's ideas that research should "energize the participants to know reality so they can transform it."
- "Dialogic validity" in which research allows for a "reflective dialogue among the participants" (p. 319).

Within this study, I am most drawn to the ideas of democratic, outcome, and catalytic validity. From the framework of democratic validity, I seek to give voices to the multiple perspectives of participants involved in the study. Further, I hope that their voices, actions, and opinions, are the guiding forces of the study, rather than simply my own as a researcher. As a study guided by PAR and critical theory as practical and theoretical frameworks, the outcomes or resultant actions are important to examine (as in outcome validity). Practical questions, such as does the study enact change in the community, are part of the study. Also, in terms of catalytic validity, a goal of this study is to allow students to develop knowledge sources in order to change their own realities for the better.

I believe that this study adds a more complete examination of the processes of students engaged in community environmental action projects than currently exists in the literature. The research methodology of PAR provides a theoretical and practical framework, such as Mordock and Krasny (2001) suggest. I believe PAR is a methodology that can generate new knowledge that has meaning in theoretical and practical contexts within environmental education.

I use data crystallization and member checks in my case study as related to verification procedures. Crystallization of data includes multiple perspectives of sources, participants, theories, and methods. Data sources include interviews, observations, student work, journals, surveys, and curriculum documents. Participants are both a part of the data as well as help collect it, and inform the research questions. Theories building this study include curriculum theories such as place-based education, and research theories such as PAR. I use mixed or complementary methods in this study as well, in which data are collected both qualitatively (interviews, observations, journals) and quantitatively (environmental literacy survey instruments). Member checks also occur throughout the study as part of the participants guiding of the study and the questions. I ask some participants such as students to help collect the data and analyze it.

I follow the "critique checklist" of 20 criteria that Creswell (1998) and Stake (2000) suggest. I address many of these criteria while I conduct data analysis, including such criteria as "Is the paper easy to read?" and "Does it fit together, each sentence contributing to the whole?" My research has conceptual structures related to participatory action research, place-based education, and roles of power within the classroom and community. I use quotations throughout the research as way to incorporate the multiple perspectives and voices of the participants. These quotations, as well as other transcript data, student work, and surveys are presented as raw data. I make clear my role and point of view in the study, while also allowing others to be heard. My personal intentions in the study are examined also. The audience of the study is first an academic one, but my hope is for it to be accessible to other teachers and participants in the study as well. The central office of the school district in which this study took place

is also an audience. I emphasize that individuals were not put at risk in this study through the nature of their participation and voice in guiding the study.

I would like to address the validity threats of researcher bias and reactivity in my study. For researcher bias, I am specifically concerned with how I analyze data to fit into my preexisting theories and conceptions and the topic of the study. It is not necessary for me to eliminate my prior experiences and values, but I need to explain them clearly and give ways that I examine them in the study. For example, one way that I can examine my own values, beliefs, theories, and conceptions about environmental education is to survey other participants in the study and compare our views. I also consider how reactivity might affect my study. As a participant myself in the study and through a naturalistic setting, I have tried to allow for authentic data to emerge. I am careful in discussions and interviews with participants to not lead them in questioning, i.e. by asking open-ended questions in interviews.

I demonstrate credibility of my study through an "in-depth" description of the setting, processes, and participants involved. The boundaries of the study are within one specific case, but described in enough detail so that it is credible. This detail in description also allows the study to be transferable to other settings. The study addresses the construct of dependability by accounting for changes that are necessary in the research design, especially those deemed necessary by participants. I address confirmability by looking at the data through multiple perspectives. I also make sure to include enough data in my research to allow the reader to see how the findings are directly linked to the raw data of the study.

I address questions related to how readers will view my study as well as ethical considerations by using Schram's (2003) "practical considerations in establishing trustworthiness." My presence in the study is as one of the participants, and so my voice is in the study as one of many. I hope for this to add credibility to the study by giving voice to all participants.

In terms of selecting experience, I pay attention to the qualities of "selectivity" that Schram (2003) suggests including being "purposeful," "circumstantial," "intuitive," and "empathetic" (p. 98). In my own study, being purposeful can be defined as identifying experiences that relate to the purposes of studying environmental action project. Circumstantial and intuitive data reflects what I and the other participants identify as important developments in the study. Data selection is empathetic based on what information participants deem as important and useful. As a research participant, I am engaged in the study myself, and recognize and describe my own growth, views, and development over the course of the study. Recognizing what views I bring to the study is also addressed throughout data collection.

Ethical and Political Considerations

In these times of high stakes standardized testing, I further consider and argue how the pedagogy of environmental place-based learning leads to students' ability to perform at high levels on assessment. Sobel (2004) gives examples of how place-based education (specifically examining local environmental issues) increased student performance on a variety of measures. It is important to consider how to frame this study within the current political climate.

Another ethical dilemma to consider is the value and role of all community members in environmental decision making. I am careful not to assume that others have the same pro-environmental values and beliefs that I do. How I encounter others' values and my own is a part of this study. I am very careful not to judge others based on their environmental views, and openly state my views on issues throughout the study.

Also, any study that seeks to enact changes can be ethically difficult. Change is not something all people want. How I approached resistance to change is an ethical and political issue that I also address as part of the study. Again, it is my hope that others can learn from these processes so as to see how environmental action projects can happen in their own contexts.

Concerning ethical considerations of data collection, I consider closely my own "posturing and role presentation" (Schram, 2003, p. 101). One of the simplest ways to do this is to be very straight forward with the other research participants about my views and values, while at the same time recognizing an openness to hear and give voice to all opinions. As a teacher in the study, I am engaged authentically in the study, and the development of relationships and rapport is important as well. In terms of disclosure and exchange, I give out all information that is relevant and admissible about the research with the other participants. I am committed to my study being a story about empowering students and other teachers so that their voice comes through more clearly in research. However, I am sensitive to privacy issues, and obtained informed consent with the participants through the IRB committee. In terms of the potential for betraying participants, I found it to be important to have open discussions with the participants in

groups and as individuals about any concerns about the study, and their role of power in the study.

Summary and Foreshadowing

In this chapter, I examined the design and research methodology for the study. This included a review of a summary description of context (a more detailed description will be given next in Chapter Four), the overall approach and rationale for the research methodology, data-gathering and analysis procedures for qualitative and quantitative data, philosophical assumptions and trustworthiness issues related to the study, and ethical and political considerations.

The context of the study is within two middle school classrooms in a relatively large middle school in a largely populated suburban district. Data collection took place from May 11—June 10, 2005, with an additional one-year follow-up data collection period during May 2006. Fifty-three students (from one seventh grade class and one eighth grade class), three science teachers (for grades six, seven, and eight), and I participated. The study is a case study that uses participatory action research and critical theory as practical and theoretical frameworks.

Qualitative data included observations, interviews, student work, and surveys. Three students and three teachers were also interviewed on their views about the projects and where they fit into curricular frameworks. Five students were interviewed approximately one year after completing the environmental action projects, in May 2006. Qualitative data is analyzed using an interpretive approach, with power constructs as a filter.

Quantitative data included a comparison of students' scores on the Middle School Environmental Literacy Instrument (MSELI) before and after instruction (Volk & Cheak, 2003) (see Appendix I). The MSELI was designed to "measure a variety of components of environmental literacy" and includes eight subtests including "knowledge of issues, ecological foundations, issue identification, issue analysis, action planning, perceived knowledge of action, perceived skill in action, and self-reported action" (p. 14). Scores were analyzed using dependent samples t-test comparisons.

As my data sources come from different perspectives, I use data crystallization to develop overall insights and implications related to the study, and view the data as complex and changing within this perspective (Richardson, 2000).

I have also reviewed how I will address philosophical assumptions related to the study, including ontological, epistemological, axiological, rhetorical, and methodological (Creswell, 1998). I will come back to a discussion from my perspective on how I addressed these assumptions in practice at the end of Chapter Five.

Next, I reviewed trustworthiness and validity issues related to the study. I take the position that practitioner research is a "trustworthy way of knowing" that Zeichner and Noffke (2000) suggest (pp. 314-323). I addressed validity issues as related to the study—particularly democratic validity (through multiple voices) and catalytic validity (through the transformation of realities) (p. 319).

Finally, I discussed ethical and political considerations related to the study, particularly those involving my role working with students as both the teacher and researcher, the current political climate and its influence on pedagogy, and perspectives on change.

Next, in Chapter Four, I will present my insights from the quantitative and qualitative data. This will include a summary description of the projects' development, including the planning and progression of classroom activities and an overview of students' activities. I will also present a quantitative analysis of MSELI Survey. Then, I will review the qualitative data in detail through a detailed description of the projects' development, including a description of the context, pedagogy, teaching practice and reflection, vignettes of student groups, insights from the student and teacher interviews, and qualitative surveys. Finally, I will review emerging ideas and insights of the data collectively, and summarize the ideas presented in the chapter.

CHAPTER FOUR: INSIGHTS

In this chapter I present my insights that emerged as a result of my immersion over time in my rich set of quantitative and qualitative data. First, I describe a summary description of the projects' development, including the planning and progression of classroom activities and an overview of students' activities. Next, I present a quantitative analysis of MSELI Survey. Then, I review a detailed description of the projects' development, including a description of the context, pedagogy, teaching practice and reflection, vignettes of student groups, insights from the student and teacher interviews, and qualitative surveys. Finally, I review emerging ideas and insights of the data collectively, and summarize the ideas presented in the chapter.

Description of Projects' Development

Activity Planning and Progression

Through cycles of planning, acting, observing, and reflecting, I designed activities for the students to complete, to guide them in developing their project. I did not anticipate consciously this at the outset of the projects, but the development ended up breaking down into three somewhat distinct phases—idea conceptualization, background research, and action component. Each of these stages lasted a little over a week within the four week time frame we had to complete the projects. In Table 2, I've referred to these stages as Week 1-2: Idea Conceptualization--Topic Choice and Planning, Week 2-3: Project Application and Background Research, and Week 3-4: Project Action, Connections, and Reporting. See Table 2 and Table 3 below for a summary of the schedule and activities as related to the project.

Table 2: Summary Project Schedule

Week and Topic	Activities
WEEK 1-2: Idea Conceptualization: Topic Choice and Planning	• MSELI Pre-test • Environmental Action Survey (pre) • Project Questionnaire • Poster presentations at group tables • Possible project topics—selection sheet • Planning sheet and brochure • Steps needed
WEEK 2-3: Project application and Background Research	• Earth Charter Activity • Background Research at library on group topics • Plan for action based on research findings
WEEK 3-4: Project action, connections, and reporting	• Project action in groups • Curriculum connections: dissection, 8th grade Green Day, climate change • Your Project—Issues (Issue Analysis) • Group Presentations • Project Report

	• MSELI Post-test • Environmental Action Survey (post)

Table 3: Student Activities Descriptions

Activity	Description
MSELI (pre-)	Quantitative assessment
Environmental action Survey (pre-)	Students answer questions and give reasons for their current environmental actions
Project Questionnaire	Asks students what types of projects they would be interested in working on, what steps they would need to complete, and how their project would help.
Poster presentations at group tables	Students completed posters and presentations in groups on their initial ideas
Possible project topics—check off sheet	Students chose interest areas from a list after hearing all the presentations on possible topics
Planning sheet and brochure	Students form groups according to their interest areas and complete planning sheet and brochure describing their project
Steps needed	Students write out steps needed, not previously covered
Earth Charter Activity	Students relate their projects to principles of a

	global document on environmental conditions and human rights
Background Research	Students complete background research at the library on the topic of their project, including formulating 5 of their own questions, which they seek answers to, to help them complete their project
Project—action, reflections, final report, and presentation materials	Students complete the project, write up reflections, summary of content, and complete a presentation
Your Project—Issues (Issue Analysis)	Students analyze what environmental issues play a part in their project and try to analyze these critically, from multiple perspectives
MSELI (post)	Quantitative action assessment after completing projects
Environmental Action Survey (post)	Qualitative survey on actions after completing projects
Presentation notes	Students take notes during other groups' presentations
Frog Dissection and articles (6th pd.)	Students complete a virtual frog dissection, as part of human body unit; read environmental articles on current status of frog populations in the wild

Global Environment and climate article (4th pd.)	Students read and analyze article on global environment and climate in relation to action projects and atmosphere curriculum
Also: project emails	Emails from students, teachers, parents, and administrators related to projects and teaching during the time of study
Also: Rubrics	Rubrics as given for the completion of the project, including background research, report, and presentation

Student Work and Observations

Through the projects' activities, students also completed cycles of planning, acting, observing, and reflecting during the completion of the project. Many students from both classes changed the content of the environmental action project over the course of the project. It became important for students to differentiate between their projects' topic content and its action content. See Table 4 and 5 for an overview of the final projects students completed.

Table 4: Grade Seven Final Projects

Group Number	Action	Topic
1	Educating others—Website	Endangered animals and recycling
2	Planting	Native plants, ecosystem health
3	Educating others	Recycling
4	Petition	Cow hormone treatment

5	Educating others—CD and music compilations	Trees and wildlife habitat
6	Fundraising and letter to senator	Global warming impact on living things
7	Petition	Dolphin captivity

Table 5: Grade Eight Final Projects

Group Number	Action	Topic
1	Educating others—Website	Recycling
2	Educating others—video	Local environment issues
3	Educating others—Website	Recycling
4	Educating others—video	Planting (instructional)
5	Educating others—Bumper stickers	Recycling
6	Educating others—Bumper stickers	Recycling
7	Educating others—video	Environmental choices (food, transportation)

Quantitative Data: Middle School Environmental Literacy Instrument (MSELI) Pre-Post Scores

My students completed the MSELI Test 2: Issue Analysis and Citizenship Action before and after the development of the environmental action projects (Wilke et al.,

1995). (Test 1 measured specific ecological content knowledge that I determined was not within the scope of the project or relevant to the content knowledge students' were learning in this context.) Test 2 was relevant because Part 1 of Test 2 includes a scale assessment of students' perceived knowledge, skill level, and behavior regarding environmental issues (See Appendix I for copy of MSELI survey.). The development of these student perceptions were relevant to the knowledge, skills, and behavior related to the projects the students were completing. Part 2 of Test 2 asks students to apply what they know about environmental issues to a new scenario, much like issues they are discussing and acting on in their projects. This instrument and data analysis most closely attempts to answer research question 2: what literacy, content knowledge, and skills do students learn when completing an environmental action project? Test 2 included two parts with three subsections each, which were labeled:

- Part 1: How I Feel About Things and What I Do About Things
    - Part A: Knowledge
    - Part B: Skill Level
    - Part C: Behavior
- Part 2: Issue Analysis Test
    - Section 1: Issue Statement Component
    - Section 2: Issue Analysis Component
    - Section 3: Action Plan Component

I scored the test using the scoring guide that was developed with the assessment by the developers (Wilke et al., 1995). (See Appendix I for description of the scoring.)

Dependent sample t-tests were completed for pre-post test scores for each class—analysis was conducted on the Test 2: Parts 1 and 2 combined, Part 1 and 2 individually, and each of the 6 subsections within Test 1 and Test 2.

There were no significant differences found in the seventh grade scores. [One possible explanation for this was that my schedule was changed the day that I was scheduled to administer the post-test to the students and a substitute teacher had to administer the test in my place. He told the students not to write their name on the test. This happened on the second to last day of school, and I spent the last day trying to match students up with their correct assessment. As the students did not write their names on the tests originally, I speculate that they did not take as much ownership or accountability for their answers. This is one speculation for why the seventh grade students did not show significant differences in any of the scores.] Another speculation might be that the time frame to complete this project was too short for the students to undergo any real changes in their perceptions regarding how they feel about environmental issues or to allow them to develop new ideas on how to analyze environmental issues. I will discuss this further in Chapter Five.)

Two subsections (out of six) had significant differences for the eighth grade scores. Part 1-Part A: Knowledge was significant with $p<.013$. Part 2-Section 2: Issue Analysis Component was significant with $p<.004$. (See Figure 2 and 3.) The changes in these two subsections also had medium effect size values, as measured by Cohen's d (with Part 1-Part A, $d=.5418$ and Part 2-Part 2, $d=.7634$) (Cohen, 1988). (Other tests, measured as nonsignificant through p-value calculations, had low effect sizes. See Table 6 and Table 7.) The significant differences in the two eighth grade subsections are

reasonable considering the other qualitative data in the eighth grade that students voiced they felt more knowledgeable in a particular environmental issue content, including issue analysis.

A significant improvement in the scores of Part 1-A might indicate that students viewed or perceived themselves as more knowledgeable in environmental issues after completing the projects than before completing the projects. This is expected since students needed to study one issue in depth and learn from their classmates on a range of other topics and issues. Notably, while the eighth grade scores changed significantly prior to the project development and after completing the projects for Part 1-A, the pre-post scores were not significant for Part 1-B (Skill) and Part 1-C (Behavior). A possible explanation for this, similar to the seventh grade, is that the shortened time did not allow students to develop new perceptions in these areas.

The dependent t-scores for Part 2-2 were significant for eighth grade students as well. This measure showed a medium effect size as well, with a higher value than Part 1-Part A at .7634. A possible insight regarding this change is that students were able to develop new understandings on how to analyze environmental issues through completing their projects, and especially from completing the activity, "Your Project-The Issues", which asked students to analyze their project topic in much the same way as Part 2-2 asked the students to analyze an example of an environmental issue. Eighth grade student pre-post test scores were not significantly different in Part 2-1 or Part 2-3, perhaps indicating that while completing their own projects and the activity "Your Project-The Issues" helped students develop new understandings in issue analysis, the activities didn't allow for the students to reach new gains in understanding how to analyze an issue from

the its beginning components (Part 2-1) or to recognize the most effective action plan in addressing a specific issue (Part 2-3).

I also analyzed the standard deviations of each of the pre-post test dependent scores for both classes. For the overall test, standard deviation was higher in the seventh grade class than in the eighth grade class. Seventh grade had higher standard deviations for most of Part 1 and eighth grade had higher standard deviations for most of Part 2. The highest standard deviations for both classes were found in Part 1 (overall) and Part 1-C (Behavior). This result makes sense in that Part 1 and Part 1-C allowed for the largest range in scores (see Table 6 and 7 below for points possible by section, and Appendix I for scoring guide). It is relevant to note that the second largest standard deviations for both classes, after the overall score, also occurred in Part 1-C and reflects the possible idea that the largest differences in student perceptions occurred in what they saw as their individual behaviors, not necessarily their perceived knowledge or skill levels. See Table 6 and Table 7 for complete results (p scores and standard deviations).

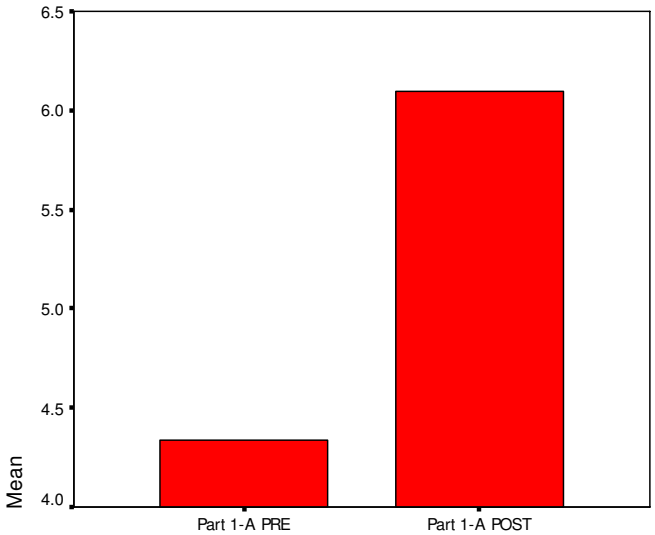

Figure 2: Eighth Grade Part 1-A Knowledge; p<.013; n=22.

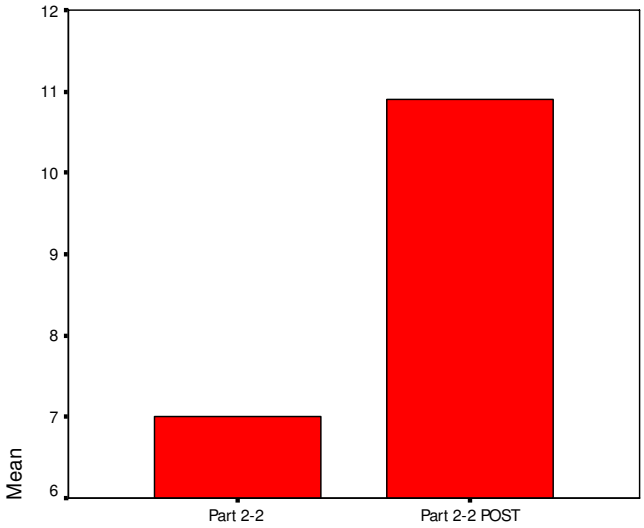

Figure 3: Eighth Grade Part 2-2 Issue Analysis; p<.004; n=22.

Table 6: MSELI Seventh Grade p-value, Standard Deviations, and Effect Size by Section

	Points Possible (per test)	p-value	Standard Deviation (paired difference)	Effect Size (Cohen's d)
Test 2	214	.268	24.607	.3427
Part 1	172	.406	25.020	.2870
Part 1-A	16	.959	4.935	.0159
Part 1-B	16	.649	4.438	.1350
Part 1-C	140	.270	18.654	.4176
Part 2	42	.380	8.544	.2297
Part 2-1	6	.417	3.086	.2949
Part 2-2	16	.628	4.172	.0961
Part 2-3	20	.509	7.076	.2082

Table 7: MSELI Eighth Grade p-value, Standard Deviations, and Effect Size by Section

	Points Possible (per test)	p-value	Standard Deviation (paired difference)	Effect Size (Cohen's d)
Test 2	214	.069	21.10415	.3983
Part 1	172	.255	4.856	.2482
Part 1-A	16	.013	2.918	.5418
Part 1-B	16	.477	4.211	.2090
Part 1-C	140	.422	19.529	.1721
Part 2	42	.228	11.163	.3624
Part 2-1	6	.465	2.382	.3283
Part 2-2	16	.004	5.251	.7634
Part 2-3	20	.813	8.201	.0837

Qualitative Results

Detailed Description of the Projects' Development

Context

As previously described, this study took place at a large suburban middle school in one of the largest school districts in the Northeastern USA. My experience teaching in this context was quite different than my previous experiences teaching for several reasons. My previous 3 years teaching full time had been in a smaller school district, (approximately one-third the population of this district) in the same state as the research site. The positions I previously taught were 7th grade science, 3rd grade, and 4th-6th grade (general classroom). In addition, I had also taken a "year off" teaching to pursue

graduate study full-time in between the last position I held teaching 4th-6th grade and this position described teaching one section each of 7th and 8th grade.

Of these three previous teaching experiences, the context described in this study was most similar to the middle school in which I taught seventh grade science. The middle school I had taught at previously was approximately half the size of the school described here. The day-to-day schedule was also very different. In my first position, the students had science for 90 minutes every day for a semester. In the current context, students had an A-B-C day schedule—this meant that I met with the students on Monday for 45 minutes and for 90 minutes on Wednesday and Friday. The every-other-day scheduling also made things difficult from my perspective because I did not feel like I developed consistent routines at the school. I had to wait at least 2 days before I could talk face-face with a student or another adult in the building about any issue that should come up. This was the first time I taught eighth grade science and two different grade levels in middle school. Also, the elementary schools I taught at were even more dissimilar—they were much smaller, about 300 and 150 students, and I was the students' teacher everyday, for most of the day. Further, the curriculum was very different in both grade levels from the curriculum outlined in the previous district—which I found compelling since both districts neighbored each other and were in the same state, i.e. followed the same state standards. In my previous position teaching seventh grade, the curriculum followed an integrative or interdisciplinary model, merging the various science content areas into three environmental thematic units—endangerment, waste management, and oceanography. The seventh grade curriculum in the position described here included stand-alone units each in specific content areas—biology/human body

systems, physics/forces of motion, and astronomy. Eighth grade curriculum included units in earth science (weather and climate), chemistry, and astronomy. All of these differences compiled together, made this teaching experience feel quite different and new to me.

The ideology, especially of the last school I taught at—a Montessori school and the first charter school in the state—was also very different, and I think this influenced my experience described here as well. Montessori philosophy and theory was developed by Maria Montessori, a physician from Italy, in the first half of the twentieth century. The philosophy behind the Montessori curriculum is that the students drive the direction of the curricular content, and that the curriculum is not generic or decided by someone else ahead of time. Montessori classrooms typically are multi-grade level, such as six students each from fourth, fifth, and sixth grade, and include a head teacher and an additional education professional. The school I was a part of was the first charter school in the state—a grassroots group made up mostly of parents whom lobbied the county for this school. They choose Montessori as the guiding philosophy for the school. While teaching at this school, I felt that my beliefs regarding teaching and pedagogy were in line with the school's philosophy and this seemed to influence my experience at the school positively. Perhaps, I felt the greatest sense of place in this setting and the greatest sense of respect partly because of the combination of the small size and the guiding pedagogical philosophy at the school.

Another new factor for me in the described middle school experience is for the first time I was a part-time teacher. (I taught 2 courses instead of the typical 5.) Both the other teachers and students saw me as a part-time teacher, meaning literally I was only in

the school part-of-the-time. This had implications on my feeling of place at this school, as well as how I believed students and staff viewed my role in the school. I tried to attend as many meetings and activities as possible given the part-time nature of my position and my other commitments, but perhaps because of my absence at these events oftentimes and other reasons, I did not feel as much a part of the community of this school as I had in previous positions. (This is in contrast especially with the last school in which I had taught 4th-6th grade. In fact, this realization came about when writing this paper. At one point, I wrote "I was a part of the first charter school in [the state]"—referring to teaching 4th-6th grade. But then I realized, I would never have written, I was "a part" of the present described middle school.) The size of the school may have also been a factor affecting my feeling of place in this setting.

I felt very isolated most of the year and most interactions I had with other teachers at the school were fairly shallow and not to the depth of the relationships I had with teachers in the other settings I worked in. I also did not have the depth of relationship with the students that I had had in previous teaching experiences, perhaps in part to the shortened length of time I was present in the school. There were a few students I felt as though I had meaningful relationships, but this number was much smaller than in my previous positions, even at the other middle school. Interestingly, the time I felt the least isolated was when working on the environmental action projects because different needs of the project encouraged me to seek out other staffs' and parents' help and ideas at the school. Working on the projects also helped me to develop more meaningful relationships with the students than I had previously during the school year, which I will describe below.

Therefore, I think some of my perceived disconnection to other adults and students and lack of sense of place at the school could be partially attributed to my part-time status at the school, my schedule, and the size of the school and district. The curriculum model and larger philosophies of the school and district may have also played a part. Within this context, however, I was able to carry out the participatory action research of this study and answer the research questions presented in previous chapters. The development of the described projects worked to alleviate these disconnections also, and this experience is described further below.

Pedagogy, Teaching Practice, and Reflection

Setting the stage—previous teaching experiences.

I developed the activities described in Table 2 and 3, based on my previous experiences teaching for three years and developing similar projects with third through seventh grade students. My first experience working with students on this type of project was as a volunteer at a Nature Center in college. I then went on to develop similar types of projects with students at a Nature Center after college, then with fourth grade students as a student teacher intern, with seventh graders as a science teacher, third graders as a general classroom teacher, and with fourth-sixth graders as general Montessori classroom teacher (see Chapter 1 for a more detailed description of these experiences).

My experiences working with these particular seventh and eighth students throughout the school year from August 2004-June 2005 also influenced and guided the development of the projects described in this study and below. I also referred to the county curriculum so that the activities I developed would make sense in that framework and would follow required objectives in the district. I did not construct all the activities

at the start of the project, but rather developed them inductively, and in response to what I saw as the needs of the students at particular times. Therefore, the description of the projects are based both on how myself, the teacher, and the students developed them. Based on my earlier teaching experiences, though, I did have some ideas in mind to begin the projects, which I will explain in further detail below.

MSELI and qualitative pre-surveys.

Before getting started on designing their projects, and before I had discussed the project with the students, I asked the students to complete the MSELI survey (quantitative survey—see above and Chapter 3 for a more detailed description) and the three-question qualitative survey I had designed (See Appendix F). I encouraged the students to be as honest as possible and try their best. It was not unusual for the students to complete these surveys, as for most units of study, they were required to complete a pre-test at the beginning of the unit and a post-test at the end. I framed the surveys in this way. I asked them to be honest and truthful and try their best. One difficulty with framing the surveys as a pre-test is that district guidelines state that students could not receive a grade on this type of assessment or on other formative assessment activities such as homework. I was worried that some students might not take the surveys seriously, and I still believe this to be a legitimate concern.

After the students completed the surveys, I discussed what we would be working on over the next few weeks of class. (As this project was not mandated as an "essential indicator" in the curriculum, there was additional content that students would need to understand as part of the project. In essence, what I actually did was incorporate the project into the particular indicators and objectives given for that time in the year. For

seventh grade, this was life science, including a study of living things and human body systems. For eighth grade, this was earth science and study of earth systems.) There was a real tension between what I perceived as strict curriculum mandates, and the choices that I wanted the students to have. In many ways, part of this study is about this tension—how did the two classrooms I was a part of enact original, unique, and student driven projects within a system that had a rigid curriculum. To clarify what I mean by rigid, when I asked students earlier in the year to complete "inquiry projects" that were in the curriculum but were written as "supplementary" other teachers and parents questioned why my classes were not doing the same activities on the same days as the other teachers' classes. In many ways, this was a different and difficult teaching context for me.

Project questionnaire.

Next, students completed a series of open-ended activities which I developed to help them construct their own idea, as part of a group, for an action project to help the environment. I framed the project for seventh grade as "Study of Living Things: Earth Project" and for eighth grade as "The Earth Project". For the first project questionnaire, I presented the objectives of the project (as they aligned with required county curriculum objectives) and asked the students to discuss and answer three questions within groups of 2-4. These three questions included (see also Appendix F):

1. What type of project that helps the Earth (and/or living things on Earth) would you like to work on (can be in the context of our school, local community, or larger world)?
2. What steps would we need to follow to complete your project idea?

3. How does your project help the environment of the school, community, or world? Why do you think it's a good idea?

Students discussed and completed this questionnaire at group tables. It was very important to me that students chose projects they were interested in. I did not require each small group to have a consensus of ideas, but the goal was that the groups discuss ideas, and each individual student completed his or her own questionnaire.

Poster presentations at group tables.

Next, each small group wrote up or drew their idea or ideas on a poster to present to the rest of the class. From my own previous experiences teaching third through seventh grade, having students work on the initial ideas in small groups included more students in the discussion than having an initial whole class discussion. In my previous experience teaching fourth – sixth grade, I also added an additional step at this point, which I did not have time or the means to do in this context. With my previous students, I then met with each group of students, often in pairs, to discuss their ideas. This worked well in my previous position because of the context of that particular situation—students did almost all their work independently or met in small groups and there was another educator in the room to act as an aid to the rest of the students in the classroom. Looking back on both experiences, this meeting time at the beginning stage of the project was perhaps an important step missing with the research experience described here. This step would require simply more time and slightly different scheduling in the classroom. Also, having an educational aid also provided support for the rest of the students in the class while I was meeting with the small groups—from my perspective, the support this provided was substantial. Another important difference between the experience

described here and my prior experiences teaching third grade, fourth grade, and fourth-sixth grade, is that I was the classroom teacher for these students almost the entire day. This gave me considerably more flexibility and time throughout the day to develop the projects with the students. In the experience described here, I met with the students only 3 days a week—Monday for a 45 minute period and Wednesday and Friday for 90 minutes. This point seems obvious in retrospect, but I believe is very important to consider when looking at the development of similar projects in elementary versus a secondary setting. Therefore, my perspective on the development of the projects in elementary school was that it felt more successful to me, in part because of time and scheduling, than this particular middle school experience.

Possible project topics.

After each of the groups, six in each class, had presented ideas, I typed up all of the possible ideas that had been presented and included a new category "other/new idea". I called this the "Possible Projects" sheet (also see Appendix F). Then, I asked each individual student to circle one of the ideas that had been presented, including their own, or to enter a new idea. Then, the following day, students grouped themselves according to the project idea which they had chosen. (I was expecting students to consider the social implications of their choice of project. I asked the students to circle their choices individually to try to balance this. However, I understood when asking students to choose their project, they might choose to work with friends regardless of their personal interest in the topic.)

Environmental Project Planning Sheet.

In these new small groups (by project choice), I asked students to complete the "Environmental Project Planning Sheet" first. The main goal of this activity was to help students plan ahead for what materials, resources, and knowledge they would need to complete the projects. The activity also asked the students to reflect in their new groups about the goal of their project, how the action would be helpful to the community, and what specific steps would need to be completed (and by whom) to carry out the project. Finally, the activity also helped me think ahead as to any special materials or issues that I needed to consider in working with the students to complete their projects. Therefore, the "Environmental Project Planning Sheet" included the following questions (also see Appendix F):

1. What is the goal of your group's project?
2. Why or how is it helpful to the community's environment?
3. What materials do you need for your project?
4. What tasks or jobs are needed for your project? Each group member should sign up for at least one job in the chart. [Job/Name of person to complete job/Materials needed to complete job/Date job should be completed]
5. What other resources (such as books, environmental websites, or people) can help you complete your project?
6. On a separate sheet of paper, design a half page flyer that includes:
    a. A short description of your project (goals)
    b. Why your project is helpful to the community's environment
    c. How other people can be a part or contribute

d. A picture to show what your project will look like

From my past experiences developing similar projects with students, I was anticipating and hoping that the rest of the projects' development would run smoothly, given this week and a half investment in reflecting on projects and planning out the execution of them. What I found though, in this particular context, with these particular students, or in these particular grade levels, more planning was needed. I reflected on this and came to the understanding through my observation that students were not planning sufficiently on the "Environment Project Planning Sheet" or they forgot/did not complete what they had written on the planning sheet. This could have also happened because of the limits on time, the alternating day schedule which the students came to class, and/or other major responsibilities placed on students and me.

Steps needed.

Through the observation that the students needed further structure around developing their project ideas and planning, I designed a second shorter planning sheet, that simply included "Steps needed to complete project" (with deadlines), "Materials needed", and "Possible Sources" (see also Appendix F). I was somewhat surprised at first that students were having difficulty following their previous plans, as these students were older than most students I had worked with before, and intuitively I think I believed that they would have an easier time planning the projects and carrying out their plans. After reflecting on this, though, it started to make sense that the older students might need more structured activities, not less. Many of the students seemed intimidated by coming up with their own ideas, or at least didn't seem to like this aspect of the projects. Again, I was expecting the students to like choosing their own project ideas, but many students

told me that they wanted me to give them additional ideas on what to do or how to go about completing the project. The second planning sheet did seem to help a little; it simplified the project some, and presented a fast approaching deadline.

Earth Charter Activity.

The next activity I asked the students to complete was the "Earth Charter Activity". While I was asking the students to complete a small project that I hoped would have local implications, I also wanted them to understand how their (local) project could fit into a larger global/international framework. The Earth Charter (www.earthcharter.org; see also Appendix F) is a global document developed by an international commission and steering committee and endorsed by thousands of non-governmental organizations, as well as schools and individuals. It was written by the Earth Charter Commission in response to a request from the United Nations World Commission on Environment and Development for a document that would set forth principles of sustainable development that would then be relevant and applicable in global contexts. In 2000, it was approved and endorsed as an educational document by the United Nations Educational Scientific and Cultural Organization (UNESCO). I asked the students to read the document, including its 16 principles for sustainable living, and to see if they could make a connection between their project and one of the16 principles for sustainability described in the document.

More specifically, I asked the students to (see also Appendix F):

Read the Earth Charter brochure with your group. Pay particular attention to the "principles" in the inside.

1. Which principle or principles do you think your project matches most closely in trying to make a difference [completing your project action]? (If you see more than one, it is okay to list them.)

2. Circle the main principle you think your principle matches below:

I. Respect and Care for the Community of Life

II. Ecological Integrity

III. Social and Economic Justice

IV. Democracy, Nonviolence, and Peace

3. What numbered principle(s) (#1-16) does your project most closely fit? Name the small letter(s) (a-f) if you can too.

4. Explain your choice using a description of your project and how you believe it fits the principle or principles.

5. In what other way or ways do you or could you support the principles of this charter?

6. On the back of this paper, draw a slogan and/or picture that you think would be a good representation of the Earth Charter worldwide and that you could possibly use for your project presentation.

Background research.

Next, or at this same time, both the students and I realized that they needed to have considerable more content knowledge to complete the projects than either most of the students or I had anticipated. Actually, I was hoping for this to be the case—that the students would need to do research on their topics—but I was hoping that the drive for them to do this research would come from their own perceived need for more information, not because I was telling them to. So, I perceived the students wanting and

needing more information as a positive development. It did end up necessitating several trips to the library—more than I was expecting. Simply having a topic to research in the library was not enough structure for these students at this time, in this context. I therefore developed an 8-page "Background Research" packet to help the students structure their research and research questions. It also seemed obvious after this realization, but both students and I also came to realize that the project could be broken down into two distinct parts: action and topic knowledge, and in some cases their research on these two distinct types of knowledge was important. (For example, students planting native plants in the schoolyard needed to research both "native plants" and "planting or plant care", students designing a website on recycling needed to research "recycling" and "website design".) Both during the project and after the project, when I asked students what they would recommend to others completing similar projects, the most common answer was "do research [on your topic]".

The "Background Research" packet included the following items (see also Appendix F):

Mastery Objective: Use scientific ideas to solve an authentic problem.

At this point, you should have an idea about what type of action project you would like to work on that improves environmental conditions. Next, you need to do some background research on the topic that will be the focus of your project.

Please answer the following questions, to help you get started, and then we will complete the research.

1. Project activity: Describe the activity or action that you are seeking to complete. (Example: Creating an educational videotape that others in the community and school can learn from.)
2. Project topic: Describe what environmental topic your project will be about. (Example: The effects of lawn fertilizer on the local environment.)
3. Project knowledge: Describe what kind of information you will need to know to complete the complete and share what you did with others. (Example: The types of fertilizers that are used in our area and their effects on the environment and people.)
4. Please list five questions related to your topic that you will research to complete your project. (Example: What are the names of the fertilizers? How much fertilizer is used on average lawns in the area? What chemicals make up the fertilizers? How do fertilizers affect life in backyard streams? How do fertilizers affect plants in yards and parks?)

On the following pages, you will be finding and recording the answers to these questions using websites and books [or topic experts]. You will also record other important information that you find. Finally, you will decide how to use this information to guide your project.

The following websites are permitted for this research. If you know of and would like to use any additional sites, you will need to get teacher approval.

1. Any of the sites on the media center webpage (online encyclopedias, etc.)
2. Environmental Protection Agency: http://www.epa.gov This page contains a list of topics under the heading "quick finder" that you can click on. You can also

click on the link "For kids" on the left hand side, and scroll down the page and click on "for middle school."

3. Environmental Link: http://www.envirolink.org This page contains numerous resources by topic that you can click on to find out more information.
4. Environmental Education Link: http://www.eelink.net This site contains "Class Resources" on the left hand side and you can scroll down to see "environmental education student resources."
5. National Wildlife Federation: http://www.nwf.org On the right hand side, you can click on "for kids and teens" and "education." This site contains mostly information on wildlife.

Question 1 [and then 2-5 similarly]:

Related information:

Resource(s):

Picture (if applies):

Additional important notes [after Questions 1-5]:

Resource:

Please include a paragraph summary of the information you have found related to your topic below. Be prepared to share it with the class.

How do you plan to use this information as part of your action project? Please describe in detail how you will use this information in your project below. Please use complete sentences.

What additional questions do you still have about your topic?

Finally, what additional resources or materials do you still need to complete your project?

At this point, I also presented students with an overview of the assessment for the entire project (up to this point, I had presented rubrics for each of the assignments—surveys, questionnaires, planning sheets, etc.) but now seemed like the right time to present the entire "point" breakdown, as follows at the end of the Background Research packet (see also Appendix F):

Overall Earth Project Rubric

Complete surveys/questionnaires (formative)	10 points each
Due in class on day given	
Complete background research packet (formative)	50 points
Due Friday, May 26, 2005	
Complete action project, and show product (summative)	50 points
Due Wednesday, June 8, 2005	
(In celebration of Environmental World Day June 5!)	
Project presentations to the class (summative)	50 points
Due Friday, June 10, 2005	

I also further broke the project down into Rubrics for the "Complete action project and show product" component and the "Project presentations to the class" component (both listed above as 50 points). These were described as follows:

Earth Project Rubric (Action) 50 points total

Evidence of action activity—your project helps improve the environmental problem or condition in some way	15 points
Background information about the topic—1 page description	15 points

Reflection on project—1 page describing what you learned doing the project and why you think it helped	15 points
References	5 points

Earth Project Presentation Rubric 50 points total

Describe what you did for your project activity, including how it helps	15 points
Describe background information on topic	15 points
Reflection on your project—what others can learn from what you did	15 points
Creativity, neatness, and references included	5 points

Typically, it might have been useful to present this overview of the assessment at the beginning of the project. However, in this case, it seemed to work out well to present it at this point, as the students had helped drive the need to do the background research packet (I hadn't developed it at the start of the project). It seemed more intuitive as well as involving some student participation. Also, giving the assessment breakdown did seem to motivate some students to work harder at this point—I'm not sure if this is desirable, but I did notice a larger effort on the part of many of the students after seeing this breakdown in their grades. I had been hesitant to assign a large grade to this project for a few reasons—it was not an "activity" in the county curriculum guide, and it increased my "power" roles in the classroom during this time when I wanted to be examining student power and empowerment more closely. However, I made the choice at the time to grade the project in this way for similar reasons to the concerns I had—the activity did align with curriculum objectives and students wanted to know that their work counted—grades and assessment were types of feedback that were important to most of

them. I believe they saw it as their "job" to complete the work, and my "job" to grade them for it, or give them "credit."

Research in the library took more time than I had initially anticipated—we were increasingly running short on time in the school year. Some students needed to complete their research after school or at home. But, another added bonus to working on the library research with the students was that the school media specialist also worked with the class. I had been feeling very short on time in terms of meeting all of the needs of the individual student groups, and the media specialist was another educator/adult who the students could talk to about their ideas and receive feedback. Therefore, in general, the payback for completing the research felt good, the students felt more confident and knowledgeable about their topic, it had spurred ideas for their actions, and they had the opportunity to talk with other adults as well as their peers.

One of the problems with the library research is that the students were not always able to find the information they were looking for. One of my additional suggestions to the students was to email or otherwise contact some adult professionals (or "experts") in their topics' field, if they had additional questions. I should have done this earlier, because it seemed talking to a professional was more authentic to some students then reading about the information in a book or on the internet. The research also spurred some discussions by the librarian and me, as to the credibility of sources, and reading information critically (especially on the internet, but also in books.) We asked the students to think critically about whom (what person or organization) had written or published information, what their inherent beliefs might be about a topic, and how their belief systems could influence what information they present, and how they present it.

In this way, I found that I needed to help guide students' understanding of controversial science topics with great care. I encouraged students to read a variety of texts by a variety of authors (or speak with those professionals) related to their subjects, and analyze these texts critically. I tried to present science as one way of knowing but not as a final authority, and that learning science could help students communicate within a scientific community. Students' developing knowledge was the knowledge that was important and most meaningful in this context.

Project-action, reflection, final report, and presentation.

After the library research, the end of the school year was rapidly approaching. It was difficult to keep students on track, but at the same time, this seemed like an appropriate, cumulative project to be working on. I was asking students to apply all of the skills and knowledge that they had learned throughout the year to complete the projects. But as time was running out, many students had to come in during lunch or work after school to finish them. The students that worked on the project outside of class time, did this by choice. For many this worked well, but for some this was difficult, because most of the students were working in groups. I did get one email from parents concerned about their child working on the project with other students after school, at another student's house. I told the parents that I was very flexible, and this particular student ended up finishing the project individually.

In general, the students worked in groups to finish their projects, or as we ended up referring to them, as their "actions", during the remaining class time. This became more difficult to structure, because each individual group was different and needed to follow their own steps to complete the projects. Some of the projects ended up being

more difficult or time intensive then others, but I tried my best to support each of the groups and individual students as needed. (See Table 4 and 5 above for a listing of projects by class and group number.)

At the same time as the students were completing their actions, I also wanted the students to plan how they would present their projects to the other students in their class. This was an additional amount of work that I was planning on at the beginning of the project, but realized the importance of more during the projects' development. As students were working on very different topics and actions, they really had a lot of experiences to share with each other. Formulating a presentation (in most cases students choose a PowerPoint presentation), also took time. Many students worked on the presentation component at home. We also went to the computer lab three times as part of the research and to work on presentations. We took two class days at the end of the project—during the last week of school—completing the presentations. I also presented the students with a detailed rubric for the presentations, and asked the students in the audience to complete a reflection piece on their classmates' presentation.

Content activities— dissection, climate change.

During the development of the projects, I also asked the students to complete two activities to help them situate their projects within larger frameworks of global and local environmental issues, as well as the curricular unit the students were currently studying. In seventh grade, students were studying human body systems. Other classes were completing frog dissections during the last week of school. I developed an activity related to the environmental implications of dissection and an activity connected with an

online dissection. In eighth grade, the students were studying weather and climate, so I developed an activity on climate change.

Your project—issues (Issue Analysis Activity).

Most of the students did not score highly on the Issue Analysis section of the pre-test of the MSELI (Part 2: Section 2). (The average seventh grade average score on this section was 8.67 out of 16 points possible, with a standard deviation of 4.821; the average eighth grade score was 7 with a standard deviation of 5.712.) This was a critical thinking activity that asked the students to look at an environmental situation and identify the issues involved, as well as the people and their connected beliefs and values about the problem. I wanted to design an activity that would allow students to think about the topic and action they had chosen to complete from these perspectives. (See Appendix F).

I asked them to complete the activity that I developed "Your Project—The Issues" (based on the MSELI survey; see Appendix F):

The topic of your project involves some environmental issues. For example, the effect of pollution on water quality (or written as a question, what is the effect of water pollution on water quality?)

Below, list as many environmental issues as you can, that relate to your project. Try to include a cause and effect for each issue (example of a cause is pollution, and an effect is water quality). _____

People and groups of people are involved in each of these issues. Each of these people has their own beliefs and values related to the issues. ("A belief is something someone holds to be true. A value is the worth placed on something by someone." MSELI Survey)

Please choose the issue above that you think is most important and write a list of the

people or groups involved, and what you think their beliefs and values are.

_____

At the end of this project, you have a good understanding of your topic and the issues involved. Below, list as many action strategies as you can that you might use to make a difference. These strategies can include activities you did for your project or other ones that you did not complete. Please include as much detail as you can to describe what you or someone else could do to complete these strategies. Please put a star (*) next to those strategies you believe would work the best. _____

I was not sure about the definitions of the words—issues, cause and effect, beliefs, and values--I was conveying to the students. I would have liked to have spent more time developing the definitions of these words with students—I think that would have made the activity more constructive and participatory. We did have a short discussion about the words at the beginning of this activity, but I think the students would have developed more meaning from the activity if the students developed the definitions. For consistency, I took the definitions from those given in the MSELI survey, but they seemed rather simplistic to me, especially the definition of "value"—"the worth placed on something by someone". It also caused me to wonder what does "worth" mean? This seemed to have a monetary connotation to me and I was wondering what the students thought of the meaning of worth. In our discussion, we did talk briefly about worth and their related ideas. They continued to ascribe their own working definitions of the words from reading their explanations on the activity.

Some seventh grade students (10) and eighth grade students (7) clearly described cause and effect as related to their issue(s) through a direct cause/effect relationship or a

question. For example, "toxic chemical seepage—affects underground water" and "will acid rain affect trees?" One student wrote a list of several cause/effect relationships showing the link between deforestation and possible animal extinction: "trees cut down=no habitats for animals=no reproduction=endangered animals=extinct animal=animals can't perform job in ecosystem." From reading all the students' responses though, I do not think the relationship between cause and effect as related to environmental issues was clear for most students from the activity and our discussion. Cause and effect as related to these students' projects is an area that could have used more attention.

Conceptual categories related to the students' identification of environmental issues included issues of pollution, climate change, recycling, population, animals, and resource conservation. Many of these issues the students described were related to their project content, but some were also new ideas, outside the scope of the issues described in their projects. For the most part, the issues students listed had a negative connotation which makes sense as these were how "issues" were framed—things that need to be fixed. Some of the students' responses for each of the conceptual categories are listed in Table 8 (direct quotes) below.

Table 8: Issues Students Listed Organized by Conceptual Category

Conceptual Categories—Issues	Students' Responses (indicates grade level)
Pollution	• Pollution, water quality, air quality (8), (7) • Amount of trash (8) • Littering , (8), (7)

	• Toxic chemicals; toxic chemical seepage—affects underground water (8) • Trash building; Trash build-up--no place to put it (8) • Littering to pollute earth (8) • Too much fertilizer will damage the Earth (8); trying not to fertilize grass (7) • How good will the water quality be? (8) • Car pollution, car exhaust (8) • Factory pollution (8) • Will pollution affect trees? Will acid rain affect trees? (8) • Pollution—bad air quality (7) • Don't pollute—pollution hurts trees (7) • Garbage pollution—contributes to overall pollution (7) • Trash in the water/ocean (7)
Climate change	• Green house gas (8) • Global warming (8) • Greenhouse effect (7) • Global warming—artic/Antarctic melting down (7)
Recycling	• recycling (8); recycle (7) • recycling things to conserve energy (8) • recycling helps save trees, but not many people

	recycle (8)
Population	• population (8) • How much water will you use? (8)
Animals--wild and domestic (food)	• Animals in/used for clothing, animal based clothing (8) • Animals in/food(8) • Vegetarian/veganism (8) • Wildlife (8) • Animal survival (8) • Dolphins (8) • Fast food, obesity (8) • Food trash (8) • Slaughtering animals-pain or death (7) • Shipped (animals) in extreme conditions—give disease (7) • Trash harming other animals (7) • habitat endangerment, habitat loss—endangered black footed ferret (7) • endangered animals—unstable ecosystem (7) • save wildlife (7) • trees cut down=no habitats for animals=no reproduction=endangered animals=extinct

	animal=animals can't perform job in ecosystem (7) • branding animals—harmed (7) • ways animals are raised—harmed sickness (7) • declining population—no animals in the ocean (7) • dolphins in the wild—no dolphin shows (7)
Natural resource conservation	• Reducing needs of raw materials (8) • conserving natural resources (8) • people are cutting down forests (8) • purchasing earth friendly cleaning products (7) • improper treatment of the environment (7) • using more paper—more trees being cut down (7) • cutting down trees—beauty; lack or air (7) • cut down trees only when they reach a certain length (7) • forest restoration (7)

This activity revealed the polarities through which most of the students perceived environmental issues. Overall, students described both the issues and the person or group involved in the issues in opposites, as "good" or "bad". Students often described themselves, me, their friends and family as the "people involved" in the issue they chose to describe. I did not originally intend for the students to examine their position or mine on these issues—this was an interesting finding in that students identified themselves as a player in the particular environmental issue, but did they did not necessarily identify the

larger groups and organizations involved. They especially did not identify people or groups who might possibly have "mixed" positions or values related to an issue, i.e. their descriptions of this issues rarely revealed any "grey" areas.

Further, as the third part of this activity, the students described possible action strategies they could use to "make a difference" related to the issues they identified. Many of the students described the strategies as actions they did for their project, while others presented new, original ideas. Some of these new ideas included (direct quotes) the following:

Eighth Grade:

- signs on the streets to encourage recycling
- create a commercial for TV to encourage recycling
- parade to save the Earth
- make brochures-talking about the details of recycling
- take public transportation; ride a bike; carpool
- fix the faucet
- buy organic food
- promote hybrid cars-more people learn; give test drives-let them see how better; create more hybrid cars-people have more choices
- influence people on proper use of fertilizers; educate others on proper waste disposal; show animal life affected by litter
- get someone famous to start a campaign
- create more government outreach programs
- create well designed waste baskets

- hand out flyers-encouraging recycling
- People can help keep their community clean by cleaning up the trees. If trees are kept properly they will last long and grow large. Trees will protect everyone from pollution and acid rain.

Seventh Grade:

- Make advertisements; advertise in the community
- Create a product of interest
- Get community involved
- Rally
- Boycott
- Make an organization/club; join club
- Take metro instead of car
- Speeches; using public transportation; They (or me) could get people to carpool or use public transportation and get to and from work.
- Sell CDs to make money for EPA
- Book; because a book informs people about the loss of trees.
- Pop-ups on the computer-will cause people to understand and see what's happening.
- Get a VERY large petition
- Make a videotape about the issue and send it to someone that has a huge part on dolphin captivity
- Sell shirts with tree logo
- Fundraiser to raise money for forest restoration

- Make product to help with activities like fertilizing that are safe

Presentations

I asked the students to formally present their projects in groups to the class for two main reasons—as a content assessment for me to measure what they had learned in the project, and so that each of the student groups could learn from each other. I presented the rubric for students (described above) and most student groups decided to develop a PowerPoint presentation to share both what content they had learned and to do describe the action of their projects. Students presented their projects as a group, so there were seven presentations in each class. As part of their final assessment, I also asked each individual student to write a one page summary on the background content information they had researched related to their project and a one page reflection on their experience developing the project and their specific action. Examples of some of these student presentations and summaries are described and presented below in the Group Vignette section.

Green Day activities.

The Green Day developed as an idea before I started working at the school. The year prior to this study, the school had received a grant through the US EPA to work on an environmental theme day for students. I ended up joining the committee that was working on this project and met with staff from EPA and 3 other teachers on the committee (one from 6, 7, and 8 grade, and whom I also interviewed for this project—which is described later in this chapter). Because the population of the school was large, we (they) decided to focus on one grade level. The other teachers decided that it fit eighth grade best during the time of the year that it was being held (spring). The eighth

grade had a unit on earth science happening at this approximate time of year in March. It would have been nice to more directly tie the Earth Day into this study, but I did not receive approval from the county to conduct this study until May. The Green Day involved the students in several different rotational activities throughout the day, similar to the projects that I had completed with fourth-sixth grade earlier, except in this case teachers designed the activities, whereas in my experience students had designed the activities. The students were able to fill out and choose their schedule. I wrote and received a grant through the Chesapeake Bay Foundation with the help of the Schoolyard Habitat Program for tree planting along bordering areas of the school's property and a rain garden near drainage on the large field behind the school. I did refer to the Green Day when we were developing the projects.

The Green Day was not a part of the projects, but it did seem to affect the direction of the projects in each of the grades, albeit differently. The seventh graders had wanted to participate and many of them expressed that they felt left out of the process—this was probably amplified for my seventh grade class as they knew I was involved in planning the projects and taught an eighth grade section. This led several of the seventh grade classes to emulate activities they saw happening in Green Day—especially the planting on school grounds. For the eighth grade, some students were dismayed that we were doing the Earth Projects at all. "But we just did Green Day!" one said. Other students enjoyed Earth Day and were glad to continue it. "Oh cool, it's like Green Day." Or, the eighth grade students decided to do an activity that they had wanted to do at Green Day, but hadn't been able to because of scheduling or other reasons. One of the activities at Green Day was to create a bumper sticker with an environmental message.

Several students in eighth grade chose to complete this as a project, since they were not able to complete the activity during Green Day. In retrospect, I wish I had encouraged these students to work on a different project, something requiring more depth and intensity of study, but at the time I was glad they were excited about working on anything and really wanted them to choose the project they were going to do. Through this experience, I again learned, as I had with the fourth-sixth grade, that student choice is even more complex than I had anticipated.

Teacher researcher journal.

My journal, as the teacher researcher, reviewed areas of my perceived successes and challenges through my day-day experiences developing the projects with the students. This data is crucial to include in a study of participatory action research from a critical theory perspective, as my own voice further describes the perspective of a participant in this study. I completed the following entries over the time of the study:

May 18, 2005

It has been a week since I introduced the environmental projects. I have mixed feelings so far about their implementations.

On the first day, I gave an introductory survey and asked the students to pick a project they were interested working on (maybe I should have identified more topics here). The students completed the survey with a partner and then presented their ideas on a poster as a group of four. Several students from both classes asked, "Are we really going to do this?" The next day I had the students finish their posters and present them (see class notes and posters). I remember feeling upset because many of the students were not respecting each other or their ideas, I felt. For example, James in 4th pd. called

out "tree-hugger" several times in Brian's presentation. Keagan also raised his hand and said he had another idea. When he stood up in front of the class, he said "we can have a tree-hugging day. We can hug trees all day." It seemed very sarcastic to me. In the 6th pd class, students laughed a great deal during their presentations. It seemed like environmental topics had become so pas se for them, they were almost funny. Jason wrote a song which he sung in front of the class. I couldn't understand a word he said because he was laughing. I felt defeated at the end of this second day. I even thought, "this isn't going to work." But, I still kept trying. I decided to keep adding specificity now that I knew what the students were interested in. I wrote up a list of possible topics for each class that I would ask them to choose from next time. I noticed that many of the projects students wanted to work on weren't topics or content specific, but activity specific. For example, "educating others" through a videotape and giving presentations were some. (However, Monroe did say that he wanted to make a videotape about littering.) Students also wanted to create bumper stickers to encourage recycling, work on fundraising ("for those environmental groups" in Jordan's words and "for an animal shelter and Second Chance Farm" in Kelsey's words). I added a few things to the list I thought students might be interested in, including educating younger students and making a webpage, which several students in both classes had brought up casually as ideas. I also added study of earthquakes and volcanoes related to environmental conditions (a stretch?) for pd. 4 and study of environment and health of pd. 6 since these were closely linked to curriculum indicators. On the third day, when I presented these lists, this seemed to make sense. Students circled their answers and several asked, are we going to start on this today? (Keagan, Liang, Martin 4th pd.; Lyndon, 6th pd.) I had other activities

to do with them this day, so I indicated if we had time. Liang and Mike had their other activities at home, so I allowed them to start on their webpage. I was impressed by how excited they were and the page layout they came up with—on recycling and energy sources. I also had Shivani read through some resources on green schools I had, since she had finished the other assignment and had time.

Class today was frustrating in some ways. I had students complete the environmental literacy test. Most did not seem to understand the beliefs and values section. Is this what I am trying to ask students to understand? I'm not sure if this section was appropriate, but hopefully it is. The other section made sense on number of actions.

In 4th pd., I asked students to form groups depending on their interest. I was impressed that Monroe finished his planning sheet on videotaping and he seems more cooperative in general lately. I need to add more content into the activities somehow especially the bumper stickers group. Should I require a report as well? I need to develop a more specific rubric with what I'm expecting the groups to do and a research paper for groups to use for next time. Liang and Martin were again eager to work on their website. I am a little concerned about creating "an active site". I need to really stay on top of this. The sixth period class didn't get to the planning stage because the literacy test took longer. I had students write down their project of interest again because several indicated several choices and I wasn't sure how to group.

I am still having something of an unusual time with one group that wants to work on a project "save the cows, eat chicken"—the popular fast food restaurant "Chic-Fil-A" slogan. I tried having a discussion with the students but I didn't feel I did a good job. I

think I was having a hard time with my own value system towards humane treatment of all animals. Bart said, "I like cows. Chickens are mean and peck at you. So I'd rather eat chicken." I asked the group if it was okay to help one animal at the sacrifice of another? This was okay with them because they didn't "like" chickens and they were "healthier" (Russell). Bart asked on the third day if he could do something on hormone use in milking cows to "help the cows." He mentioned his sister had studied this earlier and thought it sounded interesting. The rest of his group still wrote "eat more chicken" as their project. I'm still not sure the best way to proceed here.

May 20, 2005

I feel very limited on time. It is very hectic at school and hard to get much done with the students. We have less than a month left of school and many of the students, especially the 8th graders are burnt out of school. It seems like the schedule has many interruptions as well. I am worried the projects will not have a large community action component, because there's not much time left, and I am struggling to get something or anything out of them.

The 8th graders have also just finished the Green Day, which is all about community environmental action projects. They don't really get why I want them to "do it again." I think that's why many of them want to do the bumper stickers—they probably think it will be easy, and many of them wanted to do them at Green Day, but weren't able to. So in a sense, for the 8th grade, the project is a little bit of an extension of Green Day.

For the 7th grade, it's a little bit different. Some of them felt left out, that their grade didn't get to experience the Green Day, so I'm trying to introduce this as their

chance to get involved. So some of them want to plant things outside, which is great, and the majority want to do something to help animals (which is great and tied into living things curriculum).

I'm definitely learning that tying things in with curriculum, student interest, and environmental action is very hard at this level or at this particular time. It almost seems impossible to have all three. Now, I am unsure the exact definition of what constitutes environmental action. I can see some of these projects that are being developed might not be considered action, or community action. Is this defined more clearly somewhere?

May 23, 2005

I continue to try to be flexible about the grouping and allow students to change their minds on what they want to work on. But we have so little time left! I really wanted to do the majority of the project in school to support the students and show them that this is a valuable use of our time, and give the students opportunities to work together. For students to complete all parts of the project though, I think they're going to have to do some work outside school.

Other curriculum requirements are difficult to work with and don't really "fit" with the environmental action project. I think this is particularly difficult because of the time constraints. If I'd had more flexibility to when I could have done the project throughout the year, I might have been able to fit it into the curriculum better. This is hard because there are 4 sections at each grade level in the school and parents, other teachers, and administrators expect all of the classes to be doing the same things each day. It is hard to cover everything the other teachers are covering in their classes and do this project. I have general indicators that the project matches, but it is hard to relate

plotting earthquakes and volcanoes to the action project, and the end of the year dissection happening in the 7th grade classes is particularly an issue.

May 25, 2005

I feel like the library research has definitely been positive in giving a more specific topic and content based focus to the project. Being at the library with the school librarian to support us, also allows me to talk more with individual students and groups. The differences in student abilities to work independently has been fascinating.

It sees like for the students and myself, we've separated the project into two parts—their activity, and the content knowledge they need to complete it and understand it. For their class presentations, I'm going to ask the students to report on what content they learned and what activity they completed. I want them to see how both are important. I'm hoping that this library research shows students how science is also interdisciplinary, as their literacy and technology skills, as well as math and social studies disciplines are often a part of their learning.

The students seem to especially enjoy the technology related components of the project—working on computer-based research, developing websites and videos. With each passing year that I've taught, technology opportunities seem to increase. The motivation that technology provides students seems to be significant. I also feel that they are learning important technology skills that will help them throughout life.

May 27, 2005

Mitchell (4th pd.) had an interesting comment today. He asked if we were going to work on the projects today, but he didn't seem happy. I said yes, and asked what was bothering him. He told me that they were "hard" and he wanted to do something easier.

I asked him to explain more and he said, “they’re too much thinking, not enough book work.” I was excited to hear this, as Mitchell is probably one of the most advanced students in the class, and was happy to hear that the project was challenging him to “think.” I also believe his cognitive discomfort might have also been in the choices that were open to him—the project asked students to think about a topic and activity, to form their own questions, and decide how they wanted to present what they had learned. I realized after his comment how few opportunities students had to structure their own learning this way in school.

June 1, 2005

I’m trying to stay positive, but sometimes the projects seem more difficult than my experiences with students other years. I realized that I have only done these specific types of projects with elementary students (grade 3 and grades 4-6) whom I taught for the entire day. In this middle school context, I have found it truly more difficult to keep up with what each of the groups (let alone individual students) are doing. I have found there are more external curriculum requirements that take up time, and a much more limited amount of time in general. I don’t feel as though I have had enough time to really meet and discuss in detail with all of the groups their projects. In the elementary setting, I felt like I had so much more time because I was with the students all day and the required curriculum content was not as intensive.

Something else I wasn’t expecting is that the middle school students seem to need more structure than the younger students I’ve taught. I wasn’t expecting this. For some reason, I thought they would be able to conceive and develop their projects more independently. I don’t get the impression that most of these students have experienced

much choice in their learning. I thought that choice would be empowering for them, but I think it has been frustrating for some, and I have had to provide more support then I originally had thought necessary. But I do think that after thinking about the experiences with students each day, I was able to go home and think about what could help them for the next step in their project. I developed many worksheets and rubrics as we went through the project. It was nice to tailor them to the students needs at the time. I think they might work for another situation as well, but in terms of this project, I specifically designed steps that seemed most appropriate. Of course, this was very time intensive for me.

June 3, 2005

The frog dissection has become more of an issue. I thought one of the other teachers wasn't going to do it, but she changed her mind. Here is a very clear example of how a teacher's personal values and belief systems can come into conflict with a curriculum. I not only believe that dissection supports inhumane treatment of wildlife, but also affects populations in the environment and is unnecessary. Students have shown to perform at the same or better levels when using alternative models (Balcombe, 2000). However, after doing some investigation myself, I have found no laws or materials that support a teacher's disagreement with dissection, only individual students. After talking with others, they seemed to think it was unnecessary for the law to impact teachers, because teachers were not directed *how* to teach, but what objectives students needed to learn. This makes sense, but I still feel under a lot of pressure to have the students complete dissections in class. I find the dissection issue particularly problematic in the context of the environmental action projects, because it seems to go against all of the

work that we doing—students are developing projects many of which deal with protecting wildlife. Why would we choose to support frog dissection when other technological models are available?

I have always connected the issues of humane education and environmental education in my own framework, but am learning that other teachers, parents, and administrators, in this school, at least do not share this way of thinking. One parent, that has been very supportive of the environmental project (his child is planting native plants to help wildlife in the area), is very insistent that his child dissect a once living frog. He called in to the school, and spoke with the science department chair. She came to speak with me about it, and I was surprised that he had contacted her, or been relayed to her, not me. I talked to her about my reasoning—that we are completing environmental action projects, that I have incorporated as a part of the living things curriculum, and dissection does not support these activities. How can we talk about protecting wildlife and ecosystems one day, and dissect frogs the next? She told me that I "can't use that argument." I also said that dissection is not in the curriculum, but the objectives and indicators are, i.e. students will be able to describe human body systems. The curriculum as it is written now does not dictate how we teach, but what we teach. She said that she was looking in to that. One of the VPs also called me to her office to ask if I was teaching the "curriculum" and that she had heard that my class wasn't doing dissection. She asked me if it was in the curriculum. I said that understanding the parts and functions of the human body were in the curriculum, but that dissection per se was not in the curriculum. She said, oh, she didn't know that.

At this point, since it's the end of the year, and I know I'm not coming back to this school next year, I'm going to teach how I believe to be best for the students. This is perhaps controversial and I recognize most people in the science education community may not agree with this approach. I have borrowed materials from HSUS that include virtual frog dissection CDs and large models. I also have developed my own "dissection" using an online program where students follow the steps of a dissection, identify parts, etc. that is the same as what others are doing on the actual frog. The parts are easily identifiable in the online version.

June 6, 2005

The 8th grade group that is developing a video on environmental protection, has stayed after school twice to work on the video, and has come in once during lunch. I have been impressed with their hard work. They have spent a good deal of time writing scripts, and "redoing" the video until it was how they wanted it. Staying after school with them in a small group has been a nice way for me to develop more personal relationships with them too.

June 8, 2005

Mitchell's comment on "too much thinking" became a running joke between us and the rest of his group. Sometimes he would come in to class and ask if we were going to have to do a "lot of thinking" today and then groan and kinda laugh. I do think the project was challenging him, but in the end this was something that he enjoyed.

There were some mix-ups with the MSELI I hope are straightened out. For pd. 4, the pages got copies incorrectly, and the students had to take it a second time—they were not happy about this, and I worry the results might suffer. In pd. 6, I had to be out of

class for a meeting, and the sub thought I wanted the survey to be anonymous, so none of the students wrote their names on them—I'll have to go through them in class next time to figure out which was which. I worry about the results in this case as well, since the students did not think they were going to be held accountable for their answers.

June 10, 2005

Today, most of the student groups presented their projects. School is almost over, and was a little hard. Most of the students did a nice job presenting, but I did see that different students put more effort into the project than others, and some perhaps learned more than others. Many students are just trying to "get by" at this point, and try to say what they think I want to hear.

June 13, 2005

Today I couldn't even get the projector, so a few last groups had to present without their PowerPoint presentation. Things were very hectic as I was trying to get missing materials from students and follow-up on any loose ends.

June 15, 2005

I was pleased with the interviews I completed today, and wish I had had time for more. I feel like I learned things by talking with the students that did not come out in their work—like the influence of culture on their ideas and their (seeming) desire to do more and continue the projects. All three of the teachers I interviewed spoke about positive experiences involving students in community action projects, but that it really only fit 6th grade curriculum. One saw them as "supplementary" indicators in 8th grade, one didn't really know how to fit it in in 7th grade, and the other thought after school programs could help. Overall, from these interviews I felt that my own impressions were

validated, but frustrated that they believed there was not a real place for community action in the 7th and 8th middle school science curriculum.

My evaluation with the VP went well overall. He did bring up the dissection though. He said he understood my desire to want to present the students with alternatives. However, in this case, he said, I should have "done both—presented students with alternatives and real frog models." He said one parent called and said that they thought I was "pushing my beliefs on the students." But he didn't identify this parent. Also, at this point, there wasn't much I could do, so I just said my basic reasoning from before, and that I always tried to present materials and ideas so that students could think critically about issues. We just talked about this verbally though, there was nothing about the dissection or parent phone calls in the written evaluation.

Journal Summary and Overall Insights

The journals revealed to me a few overall insights regarding the students' and my experiences developing the projects. First, in this context, many of the students had been overwhelmed with environmental messages perhaps through previous experiences, both at school (such as the Green Day) and outside school. Because of this, I didn't believe that the students found the projects motivating or out of the ordinary in the beginning stages. My experiences over the first two days with the students illustrated this—when I described in the journal my frustration that many of the students were perhaps mocking the projects or referring to others/environmentalists as "tree huggers".

The next emerging idea the journals revealed to me was the students often chose the activity the wished to complete first—video, website, CD. Any environmental issue could have been attached to many of these activities. This was when I first realized the

motivation that working on projects with technology had for many of the students—that perhaps the action of creating a technical product was more relevant to the students than the topics or issues involved in the project, at least at first. This realization both developed and created a need to distinguish between activity and issue.

Further, connected to both of these insights above, structuring choice was challenging. I was expecting the balance of structure and choice to be difficult, but I wasn't expected the choices to challenge students to the level/amount that they did. For example, the joke that developed between Mitchell and I related to the projects being "too much thinking." Both Mitchell and other students needed more specific direction than I initially anticipated to organize their choices and planning, which led to my formulating additional planning and choice activities, as described in my journal and the pedagogy section.

Additionally, my journal reveals not only the students' difficulty making choices or formulating questions/planning, but my difficulty making choices in the classroom as well. For example, how did I decide which projects were okay for the students to pursue and which did I decide they would need to rework? I had rubrics for many aspects of the project, but the issue the students choose to explore was approved mostly through a judgment by me. The journals helped me to begin to look more closely at what types of choices I was making and why—for example, my decision to steer the students in the "Chic-Fil-A" group to another topic. Not only did I see myself as having choices related to the direction of the students' projects, but also how I interwove the environmental action projects into other parts of the curriculum. The journal particularly illuminates my

struggle fitting my conception of the environmental action projects into a dissection activity that other classes in the school were completing.

In summary, my journal serves as "in-the-moment" data—I look back at my decisions and day-to-day experiences differently after the completion of the projects. In hindsight, I look at how I might have done things differently—presented the projects differently so they were more engaging for the students, worked with individual groups more critically about their topics, planned for the needs of middle school students, particularly on the topics of choice and structure, at a deeper level. This was my first year developing projects with middle school students and the journal presents a reflection on this new venture from the lived day-to-day experiences.

Student Group Vignettes

Students completed several activities leading towards their choice of a project—individual project questionnaire, small group discussion, small group poster presentations about ideas, possible project topics worksheet, planning sheet and brochure, and steps needed to complete their project, as discussed above (see Appendix F). Within these activities, and in their early research stages, students could also change their project and group as their ideas evolved and changed. To clarify, there were actually several choices students were making during this stage (Stage 1: Conceptualization) of the project: what topic were they interested in learning more about, what environmental action did they think appropriate to complete, and how did they want to organize as part of a group (or alternatively work individually). Making these three distinct decisions was challenging for many students. I anticipated forming groups would be the most challenging part of the project for many of the students, and further anticipated that students would choose groups, based not on topics and actions, but on the identity of students in groups. To

structure this process and try to alleviate potential stress this was causing for students as much as possible, while still allowing for choice, I created the "Possible Project Check Off Sheet" (See Appendix F). On this very brief worksheet, students checked off areas of topic and action interest in response to the group presentations (including their own) on ideas the previous class session. The next day, I divided the class into groups based on what projects the students had checked off and grouped the students accordingly.

Initial student groups.

First, I'll review the initial projects and groups that students chose. These groups were formed after students indicated which possible project ideas they were interested in working on, on the possible project topics worksheet. I'll refer to the number of the group in the discussion.

Table 9: Seventh Grade Initial Groups

Group #	Activity/Content	Students	Resources needed
1	Educating others/ Endangered animals and recycling?	Blakley, Kelsey, Nakia, Jin	Video camera
2	Outdoor planting/native plants and ecosystems	Kellie, Lyndon, Hanna, Moira, Ashley, Lenora	Plants, shovel, dirt, watering can
3	Educating others?/human health	Boone, Walker	
4	Education and petitioning/Animals	Karla, Brinkley, Russell, Joanna	

5	Educating others (CD)/trees	Jason, Cameron, Mikhail, Jeremy, Russell, Marcus	Recording device
6	Fundraising/endangered animals?	Dhara, Linus, Craig	
7	Undecided	Brooks, Shawna, JD	

Table 10: Eighth Grade Initial Groups

Group #	Activity/Content	Students	Resources needed
1	Webpage/recycling	Martin, Liang, Bryson, Keagan	Computer
2	Video/recycling?	Christopher, Nayan, Amelia, (Keagan), Monroe, Aiden	Video camera
3	Planting/ecosystem	Shivani, Jen, Mitchell	Plants, etc.
4	Educating younger students/recycling	Sam, Powell, Bart, Amelia, (Aiden)	Time to go
5	Bumper stickers/recycling	Machiko, Mitchell James, Jenna, Karise, Hedy, Ashley, Nam-Kyu,	Sticker material

		Gavin	
6	Undecided	Geet, Keagan, Aiden, Mitchell	

Because I was especially interested in the students having choice in the projects they completed, I did allow students to change their project topics, ideas, and groups. Changes generally happened still during the Conceptualization Stage, most often while completing the planning and steps needed parts of the project. Most students were set in groups by the Research stage, although I did allow students to switch if it appeared reasonable. This was definitely an area where I had control over the students' choice of projects.

Final student groups.

Table 11: Seventh Grade Final Groups

Group #	Activity/Content	Students	Resources needed
1	Educating others—Website/endangered animals and recycling	Dhara, Kelsey, Helena, Jin, Blakley	Computer
2	Planting/native plants, ecosystem health	Lyndon, Brooks, Moira, Lenora	Plants, etc.
3	Educating others/recycling	Whitney, Jeremy	
4	Petition/cow hormone treatment	Cameron, Brinkley, Linus, Shawna	

5	Educating others—CD/Trees and habitat	Russell, Jason, Marcus, Mikhail, JD, Jordan, Walker	
6	Fundraising and letter to senator/Global warming	Kellie, Nakia, Ashley	Approval for fundraiser (did not get)
7	Petition/dolphin captivity	Karla, Joanna, Boone	

Table 12: Eighth Grade Final Groups

Group #	Activity/Content	Students	Resources needed
1	Educating others—Website/recycling	Liang, Martin	Computer
2	Educating others—video/local environment issues	Christopher, Monroe, Gage	Video camera
3	Educating others—Website/recycling	Abbey, Keagan (separate sites)	Computer
4	Planting and educating others—video on how to plant a tree	Sam, Bart	Video camera
5	Educating others—Bumper	Karise, Jenna, Hedy, Ashley,	Sticker material; scanner?

	stickers/recycling	James, Keagan	
6	Educating others—Bumper stickers/recycling	Mitchell, Nayan, Nam-Kyu, Machiko, Powell	Sticker material
7	Educating others—video/environment general	Shivani, Amelia, Bryson, Geet, Aiden	Video camera

In both classes, the number of groups increased from the initial groups to the final groups (initially 5 and 6 groups to 7 groups in each class).

For the most part, the projects remained the same, but some of the students making up the different groups changed. In a few cases, the actual topic and action of the projects changed.

I'll organize the remainder of the paper around the final groups, but will sometimes refer back to the initial groups. Below, I'll describe each of the final group in vignettes.

Seventh grade (7 groups).

Group #1: Educating others—Website/endangered animals and recycling

This group developed a website designed to provide information to other students and adults on specific endangered animals and recycling. Kelsey had the original idea to create a website and became the acting leader of the group. Blakley and Jin were also interested in this project from the beginning of the project. One student left the group—Nakia—and one student joined the group—Dhara.

The group worked very well together and divided their tasks easily early on and with little intervention or assistance from myself. They produced a very detailed and thorough final project.

The url of the website they developed was www.freewebs.com/helpenvironment , and included the following content:

Content Page 1: Pollution

What is pollution?

Pollution can be described as many things. It's the act of polluting or the act of being polluted. In other words, it's unclean air. Pollution is also a worldwide problem. There are two types of pollution, water pollution and air pollution.

What causes pollution? …

How does pollution affect the environment?...

How does pollution affect us?...

How can we help?

Here are some tips on how to prevent pollution. Remember, you are only one person, but you can still make a difference:

When traveling somewhere close to your home, ride a bike or walk.

Let air from outside your house in for awhile. Open a window [or u..?] to make the air indoors cleaner.

Content Page Two: Recycling

What is recycling?

Recycling is when items such as glass, metal, plastic, paper, etc. are recycled instead of thrown in the trash. These items can be reused so that they are not wasted.

Does recycling make a difference?

Yes recycling makes a huge difference. A problem for many places around the world is having over loads of trash. Recycling gets rid of a lot of trash. Recycling has summed up to 40% of waste in many cities.

Content Page Three: The Black-footed Ferret

Physical Appearance…

Their habitat…

Life style…

Why they are endangered…

How we can help…

Content Page Four: Florida Panther

Description: Coloring…Physical…Diet…Population…Threats…In the future…

Content Page Five: Red Wolf Picture

Description: Coloring…Physical…Diet…Population…Threats…Whey they live…The future…

Content Page Five: Guestbook

Name:

Email:

[Message area]

[One entry:]

Name: KV

Email: ___

Date: Wed June 8 19:51:24 EDT 2005

This is so cool you guys! I think we did an awesome job!

Dhara described both why the topic she chose to research was important, as well as the meaning she identified with creating a website in her final reflection:

> For my environment project, I made a website with my group. I researched about Ethiopian Wolf, and Black Footed Ferret, that are endangered animals. I learned why they became endangered, and a lot of other facts about them. These mammals need help to exist, or they will eventually become extinct. Making a website is helpful, because I can educate other people about the decline in the population of The Ethiopian Wolf, and The Black Footed Ferret. (I can't fit the information of an Ethiopian Wolf on the website.) I can't help them on my own, but I can with other people involved in it. The more people aware of the endangered animals, the more chances the animals have in surviving longer. Other people might have better ideas on how to help those animals. There are a lot of other animals endangered, not just the ones I did research on. I also included some solutions of some organizations, and what people could to help the endangered animals, on the website.

I wish that I would have had more interactions or discussions with this group. After reflecting on the projects, I feel I should have encouraged them to work on local, native endangered species to our specific geographic area (although the three animals they chose to bring attention to on the website are, or have been located nearby), as well

as more on the connections between pollution and endangered animals. I am unclear why they chose to profile the endangered animals that they did, and I wish I had explored this further with them.

This group's work also brought forth a number of additional questions:

- Do the students in this experience see animals as part of the environment, making up the environment, or as separate? (Shepardson, 2007)
- How do students conceptualize "environment"?
- Should I have worked on students' conceptions of "environment" in greater depth, and assumed less about their understanding?

Strikingly, this is one of two groups (out of five who completed websites as part of their project) whose website remains active in 2007 (accessed November 25, 2007). Some of the content has changed, so I can't be certain if the students working on the website are the same. There are however several similarities, that show evidence that the current website is a revised version of the site created in 2005. The updated website is titled "Ways to help your environment" and includes the section "how kids can help"—this is similar to the section on each of the pages in the last site called "how can we help?" There is also a statement on the first page, "You can make a difference!" which is similarly stated on the older version of the site—"Remember you are only one person but you can still make a difference." When I interviewed Kelsey at the end of the year, she did indicate that she wanted to continue working on the website over the summer and in the future. She had set up a "guestbook" and added a section for others to write comments. (I have entered a comment on the "blog to tell tips to help" to try to find out if in fact this is a revised version of the original Group #1's website. If it is, I believe it

would provide a remarkable insight on the influence the project had on at least one student and her perception that she is helping the environment through using a technology as a means of communicating with others. The website has been considerably updated since the project's completion in 2005 and includes new content on The Kyoto Protocol, "facts about lightbulbs", and global warming. (The "copyright" date on the website says 2006 and looks as though the blog was started in 2007.)

Group #2: Planting/native plants--Ecosystem health

This group decided to plant native plants outside the school to 1) support native plant ecosystem, 2) help wildlife local to the area, and 3) beautify the school aesthetically. This group started with six interested students, and changed to four, including three original group members and 1 student who changed groups. The group developed their ideas and actions over time, particularly in their knowledge of native plants and their importance to the local ecosystem. The final group members included Lyndon, Lenora, Moira, and Brooks.

Lyndon seemed to lead this group's idea generation and communication, although all of the group members were involved. He wrote letters to the science department chair and principal for permission to complete planting on the school grounds, which the other group members signed. The letters helped the students share what they were working on with others in the school building, as well as connecting us further to the community in the school. The letter included the following text:

Dear ____,

In Miss Charmatz' class we are doing a project in which we need the school's approval. For our project we are going to plant plants around Humana

> Middle School. This is where we need your approval. We also need to know if the school will provide us with some money. We will not need more than $50 from the school. With your help and funding we can make Humana a more beautiful place. These plants will also help the environment of Humana because all plants produce oxygen.

The whole group decided on the local plants they thought were most appropriate. Lyndon volunteered to help me bring in the plants from the car that I purchased from the groups' list, and helped start the planting. The group finished the planting during class.

This group's content topic and action seemed to most closely match the construct of a place-based project, and the students worked after school and during lunch periods to complete it. They might have done more thorough research on native plants and local wildlife. However, Lenora's final reflection and summary of the project indicates that she did come to new understandings about ecology and native plants:

> Lyndon, Moira, Brooks and I decided to plant flowers and trees native to Maryland to beautify KMS. In the process of beautifying the community, we hope our plants will attract wildlife as well as making the school's appearance nicer. We also sent a few students to help us clean up trash around the school. This reduces the risk of injury to animals and cleans up the school. This project taught us that planting flowers is not just to make an area look pretty, but to give animals a place to live, food, and many more things animals need to survive. Planting the trees also helps to provide more oxygen. More oxygen means a healthier environment. I believe that our project taught us a lot and benefited the community greatly in many different ways.

In order to do this project, we had to do some researching first. Well what exactly do you research when you want to beautify a community? That's easy…First of all; you have to research what types of plants are native to the area you are in. Since we are located in Maryland, we looked for plants that naturally grew in Maryland. Some of the many plants we found were Black Eyed Susans (found on roadsides, prairies, fields, and meadows), Morning Glories (grow on roadsides, waste places, in fields, and thickets throughout the U.S.) Common Evening Primrose (found in waste places, in fields and roadsides), Carolina (grow in dry open, grassy places). {All of these flowers were found in An Instant Guide to Wildflowers.}

Another topic important to research when you are planning on planting flowers/trees is interesting facts about plants. What may seem like something useless could be really important. Something as simple as "The roots anchor the plants to the ground," can be extremely important. Some other facts we found were:

- Plants continue to grow their entire life
- Roots take in water and minerals from the soil
- A typical leaf has two parts: the lamina (leaf blade) and the petiole (stalk)
- Plants can adapt to new environments (depending on the conditions that change and the type of plant it is)

Those facts may play a major role in planting the trees and flowers…I am positive that our project will help save the environment and I am hoping that all of our research paid off in the end.

Similar to other groups, I would have liked to have spent more time discussing the goals and content of these students' project. I learned that students (in this context) do not intuitively go towards projects and ideas related to native, local place environments. In this case, these students needed some guidance to stay "local", as they were not initially aware native versus non-native plants. In other groups, students were most often interested in working on projects more "global" in scope—one of the most popular project ideas considering both classes was to create a website, and I think this was because they viewed this as having a greater impact over a larger population or area of people. Three of the students interviewed said they were most interested in working on "big" topics and all chose the word "big".

Moira's interview one year after completing the projects indicated that she remembered the importance of native planting and that she had prior experience gardening. She did report applying her new learning about native species to home projects with her mother one year later. She recalled the physical aspects of completing the project as well as specific content concerning the plants during this interview as well.

Group #3: Educating others--recycling

This group of two—Whitney and Jeremy--completed a simple poster presentation for other students at the school on the importance of recycling. An interview with Whitney 1 year after completing the project showed that he remembered recycling information that he had learned and presented, e.g. it takes about 18 trees to produce 1 ton of paper. He said he would be interested in doing a similar project if he had another opportunity. He also brought up the idea that he wanted to work on "something big." Recycling is a topic that has both local and global significance. Again, this group made

me question students' understanding that local projects are or can be part of the bigger, global picture?

Even though Whitney spoke of the importance of working on "something big"—meaning a "big" topic—the scope of their project was relatively smaller than the other groups. I tried to push them to create more posters to display around the school or in a community center, but I had a hard time motivating this group to do more. Again, if I had more time to meet with this group, or the group had a longer time during the school day to work on the project, more might have been accomplished.

Whitney described his experience working on the project in the following summary:

> Our project displays the process of recycling and why to recycle. Also, it shows what to recycle. For example, paper. Even glass can be recycled. Next, our project shows how easy it is to recycle and why recycling helps everything in our environment. Such as saving trees. Did you know that recycling 1 ton of paper saves 17 trees? After that, recycling saves trees, helps the ecosystem, and keeps the trash level down. If we hadn't recycled, living would be very hard to do on earth after while of not recycling. In the end, our project tells about what, why, and how to recycle. Also, it shows how recycling helps. So, recycle everyone!

Group #4: Petition--cow hormone treatment

Two of the members in this group, Karla and Joanna, were initially in the group that was interested in the Chic-Fil-a ad campaign, to "save cows, eat more chicken." The students in this original group had seen this advertisement campaign and decided that they would like to help cows and they could do this by "eating more

chicken." From this advertising campaign, as well as other personal experiences they had had, the students in this initial group decided they "didn't like chickens as much as cows," that "chickens were mean and pecked at you" (Brinkley) and that "eating chicken was healthier for you than eating cows" (Russell). In this initial group, Karla and Joanna agreed that they also "did not like chickens as much as cows" and wanted to "help cows not chickens."

This was a case in which I did ask the students to reconsider their idea, for several reasons: (1) I wanted the students to come up with their own original ideas and although I found it very interesting that Chic-Fil-A's ad campaign had influenced them to this degree, I found it inappropriate to use a fast food company's advertisement as the basis of an original environmental action project. (2) The students had not given any specific reasons that this project would benefit the environment (or animals in the environment). (Simply eating chicken, doesn't necessarily "help" cows.) (3) Further, I decided it was unethical for me to help one animal (if this is the case) at the expense of another. This was most certainly a moral stance and opinion on my part.

It is also possible that the students were testing me, and thought it might be funny to see how I reacted to this idea. I asked the students to reconsider their idea based on the reasons above, and think about designing their own original project, perhaps incorporating the idea of helping animals in their environment. Since the students seemed interested in cows, I also suggested that students perhaps try focusing on one animal, such as the cow, their well-being, and their connection to the environment and human health. Since the seventh grade curriculum topics included living things and human health, environmental and health issues related to farm animals fit this framework.

This initial group #4 ended up splitting into 2 groups—final group #4 and #7. Karla and Joanna, along with a new group member Boone, formed group #7—a petition on ending dolphins kept in captivity. Russell and Brinkley, along with new group members Linus and Shawna, formed group #4—they worked on a petition related to ending hormone treatment in cows, which I'll continue to describe below.

The students became interested in working on this project through brainstorming on what they could do that would help the lives of cows, while also helping the environment and human health. This led them to research organic meat and milk production and the differences between conventional milk production and organic milk production. Bart remembered that his sister had completed a project on the use of the hormone rBGH to increase milk production in cows and remembered he thought this was interesting, and so the group members starting researching the implications of its use in conventional milk production. They decided the best action they could take in this case was to develop a petition to end of the use of the hormone in milk production that they were planning to send to the U.S. agricultural department. I'm not sure if the students or I thought that this would have a real impact on the use of the hormone, but I do think that the students saw the idea of citizen activism as interesting and it was something they wanted to try in this context.

One of the group members—Shawna—also became interested in Mad Cow Disease and what caused it. She wrote a separate letter on this issue to the FDA.

Cameron wrote the following summary of the project including the following subsections:

What we did and how it helps:

- Our group made a petition about how cows are being injected with the hormone rBGH and what effects it has on both people and animals.
- This petition can help because if we get enough signatures then the government can realize that a lot of people care about this problem. With the government it could save millions of cows and people's lives.

What others can learn:

- Others can learn that if you speak out your beliefs can make a difference.
- Also people can learn that often others have the same thoughts but you must speak out about it.

I found Cameron's perspective in both these subsections fascinating, in that he believed or hoped that citizen activism could make a difference, and especially the idea the "others have the same thoughts" but that it takes an individual speaking out to help others be heard. I thought this was particularly interesting way to describe developing a petition.

A number of questions arose for me from working with this group:

- Similar to group #1, how do students see animals as part of the environment, making up the environment, or separate? Further, does the species and cultural significance of an animal matter in terms of students' conceptions of animals and the environment?
- Does improving animal quality of life and human health "count" as an environmental action project?
- Do animals raised for human use—food, education, research—require the same protection as wildlife from students' perspectives?

Group #5: Educating others—CD/Trees and habitat

This group was the largest in the 2 classes and focused on educating other students their own age on the importance of trees to local habitats. Their activity was creating a website and lyrics for a song. In retrospect, I think I should have split this group up, although in the end they split up the project themselves by some of them working on the song and some designing the website.

I was very interested in the idea of connecting music, technology, and science topics in this project for several reasons, especially related to the group of students I was working with. As I realized from observing these students throughout the school year, at the beginning of the project, and through analyzing their initial surveys, I observed that most of the students in the group were not interested in environmental issues or in making a difference in the environment. Further, as evidenced in some of my early observations, the students making up this group, in particular, did not see themselves as part of the environment, but the "environment" was a place that existed somewhere else (Shepardson, 2007). For instance, in their initial surveys, some of the students' comments included:

- I don't [take any actions to help the environment] because I don't do anything for the environment. I don't never plant nothing nowhere. Ever!!! (Jordan)
- I couldn't because I don't feel like it. I really don't care about the environment.
- If the environment was bad I wouldn't care. I don't care about the environment (grass, trees, plants), it's all boring to me.

The opportunity for them to choose an activity that was particularly motivating and personally relevant was therefore particularly important to me. The combination of music, science topics (in this case ecology), and technology also involved student creativity and innovation, peer interest, increased novelty for a topic many of the students seemed to approach as passé, and was more culturally relevant.

This was also a group that seemed to need more time to fully complete their project and ended up falling short of time at the end of the year. They were able to complete lyrics related to tree habitats, and post these and other information on a website, but were not able to make a CD of their song for distribution to other peers. At the beginning of the project, one of the students thought he had a recording device they could use to make the CD, but this did not work out. I was not familiar with creating CDs from the recording stage, and so my lack of knowledge in this area did not help either.

One of my understandings from this project was that, as the teacher, I needed to be ready to familiarize myself with new technologies as they were appropriate to students' interests and needs in the project. In this case, I was not able to find and implement the CD recording device in a timely way, when the student's equipment did not come through. The students were, however, able to finish the lyrics and music to their song, as well as completing a website with their findings and lyrics.

The url for this group's website was www.freewebs.com/Humana. It was titled "Tree Unit Save Da Environment: Where the Real Tree Savers Be." (The group named themselves T-Unit short for "Tree-Unit" included the following content:

Content Page One: Home

So you have reached the official tree savers unit website where the real tree savers are..

Content Page Two: Y we made dis CD

Here is where you find out the reason t-unit made this cd.

We made this cd for many reasons. We wanted to tell people in a cool way how to save the environment, mostly trees. We didn't want our project to be boring. We wanted to inform people in a really fun way. We made sure that everybody would get something out of our cd.

Song lyrics:

The bugs are ringing

The birds are singing

The owls are hooing

And the earth is renewing

Cuz its earth rebirth 2k5 (3 times)

We can all start to recycle

We can all save da trees

So there can be green leaves.

Chorus repeat

Like Group # 3, I would have liked to work more with this group to further develop project content. The students in the group did write up fairly detailed summaries and reflections of their projects including what they did, what they learned, why they enjoyed the project, and how they think it helps.

For example, Russell described their project:

What did I do for my project?

For my science project, my group and I decided to make a CD informing people about saving the environment and why trees need to be saved. My group did this because we wanted to have fun while doing a project. The CD was a great was for the group to have fun while doing the project. This helps people and the environment in many ways. It helps the people because it will remind them that the environment is important and that people should take care of it. It helps the environment because people will start paying attention to it and begin to get involved in activities to help the environment.

Background Information

For this project, my group and I needed a lot of background information. First, somebody needed to know how to get our song recordings onto a CD. Fortunately, Whitney knew how with the help of a machine his ant had. We also had to know a little bit about why trees are being cut down and why the environment was in such bad condition. We found that trees are being cut down and cleared out to make room for new roadways being built. Some ways people could help protect the trees is by raising money for tree care products and for new trees. A way to help trees that are already planted is to first put four poles in the ground. Then using string, tie the string to the tree bark. This will hold the tree up. People need to stop hurting trees and the environment and start taking better care of the earth. We hope our CD can help this feat be accomplished.

Reflection

There are many things people could learn from our CD. One thing people could learn is that the environment is important and it isn't right to treat it the way people are treating it right now. Another thing that could be learned is that there are fun ways to convince people to help with any other task. My group and I had lots of fun making this CD for the project. If you ever end up with a project involving presentation and convincing people to help you, I'd recommend making a CD. Overall, this was a great project for many reasons. One reason is that the environment is in bad condition now and that people need to start taking better care of it. By losing trees, we are losing oxygen and habitats for animals. This project was great because not only does it inform people about the environment, but it was fun to make a CD as well.

Marcus wrote in his final paper for their project:

Background Information

Before this project I knew some about trees. I knew a lot of trees were getting cut down and it was becoming a problem. I also knew that some animals like squirrels, and birds lived in trees. I thought that these animals just like in the trees peacefully, now I know differently. Finally I knew that some trees could grow around a hundred feet tall and live for hundreds of years.

I also knew the very basic things about trees. Like, that in Autumn the green leaves would turn red, yellow, and orange. This was the beautiful thing about nature. Also, I knew that there hundreds of different kinds of trees. When I

found out that trees were becoming endangered I was amazed because all the types of trees and they are becoming endangered.

This project helped me a lot. It help me because I started this project with little information about trees and now I have a lot of information about trees. Since I have all of this information it has helped me understand nature. Understanding nature has helped me with Science. I am glad we have done this project because it has helped me and the environment.

Reflection on Project

While doing this project I learned a lot of new and important things about trees and nature. I learned that eighty acres of trees get cut down every minute. At that rate there will be no trees left in the world. Also, I learned that animals lose their habitat when trees get cut down. Since these animals do not have their habitat they will probably die. If these animals keep on dieing they will become extinct. I also learned some more facts about trees. One fact is that is illegal to cut down trees in The Amazon Rainforest. The sad part is that people still cut down trees anyway. These people just do not understand that not only are they killing trees but animals. Some of these animals are the boa constrictor, sloth, and the chimpanzee. If these animals go extinct then the ecosystem would collapse and many more animals would go extinct.

When I learned about all of these trees and animals dieing I thought this information was very helpful. I thought this because I now know what bad things are happening in forests. Since I now know what is going on I might tell people about how bad it is and try to influence them to tell even more people about what

is going on. Also, because of all of these trees and animals are dieing I might even protest! I am grateful that I learned this much about the trees and wildlife.

Group #6: Fundraising and letter to senator--Global warming

This group changed activities and participants over the course of project. Initially, the students in this group were interested in doing a fundraising activity to give to an environmental group that was working to help animals. While I think both the students and I saw the value in fundraising in terms of making a difference for animals, I was concerned that this was not a direct action and was uncertain of what the students would learn and take away from this activity. I came to see fundraising as an "indirect" action, a classification I used to define several other student activities as well.

However, as I wanted the students to explore their ideas further, and I understood their argument that fundraising could help environmental issues, I tentatively approved their project, with the understanding that the students would need to research both the cause and issues they were fundraising for, as well as what actions the groups were participating in, and if these were something they wanted to support.

As it turned out, the students in the initial group changed groups and three new students ended up forming this small group. They researched endangered animals and then global warming and decided they wanted to have an environmental bake sale to raise money for the group Environmental Defense. As part of this process, I asked the students to write a letter to our principal asking for permission to hold this sale either during lunch or at the end of the school day. I did this for two reasons—so that the students had an opportunity to explain to another adult in the community what they were working on and learning, and so that we could have further participation in the school community (and of

course make sure this was okay). I wanted the students to have direct contact with the principal about the project, so I asked them to hand deliver their letter to his office. He wrote back and told them that it was too late in the school year for this type of activity so they could not hold their sale. This was surprising to me (as it didn't seem to be an interruption to the school day). However, I did not meet with him or push this any further. Instead, I told the students that sometimes these things happen, and now that they know how to set up a fundraiser, this would give them an opportunity to try something different to help.

I knew the students were frustrated, running out of time, and unsure what to do at this point. I suggested that they write to their congressperson about what they had learned concerning global warming through their research and encourage him or her to support legislation that would lesson global warming's impact, specifically with ideas they had found in their research. Fortunately, this worked out, in this limited time frame. The three students worked together to research which congressmen represented their district, and drafted a letter to send in. This ended up being an interdisciplinary activity involving science, reading, writing, social studies, and technology.

Kellie's letter and reflection:

Dear Senator,

Hello, my name is Kellie___ and I am a soon-to-be 8th grade student at [Humana] Middle School in Maryland. I am arising an issue of concern. The concern is global warming. Global warming is a very big issue and actions need to be taken to prevent it. The problem is that the earth's surface temperature has risen one degree in the past century. This may not seem like a problem right now,

but it will be in the future. Rising global temperatures are expected to raise sea level, change climate, precipitation, and ecosystems, and cause more frequent hurricanes, heat waves, cyclones, and typhoons. Global warming is a threat to mountain areas. It will also affect human health. In some places in 50 years, there will be a water shortage due to heat waves. What causes it is greenhouse gases. Some greenhouse gases are methane, nitrous oxide, and carbon dioxide. Methane is emitted when producing and transporting coal, natural gas, and oil and nitrous oxide is emitted when doing agriculture and industrial activities. Approximately 6.6 tons of greenhouse gases are emitted for each person in the United States per year. What can be down to stop this is plant more trees, use less energy, spread information about global warming, purchase energy efficient appliances, insulate homes, use less water, and reforest. Every tropical rainforest can hold about 5.5 tons of carbon, which will bring down how much carbon dioxide is in the air. What I think you could do is not only campaign about global warming, but also help to pass a law on how much greenhouse gases are emitted into the air. These are just some ideas and information on what to do about global warming. Thank you so much for taking the time to read this letter.

Sincerely,

Kellie

My Background Information

My group found a lot of information on Global Warming. One of the things we found out was what global warming really is. It is the fact that earth's temperature is getting warmer and warmer. In the past century, earth's

temperature has changed one degree. That may not seem like a lot, but it affects the future. Rising global warming temperatures cause sea level to change, changes climate, precipitation, and ecosystems. It also will cause deserts to expand, National Parks will be permanently altered, and will cause more frequent hurricanes, heat waves, cyclones, and typhoons. Research proves that human activities are what cause it. Increasing levels of carbon-dioxide and greenhouse are the main causes. What's being done to improve the issue is reducing and avoiding climate changes and risks, there are prepared greenhouse gases inventories, more research is being done, and there is a firm commitment to stop the risks of climate change. What you can do as an individual is to plant trees, use a push mower instead of a power mower, recycle, purchase energy-efficient appliances, fixtures, and other home equipment and products, insulate your home and tune up your furnace, use low-flow faucets, replace normal toilets with water saving toilets, and lower the temperature on your hot tank to 120 degrees. These are just some suggestions to help. Another idea is to spread info around. Did you know that approximately 6.6 tons of greenhouse gases are emitted per person, per year? Well, if you don't, then most likely people around you won't. Also, a small increase in climate over a long period of time can also change human health.

Reflection

I learned many things when doing this project on global warming. I now understand the real issue with it. I now also know the seriousness of it and how it will affect the future. For example, I didn't know that global warming in the

future will cause more hurricanes, typhoons, and cyclones. I also didn't know that global warming affects human health or the in the future, deserts will expand and national parks will be permanently altered. I think this project is very helpful in many ways. One way is that it informs people about global warming. Another is that it alerts people of how serious it is and gives them a small insight.

Presentational Part

What we ended up doing for our project was to write letters to congress/senators about global warming. We each wrote about what global warming is and what can be done to help prevent it. Some of us also collected money for the environmental defense. This project not only alerts the senators, but it also informs other people to. It shows an insight into global warming and just letting people know about global warming helps.

Others can learn a lot from what we did. Others may choose that they want to help also and fight for the cause. Also, people may want to write letters to different people.

Nakia wrote a separate letter from her own perspective:

Dear Senator:

My friends and I are concerned about the topic "Global Warming" science this is a topic with a lot of importance we want you to know how harmful it can be to the environment as well as to the Earth. First we want you to know that the temperature of the Earth's surface has risen 1 degree Fahrenheit in the past century even dough it is a small increase over a long time it can damage the climate which can affect the environment by changing the ecosystems. If it

> changes the climate it will affect the Earth by heat waves that could cause more hurricanes and cyclones all of this because the atmosphere heats up. A lot of evidence proves that this effects on global warming are caused be mainly humans, for example using an excess of electricity causes a big increase in the levels of carbon dioxide or green house effects / gases which are the main cause of Global Warming; statistics show that approximately 6.6 tons of green house gases are emitted per person in a year and every hectare of tropical rain forest can hold 5.5 tons of green house, this is destroying the ecosystem hugely. We can prevent global warming by reducing products and fuels that are harmful to the Earth by giving off extra carbon dioxide also, reforestation will help with Global Warming like planting trees, bushes this will help reduce carbon dioxide which will reduce the green house effect greatly, also using low flow faucets and prevent forestation will all help with this extensive topic.
>
> hoping your consideration in this topic
>
> students from [Humana] M.S
>
> seventh grade

More time would have been helpful, as we were not able to see the representatives' responses to the students' letter. I do wonder if any of the students heard back at their home address. One of the students in this group wrote me a thank you note at the end of the year, which included:

> I enjoyed doing all of the projects we did this year in science! I really enjoyed doing the environmental project at the end of the year! You really helped me understand global warming!

Group #7: Petition--dolphin captivity

This was not one of the initial groups that the students formed, but instead included three students from other groups that changed their initial ideas. Two students originally in Group # 4 decided that dolphin captivity was a topic they were more interested in, that also helped animals in their environment. One additional student changed to this topic as well, who was originally in Group #3.

I thought this was an interesting topic, although I am unsure after reflection that it fits the definition of place-based or environmental action. However, it was personally relevant to the students, as they had attended swim with the dolphins programs and had reservations about the impact on the dolphins' lives. Reflecting on this project and others, I have begun to think further about place-based projects and their relationship with relevancy. Many students did not seem motivated to work on environmental projects in "their backyard". Is this then one of the goals of place-based education—to make local issues more relevant to students? In my experiences with this research project, most students (with the exception of the local planting group, Group #2) were more motivated and interested in working on topics that were not local, but rather were on a larger global scale. During the scope of this project, I actually ended up going with what seemed most personally relevant to students, rather than necessarily what would be defined as place-based, although I certainly encouraged place-based projects.

The group researched the issue of dolphin captivity, developed a petition for students to sign protesting dolphins in captivity, and summarized their project findings in a PowerPoint presentation. The first slide of their presentation included the following summary:

The issue that occurs all over the world is dolphin captivity and the carelessness of trainers in how they treat them. Our project helps the environment because it may alert people on the issues of dolphins and maybe not just dolphins, but other animals as well. We helped improve the issue by making a petition and had as many people we could sign it to agree with us that [keeping] dolphins in captivity is wrong. We will then send it to an organization that keeps dolphins in captivity. We hope that they will see that [keeping] dolphins in captivity is wrong and hopefully they will let the dolphins go back into the wild.

Eighth grade (7 groups).

The eighth class projects were more centered on using technology and technology issues than the seventh grade projects. The eighth graders overall seemed less interested in the environmental aspect of the projects from my perspective as well, perhaps because they had just been involved in participating in the eighth grade "Green Day." I thought that the Green Day would work well as a good introduction into these projects, but it seemed to burn some of the students out of them in a way.

Group #1: Educating others—Website/recycling

Many of the students were interested in developing a website in order to educate others about what they had learned and what actions they have taken, and then what others could do to help. I speculate this might have been that they learned action skills and concepts through the Green Day project and a website was a tool they could use to share information they had learned with others. I'm also not sure if a website was the best choice for an action activity, but again at the time, it seemed like a good idea to

encourage them since this was an area of interest for them that they had not been able to explore previously.

This first group was originally four group members but two of the members ended up going to do their own webpages. The two students that made up this final group—Liang and Martin—rarely completed their classwork or homework. However, both worked on this project, during class and lunch, and at home. Both of them would ask me when they came into class when they could work on their project. They were also the "experts" in the class on their website work, i.e. they were the first group to start working on their site, and gave suggestions to other groups working on websites on how to work out some technical features of the site.

Their website contained content on a variety of issues, including recycling and environmental energy choices. This group got a great start and worked quite hard on their site (from my perspective and relative to other work they completed in class). This was the only class project that both Martin and Liang came in and asked me questions about all year. They often asked me if they could stop their other class work and go to work on their site. Or, they would say "my other work is at home, can I work on the site". Both students came in a few times during lunch to work on the site.

The site was located at www.freewebs.com/recycle_alot . They planned the topics and created a basic layout on scratch paper first. For this group, it seemed helpful to be working on the project at the same time as doing the background research. Other groups seemed to prefer doing the background research first and then getting into the project action. Their basic draft layout included the following title: Recycle…It helps the

Earth. The topics included nuclear power, solar power, reuse, reduce, and trees. The draft layout included alternating spaces for pictures and text.

The site included the following text:

Content Page 1: Recycling is a great part of the world. When you have a plastic bottle, or something aluminum, you should recycle it instead of throwing it away. You can even make money out of recycling. When you go to the recycling center near you, you can bring a glass bottle and give it to them for a little money. Recycling can also be used for making new items from old ones. One example is when you recycle a pair of old jeans, the jeans could be made into a pencil. When we recycle cardboard, cereal boxes or anything made of paper, the recycling center can use it to make other paper products. When we use recycled paper instead of regular paper, we save trees from getting cut down and which in turn helps the environment. To learn more about the importance of trees, click here [clicking on "click here" takes you to the following page].

[Content Page 2: Importance of Trees: Trees are very important to the earth. Trees take in carbon dioxide and give out oxygen for us to breath. Trees are used for more than oxygen, but giving out oxygen is the most important thing a tree can do. The more obvious reasons are trees can be made into paper and other paper products. The world needs paper so lumberjacks cut down trees to provide paper. When paper is made a tree is cut down. Soon there will be no trees on earth and we will all die. So when you recycle, a tree is saved. When a tree is saved you save oxygen for everybody in the world.]

[recycle cont…] Think about this for a second. If the environment is destroyed, the animals would die because there will be no shelter. Then the humans will die out

because we won't have anything to eat. After that everything else will get destroyed because humans aren't there to tend it. That is why preserving the environment is such an issue and not just because the animals look good.

When the recycled items are made, they cost less than all the other items of its kind. You might be wondering how you can turn old items like paper and remake it into cardboard. When paper arrives at the recycling center it is sorted into colored and blank paper. Then the colored paper gets separated again into all the colors of the rainbow. When the sorting is down, the paper gets melted into paste. The paste is then mixed with other chemicals. The finished product smashed together in a machine and left to dry until the new paper is dry and crisp. That is the recycling process… if you would like to learn more go to any search engine and type in "recycling paper".

Content Page 3: Nuclear Power

Nuclear Power is one of the most sources of power in existence. Ever since nuclear weapons were developed, people have lived in suspicious fear of anything nuclear. Despite this fear, nuclear energy is becoming more and more popular throughout the world.

Nuclear power is created by the same process as a nuclear blast. A neutron charges through an atom, creating fission and extreme heat. This provides the energy for the reactor. Unfortunately, this extreme can cause a failure in the system, called a "nuclear meltdown."

The reason that nuclear power is so efficient is because of the fact that it doesn't release any wastes expect for the controlled amounts that they're going to bury under a mountain in Nevada. Otherwise, there are no problems.

Content Page 4: Solar Power

Solar power is one of the only power sources that doesn't pollute at all. The question is why do we not build only solar power plants. The answer is that even though solar power is clean it isn't the most efficient power source. When a solar plant is built, the size of it can be the same as a nuclear power plant but the energy produced by the solar plant isn't even close to the power produced by the nuclear plant. To read more about nuclear power, click here. [clicking on this link takes you back to Content 3 page.]

Even though solar power is not the best way to give people power, it is the cleanest way. Therefore when we have enough space in the world, we should destroy every power plant that is not solar and replace it with solar plants. This way we could live cleaner and healthier.

Solar power plants get power from the sun (you probably know that). When a solar power plant is built, a whole bunch of solar panels are installed into the ground near the plants. The panels are then connected through wiring to the actual plant itself. The plant converts the heat it gets into electricity and sends it to all the people that need power.

Content Page 5: Reuse

Reusing items are what recycling centers are for. They first collect all the recycled items people put in the recycle bin. Then the items are burned until they are one big mush. The items are then washed and transferred to another plant. The mush is then molded into a shape *like a newspaper* and then remade into paper or glass. Then the newly made paper or glass is transferred to a factory and they use the item to make paper like any other paper.

Content Page 6: Reducing Paper Waste and Emissions

Another problem these days is fuel emissions. Vehicles like SUVs and pick-ups send out enormous amounts of carbon dioxide, along with carbon monoxide, which are two of many types of greenhouse gases. As these build up, the oxygen in the atmosphere is depleted, which in turn will suffocate us all. [picture from another website on greenhouse effect.]

The Kyoto Pact was a contract made by Japan that many countries signed to reduce carbon dioxide and monoxide emissions. In the 1990s, President Clinton signed the pact. However, Bush withdrew the United States from the pact, stating that the two gases are not greenhouse gases.

Many car companies are finding ways to reduce fuel emissions, despite Bush's denial. The most anticipated design is the fuel cell, which will only use water as a fuel, therefore emitting only water vapor. Below is a picture of a fuel cell. [picture from another website of a fuel cell with labels]

So, when you consider buying a new car, think about purchasing one that has high gas mileage and reduced emissions.

In terms of relationships with these students, both were fairly quiet in class and usually kept to themselves unless other students approached them, or challenged them. I had a very positive relationship with both as well. Liang was in my after school club "Future Cities"—where we had worked with an engineer to design a scale model city of the future and traveled to Baltimore to compete in a state competition. I believe that Liang first learned about the fuel cells he and Martin describe on the website from the engineer who worked with us on the future cities project. Liang enjoyed working on the computer and was often uninterested in other activities in class. In terms of Liang's

perceived role of me in the school as a part-time teacher, he once said, "you're like a sub, except cooler." Martin did not complete a lot of his other classroom activities, not because he wasn't capable, but I think because he was uninterested. He was fairly shy socially, and did not like to be pressed by other students, which sometimes happened when transitioning between classes.

I wish I had more time to push this group a bit further. They did get off to a fast start, but spent time towards the end of the project simply adding special effects and other technical features to the site. They also found a significant amount of information on nuclear power as an environmental energy source, which I thought was interesting but I would have liked to have more time to critically analyze this further with them.

Group #2: Educating others—video/local environment issues

This is the third of three groups who choose to do a video on environmental issues—including recycling. Monroe was the first student to come up with the idea of filming a video for the project. I did have some reservations about their completing a video as an action project but I decided to follow his interest on this and see what they were able to do. I had had a strained relationship Monroe for quite awhile in class, and was in considerable contact with his parents. Two of his friends had been transferred out of my class for throwing objects in class as well as some other serious behavioral problems. I wanted to support Monroe in his choice and this did seem to positively affect our relationship. Monroe was also a popular student in class, and his opinions and ideas did influence others. I perhaps had a more positive relationship with the other two students that ended up being a part of this group, but these relationships were a bit tenuous.

They did end up filming a video around the schoolyard using a video camera I borrowed from the library. This was difficult because I had to be with the rest of the class, so I had the students do the video during lunch when I could be available. The video included information on recycling and littering—two local issues in a sense, but neither of which I thought ultimately challenged this group of students. I found the idea and medium of video interesting and culturally relevant for the students, but of all the groups, I thought that this one really grew the least in terms of their new understandings. I hypothesize that this may have been due, in part, with my somewhat strained relationship with the group's most vocal student. It was late in the school-year and at some points in time, I was relieved to see that Monroe was happy working on something.

Group #3: Educating others—Website/recycling

This group was also interested in creating websites focused on recycling. I grouped these two students together into one group (Keagan and Abbey) because they both worked on websites related to recycling even though they didn't really work together on the content. Initially, Keagan was working with Liang and Martin but decided that he wanted to do his own site. Abbey wasn't initially sure what group she wanted to work in and then decided that she wanted to do her own website on recycling also. They often discussed their websites with each other and how to manage them.

I will discuss Keagan's website first, www.freewebs.recyclesaves.com .

Keagan seemed to take the project very seriously from my perspective. He found out most of the background information from sites on the internet (see resources) and included the following pages on:

1. The Importance of Recycling

2. 5 Common Asked Questions
3. Fun Facts
4. Polls
5. Resources

His reflection on the project was particularly interesting, especially related to his perspective on how creating a website influences others and their actions, and ultimately makes a difference:

> "…I believe the project I did will help thousands of people everyday across the world. Everyday millions of people go on the internet so my web page is very accessible and easy to get to. If you need to know more about recycling all you have to do is go to the website because it is very reliable because it got my information from big time organizations and from experts. It will help school kids with projects and it could later on be some stats because I plan to put my polls onto the search engines such as Google…"

It is difficult to prove if Keagan believed that "thousands" or "millions" of people would read his website. However, the idea that students believed they could make a difference in the world by educating others on the web was one I hadn't considered. The first page of his website also shows how Keagan believes his website might help the larger world:

> "Recycling is a huge part of the environment and is clutch [?] in protecting planet Earth. Over the years recycling has become less important to the people in the world. Fantastic rainforests are being destroyed and trees are diminishing at a high rate for wood and paper. If you recycle you can change all this and bring

good to the world. Play your role and make recycling a part of your everyday life. Enjoy this site and make sure you check out the cool links! Recycle Saves!"

Simply the title of his website alone—"Recycle Saves"--is a revealing statement on his possible beliefs.

Keagan also created a cartoon that he posted on the site, which he titled "Don't throw Earth Away, Recycle!"

As students developed these projects and I thought about their connection to the outside world, I did make sure that they did not reveal their identity on the sites, and asked if they used names, they should be first names only. [At the time these seemed like reasonable projects and accommodations, but I now question if the websites were in fact something that the school district would approve of, and what the rules say about students authoring websites.]

In some contrast to Keagan's site, Abbey's website was called www.freewebs.com/recycledorks . It included the following components:

1. Recycle (What can you recycle? What can't you recycle?)
2. Resources
3. Facts
4. Recycle pictures

One interesting part of Abbey's project to me was her motivation to complete it and work on it at home. I had had several phone conversations with her mother concerning missing work and low grades on assessments. This was the first project all year that Abbey emailed me personally about during the evening hours. She emailed several times, usually asking if I could print out materials for her, or what I thought about

the facts she had found. I therefore found her effort on the project even more interesting than the project itself. It was also interesting to me that Abbey chose to work on this project on her own, as she usually enjoyed working with the girls in the class in group #6 (bumper stickers).

After searching for all the websites that were created (two in the seventh grade class, and three in the eighth grade), this is the only one I'm certain has remained active. It has the same content but different graphics after completing a search on September 29, 2007. (One other website from Group #1 in the seventh grade is also active, but the content has changed somewhat, so I can't be certain if it is the original group's work.)

Group #4: Educating others—video/planting

This is the second of three groups who choose to do a video on an environmental issue—how to plant a tree and why, for younger students. This was a particularly interesting video project because these students completed an environmental action, and then also filmed it so others could learn from it. In this way, I found this to be the most interesting and meaningful video project—it was both an action in itself as well as an educational piece.

Bart and Sam made up this final group. Their background research questions covered content related to trees and habitat formation and the action of where and how to plant:

1. How will planting trees and plants help the environment?
2. What animals will use our trees and plants as shelter?
3. About how big should the trees and plants get?
4. Does the location affect our project?

5. Will fertilizer and pollutants come into affect?

I found both students' answers to the question "How do you plan to use the information [from the research packet] as part of your action project?" interesting in that they were able to apply what they learned to an action and express how they felt what they learned could make a difference.

Bart answered about the influence of planting the tree more than the video:

> "I plan to use the information as part of my action project by just simply planting a tree. All the things listed above—cleaning the air, giving shelter to animals, giving food to animals—I can do all that simply planning just one tree."

Sam's answer incorporated ideas on how the influence of other younger students planting a tree:

> "To make a learning and joyful experience for the younger kids. Also, so they can plant plants and get animals to come and let them have a home. Also, make a video tape telling kids tips on gardening from a garden."

Sam and Bart completed the planting and videotaping at one of their houses. This project did fit into my original schema of a project that was place and community-based, although it did not take place on the school grounds. I believe they may have had an introduction to tree planting during the Green Day and this may have influenced their decision to work on this project. Also, one of the other students in the class had a parent who taught at a local elementary school, and had done activities with younger students in his parent's class. I think they may have gotten the idea to educate younger students from a presentation Powell completed earlier in the school year (a presentation on teaching weather topics to elementary students). Overall, I found this project to be an

interesting combination of a specific local action and a broader educational action. I believe that the students planned to give the video to Powell's dad for the younger students in his classes to view.

Group #5: Educating others—Bumper stickers/recycling

This group began as a larger group and split into two. The split mostly happened because of how the students grouping at the large tables in the room. I've grouped them into two groups based on how they were seated and working together. Each student in each of these groups designed their own bumper sticker and did their own research, but they shared their ideas and worked on their project together. They also presented what they had learned together. These two groups--#5 and #6—consisted of five students each; therefore, a large percentage of students in this class worked on creating bumper stickers as their action project.

At first, I wasn't sure if this project was up to the level of action or activity that I was hoping for students to be involved in. The students came up with the idea of the project from one of the activities at Green Day—one that none of these students had had an opportunity to complete. I again wanted to follow students' interests, and I thought the idea that the students would continue with activities from the previous Green Day might be interesting and rewarding for them. Also, the students tried hard to make an argument to me as to why this project would be a meaningful action, and I wanted to support them.

I encouraged them to complete background information to help them decide what the "best" slogan for their bumper sticker would be. For both of the groups designing bumper stickers, I found that the content knowledge the students learned exceeded my

expectations. Through their background research, I felt that the students had developed new meaningful understandings.

The students in Group #5 included Karise, Jenna, Hedy, Ashley, and James. Keagan (who completed the website on recycling) also joined them for part of their presentation, as recycling was the content of both presentations. The presentation was particularly revealing in terms of how the students framed this project as an action and what content they learned from it.

As an "introduction" to their presentation, they presented their project as:

"Our project is making bumper stickers to help advertise the idea of recycling and other ways to preserve the environment."

Their presentation also included the following topics:

1. Why should we recycle?
2. What can be recycled?
3. Background information on recycling and why recycling and making bumper stickers helps the environment
4. What else can we do to help the environment?
5. Reflection
6. Organizations the Agree
7. Bibliography

An interesting connection in their reflection is the connection they make between planting trees (one of the other actions they discussed in their presentation that you can do to help the environment) and recycling: "…if you want to take the next step you can help by planting trees in your community. Because recycling saves trees, you can take

the next step by planting more…" They also make an interesting reflection on using alternative transportation: "Also ways to use alternate transportation is by riding your bike, carpooling, or take a bus. This helps reduce pollution….By putting this information on bumper stickers, it advertises the importance of keeping our community and earth healthy and hopefully people will see this when they're driving in other cars."

I also found the section of their presentation and report on "organizations that agree" to be very engaging. They identified the following organizations (which I did not point out to them) as organizations that aligned with the views they expressed in their project:

1. Southwest Forest Alliance
2. Graduation Pledge for Social and Environmental Responsibility (I found this one particularly interesting for students to identify with)
3. Forever Wild Tree Conservancy
4. California Climate Action Registry
5. Wildlife Habitat Council
6. Pennsylvania Watershed Program
7. Trees for the Future
8. Fairfield Recycles

I found it fascinating that these are not local groups they listed but environmental organizations in places such as California, Pennsylvania, and Fairfield. Where are local county or state groups on their list, i.e. Sienna Country Recycle, the Chesapeake Bay Foundation? This is another revealing example of how students do not necessarily relate

to or gravitate towards local groups or projects. I speculate that they found these groups through a web search on a topic like "recycle".

Also of note for this project is the technology it involved. Most of these students designed their bumper stickers on the computer (using a graphic program) or scanned a picture into the computer. I had thought that another teacher had magnetic paper that was left over and not used in the Green Day, but they did not. I ended up going to Staples and getting the magnetic paper that could be used in the printer. Interestedly, most students did not understand initially how this could or could not work on cars.

Content of their bumper stickers included (see Appendix J for examples of two images of the bumper stickers):

1. There shouldn't be one tree on a hill! Plant more trees! [picture of a tree on a hill]
2. Obey the Law [picture of 2 recycling bins and trash can] DON'T LITTER!
3. Recycle [within the recycle symbol]
4. Recycle [repeated in different colors over a recycle symbol]
5. Preserve the environment…[bulleted list] pick up trash, plant trees, alternate transportation, don't litter, recycle! [picture of a recycle symbol, tree, paper, and recycle can]

Group #6: Educating others—Bumper stickers/recycling

This group also completed bumper stickers, mostly related to encouraging recycling. They also did a great deal of background information on recycling. The following students were in this final group: Mitchell, Nayan, Nam-Kyu, Machiko.

Powell also presented and joined this group toward the end of the project. The title of their presentation was "Reduce, Reuse, Recycle To Save the Earth!"

One difference between this group and Group #5 is that they described more information concerning local recycling issues in the local district. For example, Nam-Kyu wrote in her reflection, "One question I had was: how many people in our community, Sienna County, recycles?" I found out that 30-39% of people in Sienna County recycle. That is not enough to be doing anything…" She also broadened her research to the larger country as a whole: "In order to make the bumper stickers I had to research how many times the average person recycles in the U.S. A person only recycles 28% of their waste. I found out that 64 million tons of material is recycled…." Nayan and Mitchell also reported similar information about the county. Mitchell interpreted the information on Sienna County differently though: "That is a fairly huge amount of people, but it still can be worked on." He then related the information and his perspective to creating and displaying the bumper stickers: "If we create bumper stickers to persuade people to recycle, then many people will see the bumper stickers on their way to work, in parking lots, at traffic lights, or just looking at their neighbor's cars while taking a stroll through their neighborhood…people will be surrounded with bumper stickers to recycle, and it will always remind people to recycle."

Mitchell consistently had the highest scores on assessments in the class. He also was a transfer student and came into the class about halfway through the school year. At first, he showed a lot of concern over completing the projects. As he was usually very amenable and a pleasant student to work with, I was surprised one day when he asked if we were going to work on the project and then said they were too hard. I asked what he

meant, and he said he would rather "do more bookwork and less thinking." I was surprised by this comment, and it occurred during the stage of the project when I asked the students to develop their own questions related to their topics. He struggled to form his own questions about the topic, but after completing the research part of the project, he seemed more at ease. In fact, we would often joke later, when he came into the room, he would ask "are we doing thinking today"? (Also described in teacher journal.)

Mitchell's bumper sticker included the following text:

Keep the Earth Clean! Don't litter…

Reduce: Try to buy things that won't produce a lot of trash.

Reuse: Reuse things to save resources and save energy.

Recycle: It reuses many useful materials such as tin, plastic, and paper. They all can be reused in plenty of different ways in our world today.

So when you are throwing away paper, plastic, tin, metal, or any useful resource, think of the 3 R's!

[picture of Earth with text underneath: Think of it!]

Group #7: Educating others—video/environment issues

This was one of three groups who choose to do a video to educate others concerning environmental issues. Students in this group included Amelia, Shivani, Geet, and Bryson. This final group was not a group that formed initially or is included in the description of initial groups. Amelia was initially in group #4, Shivani was considering a planting project with Mitchell, Bryson was in group #1, and Geet was undecided for his project. Shivani, described the topic of the project as "Environment in Community." She

described the development of the project further in her final summary of "Background Information on Environment in the Community" and "Reflection":

In order to grasp key points of this topic, I chose five questions to answer.

The first question I had was: what are some basic environmental needs of the community? Since our community is the Chesapeake Bay watershed, we have a lot of unique environmental needs, besides the average needs of most other communities in our nation. Our community needs attract more wildlife. They keep the balance of plants and insects in check, and the balance of the Bay Area too. We also need to lose the amount of waste we are making. A lot of trash ends up in the Chesapeake Bay, which kills the plants and animals living there, along with making the water unsafe in general.

My next question was: what can we do about that? Since this question was too general, I created two other Helping Questions: like: 'what are some steps that you (as an individual) can take', and 'What are some steps the community can take'? You, as a person can do a lot. You could adopt a tree, reduce the amount of waste you create at home by reusing bags and not buying small plastic packets of food. You can also help organize environmentally-friendly events, and put up posters reminding people what they can do to help the environment. The community can adopt a National Estuary Program, which teaches people what they can do for that specific responsibility we have in our environment. They can also test water, air, and other local natural resources weekly or daily to see how the community is doing. Finally, the community can encourage people to participate in environmental activities.

My final question was: what is the point of having a healthy community? Well, it will improve the health of the estuary and your community. It will make the community

prettier and fill it with life and vitality. It will make you feel better and preserve homes and cars for years.

Supporting the environment in the community is very important, and by asking these questions I have successfully reviewed the background information about this topic….

Our group decided to make a short video-skit to explain our project topics. First, we chose separate topics and then did background research. Then we made a list of possible materials and an agenda. This agenda included many steps. The step was to allot specific times to work on our project. The second step was to find all the materials. The third step was to make the script, and the fourth step was to actually begin shooting. In the video itself, we choose two topics, being veganism and animal protection. We introduced the people in our group who had become 'experts' on the topics, and they summarized what they had learned. This helps because now people will have become aware of many issues relating to animal protection and rights, and in becoming aware will also help to work toward this, leading to the common environmental good. Using the video to talk about veganism also helps because people will also thing twice about how healthy and environmentally safe their food and clothing decisions are.

While making this project, our group included ways to help the watcher take something from the movie. We used plain language that would help the watcher understand what we were saying, and also took time and said them in a way as to not be too much information at one time. What others can learn from what we did is that animals and wildlife are an essential part of a healthy environment, in order to protect them from the cruelties of industry we must take action by boycotting, becoming

informed, or by simply becoming aware. Also, veganism alerts people to how healthy they are and how they can improve their health and the health of animals by remaining vegetarian.

This group included Shivani, Amelia, Aiden, Bryson, and Geet. This group decided to do a video that they could share with others about their research topic on "helping the environment in the community". I'm not sure how they came up with the idea to film a video, but I think it might have been a result of the influence of the other groups in the class working on a video as well as the increasing use of video on websites, particularly related to environmental and vegetarian issues. Their video took the format of a news cast.

Analytic Interpretation of the Group Projects

I found explanatory power in organizing the group projects by general activity, specific activity, and content area. All 14 projects fit into three activity structures—local outdoor action, educating individuals on issues and actions, and lobbying government or large groups to take action. Specific activities included planting, video, bumper stickers, websites, compact disc (music), petitions, and letters to congresspersons. Finally, content areas were organized as native plants and habitats, how to plant a tree, cleaning/environmental pollution, environmental issues in community, recycling, endangered animals, habitat protection, power sources, global warming, and ending growth hormones-dairy cow. Please see Figure 4 below for a summary of the group projects analyzed by general activity, specific activity, and content area.

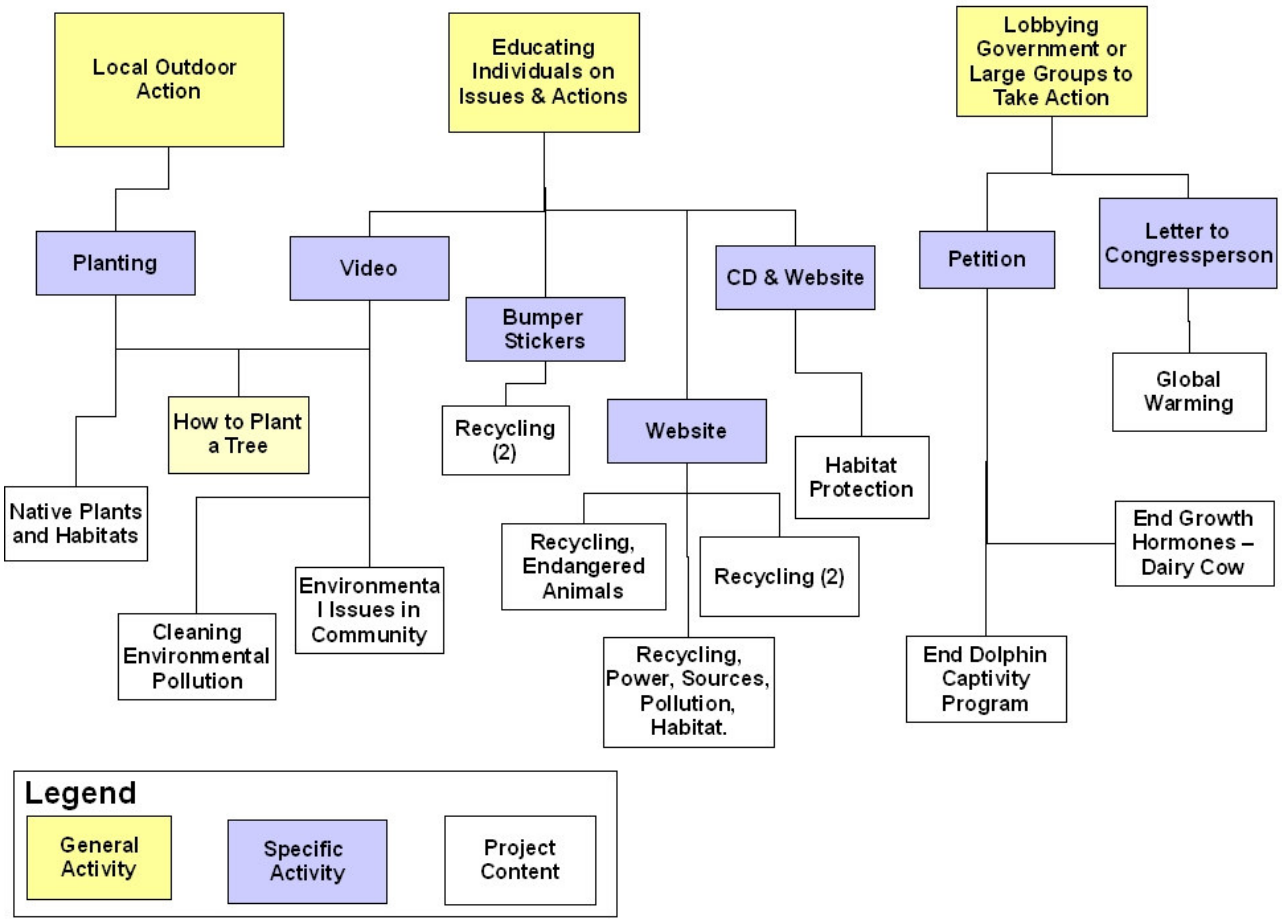

Figure 4: Summary of Group Projects by General Activity, Specific Activity, and Project Content

Interviews

Student Interviews

Eight student interviews took place: three were conducted at the completion of the project, and five one year after the project's completion. A number of common insights emerged from the interview transcripts, which are described further below through discussion and selected quotations from the interviews (KC is me in the discussions; other initials refer to students). These insights found in the interviews relate to the overall insights also further described at the end of this chapter.

Common insights emerging from student interviews:

1. "Research" is an important component of action projects from the perspective of the students interviewed.
2. Students learned varying types and depth of content knowledge.
3. Most students interviewed reflected on helping the environment indirectly. (One student who reported on helping the environment directly was able to remember many details of her project and content learned.)
4. Students' actions before completing the project varied.
5. Students' actions reported after completing the project also varied; however, this time all students reported some kind of action.
6. The most common connections made between the environmental action projects and to other activities were to the school's Green Day, and planting activities.
7. Most students recommended that other students complete "research" before taking actions or completing the project. One student suggested more "sample" activities as a class.
8. Most students reported from their perspective that the project was "fun" and allowed them to be "independent." Two students reported feeling confused at certain points.
9. Most students (five) reported that they would like to continue on the same topic if they were to complete another environmental action project in the future. Two students suggested learning more about different topics.

10. Three students reported on the importance of working on something "big" and tried to explain this. They also explained the influence of media and culture on their ideas.

"Research" is an important component of action projects from the perspective of the students interviewed.

When I asked the students what they remembered about the projects a year later, how they would approach a similar project if they were to complete one again, or what types of ideas they would recommend to others working on similar projects, five of the students identified "research" as one of the most important steps in the project. These students included Moira (native planting), Whitney (poster representation on recycling), Blakely (website), Linus (petition), and Kelsey (website). These students represented different groups and different types of actions, ranging from creating a website on recycling to developing a petition to end the use of growth hormones, and planting native species of plants outside the school. They each situated the importance or place of research in their project a little differently however.

For example, Moira, in the native planting group, described research as helping their group learn the content necessary to complete their project:

> MG: I remember we had to do research about what plants best survived the MD climate and like what would help the area the most and what was most like reasonable. And then we planted them. And like in front of the school.
>
> MG: To do research before you start anything. To make sure you know what you're doing and stuff.

Whitney described research as an inherent part of the project and as a recommendation to others:

WH: We kinda just researched and did our groups, and we made a poster, and we wrote about.

WH: Do a lot of research. It helps you to learn about it, and it can help you later.

KC: What kind of research?

WH: I think we went to library and used the internet. And that's how we learned that 1 ton thing. And then we used a couple books. Just stuff like that.

KC: How did you know what to look for?

WH: For the internet, we looked up recycling and found places to use. And recycling plants. I think we took a field trip there once. Just anything that had to do with recycling we found out.

Blakley further described research as a recommendation, and the importance she ascribed to looking critically at the information on the internet. She seemed to have the understanding that she needs to be more critical of information she reads online, versus what she reads in books, with the later being more likely to be "correct":

BR: Um, what advice. . .to research a lot, and to make sure the facts that you get are true. Cause I know that there are a lot of things online that aren't true, that are just made up. Just make sure that you research a lot, and try to make sure that your facts are correct.

KC: Mmhm. How would you go about making sure that the facts are correct online?

BR: I guess still look at books too, and see what books say, because normally books have correct information, and see if it is the same that you got online.

Kelsey, who was in the same group as Blakley, also recognized places where she found information concerning her project, but we did not have the same conversation on the critique of the content she found:

KC: How did you find your information?

KV: I used some of the resources on the school website, Sirs Knowledge Resource, and I also goggled a little bit.

Linus, who was in the group who completed a petition, also spoke about research as it connected to his group's prior knowledge about a topic and his comfort level with reading books over information on the internet (computer) for his research. He perceived information on the internet to be more difficult to comprehend in this case than information in books he read or had access to at the school library.

LO: Definitely do a lot of research. Because, it makes it much easier if you actually know about what you're doing and stuff. Like, the first three things that we started we didn't know a lot about, so we just did the cows, because we sort of knew a lot about mad cow disease, Shawna's mom, she told us about stuff.

KC: So you picked a topic that you were sort of familiar with, that you could build on?

LO: Yeah. Like don't do something that you definitely wouldn't understand, even if you finish the whole project.

KC: Okay, and what do you mean by research? How would you go about your research?

LO: Um, computers, books mostly. I like books mostly, because they tell specifically what's wrong, with cows and diseases and fertilizers.

KC: You didn't have as much luck with the computer?

LO: Well, I don't know. The computer always gets me weird stuff that I don't understand. Big words.

Students learned varying types and depth of content knowledge.

Students learned several different areas of science content. The areas reflected on in the interviews included native plants and habitats, recycling's possible impact on trees, endangered animals and pollution, and the effects of industrial fertilizer use on the environment. Some of the students, e.g. Moira, reflected in greater depth on their content understandings than others, e.g. Whitney. Some students reflected on concepts that they did not understand after completing the projects—Dhara, Blakley, and Linus.

Moira described her new understanding of planting native plants, one year after completing the project.

MG: I learned what plants best survived in the MD climate, and you can't plant any type of plant in the area.

MG: because some plants don't survive in certain climates, and it's not best for the wildlife that lives around.

MG: It depends what the wildlife eats and stuff like that; some animals don't eat certain plants and stuff.

Whitney described a fact he had learned concerning the connection between recycling (paper) and trees.

WH: Yeah. I learned that like 1 ton saves 17 trees. And just like other ways to like save everything. And not like throw it away.

WH: Oh of like paper, or anything from a tree, like anything you can recycle. Any 1 ton saves 17 trees.

Dhara reflected on her understandings of why a species becomes endangered and her lack of understanding on how pollution and endangered species are connected.

KC: I thought it was interesting that you guys choose endangered animals and pollution. You just picked that as two ways to help the environment?

DK: Yeah, they're not related but they still have something to do with the environment.

KC: Do you think endangered species and pollution are related at all?

DK: No. Well, pollution could kind of like damage endangered species. I don't know how.

KC: Okay. Do you remember at all why the animals you choose were endangered, or what was causing them to be endangered?

DK: Yeah, because loss of food supply and habitat. They don't have anything to eat. . .but they don't have any, wait, they don't have any prey, but they have lot of predators. That's the same thing with the Ethiopian wolf.

Blakley, also in Dhara's group, briefly reflected on topics she had learned about, but reflected that she didn't remember some of the additional learnings she had thought she made, one year later when I interviewed her.

BR: I remember that our project was on pollution, and like habitat loss, and global warming. And like endangered animals, and just how to recycle and stuff.

BR: Um, I learned um, other ways that I can recycle, by like trying to save paper, and just trying to save the trees. Um, and just not littering and stuff.

KC: Do you remember any ways that you were talking about?

BR: I actually don't.

Linus discussed several areas of content knowledge he had learned related to fertilizer and antibiotic use on farms and their impact on people and the environment. When asked about antibiotic topic, he did reveal that he did not remember perhaps because he considered this content another student's part.

LO: We were talking about how fertilizer and stuff like that effected how cows grow, and how their lifestyles change because we like, change the way they live.

KC: Okay, how's mad cow disease, do you remember any connection between mad cow disease and the farms you looked at?

LO: Um, I think, I don't know how they got the disease, but I do know that it goes in the meats that we get from them. And everyone eats meats from cows and stuff, and so that's very important.

KC: Okay, so this is related, but is there anything else you learned from completing the project?

LO: I learned that um saving the environment and making sure that everyone is okay and stuff is always good. And that we should always treat animals the way we'd like to treat humans.

KC: Any other content knowledge that you learned? Like you learned about mad cow disease? And you learned about fertilizer?

LO: Oh yeah, we learned that the grass that we give, the grass that we spray, and spread fertilizer on the grass, and stuff, always leaks into the sewer drains, which goes into the Chesapeake Bay, and that effects fishes' lives, and people that drink the water.

KC: Did you guys also look at antibiotics?

LO: Oh yeah, that was Shawna's part. I forget, something like we have to give shots to animals or something, and it would like cure them. We have to treat them how they would live in their natural world and stuff.

Most students interviewed reflected on helping the environment indirectly. (One student who reported on helping the environment directly was able to remember many details of her project and content learned.)

Moira was the one student interviewed that was able to relate her project's action to a direct impact/action on the environment:

MG: Well um it made the area look nicer and then it gave animals food and places to live I guess.

Whitney revealed that his project "informed people". I stipulate this counts as an "indirect action" because he was not able to perceive environmental improvements directly as a result of his action.

WH: To show what you can do. A ton of paper could save 17 trees or something like that.

WH: It just informed everybody, I guess.

WH: Just our class. And I don't know if we put them up, so no one really found out.

Dhara more clearly reveals how she perceives her project as an indirect action, through providing information. She further states that other people "could probably do something we can't".

> DK: We didn't literally do anything. But we made other people realize how bad endangered species are. We let other people know how they could help. And they could probably do something we can't.
>
> DK: There's an organization called recovery program, and they helped reproduce the black-footed ferrets. And so when they reproduced, there's more ferrets and then there's less chances for them to become endangered.
>
> DK: Oh, we also did something about recycling. And how recycling would also help pollution, to become less. Because if you don't recycle, then you would need to cut down more trees, and that would cause more pollution. So, if you recycle, then you could just use the same paper over and over again, so you don't need to damage the environment by cutting down more trees.

Blakely believed that her project, with Dhara, actually had a different audience. Instead of influencing adults who "could probably do something", Blakely believed that adults would not be interested in their site, but that "probably just kids" would view it. This provides an example of different individual views within the same group of students.

> BR: Our project helped the environment, because we made a website, so it would inform people of how, what they could do help the environment. So I guess that's it, how it helped it.
>
> KC: Do you have any idea about what type of people would like to go to the site?

BR: Probably kids, since it was like made by us. I don't think an adult would want to see [what we did?]. So probably just kids.

Similar to Dhara, Linus revealed that other people could help, including the government.

KC: What do you think people could do to help?

LO: They could to write their government. The government could help. I think.

Kelsey reflected on how her project could inform others about topics she had learned more about. Her statement "actually taking action and doing something would help" possibly implies that she considered her project an indirect action and that "actually doing something" would require a physical presence in the environment—e.g. "cleaning up an owl house".

KC: Do you think that when they read it, it would change people's minds or inform them about something they didn't already know?

KV: Yea. Cause when I did the Florida Panther, I didn't know they were 7 ft. long, and I didn't know how they were endangered, I just knew they were endangered. And I knew there wasn't that many, but I didn't know there were only 30-50 left. So it really helped me a lot.

KC: Okay, good. So what you found could help someone else too. So do you think the project could influence the community at the school or around the school, that we worked on? Thinking of the Humana community?

KV: It could.

KC: Do you think more kids could read the site?

KV: Yea. That would be cool.

KC: So what are some of the things that you do that you think might help the environment?

KV: Informing people could help. Actually taking action and doing something, would help. Like me and my friend Sarah, we're actually we cleaning up the [owl?] house.

KC: Neat. Why'd you start doing that?

KV: She had to do it as a service project and I told her I'd help her and I gave her the idea.

KC: That is cool. That's very nice Kelsey. Is there anything you can think about the projects that you would add, anything you would want to improve on or do differently?

KV: Not really. I wish I'd gotten a little bit more in depth on the animals and how other people could help and stuff.

KC: So you probably could have used a little more time.

KV: Yea.

KC: Is there anything you think in your own life that you might connect to with the project, outside of school? . ..Like do you think you'll monitor the site or something when you go home?

KV: Yea that was something I wanted to do. See if I could.

Marcus and Jason revealed that they believed other students their age would be influenced by their project, but only if they listened to the genre of rap music that they created their project in.

KC: You would make the CD, and who would be the audience? Who would you want to listen to your CD?

MW: People who hate trees. And are young.

JH: And don't know better. They could see our CD and change their way of thinking.

KC: You think that it would help them change?

MW: yep

JH: mmhmm

KC: So do you think that the project will influence the community at all, around the school?

MW: Well, it depends, if there are people who don't listen to rap music, no. If they listen to rap music, maybe.

KC: So they'd have to listen to that type of music?

MW: Mmhmm.

Students' actions before completing the project varied; some students reported taking no helpful environmental actions.

Of the eight students interviewed, they each reflected on a range of environmental actions before completing the projects, from no action to planting trees and flowers at their home or elementary schools and recycling at home.

MG: I recycled. And I planted flowers in my garden at home. Um, that's about it.

WH: Just like recycled. And I think we just had a green day at our school. And school clean up day or something.

DK: Yeah, I usually plant trees. Um, I go to this organization group, and usually we plant trees, around places, if there's any places to plant trees, we plant it there as much as we can.

BR: Um, before I did the project, not really.

LO: We did posters or like, I forget like drawing on bags or something [Earth Day Groceries project the class completed in April], that we'd uh show, that saving the way we recycle paper and bottles, is always helpful, because it's wasteful to through away things in the trash, there's all this gathering up to huge amount of piles on earth, and stuff. It's polluting [the water?].

KC: What other actions do you participate in that helps the environment, besides this project?

MW: My family recycles.

KC: Okay.

JH: Since 4th grade, I've been going to my elementary school green day to plant trees in big holes.

KC: Okay, cool, you go to your elementary school to do that?

JH: mmhmm.

Students' actions reported after completing the project also varied; however, this time all students reported some kind of helpful environmental action.

Many of the students reflected on actions related to their projects' action, and especially related to recycling. Moira reflected that she and her mom now plant native plants in their yard after completing the projects. Whitney, Dhara, Blakley, and Linus all described how their recycling habits increased after completing the projects. Whitney,

Dhara, and Blakley all completed projects that involved recycling content, but Linus's did not. His statements reveal that the importance he connected to recycling after completing the projects, perhaps as a result of listening to other students' projects and presentations.

MG: um, still recycle. Still plant flowers. And we did Green Day this year, in 8th grade.

MG: Yeah, like I taught my mom what plants that we can plant and we can't.

WH: Still like the same. Like the Green Day, and recycling, and everything like that.

WH: We're still doing the same. Well actually now, we have a recycling bin. We do that now.

KC: What did you have before?

WH: Little one, that you put cans in. But now they gave us like a paper one.

KC: "They" meaning?

WH: The recycle people? I guess like the trash people like dropped it off or something. I don't know.

DK: Mm, well yeah. Like, before, if I had any extra papers that I didn't want I just trashed it. But now, every single paper, that I see, I recycle it.

KC: Do you tell other people also?

DK: Yeah, everyone in my house.

KC: Oh, okay. So you got your family recycling?

DK: Yeah.

KC: Paper or other stuff too?

DK: Mostly paper. And other stuff. Like plastic bags. If we get any plastic bags from the grocery store, instead of just trashing it, we reuse it.

KC: Interesting. I guess that is related to your project. Is there anything else in your life now, related to your project? Anything with animals you researched?

DK: Hmm. Nothing to do with the animals.

BR: Mmhmm. I actually started recycling more, and like watching like what I throw in the trash. I would more go to the recycling bin instead of the trash can. And just, took shorter showers.

KC: Okay, and was the recycling more at home or at school, or both?

BR: More at home, but at school too.

LO: Now, my mom and me recycle bottles and paper and cardboard and stuff like that.

KC: Oh okay.

LO: Cause usually we never recycled them, we just threw them away. But now we do, because um, well one, because my neighbors are, and two because I told them what happens if we don't and stuff, and that there's already an amount of trash that can reach the moon and stuff like that.

KC: Okay, so you were doing that after you completed the project?

LO: Yeah, after I did this project, and after I made like, pretty much here, until like Green Day, that we did, and then started into it again.

KC: Okay, so before we did the projects, you weren't recycling at all?

LO: No, I wasn't recycling then.

KC: Okay, that's good to know. How bout are there any activities in your own life related specifically to your group project?

LO: Not really. My sister's a vegetarian now though.

KC: Really?

LO: That's it.

KC: Oh okay. Because of other reasons, or something you told her?

LO: Because my uncle told her about mad cow disease and stuff like, and he's a farmer. He's very environmental, he puts like vegetable oil in his cars and stuff, instead of gasoline.

The most common connections made between the environmental action projects and to other activities were to the school's Green Day, and planting activities. Moira, Whitney, Blakley, and Linus related activities from the Green Day they participated in during eighth grade to the action projects they completed in seventh grade.

MG: We planted rain gardens. And um we want things out of recyclable materials and stuff.

MG: Not really, but I guess for Green Day like I saw some of the plants that you said we could plant and that's what we planted. For Green Day.

WH: In the Green Day, we learned how to make little pots of like plants. Oh, in one of our classes, we made like a new garden, and everything. We spent a couple days doing that. It's in the back, near the fields. We made like 4 of them.

BR: Also, because the Green Day, that we did, also taught me.

KC: From this year?

BR: Mmhmm. And also last year, we also helped you on the Green Day [for 8th graders].

BR: Um, not really. Maybe from Green Day, I learned that if we're doing projects in another class, save the paper that we don't use, and save materials so other people can use them. And not just throw them away.

LO: Um, well we just had Green Day. That was sort of like how our class was last year. That's pretty much it. We haven't had like a lot of environmental stuff besides Green Day.

KC: Okay, what types of stuff did you like at Green Day?

LO: We had these reusable containers and stuff, instead of lots of bags that are wasteful and stuff. We learned how the food that we give to our dogs, or the food that we, or the fertilizer that we put on grass the bugs eat, and then the bugs get eaten by the spider, and the cat eats the spider, and the spider gets poisoned too. So everyone dies in this, and that's bad.

Dhara also made connections to 2 out-of-school programs. Whitney made a connection to a possible future course in ecology.

KC: Any other similarities with other courses you've taken?

DK: Classes in school? Can it also be classes not in school?

KC: Sure.

DK: Cause I go to this other science class, and we usually do scientific stuff there. And so, um, we talk a lot about recycling and pollution.

DK: No, it's a different group. But in the other group too, the science group, we sometimes do tree planting too.

KC: So, you do this other thing outside of school? What's that program?

DK: Do you know NIST? It's an "Adventure in Science" class at NIST.

KC: Oh, okay. That's neat. So you learn specifically about pollution and recycling?

DK: No, it's anything about science. But most of the time, not most of the time, but sometimes, we talk how about pollution and recycling could effect the environment. We do projects about it.

KC: Wow, and have they been similar at all to what you did for this project?

DK: Yeah, we talked about endangered species. And we talked what do they do when they recycle, and how they recycle.

KC: And have you done any sort of active things?

DK: Yeah, we went to a recycle center to see how it's done.

KC: And have you done anything to actually help the environment, or taken any action?

DK: Mm, I don't think so.

KC: So it was more learning?

DK: Yeah.

WH: Um, not really. Not right now. But I think in high school, I'll do something like that in ecology systems.

Most students recommended that other students complete "research" before taking actions or completing the project.

This insight is similar to the finding in the first insight—that students identified research as an important component of the projects. It makes sense that the students

would then recommend that other students complete research as well. Moira also suggested more "sample" activities as a class as a pedagogical recommendation. Whitney suggested taking field trips to places related to the content of the project, such as a trip he had taken to a recycling plant. Dhara also recommended recycling as a specific action that others could take because "at least it's something."

> MG: To do research before you start anything. To make sure you know what you're doing and stuff.
>
> MG: I guess to start out with a lesson more about what projects you can do. Like 2 or 3 lessons before you start the project.
>
> KC: What advice would you give other students now, if they were going to do a similar project, since you have already done one?
>
> WH: Do a lot of research. It helps you to learn about it, and it can help you later.
>
> KC: What kind of research?
>
> WH: I think we went to library and used the internet. And that's how we learned that 1 ton thing. And then we used a couple books. Just stuff like that.
>
> KC: How did you know what to look for?
>
> WH: For the internet, we looked up recycling and found places to use. And recycling plants. I think we took a field trip there once. Just anything that had to do with recycling we found out.
>
> KC: Where'd you take a field trip?
>
> WH: In sixth grade, or I think in seventh grade, we went to a recycling plant somewhere in Baltimore. Or something.
>
> WH: Give them places to go, if you couldn't get a field trip somewhere.

DK: Um, the best place is to start, like with recycling.

KC: Okay. . .

DK: With recycled papers. At least it's something.

KC: How about if other students needed to come up with their own project that would help the environment, what would you tell them, that could help them?

DK: Like to plant more trees? And plants. I have a big garden, and you don't plant trees there, but I plant plants and flowers.

BR: Um, what advice. . .to research a lot, and to make sure the facts that you get are true. Cause I know that there are a lot of things online that aren't true, that are just made up. Just make sure that you research a lot, and try make sure that your facts are correct.

KC: Mmhm. How would you go about making sure that the facts are correct online?

BR: I guess still look at books too, and see what books say, because normally books have correct information, and see if it is the same that you got online.

KC: Oh okay.

BR: Like cross-reference.

BR: No, cause I liked this project.

LO: Definitely do a lot of research. Because, it makes it much easier if you actually know about what you're doing and stuff. Like, the first three things that we started we didn't know a lot about, so we just did the cows, because we sort of knew a lot about mad cow disease, Shawna's mom, she told us about stuff.

LO: I would tell them what I learned from 7th grade, and um, tell them how to look up stuff. Cause you taught me how to use the books, and use the library. And you taught me how to like, like make sure you knew everything about anything. Make sure that like the antidote for the mad cow disease, you had to learn about that. And the fertilizer that makes cows sick, you had to learn about that too, you had to know everyone's background.

LO: I'd uh, I don't know. I think this was pretty fun last year. You made it like pretty easy on us. It was easy. Like, do this, write it down. What'd you learn and stuff? It's fun.

KC: I just wanted to check what you thought.

LO: Group projects are always fun.

Most students reported from their perspective that the project was "fun" and allowed them to be "independent."

Several students reflected on how the project allowed them to complete a technology activity, such as creating a website, that they had wanted to do, but had not had the opportunity. In general, the students reflected positively on the choices that they had. Blakley reflected the project and choices were "easy" because they had an "outline". Jason and Marcus reflected that the project allowed them to be "creative". However, Moira reported feeling confused at certain points, which relates to her statement above that class examples might have been helpful or could help others.

MG: Well, it was kinda fun, and it helps you feel like independent, but sometimes like you get confused when you didn't know what to do. But it was pretty fun to do it by yourself.

KC: What do you think about the whole idea of designing your own project, versus someone else telling you have to do a poster, or you have to do. . .?

WH: As long as it gets people's attention, like speaks out to them, it would be fine either way.

DK: Because I've never done a website before. And I wanted to do something. . .like if I just did a poster, no one could look it; it wouldn't be accessible to everyone, I could just take it home and like, it would just lie there. If I put it on the website, then anyone who wants to look at it, can look at it.

DK: First, I didn't know what to do. But then I figured out I could do anything you want. . .as long as it was to help the environment. So, um yeah, I just decided to make the website.

KC: And, you might have already covered this, but how did you choose endangered species?

DK: Cause I've already done a project about them in sixth grade, and that was a small project. I didn't do anything big on it. So now I wanted to know more about them, like more elaborate research.

KC: Yeah, build on what you already know?

DK: Yeah.

BR: It was pretty good. Cause we had the outline, so it wasn't too difficult. So it was okay.

BR: I guess cause we wanted to learn more about habitat loss, recycling, using more paper, and stuff like that.

BR: One of the girls, Kelsey, knew a website that would give us a website. So if we wanted to change it up, instead of doing a poster, or a slide show.

LO: Yeah. Um, definitely try to be different, definitely get something different than anyone else. Because that always makes it interesting for the person listening.

KC: Okay, so you want to make your project idea different from the other groups'?

LO: Yeah, even if it's still just as boring; make it different.

KC: Okay, and you guys did a PowerPoint I think. How did you guys come up with that idea?

LO: Um, we, we thought that, I don't know. We just thought that we'd like to make it virtual, cool.

KC: Okay, so other people could learn?

LO: Yeah, so other people could watch and stuff. It was cool. It had all of our stuff, we just put it on a colorful background, and pictures and stuff.

KV: What we decided to do was make a website, and we couldn't really choose one environmental thing that we could really agree, so we decided to do a few things. And we some stuff about a couple endangered animals and some stuff about pollution and recycling.

KV: I think in the beginning, what I wanted to do, was do a website on endangered species, to help people learn about them. And then Diva and Hedy and Blakely and Jin joined my group and we decided to add those other things.

KV: I thought it was fun cause you could do what you wanted and I always wanted to make a website.

KC: How was that—was it harder or easier than you thought? Had you ever designed a website before?

KV: No I've never done a website before, but it actually it was pretty easy.

KV: My job was to find 2 endangered animal species that we could put some information about, and I did the Florida Panther and the red wolf.

JH: Oh, I thought our project was very interesting because we got to inform people of environmental troubles.

MW: And we got to do it in a fun way.

KC: Okay, so how did you feel about designing your own projects, instead of me telling you had to do?

JH: I thought it was very good because it showed our creative side.

MW: Yeah, our creative side.

Most students (five) reported that they would like to continue on the same topic if they were to complete another environmental action project in the future. Two students suggested learning more about different topics.

This finding is interesting in that students seemed to pick topics for their original project, and for the future, that they were familiar with, such as recycling and planting. Dhara and Whitney suggested changing activities slightly to try a new way to educate others, than they had completed in their first project.

MG: Probably planting trees or flowers, because it's pretty easy and you know what to do. Or recycling, like collect recyclables around the school.

MG: Um, endangered species, I guess. And like animals.

WH: Instead of the poster, maybe we'd do like if we could like an infomercial kind of thing, and tell people about it. Like make a recording, kind of like the T-unit thing, where they made a song about it, something that would catch people's attention.

WH: Recycling, or not throwing away. Or I don't know. Saving electricity. And recycling and stuff like that.

WH: I don't know, cause recycling is really big. And I guess saving electricity is now. So we were just doing something really big so we could tell everybody about it.

KC: Yeah, are you seeing more about that in the news?

WH: Yeah.

DK: Something similar.

DK: Not really a website, but something to help, to make other people know of this. If they can't do anything, they can let other people know, and they can do something about it.

KC: Okay, that was kinda the idea behind the website idea?

DK: Yeah, because anybody could look at it.

BR: Um, probably more endangered animals. Because with the last project, I didn't really look into that, I looked more into recycling, and global. So I'd probably do animals.

KC: What do you think you could do as an action project to help them? I know a lot of times people do a lot of research with endangered animals, but can you think of anything you could do that would help them?

BR: Probably doing something to raise money to give to a company that does help animals. Because I don't think I could do anything personally to help an animal.

KC: Okay. So you would pick the same topic, or something different?

Linus described new content areas that he would like to explore in the future. These ideas are still based on areas that he has prior knowledge in.

LO: I'd pick something different, because I'd like to use something different, learn more.

KC: Okay, any ideas, what you would pick?

LO: Uh, probably cars, pollution. I'd probably pick up some. I want to research on that. See what scientists have ideas about. Like for cars, gases and stuff.

KC: Yeah, and you have that personal connection with your uncle. Okay, good, that's a timely issue.

LO: Yeah, gas prices are going up a lot these days. Isn't the limit like 5 dollars or something, and we're at 3 dollars and something?

KC: Yeah, gas is getting expensive. Is there anything you think you can do to help, in terms of car pollution?

LO: Um, I think that we can definitely send out a car that's like running on water or something; vegetable oil, like my uncle. Send that out to Mercedes, Jeep or something, and let them sell that car. Because then people will start noticing that, and then they'll make new cars, better cars, looking cars, and stuff like that.

Kelsey, Marcus, and Jason describe how they would specifically add to their projects' action by continuing to work on the website and "publishing" the CDs. (I have not been able to confirm Kelsey is the author, but after looking at the website from Kelsey's group, it has changed and been added to in the two years since the project and is still active.)

KV: I would maybe actually register the site, and advertise it to people, and maybe add some more things about different species.

KC: Okay, so if I was able to go in and publish it, do you think would help?

KV: Yea. And I wanted to add more.

KC: Good. What do you think you could do, if you were able to, next with your project?

JH: Get the CDs.

MW: Publish the CDs and try to get people to. . .

JH: Try to get people to buy it.

MW: And with that money, we'd give it to trees, and people who plant trees.

Three students reported on the importance of working on something "big" and tried to explain this. They also explained the influence of media and culture on their ideas.

When I was interviewing the students, I did not expect three of them to use the word "big" to describe the types of projects they wanted to work on. The interviews with Whitney, Marcus, and Jason revealed this common perception. This may influence their choice of issue and action. Their desire to work on a "big" topic may also be related to their perception of what media and culture have deemed "big" issues.

KC: How did you decide on the topic of recycling?

WH: Um, I don't remember. I think it was just big, it was really popular. It was a good way and easy way to get people's attention. So we did that and made a poster out of it.

KC: When you say "big" what do you mean by that?

WH: Everyone knows about most people know about recycling, most people don't know about like making organic things, or doing other things. And a lot of people will know what recycling is. So it was an easy way to get people's attention by making a poster and telling them about.

KC: What made you decide to learn more about trees?

MW: We thought of trees like nature's. . .

JH: Big thing. ..

MW: Yea. If trees aren't there, then everything else dies. Even humans.

KC: Really? So you thought of trees as being more important than some other things?

MW: yea.

KC: That's interesting. What made you, you had learned that?

JH: Yeah, the air they gave.

MW: Yea.

Marcus and Jason also reflected on the influence of media, culture, and short 1-day activities on their understanding of environmental issues.

KC: Is there anything else you would like to save besides trees?

MW: Um, thank you Ms. Charmatz? [must have misunderstood the question!]

KC: [Laugh] No, not say—save!

MW: Oh. . .I thought you said say. Um, animals.

JH: And plants.

MW: Yeah, because plants make medicines for people.

JH: I saw that in Batman last night. The girl, she made plants.

KC: Right good. . .What type of animals?

JH: Endangered species.

MW: Yea.

JH: Like the black rhinoceros.

KC: And all this stuff that you're talking about, endangered species and you know a lot about trees, did you learn that in school or at just in your own general life?

MW: School.

JH: School, and assemblies.

KC: Assemblies? That's interesting.

JH: And the big signs they have that say, "Everyday more than like ½ the world's trees are cut down."

KC: You've seen a sign? Where'd you see a sign?

JH: The highways, and on the signs in the street.

MW: Mmhmm.

KC: That's interesting. So those signs do impact you? . . So if you saw some of these bumper stickers that some of the other kids made, do you think that would help too?

MW: Yea.

JH: Yes.

Teacher Interviews

All three of the teachers interviewed agreed that environmental action projects were important and meaningful and described reasons or positive experiences they have had completing them with students. However, they did not see strong connections, if any, between the 7th and 8th grade science curriculum and the environmental action projects in the county curriculum. All three saw the strongest connection to 6th grade science curriculum, but this did not "spiral" or continue into the 7th and 8th grade curriculums. One teacher said that the students would probably not hear anything else about the Chesapeake Bay or environmental studies [from the 6th grade unit] until possibly 10th grade.

All teachers described environmental action projects as important and meaningful:

- "I think most memorable things are either small groups, outside, hands-on, involved..."
- "Well, first of all, it's very motivating for kids to get involved in. That once they learn about it, that they're out there doing stuff."
- "I'm all about the kids being involved and knowing what's happening in their community and how they can make a difference. I think that's really important for middle school kids."

All three teachers did not see strong connections between required curriculum objectives and action projects in 7th and 8th grade:

- "In the curriculum, I don't know if environmental issues are addressed completely, they're considered supplemental, if at all."

- "Now 7th grade, a project like that would not fit into 7th grade. Because theirs is mostly human body systems and sound and light."
- "I think that's really important for students to get involved with their community and know what's happening in their community, but our curriculum does not lend itself to that."

Qualitative Surveys: Pre-post open-ended written surveys

Students completed open-ended written surveys both before and after the projects. I designed this survey to further understand how the development of the projects influenced the students' thinking about their actions and their perceived effect on the world. These understandings are related to the main research question "how do participants (students) make sense of an experience developing environmental action projects"? The survey also provides further insights on questions related to empowerment, i.e. do students develop feelings of empowerment through completing the projects? Also, what types of content did students learn through completing the projects? For the survey, the students answered three yes/no questions (described below) and wrote a description explaining their answers (See also Appendix F for a copy of the questionnaire). I analyzed this data, looking most closely at the written responses. Although I primarily analyzed the students' written explanations for new understandings related to the students' perceptions of the projects, I also calculated the number of yes/no responses by question for the pre-post versions of the survey by class. I did not evaluate these responses through quantitative methods as I am most concerned with and interested in the students' written responses. However, the yes/no answers also provide a summary

and overview of their answers with which to frame my interpretation of their written responses.

See Table 13 and 14 for the results by question (yes/no response) for both classes.

Table 13: Seventh Grade Qualitative Survey Responses

	Yes	No	"Yes and No"
Question One Pre-test	14	13	
Question One Post-test	13	13	
Question Two Pre-test	20	7	
Question Two Post-test	17	9	
Question Three Pre-test	9	18	
Question Three Post-test	10	15	1

Table 14: Eighth Grade Qualitative Survey Responses

	Yes	No	"Sometimes"
Question One Pre-test	15	6	1
Question One Post-test	16	3	1
Question Two Pre-test	21	1	
Question Two Post-test	15	5	
Question Three Pre-test	13	9	
Question Three Post-test	13	7	

Survey Questions – Insights from Written Explanations

Question One: Do you think you help the environment through your actions?

In the pre-test, when students answered "yes", recycling and picking up litter were the most common ways of "helping" reported by students. Planting, energy use, and alternative transportation (from cars) were also mentioned. For example (direct quotes):

(Seventh Grade):

- I help the earth because I recycle everything that can be recycled. I also don't waste the earth's resources such as paper.
- I could try to recycle and not litter.
- I plant flowers and sometimes trees to help my community look neat. Every spring I plant flowers with my mom in my front yard. I also recycle every week at home… I also try not to litter.
- I recycle all of my used paper, and my newspapers. I don't throw candy/food wrappers on the ground.
- I circled yes because I recycle almost all things that can. Also, I ride my bike to my grandma's house instead of driving.
- planting, watering, not littering
- I recycle plastic, paper and others.
- Yes, I sometimes help the environment through my actions. I do things such as recycling and picking up litter.
- What I do to help is recycle and I donate money to wildlife and environmental organizations.

(Eighth Grade):

- I do a lot of things to help the Earth through my actions. For example, I recycle and don't litter. This keeps the Earth clean and the air fresh.

- I pick up litter and plant trees. I help put out the recycling and trash.
- I recycle, I reuse.
- I help the earth because I pick up litter and throw it away.
- I recycle any paper that is not useful to my needs anymore. I recycle plastic bottles, cans, and glass bottles as well. I reuse jars, bottles, and milk cartons.
- I recycle, I walk, and I ride my bike. I help when I recycle paper and cans at home and at school. I also reduce pollution by carpooling, walking, or riding my bike.
- I recycle everything that can be recycled. I plant trees and flowers and I don't litter.
- I do by picking up trash from others and myself. I also don't use aerosol.
- To help the earth I recycle and don't litter. I try to reuse anything I can and don't waste anything.
- I recycle plastics and paper.
- I recycle, and I turn off lights and electronic machines when no one is using them.
- I recycle and I turn off lights when no one is in the room.
- I recycle and reuse water like the excess water of pasa [?] goes to the plants.
- I recycle and reuse.
- Sometimes—If I see trash around on the ground I will pick it up, but I don't go looking for trash.

- I recycle and throw out my trash; I don't litter.

Students who answered "no" in both the pre and post test explain either why they do not help the environment through their actions, or what actions they do not take to help the environment, that they would perceive as being beneficial. For example:

- I am only in 7th grade! I'll care when I'm an adult.
- I don't help the environment because I don't clean it and try to save trees. I really don't care.
- I do not help the environment because I don't recycle and I kill bugs.
- At my house, I don't recycle paper. Also, I don't know that much about helping the earth.
- I don't pick up trash or recycle or plant trees.
- I've never done anything for the Earth except when someone made me.
- It's hard and won't help me get through my life and won't get me any money.
- I don't think I help the environment through my actions because I throw away everything in the trash instead of recycling certain things.
- No my friends and I have own clubhouse in a forest. To do this we had to chop down trees and burn some for space. I also play with fire a lot and pollute the air.
- I never bother to do anything… I waste water and I don't recycle.
- I don't I am not a rebel tip of guy.

- I don't think I help because I don't pick up litter. Also, I don't buy thing that are good for nature.
- I don't help because I don't recycle, but I do recycle paper. I don't try to save electricity or water.

(Eighth Grade):

- I use LOTS of electricity and like Hummers.
- I do not think I helped out the environment. Mainly, I have not paid attention to a lot of the environmental issues and how I can help… I do not think I help the environment. I do not make environmentally healthy decisions consciously. I do not pay attention to may things, such as the recycle label on plastic goods, and what I throw in the trash.
- I don't think I help because saving the environment isn't really ever on my mind. Also I don't think I've made an effort to clean up the environment.
- I don't think I help because I don't pick up trash or do anything to help the Earth.
- Because I didn't plant any trees or help to improve the habitat.

In the post-test, students who answered "yes" continued to describe recycling and picking up litter as environmental actions; some students also reported on additional project actions. For example:

- I could tell people ways to help them save the earth. I could also make a CD informing people to save the environment.

- I help the earth by recycling.
- I made a website with my group that informs the reader about the safety and importance of the environment. For my part, I researched two endangered animals, and put it on the website. (Only the information about one endangered animal got on the website, because it didn't have enough pages to put my second one.)
- I helped the environment by recycling, picking up trash, and writing a petition to help save the cows.
- I didn't do anything to help it. Except for the project I did with my group. So. . .yes. .
- I helped the environment through my actions because I recycled more and that helps the environment
- I recycle and I plant things. I also helped make a website about the environment and how to save it.
- I can help by recycling, not littering, and saving trees.
- What I do help the earth is that I alert other about problems, and I recycle.
- I circled yes because for my environmental project, I planted flowers and informed the public.
- Yes I do because I recycle everyday and save electricity by turning off my room light when I'm not there.

(Eighth Grade):

- I helped save animals and that will in the end save the environment.

- I reduce, reuse, and recycle. I plant trees and plants. I don't throw away toxic wastes, and dispose of them properly.
- I circled yes because I recycle, walk to the park instead of driving and I don't litter.
- To help the earth I recycle and don't litter. I try to reuse anything I can and don't waste anything.
- What I do to help the Earth is that I don't always use a car. I mostly walk or ride my bike. I also helped plant trees around our school.
- I mostly use cars, walk or sometimes ride. I plant trees and flowers around the yard.
- I recycle and I plant some trees and plants. I also inform other people of how recycling and planting trees helps the environment.
- I help the environment because I recycle.

Question Two: Do you think you could do more to help the environment?

More students indicated "Yes" in the pre-test than in the post-test in both classes. Although, I am not claiming the numbers in this survey are statistically significant, one possible interpretation of the decrease in "yes" responses is that after completing the projects, students came to perceive that they had "done enough" (as one student wrote). In other words, at the end of the projects, some students did not think they could or needed to do more to help the environment. At the same time, a number of students did still answer and explain that yes, they could do more. In the post-test, similar to the results in question one, students often described additional activities they could "do more" of in relation to activities they completed in the projects. There was therefore a

split between some students who suggested taking more action related to their projects, and some students who either thought they did not need to do more or could not do more. For example:

In the pre-test, students who responded "yes," gave explanations such as:

(Seventh Grade):

- I can recycle more and garden more by planting more flowers and grass.
- I could petition for the government to help protect the wildlife.
- I think I could raise awareness in my community by putting up signs and handing out brochures about cleaning the environment.
- Yes, but I can't only do it by myself.
- I could recycle.
- I could educate other people about the importance of keeping the earth clean. More people helping is more changes to keep the earth clean.
- I think I could recycle more and carpull along with riding my bike more to make less pollution.
- Use recyclable materials
- Plant trees; Pick up litter; Do posters about what to do to help the environment
- I could do more, such as planting trees and maybe joining an environmental club.
- I could try to donate money to a society that saves trees or animals.
- I could plant trees and flowers and clean up the environment.
- Yes I can recycle more.

- I could get more involved.
- I could plant trees.
- I could pick the trash up in the parks. Also, I could ride my bike more.
- Everything and recycling, could make a difference.

(Eighth Grade):

- People can plant more trees and pick up trash.
- I could help by making my neighborhood cleaner.
- I think I can recycle more. I can also reuse things and boycott companies.
- I could use lunchboxes instead of lunchbags.
- I think if I ever saw my friends littering or abusing the environment I would stop them, and maybe they would get the message not to do those things.
- I could pick up trash and recycle.
- I plant trees and bushes with my Dad in the summer.
- I can pick up garbage from the road.
- I could use cars less and electricity less.
- I could get more involved in environment activities.
- I could plant trees, pick up garbage, and even do speakings on helping the environment.
- I could donate old clothes.
- I could recycle more, and clean up our environment.
- I could urge my parents to buy more environmentally friendly things.
- I could plant trees.

- plant trees/flowers
- I could ride the car less.
- I could plant more trees and plants.

In the pre-test, students who responded "no," gave explanations such as:

(Seventh Grade):

- I don't think there is anymore I could do to help because there isn't a whole lot one person can do.
- I couldn't because I don't feel like it. I really don't care about the environment.
- I'm not very sure if I help out more than I do but I try.
- I am lazy.
- Because I never do anything unless people make me. That's the truth.
- I don't want to.

(Eighth Grade):

- I don't think I can because I don't have a lot of access or time to do anything else. And I think I've done enough.
- Because if I am doing a little that's OK as long as so does everybody else.

In the post-test, students who responded "yes" often related their positive additional actions to their projects or other students' projects. Some students also indicated "yes" with the explanation that they could do more, because their current actions are limited.

(Seventh Grade):

- I could recycle more paper, plastic, metal, and glass.

- I could recycle more and buy stuff with less packaging.
- I could work to fix the ozone layer. Also have people use electric cars instead of all the pollution.
- I can try using organic materials and environmental friendly products. I could help the earth more by not cutting down trees.
- I could recycle, but I don't do it a lot.
- I could plant seeds on the earth.
- I could do many things, like, recycling more, take my petition farther, and tell people to stop littering.
- clean up more, recycle
- I helped the environment by avoiding products with a lot of packaging
- I could ride a car less often.
- I really could do more because I could use less energy, I could donate more, and I could take more action.
- Yes because I never did anything for the earth.
- Save more water, conserve energy and recycle.
- I could do a lot more because I don't do much.
- I could pick up some litter in the park. Also I could buy things that are better for nature.
- I could recycle more and try to save more needed resources. I could also pick up litter when I see it.
- I could pick up trash and recycle more.

(Eighth Grade):

- I could have other people help me clean the environment and tell them not to litter.
- I could help my parents plant trees and shrubs around my house.
- I could do more. I could sort out the trash from the recycling. I could also help out cleaning the neighborhood.
- I could recycle, reuse and reduce and decrease my meat intake.
- I can help plant trees and teach other people to help the environment.
- I can try to think more about recycling, plant trees, and try to recycle all of my garbage. Also, we can promote more people to recycle.
- I can also plant trees and flowers.
- I could use the education we taught in our video.
- I could help more by being more precise about recycling, reusing, and reducing.
- Be more serious about recycling, reusing, reducing.
- I could write a letter to our governor asking him to help save trees.
- I could be more careful about recycling everything that I use.
- Buy stuff with less packaging.
- I could carpool instead of driving in separate cars.

In the post-test, students who responded "no" often did so because they believed they were already doing enough, specifically through the actions of their projects. Additional reasons for answering "no" included feeling that it was not their "job" and that others, especially adults should be doing more to help:

(Seventh Grade):

- I don't think I could because I can only do so much. The community needs to chip in as well.
- I couldn't help because I love money. And the way you get it is cutting down trees. Anyways I don't care.
- I did enough.
- I can't do anymore because I am doing everything a kid can.
- I am a lazy boy who doesn't do anything.
- I don't think I can do anything else because I won't do anything in the first place.
- Why would I want to? Other people can, not my problem.
- No because I do a lot not just what I listed above.
- I prefer just living my original life while I am a kid and not doing an adult job.

(Eighth Grade):

- I do everything I supposed to.
- I think I do enough.
- I believe I do my part. However, if everyone did what I did it would be wonderful.
- I help out a lot and in my words a little is a lot.
- I think if everybody picks up a little it will help out.

Question Three: Do you believe one person can make a difference in helping the environment?

This question revealed some inherent differences between student beliefs in this

particular seventh grade class and eighth grade class. More students in 7th grade indicated "No" than "Yes" in both pre-test and post-test, while more students in 8th grade indicated "Yes" than "No" in both pre-test and post-test. Overall, most students reported the same answer in both the pre-test and post-test. In eighth grade this was most pronounced with only one student changing her answer, from No to Yes. In the seventh grade class, four students changed from Yes to No and five students changed from No to Yes, while one student changed from No to "Yes and No". The most common reason for changing from no to yes was that one individual could influence others' actions and therefore make an individual difference. The most common reason for changing from yes to no is that it takes a group of people to create changes and therefore one person cannot really make a difference alone. Both of these reasons suggest that students saw meaningful actions as occurring through group action, either by an individual inciting a group to action, or a group taking action to begin with. Changes in the pre/post responses included the following.

The one student who changed her response from "no" to "yes" in the eighth grade wrote the following explanation:

- Pre: No-I think that you have to work together to achieve greatness.
- Post: Yes- One person can influence other people to [do] stuff.

Students in the seventh grade that changed their responses from "yes" to "no," explained their response in the following ways:

- Pre 1: Yes-I think one person can make a difference in helping the environment. If one person sparks an idea then surely people are sure to follow and the idea turns into reality.

- Post 1: No-No one person can change the environment. A group of people can influence more people more than one person.
- Pre 2: Yes- I believe one person can make a difference because everyone can do something.
- Post 2: No-One person can't change the way the environment.
- Pre 3: Yes- Recycle, no littering, I don't know. . .
- Post 3: No- there needs to be more than one to make a difference because the world is Big.
- Pre 4: Yes- planting one tree can create oxygen and that tree will drop seeds for more trees and will make a lot of oxygen
- Post 4: No- I don't think one person can make a difference it would take at least 5 just to end a war.

Students in the seventh grade that changed their responses from "no" to "yes," explained their response in the following ways:

- Pre 1: No-If one person started using less water, then there will be someone else that's using extra water to compensate it. All of the world has to cooperate to make a difference to the environment.
- Post 1: Yes-One person can inform on people about the earth. This would get more people to help the environment. One person can indirectly help the environment.
- Pre 2: No-I don't think someone could save the environment all by themselves because they can't take care of Maryland, California, Texas, and Florida at the same time.

- Post 2: Yes-For example one person could make a petition or document and one could take it to a high ranked person and they could help you.
- Pre 3: No- No because if only one person saves the earth then it's still going to be messy.
- Post 3: Yes- Yes, I can help the environment a lot by being very good to it, and being a vegetarian.
- Pre 4: No- If only one person tries, there is too much work to be done. If at least ten people try, then the environment will be a bit healthier.
- Post 4: Yes-Yes, if it's a very persuasive person. He/she could persuade others to help the environment.

One student changed her response from "no" to "yes and no":

- Pre 1: No- No because I [it] takes more than one person to make a difference. One person can't go to everyone's house and recycle things.
- Post 2: Yes and No- It takes a lot more than one person because that person can't be all over the world. But at the same time Yes because if you pick up one piece of trash you can make a difference.

Although most students did not change their yes/no answers or the basic ideas in written responses for question three from the pre-test to the post-test, some of the responses are still compelling to consider in terms of the students' perspectives. Their responses show some pointed discrepancies between individual students in terms of their beliefs that one person, including themselves, would be able to make a positive difference. This is related to the students' perception of their own internal locus of control, or their belief that their individual actions can have meaning. Also, while many

students indicated that they believed one person could not make a difference, they did seem to take this quite literally, as they concluded in their written responses that a group of people could make a difference (the most common reason students changed their responses from yes to no, described above). This question in particular provides insights on how the students experience their role, individually and collectively, in environmental action projects and whether or not the projects are related to student empowerment.

Perhaps feeling as though they can make a difference as part of a group is also a form of empowerment. In the context of these group projects, this is an interesting finding—that many students saw themselves as possibly effective, but only as a member of a larger group. One eighth grade student describes this perspective distinctly and adds the common student conception of "indirect" action as informing others: "I don't think one person can make a difference in the environment directly [underline in original quote]. However, I think if they shared their idea with multiple people, then as a group they could make a difference." Would students have responded differently if they had completed individual action projects? Some of the following examples particularly illuminate the above insights.

Students who answered "yes" provided the following explanations…

(Seventh grade):

- I helped because I talked to my family about supporting the idea of a positive environmental action like planting trees.
- One person can plant a hundred trees, donate a million $, and help out a lot!
- If one person tries hard enough, they can make a difference.
- Even if you are only one person at least you're trying.

- One person can make a difference because they can plant trees by themselves… One person can make a difference because that one person can influence a lot of people. Then, all those people can help the environment.

(Eighth grade):

- If one person does it, other people will follow their example and help.
- I think that one person can make a big difference in the environment. Just by fixing a sink, for example, they can save hundreds of gallons of water… I think that one person can make a difference because they can save many lives of animals.
- I believe this because it only takes one person to stand up for something and people will follow.
- Yes, I do believe one person can make a difference in the environment. For instance, planting trees… Each person has potential to each contribute to helping the environment.
- The president can convince people to recycle, and do things to save the Earth. Senators, also, can do things to save the Earth.
- I think this because it could only take one person to help stand up for something and sometimes others will follow… They can start to help by doing little things like not littering or picking up trash in their neighborhoods.
- One person can make a difference because they could get more people to join them and convince people to help the environment.

- One person can start an organization that grows with more people… It takes many people to change the world, but it can only take one person to start to make a difference.
- One person can encourage another.
- If one person recycles one can or picks up one piece of trash off the side of the road, even though it's a small difference, it's still a difference.
- Even a little something to help the environment still makes a difference.
- If everyone recycles then there could be a difference.
- They can do things for others and get others involved.
- Because if one person starts a group and then other people follow, then that one person has created a large group that could help the environment.

Students who answered "no" provided the following explanations…

(Seventh grade):

- If there are four people littering and one person picking it up. The four will over power that one person didn't do anything.
- To make a difference, you need a whole group of people. It is impossible to clean a park by yourself. That would take forever. But a lot of people could clean it by working together.
- If the environment was bad I wouldn't care. I don't care about the environment (grass, trees, plants), it's all boring to me.
- No, it takes more than one person to make a difference. For example, it takes more than one person to start a war, and it takes more than one to end it…No, only a lot of people can. Like an election.

- No one person can change the environment.
- Many protesters are needed to change the minds of some people. One person can't influence a whole group.
- It takes many people to accomplish one person's ideas.
- No I don't want to help environment. I just want to be a kid while I can… not one person can save the world. Only little 4 year old girls who believe in pink pixies think so.
- You can't change with one [person] cause you need help… You need a group.
- I think for one person to make a difference it would be really hard for them…. To make a difference you need a group of people for a real environmental issue to be helped or solved.

(Eighth grade):

- Many people are needed to help preserve the environment. One person can't do all of the jobs necessary to keep human beings and animals alive.
- You should work together. It will be more effective and more fun… You could get a group together and get more involved.
- I don't think one person can make a difference in the environment directly [underline in original quote]. However, I think if they shared their idea with multiple people, then as a group they could make a difference.
- If only one person uses hybrid cars that only take .0001% of the pollution… Because there will still be those thousands and thousands of people polluting.
- Everyone has to help out, not one person can change the world…Everybody has to help recycling is a "team". Everyone has to help.

- No, because one person can't save the Earth. Altogether, we can save the world.
- If I pick up trash that doesn't mean everybody else is. If I plant trees that doesn't mean everybody else is. If I build something for animals that doesn't mean everybody else will… There has to be more people to make a difference. I was the only person picking up trash.

Emerging Insights

Several assertions, a summary of insights related to multiple data sources, emerge from examining the data collectively. I discuss each of these assertions based on the data presented below. The assertions are organized through areas of student experience and teacher experience. I discuss related ideas of the connections between student and teacher experience in the following chapter on discussions and implications of the study. Table 15 below summarizes the insights, with a description that follows.

Table 15: Summary of Emerging Insights

Student Experience	• *Students learned new technology skills while also perceiving technology as a means to make a difference in the larger world. Technology tools and actions blur the conceptions of place and place-based education.* • *The project allowed students to gain new skills in reading, writing, and critical thinking.* • *The project allowed students to gain new skills and understanding related to environmental literacy.* • *Students' conceptions of what is meant by the "environment"*

	varied widely, as did their expressions about whether or not they "cared" about the environment. • *Students viewed most environmental issues in polar opposites—good vs. bad. There was also a strong emphasis on the negative actions of other people (littering, trash, government inactivity).* • *Students' idea of what constituted action was often different from my own, and often involved technical products.*
Teacher Experience	• *The pedagogical development of the projects was inductive and ended up breaking down into three distinct phases, which I was not anticipating—idea conceptualization, background research, and action component.* • *I interpreted several areas where environmental action projects could meet curriculum indicators or enduring understandings (as described in county curriculum documents).* • *I perceived alternating senses of successes and challenges related to the project related to students' construction of action and my sense of place in the school.*

Student Experience

I decided to group the following ideas under student experience as each of these insights are specific to the students' experiences. As the teacher and researcher, I am presenting my interpretation and perspective on their experiences, but I consciously work to present the products of the students, their perspectives, and their voices.

The following assertions are related to content knowledge that students used or developed.

Students learned new technology skills while also perceiving technology as a means to make a difference in the larger world. Technology tools and actions blur the conceptions of place and place-based education.

At first I was unsure that the projects involving technology fit my perceptions of environmental action projects—they were not what I envisioned for the students as an example of action in a place-based context. I had done very little with technology and action projects in previous years developing similar projects (mostly because it hadn't come up and we did not have the technological resources at the previous schools I was working at). When several of the students in both classes wanted to create websites, videos, and music, I went along with their ideas, mostly because I wanted to follow their interests and see how they developed. I came to see the incorporation of technology into the projects as culturally relevant for these particular students. I believe that they viewed technology as an action because each use of the groups' uses of technology created a new product, i.e. they acted to create something new that they believed would have an effect on others of the environment. Although I did not have a computer in my house as a young child and did not use the internet or email until college, most of the students in my classes used email and internet as a means of communication and learning about the larger world around them from a young age. This was also apparent in the library research, as most students were more comfortable finding answers to their questions on the internet than in books. I am wondering how technology impacts the nature of place-based education, and I will discuss this further in Chapter 5.

Of the seventh grade groups, two of the groups directly incorporated the use of a specific technology—Group #1: Educating Others—Websites/endangered animals and recycling, and Group #5: Educating Others—CD/Trees and Habitat. During an interview, I asked Dhara (DK), from Group #1, concerning their website: How did you come up with the idea to do the website? I thought that was very creative. DK responded:

> Because I've never done a website before. And I wanted to do something. . .like if I just did a poster, no one could look it; it wouldn't be accessible to everyone, I could just take it home and like, it would just lie there. If I put it on the website, then anyone who wants to look at it, can look at it.

KV also indicated that the website was something "new" that she had wanted to try, so perhaps part of the students' in technology was the novelty of it.

Group #5 was the largest group out of both classes and their project ended up incorporating (or attempting to incorporate) two types of technology—creating a new CD and creating a website. Many of these students identified picking this action because it made the project more "fun" to them. I would further argue that the incorporation of technology into the project, especially for these students, made the project more relevant to the interests. Many of the students in this group did not identify themselves as interested in environmental issues, as evidenced by many of the survey responses. But there were interested in technology issues and so that was one way they used choice to increase the motivation level for themselves in this particular situation. In this case technology was culturally relevant to these students because they communicated and interacted with others through technology; for them, technology, specifically the use of

the internet, video, websites, and music had social implications. Even if a specific groups' project content in the seventh grade was not tied to a technical innovation, every group still found most of their background research content on the internet, and almost every group completed a PowerPoint presentation for their final group presentation.

The incorporation of technology in the projects was even more deeply embedded in the eighth grade projects, with every group incorporating a specific type of technical activity into their project. Group 1 and Group 3 created websites; Group 2, Group 4, and Group 7 created videos; and Group 5 and Group 6 created magnetic-based bumper stickers. (The bumper stickers required relatively less technical expertise but still incorporated the use of special magnetic printer paper that could create bumper stickers to attach to the back of cars.) Similarly to group #5 in the seventh grade, many of the eighth graders had perhaps become oversaturated with working on environmental projects through the Green Day—adding a technology element to the projects made them more interesting for the students. Many of the students also reflected that the technology aspect of their project made them more accessible to others, leading to a greater impact of their action. For example, in Keagan stated in his reflection:

> …I believe the project I did will help thousands of people everyday across the world. Everyday millions of people go on the internet so my web page is very accessible and easy to get to. If you need to know more about recycling all you have to do is go to the website because it is very reliable because I got my information from big time organizations and from experts. It will help school kids with projects and it could later on be some stats because I plan to put my polls onto the search engines such as Google…

For these students, I think the lines of local places and far away places were blurred. I found as I was teaching the project, that even though I had initially wanted students to focus on projects in their "backyard", that it became more important to me that the projects were relevant in some way to students. I was not expecting that local issues would not necessarily interest students or be relevant to them. Is this a catch-22—how can we help students learn about local issues if they are not initially relevant to them? Could elementary school curriculum be framed in a different way that made local issues more relevant to students at a younger age? For example, study the habitats surrounding a particular school instead of studying the habitats of the rainforest on another continent (Sobel, 1997). Why were local places less relevant for students in this context? For this project, I don't think I had enough time to explore the relevancy of local issues with them—I think a full year or perhaps half-year's worth of activities is needed for this. Because of the short duration of the pedagogical intervention, this study is really an exploration of students' initial ideas as to projects they found relevant and personally interesting. While I encouraged them to choose topics and actions that were locally based, and in some cases did ask students to come up with new ideas, the majority of these projects are based on students' initial ideas. (Therefore, for most of the students in this particular group of students, technology (especially internet and video) is a means of communication and is culturally relevant.)

That is not to discount the influence I had on the students—I often felt students chose ideas and topics that I believe they thought would please me. It's often difficult to see whether students were genuinely interested in a topic or were trying to choose something they thought would please me (and ultimately cause me to give them a high

grade). In other words, I did often feel that students were doing or saying things that they thought I would approve of.

The project allowed students to gain new skills in reading, writing, and critical thinking.

To complete both their project action, students completed a relatively (within the time frame of the project) large amount of time researching their issue and action. To complete their research, each group and student had to develop at least five questions around their topic, which would help them complete the project successfully. Developing the questions was a critical thinking activity that proved more challenging than I was anticipating for many students. One student in particular, Mitchell remarked that the specific activity of developing questions was "too much thinking." To help structure their learning in this case, both the media specialist and I discussed and worked with individual groups and students to help them formulate what ideas they would need to know to complete their projects. Many of the students commented to me that they had never had to complete an activity like this before. The students found the answers to their questions in sources such as books, magazines and websites, as well as through email with experts and discussions with other teachers. The research challenged the students particularly in reading because they often had to read resources written at an adult level to find the specific answers to their questions. Volk and Cheak (2003) reported similar findings related to the difficulty in the level of reading materials students needed to be able to understand to complete their projects. Linus reflected on both the difficulty, related to reading, and importance of research in his interview:

> Definitely do a lot of research. Because, it makes it much easier if you actually know about what you're doing and stuff… I like books mostly, because they tell

specifically what's wrong, with cows and diseases and fertilizers… The computer always gets me weird stuff that I don't understand. Big words.

Students needed to engage in critical thinking to complete their library research but also to complete the issue analysis activity for their project—what are the issues involved? Who are the players? What are their values and beliefs? Through this particular activity, students identified a variety of issues, including pollution, climate change, recycling, population, animals, and resource conservation. Some seventh grade students (10) and eighth grade students (7) clearly described cause and effect as related to their issue(s) through a direct cause/effect relationship or a question.

Eighth graders had a significant change in their score on the Issue Analysis subsection of the MSELI. One inference from this finding is that eighth grade students were able to develop new critical thinking skills related to environmental issues through their experience developing the environmental action projects. Although the seventh grade students did not show a significant change in their score on the test, their written work on the activity "Your Project—The Issues" does indicate that they were able to identify environmental issues and in many cases develop cause-effect relationships. Perhaps, the seventh grade students were able to analyze issues within the projects they had chosen and were therefore familiar with, but they did not develop the skills yet to apply these skills to a new situation or environmental issue they were not familiar with. For example, Marcus developed a particularly complex cause and effect scenario related to the topic of his project:

trees cut down=no habitats for animals=no reproduction=endangered animals=extinct animal=animals can't perform job in ecosystem

Two other seventh grade students also described relatively complex cause and effect cases in their issues activity:

habitat endangerment, habitat loss—[leads to] endangered black footed ferret; endangered animals—[leads to] unstable ecosystem

Writing skills were developed throughout the project and were especially connected to the projects involving the development of websites and video. Through these common activities, in particular, students developed both text and scripts for their projects. The text and scripts for video and websites required that students read and understand material related to their project topic, and then reframe what they had learned to communicate this issue to others through writing and in some cases speaking.

All other projects also incorporated writing literacy skills, from writing reflections on what they had learned to writing summaries of content they learned. Additional projects that included specific writing components were projects that included a petition, letter writing to government, and native planting (writing a letter to principal and department head for permission).

All students were required to communicate their understandings and experiences related to the project in a final reflection. Shivani's reflection is particularly revealing, regarding the critical thinking and research skills she used during her project:

> In order to grasp key points of this topic, I chose five questions to answer. The first question I had was: what are some basic environmental needs of the community? Since our community is the Chesapeake Bay watershed, we have

a lot of unique environmental needs, besides the average needs of most other communities in our nation. Our community needs attract more wildlife. They keep the balance of plants and insects in check, and the balance of the Bay Area too. We also need to lose the amount of waste we are making. A lot of trash ends up in the Chesapeake Bay, which kills the plants and animals living there, along with making the water unsafe in general.

My next question was: what can we do about that? Since this question was too general, I created two other Helping Questions: like: 'what are some steps that you (as an individual) can take', and 'What are some steps the community can take'? You, as a person can do a lot. You could adopt a tree, reduce the amount of waste you create at home by reusing bags and not buying small plastic packets of food. You can also help organize environmentally-friendly events, and put up posters reminding people what they can do to help the environment. The community can adopt a National Estuary Program, which teaches people what they can do for that specific responsibility we have in our environment. They can also test water, air, and other local natural resources weekly or daily to see how the community is doing. Finally, the community can encourage people to participate in environmental activities.

My final question was: what is the point of having a healthy community? Well, it will improve the health of the estuary and your community. It will make the community prettier and fill it with life and vitality. It will make you feel better and preserve homes and cars for years.

Supporting the environment in the community is very important, and by asking these questions I have successfully reviewed the background information about this topic….

The project allowed students to gain new skills and understanding related to environmental literacy.

Students choose a variety of topics and issues for their topics as described in the group vignette sections. Issues that the students investigated included native plants and habitats, how to plant a tree, cleaning/environmental pollution, environmental issues in community, recycling, endangered animals, habitat protection, power sources, global warming, and ending growth hormones-dairy cow. Because each of the students chose different topics for their project, there was a large individualization of environmental science content knowledge learned between students. Therefore, while students were all exposed to similar content knowledge through the project presentations and discussions, individual students actually learned a variety of different content areas and in differing depths. A drawback in this type of approach is that not everyone learned exactly the same content and to the same level; the benefit is that students were able to explore content that was most relevant to them and to the depth that was most appropriate for them, leading to pedagogical differentiation between students.

The projects' action, science content, and misconceptions varied considerably between projects and students. Time spent on projects may be related to the connection of the project to student beliefs. This finding is related to the above statement on differentiation and the types of science/environmental content students learned. Some students revealed misconceptions within groups, but these also varied by individuals.

Students spent more time on projects whose topics OR actions were personally relevant to them or relate to their personal value and belief systems—leading to the question, how does a teacher relate to different students' values and beliefs?

Students' conceptions of what is meant by the "environment" varied widely, as did their expressions about whether or not they "cared" about the environment.

Just as the environmental content knowledge students developed varied, students conceptions of what is meant by the environment and the level of value they placed in protecting the environment varied widely. However, in the case of this insight, students' conception of what they understood to be "the environment" was already developed to some extent at the beginning of the project, and I found scarce evidence to show that any of the students changed their conception of the environment.

For example, in his pre and post test survey, Jordan wrote:

> Pre-test: I don't because I don't do anything for the environment. I don't never plant nothing nowhere. Ever!!!...I couldn't because I don't feel like it. I really don't care about the environment…If the environment was bad I wouldn't care. I don't care about the environment (grass, trees, plants), it's all boring to me.
>
> Post-test: I don't help the environment because I don't clean it and try to save trees. I really don't care…I couldn't help because I love money. And the way you get it is cutting down trees. Anyways I don't care…No because I don't care about the environment really. I litter sometimes and don't care. Anyway, no one cares about the environment. Everyone litters.

Jordan actually gives his definition of the environment above when he says: "I don't care about the environment (grass, trees, plants)…" This reveals that perhaps the environment, to him, is another place—"out there"--, something that he is not connected to. Other students' incorporation of animals into their environmental projects also challenged me to consider how students viewed animals (and which type of animals) as part of the environment.

As students perceptions of "the environment" varied widely, we perhaps should have discussed the meaning they ascribed to "the environment" more fully before starting the projects. For example, the following types of questions might have been helpful in an initial discussion: Where is the environment? What is your environment? Why would you care or not care about the environment (or certain parts of the environment)? What is the environment to you? What is in the environment? Are animals and other living things part of the environment? What animals? What plants, etc.?

Students conception of what is "the environment" then had implications on what topics and actions they chose for their projects. That is, and perhaps too simplistically, students who saw the environment as part of their schoolyard, chose to plant native plants; students who saw both animals and humans as part of the environment focused on their treatment and the connected impact on people; students who saw trees as representative of the "environment" or "nature" focused on the importance of "saving" trees; students who saw the "environment" as a resource to be "saved" focused on recycling and its effects.

Students viewed most environmental issues in polar opposites—good vs. bad. There was also a strong emphasis on the negative actions of other people (littering, trash, government inactivity).

In the environmental issues activity, students most often listed people involved in the issues as the students themselves, their friends, and family. They also listed people portrayed as players on opposing sides; these people were either good for the environment or bad for the environment, e.g. "environmental groups" wanted to protect the environment and were good; "loggers" wanted to destroy the environment for money and were bad.

The students' choices of activities revealed further polarities from the student perspective—thinking in terms of good vs. bad with very little gray areas, e.g. recycling is good, littering is bad; solar energy is good, coal is bad; hybrid cars are good, regular are bad; cars are bad, biking is good. Questions such as but how much energy does recycling use, and what are the positives and negatives of incineration, came up rarely in discussion.

There are a few exceptions to this insight though, such as Liang and Martin's website project. Their project shows evidence of both polar thinking related to trees, and a more complex approach related to power sources, e.g.:

> Importance of Trees: Trees are very important to the earth. Trees take in carbon dioxide and give out oxygen for us to breath. Trees are used for more than oxygen, but giving out oxygen is the most important thing a tree can do. The more obvious reasons are trees can be made into paper and other paper products. The world needs paper so lumberjacks cut down trees to provide paper. When

paper is made a tree is cut down. Soon there will be no trees on earth and we will all die. So when you recycle, a tree is saved. When a tree is saved you save oxygen for everybody in the world…

Nuclear Power is one of the most sources of power in existence. Ever since nuclear weapons were developed, people have lived in suspicious fear of anything nuclear. Despite this fear, nuclear energy is becoming more and more popular throughout the world. Nuclear power is created by the same process as a nuclear blast. A neutron charges through an atom, creating fission and extreme heat. This provides the energy for the reactor. Unfortunately, this extreme can cause a failure in the system, called a "nuclear meltdown…

Solar power is one of the only power sources that doesn't pollute at all. The question is why do we not build only solar power plants. The answer is that even though solar power is clean it isn't the most efficient power source. When a solar plant is built, the size of it can be the same as a nuclear power plant but the energy produced by the solar plant isn't even close to the power produced by the nuclear plant…

Even though solar power is not the best way to give people power, it is the cleanest way. Therefore when we have enough space in the world, we should destroy every power plant that is not solar and replace it with solar plants. This way we could live cleaner and healthier.

Solar power plants get power from the sun (you probably know that). When a solar power plant is built, a whole bunch of solar panels are installed into the ground near the plants. The panels are then connected through wiring to the

actual plant itself. The plant converts the heat it gets into electricity and sends it to all the people that need power.

Negative versus positive issues also further revealed polarities in students' thinking. Some students focused on negative issues—pollution, littering, global warming, energy crisis, growth hormones, dolphin captivity vs. positive or action issues to change something—recycling, planting, solar energy, hybrid cars, educating others. Most students' described actions are separated into either helping the environment or hurting environment; taking away a negative action or adding a positive action; caring or not caring about "the environment". Negative environmental issues were within almost all students' projects; the projects that had the greatest action impact were perhaps the planting because this was a positive action (which was what I originally had in mind I think). How did we get to focusing on the negative and less away from the experience of being outside? Why did this happen? How could this have been changed in the future, if this is desirable? Was the Your Project—Issues activity too negative or polarized? Did I frame the whole project in negative terms? How could I do this differently to emphasize more positive experiences for students?

Students' idea of what constituted action was often different from my own, and often involved technical projects.

While I had not anticipated creating technical products as action, many students did. The qualitative surveys, student reflections, and interviews in particular revealed insights related to students views and perceptions of their actions.

Question three of the qualitative survey—do you think one person can make a difference in the environment—in particular provides insights on how the students

experience their role, individually and collectively, in environmental action projects and whether or not the projects are related to student empowerment. Perhaps feeling as though they can make a difference as part of a group is also a form of empowerment. In the context of these group projects, this is an interesting finding—that many students saw themselves as possibly effective, but only as a member of a larger group. One eighth grade student describes this perspective distinctly and adds the common student conception of "indirect" action as informing others: "I don't think one person can make a difference in the environment directly [underline in original quote]. However, I think if they shared their idea with multiple people, then as a group they could make a difference." (Would students have responded differently if they had completed individual action projects?)

The survey therefore revealed that many students believed change was possible through group action, and an individual could make a difference if they influenced others, much as the students had designed their projects. Several more students identified this as a type of "indirect" action—does participating in indirect action led to feelings of empowerment? Both in the surveys and the interviews, some students did end up expressing discontent that they "didn't actually do anything" and that they would be more effective "if they actually did something." This possibly points to some unease in the projects that they chose as having real meaning. In the interviews, one student (Moira) reports on her perception that her project directly effects the environment, while the other seven students reflect on the indirect actions of their projects. It is not a clear dichotomy between direct and indirect action, in that one is good and one is bad, but there do seem

to be implications related to the students' perception that they are making a real and measurable difference.

For example, Moira was the one student interviewed that was able to relate her project's action to a direct impact/action on the environment:

> Well um it made the area look nicer and then it gave animals food and places to live I guess.

Dhara more clearly reveals how she perceives her project as an indirect action, through providing information. She further states that other people "could probably do something we can't".

> DK: We didn't literally do anything. But we made other people realize how bad endangered species are. We let other people know how they could help. And they could probably do something we can't….There's an organization called recovery program, and they helped reproduce the black-footed ferrets. And so when they reproduced, there's more ferrets and then there's less chances for them to become endangered.

Kelsey reflected on how her project could inform others about topics she had learned more about. Her statement "actually taking action and doing something would help" possibly implies that she considered her project an indirect action and that "actually doing something" would require a physical presence in the environment—e.g. "cleaning up an owl house".

Teacher Experience

The pedagogical development of the projects was inductive and ended up breaking down into three distinct phases, which I was not anticipating—idea conceptualization, background research, and action component.

I developed the project activities inductively using the research model of participatory action research in response to what I saw as the needs of the students at particular times throughout the project. I had not anticipated that we would need to break the projects into two separate components—action and issue/topic—but this helped both the students and myself through the process of their development. Both the students and I found that they needed to complete more background research on their topic than anticipated to develop a better understanding of both why and how to approach their projects. I found that many of the students had the most difficulty with developing questions and planning the steps they needed to take to complete their project.

Through my observations and journal reflections, also I learned that in this context, many of the students had been overwhelmed with environmental messages perhaps through previous experiences, both at school (such as the Green Day) and outside school (media related). I spent some time and effort trying to work with the students to develop projects that were relevant and interesting to them—I was expecting this to happen more easily and naturally.

I interpreted several areas where environmental action projects could meet curriculum indicators or enduring understandings (as described in county curriculum documents).

In 7th grade with the almost year long study of living things, the following enduring understandings are given (and these were listed on the first project questionnaire that students were given):

- Patterns and relationships underlie the systems of the natural and physical world.
- Methods of scientific inquiry involve asking testable questions, making critical observations, conducting controlled experiments, and forming summaries and analyses the often led to further questions.
- The concepts of science are continually modified and expanded based upon new information.
- Science, technology, and engineering impact the course of history, society, culture, politics, economics, the environment, and individual lives. (County Curriculum Document, source not cited for anonymity)

An additional area briefly mentioned in the seventh grade curriculum objectives was the relationship between human health or disease and the environment.

For 8th grade, the following enduring understanding, essential question, and essential indicators in Earth Science were related to environmental action projects and were given to provide a framework for students:

Enduring Understanding:

- Human activities impact the environment and the natural tendency towards balance.

Essential Question:

- In what ways have human activities both helped and hindered the Earth's natural balance?

Essential Indicators:

- 1.8.21 Use the knowledge of science and available scientific equipment to devise a plan to solve a global problem.
- 1.18.18 Evaluate the application of scientific principles and/or concepts to understand a new situation. (County Curriculum Document)

All three of the teachers interviewed agreed that environmental action projects were important and meaningful and described reasons or positive experiences they have had completing them with students. However, they did not see strong connections, if any, between the 7th and 8th grade science curriculum and the environmental action projects in the county curriculum, which was in contradiction to how interpreted the curriculum objectives.

I perceived alternating senses of successes and challenges related to the project related to students' construction of action and my sense of place in the school.

I now briefly review my perceived successes and challenges as found in my journal and other lived experiences throughout the project.

My perceived successes

Although I reflected earlier that some students were not motivated to work on the projects initially, overall I did feel that students put forth enthusiasm for the projects, especially given the timing of the year. Several groups stayed after school and came in during lunch to work on the projects by choice. The extra time I spent with the students outside of class time as well as the extra discussions we had, improved the relationships I had with many of the students. I felt as though my relationships with several students also improved that did not spend this extra time—from my perspective this occurred

because I had given them choices to work on something they found personally relevant and they appreciated this.

From my perspective, time spent working on background research for the project, in particular in library and the library and computer lab was very positive in that I saw students develop critical thinking skills and new understandings related to their environmental issues. Through this research, I felt as though the classes were developing into a community of experts—with different groups becoming experts on different topics that they then shared with the class. Students within particular groups also became experts on various subtopics related to their topics that they were able to communicate with their group members. Also, students cooperated with other groups, especially in the case of technology, to help each learn new skills. The student presentations and reflections provided further evidence of the new understandings the students had developed. Some of the students' activities—planting outdoors, instructional video for younger students, sharing with others what they had learned—I felt particularly passionate about, and was very excited to work with them on the topics. I felt that my enthusiasm, as well as many of the students, added to a more positive classroom community atmosphere. Outside the immediate classroom communities, the project helped students and I connect more with others in the school community—teachers, staff, administrators, and parents—and this helped me feel a greater sense of place in the larger school community, than I had felt before developing the projects.

Completing the interviews with the students was also a particularly positive experience for me, especially with the students I interviewed one year after the project was completed. I felt as though each of the students I interviewed (I simply interviewed

each student that brought in the permission slip so they were not students I chose for any particular reasons), really was able to reflect meaningfully on their experience and connect with day-to-day actions they were currently experiencing. The finding from the interviews that, while different, each of the students reported completing some type of environmental action to me was very encouraging. The qualitative surveys also showed that more students were able to identify specific environmental actions after completing the projects than before. I came to understand, if one of the goals was to increase students' awareness and activities concerning environmental actions, than this experience showed that this was possible.

My perceived challenges

I did not feel a sense of place—this is probably the number one thing that influenced all of my perceived difficulties; I also began to wonder in what ways students did or did not feel a sense of place at the school? It was a large school, and I did get the sense that many people, not just myself felt lost in the numbers.

I also felt discouraged in the beginning of the projects' development that several students lacked support for the projects, especially initially—their vocalization that we were "tree-huggers", my impression that students were not interested in helping the environment, that the topic of the environment was passé or "old news" to them.
I believe this challenge was related to the challenge of developing this project after Green Day—I had thought Green Day would help develop the projects, but in a sense it hindered their development for some students, because they appeared to be "burnt out" of working on environmental issues.

At times, I did not perceive many of the students' activities as action-oriented or particularly empowering—videos, stickers, etc., although I later came to appreciate how they developed and see the inherent value in the students being able to act out their own choices, even if it was not what I had envisioned.

The timing of the project was extremely difficult and challenging from my perspective, both in duration and scheduling during the school year. Time felt very short since we only had approximately one month to work on the project. Then, the month that we had to work on the project was also the last month of the school year—this proved to be especially difficult for eighth graders, many of whom had already mentally moved on to high school, while physically being required to take high school assignments. This also created logistical difficulties—scheduling, permissions, approvals, end-of-the-school-year activities. Partly as a result of the timing and my own schedule at the school, I felt that some of the relationships with students and parents were strained and difficult for me personally.

Finally, my perceived need to be an expert in all science content and all types of technology in less than a month while at the same time merging student interest into existing curriculum structure and situating the experience in my own value and belief systems (as well as student value and belief systems and school and district belief systems) was extremely challenging. I found the curriculum requirements, as well as the school's "required" activities to be particularly challenging. This generated a larger question for me: What is the intersection of my values and beliefs and this teaching practice?

An analysis of how I worked within these restrictions and challenges is a part of what this study is about. I will discuss these challenges in more detail in Chapter 5, especially in regards to their implications for future practice.

Summary and Foreshadowing

In this chapter, I presented my insights from the quantitative and qualitative data. This included a summary description of the projects' development, including the planning and progression of classroom activities and an overview of students' activities. I also presented a quantitative analysis of MSELI Survey. Then, I reviewed the qualitative data in detail through a detailed description of the projects' development, including a description of the context, pedagogy, teaching practice and reflection, vignettes of student groups, insights from the student and teacher interviews, and qualitative surveys. Finally, I will review emerging ideas and insights of the data collectively, and summarize the ideas presented in the chapter.

A summary of emerging insights discussed in this chapter are described below.

Student Experience

First, students from both classes, and individually experienced the projects very differently. This is apparent throughout the data sources, summarized further below:

Two subsections (out of six) had significant differences for the eighth grade scores. Part 1-Part A: Knowledge was significant with $p<.013$. Part 2-Section 2: Issue Analysis Component was significant with $p<.004$.

The issue analysis activity revealed that some seventh grade students (10) and eighth grade students (7) clearly described cause and effect as related to their issue(s) through a direct cause/effect relationship or a question. Conceptual categories related to

the students' identification of environmental issues included issues of pollution, climate change, recycling, population, animals, and resource conservation. This activity revealed the polarities through which most of the students perceived environmental issues. Overall, students described both the issues and the person or group involved in the issues in opposites, as "good" or "bad".

The project vignettes showed that all 14 projects could be organized under three general activity structures—local outdoor action, educating individuals on issues and actions, and lobbying government or large groups to take action. Specific activities included planting, video, bumper stickers, websites, compact disc (music), petitions, and letters to congresspersons. Finally, content areas were organized as native plants and habitats, how to plant a tree, cleaning/environmental pollution, environmental issues in community, recycling, endangered animals, habitat protection, power sources, global warming, and ending growth hormones-dairy cow.

The interviews revealed a number of findings including that:

1. "Research" is an important component of action projects from the perspective of the students interviewed
2. Students learned varying types and depth of content knowledge.
3. Most students interviewed reflected on helping the environment indirectly. (One student who reported on helping the environment directly was able to remember many details of her project and content learned.)
4. Students' actions before completing the project varied.
5. Students' actions reported after completing the project also varied; however, this time all students reported some kind of action.

6. The most common connections made between the environmental action projects and to other activities were to the school's Green Day, and planting activities.
7. Most students recommended that other students complete "research" before taking actions or completing the project. One student suggested more "sample" activities as a class.
8. Most students reported from their perspective that the project was "fun" and allowed them to be "independent." Two students reported feeling confused at certain points.
9. Most students (five) reported that they would like to continue on the same topic if they were to complete another environmental action project in the future. Two students suggested learning more about different topics.
10. Three students reported on the importance of working on something "big" and tried to explain this. They also explained the influence of media and culture on their ideas.

The qualitative survey revealed:

For question one,

- in the pre-test, when students answered "yes", recycling and picking up litter were the most common ways of "helping" reported by students. Planting, energy use, and alternative transportation (from cars) were also mentioned.
- Students who answered "no" in both the pre and post test explain either why they do not help the environment through their actions, or what actions they do not take to help the environment, that they would perceive as being beneficial.

- In the post-test, students who answered “yes” continued to describe recycling and picking up litter as environmental actions; some students also reported on additional project actions.

For question two,

- More students indicated “Yes” in the pre-test than in the post-test in both classes. Although, I am not claiming the numbers in this survey are statistically significant, one possible interpretation of the decrease in “yes” responses is that after completing the projects, students came to perceive that they had “done enough” (as one student wrote).
- In the post-test, students who responded “yes” often related their positive additional actions to their projects or other students’ projects. Some students also indicated “yes” with the explanation that they could do more, because their current actions are limited.
- In the post-test, students who responded “no” often did so because they believed they were already doing enough, specifically through the actions of their projects. Additional reasons for answering “no” included feeling that it was not their “job” and that others, especially adults should be doing more to help:

For question three,

- Overall, most students reported the same answer in both the pre-test and post-test. In eighth grade this was most pronounced with only one student changing her answer, from No to Yes. In the seventh grade class, four students changed from Yes to No and five students changed from No to Yes, while one student changed from No to “Yes and No”. The most common reason for changing from no to yes

was that one individual could influence others' actions and therefore make an individual difference. The most common reason for changing from yes to no is that it takes a group of people to create changes and therefore one person cannot really make a difference alone.

- This question in particular provides insights on how the students experience their role, individually and collectively, in environmental action projects and whether or not the projects are related to student empowerment. Perhaps feeling as though they can make a difference as part of a group is also a form of empowerment. In the context of these group projects, this is an interesting finding—that many students saw themselves as possibly effective, but only as a member of a larger group. One eighth grade student describes this perspective distinctly and adds the common student conception of "indirect" action as informing others: "I don't think one person can make a difference in the environment directly [underline in original quote]. However, I think if they shared their idea with multiple people, then as a group they could make a difference." Would students have responded differently if they had completed individual action projects?

Teacher Experience

My journal revealed several new understandings concerning the student experience, including, 1.) students often chose the activity the wished to complete first—video, website, CD, 2.) the development ended up breaking down into three somewhat distinct phases—idea conceptualization, background research, and action component, 3.) project activities and breakdown, 4.) in this context, many of the students had been

overwhelmed with environmental messages perhaps through previous experiences, both at school (such as the Green Day) and outside school, and 5.) the need to distinguish between activity and issue.

All three of the teachers interviewed agreed that environmental action projects were important and meaningful and described reasons or positive experiences they have had completing them with students. However, they did not see strong connections, if any, between the 7th and 8th grade science curriculum and the environmental action projects in the county curriculum.

In the upcoming chapter, I discuss the insights as related to my research questions and philosophical assumptions. As part of this discussion, I relate and reflect on commonalities between students and my experience, such as outlined below.

Teacher and Student Experience—Next Section

Some experiences were common and related for both teachers and students. In the next section I will discuss the conclusions that students and teachers often have parallel or connected experiences especially as related to empowerment and that experience, values, beliefs, a sense of place, and feelings of empowerment are connected.

In addition, in Chapter Five, I will discuss insights, an examination of how I addressed philosophical assumptions in the study, implications of the study, and suggestions for future research.

CHAPTER FIVE: DISCUSSION, IMPLICATIONS, AND FUTURE RESEARCH

In this chapter, I present insights and examine how I addressed philosophical assumptions in the study, implications of the study, and suggestions for future research. Continuing to reflect on the insights, I found that some experiences were common and related for both teachers and students. I discuss the conclusions that students and teachers often have parallel or connected experiences especially as related to empowerment and that experience, values, beliefs, a sense of place, and feelings of empowerment are connected. These connections have implications for critical pedagogy practice in particular.

Processes Involved for Teachers and Students in Designing an Action Project

Both I, as the teacher researcher, and my middle school students completed cycles of activity design (planning), observation, reflection, and new action in the development of the environmental action projects. At the beginning of the development process, my students and I identified 2 distinctive areas of project development: topic content and action content. After this distinction and realization, students developed their own original research questions based on both topic and action and completed research and took action accordingly. My students and I both reflected on the importance of background research in developing the projects. The students expressed many views related to the projects' development, including motivation to work on a topic and action that interested them personally, confusion on what topic to choose, and apathy towards working on the projects in general. I reflected on the time intensive nature of the project and the difficulty reaching every student in the process.

The development of the projects increased communication, cooperation, and tensions—both in the classroom and larger school community. Communication and cooperation in the classroom and larger school community improved my sense of place, while the tensions between my values and my perceived sense of other community members' values further divided me from the place. In a sense then, these were opposing experiences from my perspective.

Communication

The project facilitated more communication between me and other school staff, as well as between me and students, and between students and students:

- Email communication greatly increased. This occurred between me and other teachers facilitating environmental events at school; between the librarian and me in terms of student research topics; between me, other teachers, and other students to obtain needed supplies and equipment; between the principal and students in which students communicated their ideas or asked for permission to complete projects; between students, and between students and me for information, e.g. related to group project information, plants to purchase, final reports, and group websites.
- Students stayed after school and came in during lunch periods: three student groups worked during lunch and after school on their projects.

Cooperation

The increase in communication was perhaps related to the increase in cooperation necessary for the development of the projects. Like communication, it required students to work together, as well as teachers and students, teachers and parents, teachers and

teachers, and teachers and administration. The increase in cooperation was one positive outcome of the environmental action projects, which required students to work together and with adults towards common goals. The specific development of the projects, however, is more complicated in the types of cooperation it requires. Similar to communication, there are many dimensions involved. The social climate and culture of middle school influenced the types of cooperation that were successful.

Tensions

Tensions, in general were related to both student and teacher empowerment or struggles to find personal voice in the system and culture of schooling. As more people both communicated and cooperated in the classroom and school community, the following tensions also arose:

- Pedagogical structure and student choice
- What "counts" as environmental action? [This was a tension in the sense of which projects to "approve" as appropriate.]
- Beliefs—classroom teacher, school community, students—influence feelings of empowerment and disempowerment for both teachers and students
- Some students reported that they either did not feel capable or did not believe it was their role to improve environmental conditions

Students' Development of Literacy and Other Content Skills

Interdisciplinary Content Skills

My students developed varying understanding of interdisciplinary knowledge to complete projects, particularly related to their topical research— including literacy, science, technology, math and social studies. Students sometimes learned from others;

while many students stressed the importance of teaching others. The variety of project topics led to a diverse variety of understandings.

Further, all the students who were interviewed, both at the conclusion of the project in June 2005, and in June 2006 described content knowledge they had learned as part of the project. Each of these students emphasized the need to conduct "research" on relevant topics to complete their action projects successfully. Another interesting result was the content specific details students reported one year after completing the projects (e.g. types of plants that are native to Maryland, number of trees saved by recycling one ton of paper, reasons for recycling, reasons certain species are endangered).

Technological literacy, general (reading and writing), and environmental literacy were particularly strong areas of literacy development. This was similar to the finding by Volk and Cheak (2003) who also found increases in these three areas of literacy development. A difference, in the description of the projects studied here, is that students more fully used technology as part of the action rather than as a tool to learn about a specific issue or action.

Students' Environmental Action Beliefs and Perceived Knowledge

Students varied in their perceptions of their capability and desire to take action—this may be related to the type of project they completed (e.g., educational/informative and identified by students as "indirect"), and the duration of this particular study (1 month). Grade eight students showed significant changes in their perceived knowledge of environmental action content and their understanding of environmental issue analysis. A major focus of the projects was on developing content knowledge through background research. Students also completed an issue analysis of their project topics, both of which

may have led to these significant changes in perception and understanding over the course of the project. The seventh grade students did not show any significant changes through quantitative testing. However, as evidenced by the qualitative data, including written surveys and interviews, these students may have experienced other changes over the course of the project, not reflected in the MSELI results. These changes included new actions the students participated in, as well as their described awareness of new possible actions. Students in seventh grade experienced more changes in their perception of whether one person has the ability to make a difference in environmental improvement. For seventh grade students especially, however, the short duration of the projects may not have been long enough for them to reflect on and change previously held beliefs on their perceived knowledge of environmental actions and their ability to analyze environmental issues. Students from both classes showed evidence that they understood their particular groups' project actions, but they were not necessarily able to apply this specific understanding to new environmental action topics.

Students' environmental actions reported before completing the project varied. Students' actions reported after completing the project also varied; however, this time more students reported some kind of action. Most students reflected on helping the environment indirectly (e.g. educating others about environmental conditions or ways to help). Students who reported on helping the environment directly were able to remember more details of their project and content learned one year post. It is not clear to me if there was a relationship between the students' belief that they could make a difference or, and how they identified their project (direct or indirect action). It is not clear if all of the students made this type of distinction but a few of the students did mention this concept

in interviews and surveys. A question for future research might be do students express different perspectives on empowerment related to the way in which they identify their project or action?

When asked what type of project they would work on if given a similar assignment in the future, most students reported that they would like to continue on the same topic. This creates an interesting scenario for teachers that are interested in both student choice and the development of students' content knowledge and feelings of empowerment. Overall, students chose project topics that they were most familiar with or that they had the most background/prior knowledge in. How can teachers help students learn and choose new topics while giving them a choice? Mordock and Krasny (2001) also discuss this tension in their studies of middle school students participating in environmental action projects. One suggestion is provide choices for the students concerning topics they are interested in. I would also suggest engaging students in additional exploratory activities dealing with topics that are new to them before asking them to choose and develop environmental action projects. In this way, if teachers have ideas about important environmental issues in the community, they can allow students to develop prior knowledge in these new areas, before going on to take action. This would necessitate more time spent on the projects, and I would suggest that at least a year would be needed for this type of model.

Connections Between Action and Place-Based Learning and Required Curricula

In connecting action and place-based learning to required curriculum, teacher perspective is a factor. Three teachers interviewed from sixth, seventh, and eighth grade believed environmental action projects were meaningful experiences for students, but did

not see strong connections between environmental action projects and the specific seventh and eighth grade curriculum of this particular district. As a seventh and eighth grade science teacher, I did see curricular connections—through the study of living things (7th) and earth systems (8th) (as outlined in Chapter Four).

I also saw and experienced tensions between the environmental action projects and school-based activities—dissection (7th) and other pre-scripted activities (8th). These tensions were both related to my perspective on the goals of the projects and my interpretation of the goals of the curriculum in general.

Action projects and place-based projects did not fit naturally into high stakes testing environment as well, in this context. While administration was very supportive of my teaching in general, and I did complete open inquiry projects with the students in the early fall of the school year, I was given permission to complete these particular projects, as long as testing was over (in March). I did not receive permission from the larger district to complete the projects until mid-May, leaving me very little time to work on them with the students.

While the projects do offer students a chance for a differentiated learning experience, I do argue that the projects do follow curriculum guidelines for local, state, and national science curriculum (see Appendix A and B). Additionally, as related to environmental literacy, they are multidisciplinary so students can gain skills in several content areas, as seen in this study, including general literacy and technological literacy. This project also increased students' skills in critical thinking. Other researchers have also reported similar gains in literacy (Volk and Cheak, 2003; Ramsey and Hungerford, 1989; Greenall Robottom, 1993; Sobel, 2004). The multidisciplinary nature of the

projects may be one reason that elementary schools might be a more amenable setting for the projects.

How Participants Make Sense of a Learning Experience in Which Students Design and Carry Out an Environmental Action Project in Their Community

As a teacher researcher, I found that my values as a teacher played a role in the progression and topics of the projects. My perspective on the goals of the environmental action projects and the county curriculum objectives both fit with and conflicted with cultural conditions at the school.

Different student participants made sense of this experience in different ways, specifically regarding their understanding of environmental action and issue analysis content, perceptions concerning their understanding of environmental action knowledge, changes to their life style, the development of new views, and participation in environmental actions.

The variation in experiences could be due to a number of factors, including, but not limited to, the individual student's prior experiences, personal belief and value systems, choice of project, perceived success in completing the project, and ability to work successfully as member in their chosen group. More research is needed in this area.

Critical Pedagogy: Connections between Student and Teacher Experience

In this section, I review connections between student and teacher experience completing the project. Experiences related to feelings of place, empowerment, choice, structure, and community seemed to be particularly connected. These connected experiences informed the development of critical pedagogy I described earlier in Chapter Two and will now reflect back on through this particular study.

Experience, values, beliefs, a sense of place, and feelings of empowerment are connected. Students and teachers often have parallel or connected experiences especially as related to empowerment.

The development of experiences within this project were closely tied to both student and teacher values, beliefs, a sense of place, and feelings of empowerment. I was surprised to find certain similarities and parallels between student and teacher experiences. Issues of empowerment for students and teachers perhaps grow from each individual's perception of place, or their role in a particular place. I began this study interested in studying constructs of power and how they can be critically examined in the classroom. I recognized that I carried a position of power. I was not expecting to question my position of power as much as I did through out the study. In other words, I often questioned what role of power I had within the larger school community and school system. I do not mean this in a derogatory or negative way, but simply I came to question what role I should play in empowering students within the larger educational system. I did often feel powerless in my position, however, in my uncertainty as to what was an acceptable method of teaching in this setting. I constantly questioned if what I was doing was accepted by both the school community and larger district.

I think or speculate that students, too, might have questioned what was expected from them, not so much in my classroom, as in their larger educational experiences as a whole. I tried to clarify their experiences in our classroom through discussions, adding additional structure to assignments, creating specific rubrics and giving examples. As in previous experiences, however, they were used to working on the same activities on the same days as students in other classes. I think they often found it unsettling that we were

completing these projects and other classes weren't. Of course, this was a concern in a larger school that had multiple class sections in the same grade (four science teachers in each grade), and I had not experienced the students' perception of this cultural disconnect before. I also felt disconnected from what the other teachers were doing, and felt that they were confused as to why I was conducting my classes in the way that I was.

Student responses revealed a contradiction in that they were both empowered and disempowered during this experience. I, too, felt both empowered and disempowered in my roles. I am still trying to make sense of this area of complexity but believe it may be related to a number of inter-related factors including place or context, power, perspective of power role or authority, positionality, values and beliefs, voice, and ways of knowing, as discussed by a number of researchers concerning critical pedagogy (Lather; Freire; Maher & Tetrault; Tarule; and Gore). Students varying experiences in empowerment may also be linked to the personal relevancy of the environmental topic. That is, if students were personally interested and invested in the topic and action, they may have also believed that they were making a greater difference, because it was something that they cared about. Students revealed a range of perspectives on their conceptions of the "environment" and this can have implications on the types of projects they choose and their overall experience in the project, particularly related to empowerment.

Situating context, power and positionality within environmental action projects.

Environmental action projects are a model for democratic education and teaching for social responsibility, with the ultimate goal of "empowerment" given by Hungerford and Volk (1990). Power plays out in many ways in the context of environmental action project and roles of power in the classroom are important in understanding the meanings

students develop from the process of designing their own project. Through designing an environmental action project with students, I found that my role as teacher included many types of power, perhaps most importantly referent power or being receptive, open, and approachable to students and their ideas. I also found that students structure power roles among themselves when working in cooperative groups and in a whole classroom setting, which can have effects on the learning and performance of all students in the classroom. These student and teacher power roles affect the atmosphere and make-up of the structure of the entire classroom's power in the system of the school and even district. By classroom power I mean the collective power of the students to make a difference in the community and as a part of the school. The power roles of the students are related to their feelings of empowerment in the community as individuals, groups, part of the class, and community. I believe that the environmental action project led to some feelings of empowerment and ownership from the students' perspective, especially as related to feelings of empowerment as part of a group. Many students expressed that they thought they could make a difference either as a member of group or that they could influence other people who could make a difference. An unexpected finding was the number of students who reported that they felt one person could not make a difference because "more than one person is needed." This implies to me that for some students the environmental action project led them to development of a group local of control, but not necessarily an individual locus of control. However, this result was not across the board. Some other students expressed a strong individual locus of control which underscores how the development of a locus of control, both individual and group, is complex.

Coming back to the metaphor of the students' and my journey hiking in the

woods, this was an experience where we learned about listening to each other in a context that we were familiar with, but had not been in completely. We had some ideas of what to expect, but had to be open to new experiences and challenges as they arose. It was interesting to see that some students shared their voices louder than others, but when asked, all agreed that their opinion had been included. Even though different groups of students were interested in looking at different ideas along the journey, it was necessary for me as the guide to provide some general structure for everyone to follow, as in the planning guide, to provide safety and security to all.

This study is a case study that examined the importance of power in environmental education or other types of education that are teaching for social responsibility and democratic learning. There are many subtle implications of the use of power on the teachers' part that teachers should be aware. For example, the type and amount of power that teachers use can play a large role on how students perceive a topic or project. Student power roles and their hierarchy in the classroom also have an impact on the outcome of a project and need to be looked at carefully by teachers to understand how each student engages in a learning experience. A student's role of power can also influence his or her feelings of empowerment in the classroom community, the larger community, and relationship with others.

The teacher's role of power is important in this context of developing students' responsibility and ownership. Students look to the teacher for expert and referent power in several ways. In other words, on our journey to design this project, I am leading the hike, even if I ask for others' opinions along the way. I am responsible for the structure and guidance on the trip and the students look to me for these things.

My first issuance of power began when I asked the students to start the project and I designed a survey for them to complete (see Appendix F.) This could be called both legitimate power and referent because I told them to do it and I wanted to know their opinions. Legitimate power is a type of power used as one's position of power. For example, "You should complete the assignment because I am the teacher and I told you to do it" (O'Hair & Blasé, 1992). Next, I organized the students into small discussion groups of four students each and asked them to share their ideas in pairs and with the group. Again, I was using legitimate and referent power. My goals for these groups were for every student in the class to have an opportunity to talk and I wanted to show that I was receptive to hearing each student's idea. I felt we needed to establish this as a community after completing the previous project in the fall, and I felt as though we established these initial goals.

During these small group discussions, it also became apparent that asking students questions leaded them in their thinking. By asking questions, I could direct them where I wanted them to go, just as if we were on a hike. Questions such as, "Where?," "Do you have a similar idea?," and "How can we do it?" were questions that predominated the discussion. I also guided the discussion by choosing specific students to call on and ask questions. I believe that my role of power was most apparent during the whole class discussions.

Philosophical Assumptions

In Chapter Three, I addressed and briefly reviewed several philosophical assumptions I made in this study. As a way of further the discussion of the study, I will review how these assumptions played out in the study. Axiological and rhetorical assumptions were particularly relevant. Please see Table 16 below for a summary of these assumptions.

Table 16: Philosophical Assumptions of Study

Assumption	How do I address?
Ontological	There are multiple realities, so I attempt to understand various viewpoints around environmental action projects: • Student interviews, written work, oral discussion • Community member discussions—parents, local officials • Other professional interviews and surveys—teachers, administrators
Epistemological	I have a collaborative relationship with the students in facilitating their design of a project that improves their community. I am interested in our relationships in this process, and issues of power in the classroom.
Axiological	This research is value-laden in that I approach the study with the orientation that there is a need for environmental action by students in the community. I have to work through issues of my own values and their impact on my relationship with others in the study and the research as a whole. Students, community

	members, and other educational professionals also have value perspectives that are included in the study.
Rhetorical	Since this involves research on my own teaching, my own voice is an important part of the study, and includes narrative about my experiences within the study. I kept a researcher/teacher journal that including narrative and personal writing.
Methodological	As a case study of critical participatory action research, I begin the process of the research with broad questions about what it means for students and community members to participate in environmental action. As the study proceeds, my questions become more specific depending on the emergent data. I develop theories from the data in an inductive way.

Ontological Assumptions

There are multiple realities within this research project and I have attempted to give voice to a variety of participants within this study. Students were especially important participants and each student brought with them their own personal reality and understandings. They also developed their own individual meanings from the project which was related to the individualized and differentiated nature of the project. Through this project, I have sought to give both individual students and groups of students voice, including through multiple data sources. I have also included my voice in the study as one of the multiple realities presented within this context.

There were multiple realities outside of the classroom, including the larger school community, and district community. I attempted to situate parts of the emerging ideas and discussion within these different frameworks. Each of the participants actual brought several realities to the study when considering that we each have multiple positionalities within the life experience described here.

Epistemological Assumptions

My epistemological assumptions stemmed from my relationships with students in the classroom, as well as other staff and community members. Similar to the ontological assumptions, I recognized the various postionalities the students and myself had within the school and community. This led to my particular interest in examining power and empowerment for the participants.

Axiological Assumptions

My axiological assumptions are based in the values I bring to this study. To address these values specifically concerning environmental action, I attempted to be open with others in the community about my beliefs, as well as open to listening and presenting others' values and points of view. My strong beliefs and values on one of the major topics of the study—environmental action—both made my commitment to the study stronger and the challenges often greater, because I was so vested in the topic. It was often difficult for me when others, including students, had juxtaposing view points, but this was part of the experience I wished to study. I was open with the students and other participants in the study, and I also asked them to be open with me and each other concerning their values and belief systems. It did seem at times that this was unusual for the students and other participants in the study. They often seemed surprised that I would

share what I thought about something. I questioned myself what values are accepted to be shared within the community? I have come to believe this has limits, but what they harder to define. I wanted to students to critically analyze ideas and come to develop their own values. But at the same time, I wanted to create an atmosphere where students were comfortable exploring these ideas. I found this to be a somewhat difficult balance to achieve.

Rhetorical Assumptions

As a participatory action researcher, my voice is an important part of this study and its findings. I constructed a variety of data to present my voice as one of many, including my researcher journal. My voice is found throughout the pedagogy of the study, including the activity development and choice of activities, how I interpreted various levels of curriculum, and my interactions with the participants, including in observations as well as interviews. Not only is my voice found throughout the data, but it is also found throughout the analysis. I have interpreted all my findings though my own perspective which I have attempted to begin to identify through selective personal and professional experiences in Chapter One. Other researchers completing a similar study would have different experiences and conclusions because they would be coming from a different position, perspective, reality, and context. I hope that I have described the study in enough detail to allow others to make interpretations through their own points of view.

Methodological Assumptions

My methodological assumptions are based on the theoretical and practical perspectives of critical theory and participatory action research. The research questions, my approach to answering them, and ultimately my interpretations are based on the

perspective that research can be participatory, can challenge current structures, and can explore changes both for individuals, groups of people, and larger social entities. I have therefore interpreted the data and have written the paper through the lens of a critical social perspective that embraces the ideas of critical theory, namely seeking to give voice to people that have not traditionally believed they have a voice. I have looked at ways that different positionalities also challenge participants to understand their worlds.

Implications

I believe that due to the rigor and care I have demonstrated in my empirically rich and in situ study that this study has implications for other educators, particularly those interested in student-centered environmental action projects and democratic education models. My study is limited by being a single case study of and by one teacher doing action research. I do not claim that these results would happen in a different setting or context. Nonetheless, I do argue that there are some translatable features of this study that have some broader implications for other teachers and education.

First, environmental action projects can provide a context for students and teachers to learn interdisciplinary content knowledge, understand and develop personal beliefs, and learn ways to take action in their communities. This educational context has the potential to increase cooperation, communication, and tensions within classroom and school communities. In addition, students' participation in the development of environmental action projects may, but does not necessarily lead to feelings of empowerment or being able to make a difference in their community, as an individual or member of a group. Future research is needed to discern why individual students experience this type of educational experience differently.

Another implication is that teachers should be aware of how power plays out in their classrooms in a context such as described here, how they use it, and how students respond to their use of power. The balance between structure and choice in the classroom can create contradictions as teachers and students agree that they want to be able to make choices in the classroom but need structure within which to make these choices. Teachers' use of power in this context does not mean only coercive or reward power but can be subtle in the case of referent power. Students often need to understand that the teacher is receptive to their ideas and is willing to help them structure their learning. From this project, for example, I wanted the students to be able to design their project and journey on their own, but this did not mean without my assistance. Students often needed structure to get them started on the project. Many students are not used to learning in this way, and this structure was very important especially in the beginning of a project. This structure can be scaffolded and later eased up, so that the students become more responsible for designing parts of the planning structure. For example, if I was to have students do another environmental action project in this class, I would ask them to develop the student planning sheets with some general guidelines that need to be included. In this way, the balance between student choice and structure was a very important component of these projects' development.

Another major implication that I feel is important is that strategies need to be in place to involve all students in all types of learning. I attempted this through asking for every student's opinion on surveys, having small group discussions, using think-pair-share, asking students to choose a project that they were interested in, and coming up with a structure in which all students had to complete a "job" in the project. At the same

time, the teacher needs to be aware that some students who are more invested or interested in the project may take a natural lead in group and classroom settings.

An implication for building students' feelings of power in the classroom is to provide activities and resources that increase their background knowledge and experiences on a topic. In this instance, the students had participated in a number of environmental activities throughout the year that developed their knowledge. For Earth Day, the students also participated in the Earth Day Groceries Project where they decorated bags with environmental messages and poems to be given out to customers at the grocery store. Eighth graders participated in classwide Green Day at the school in the spring.

Developing environmental action projects in the classroom is one way to empower students to positively influence their community or world, to involve students in a service learning opportunity, to teach responsible action and citizenship, and to apply knowledge and learning to a "real world" context. However, an implication of this study is the complexity embedded in the development of empowerment. In this particular study, a higher number of students reported feelings of a group locus of control than an individual locus of control. This has implications in for others completing similar projects. An important possibility of working on environmental action projects is that students develop a stronger classroom community and strategies for working with others.

There are also some major implications regarding literacy, particularly literacy related to technology, reading and writing, and environmental literacy. This has implications that environmental action projects can provide an open-ended interdisciplinary pedagogical model in which students not only learn strategies to take

positive actions in their community, but also learn important content skills related to required curricula.

Questions for Future Research

While I end my study of my science teaching practice as represented in this report, future questions spring to mind that may build on my insights. Questions for future research include: 1) How does the type of environmental action project students develop influence their perceptions related to personal empowerment? 2) Why do some students develop the skills and desire to take action, while others do not, in the same program? 3) How do teachers and students understand and manage conflict between cultural norms of school-based curriculum and personal belief systems?

A few dilemmas arose in this study related to future questions as well. I planned this study with the goal to look more closely at the meanings students make from designing environmental action projects. What I came to find out is how critical the teacher researcher's role is in the direction of the study and project. I could not separate out my role in the study. In this sense, it became hard to look myself critically and see myself clearly in the process. At different points in the study, I was not always sure the best way to proceed, and knew that someone else might have chosen a different route on the path through the trees. I also found myself looking back in the forest and seeing a different way I could have led the students. It was hard to decide which way to lead students, especially when I thought their chosen path might not be particularly interesting for them in the end. This personal reflection and looking back really encourages the need for future questions and research.

Based on this reflection, additional future questions could include, how do other

teacher "guides" use their power and how do other students' power roles develop and intertwine? More broadly, how does power affect learning [in environmental education]? How do teachers and students develop roles of power in an environmental education classroom setting? How do other teachers ensure that all students are active participants in learning in an environmental education classroom? Why and how is the model of environmental action projects important for student empowerment? More closely, how does student empowerment develop, and what causes students to be more involved in their own communities? How do students' original understandings and conception of the "environment" influence their choice of project and their overall experience developing these types of projects? How can students learn to understand that they can influence the world around them in positive ways?

Students' interest in participating in technological activities and their resulting development of technological skills especially has implications for future research. What amount of technical knowledge is needed by teachers? Why did students feel most comfortable choosing content topics they were familiar with, but motivated to try out new types of technology they had not used? What implications does technology have on place-based education and topics of relevancy for students? How are technical topics connected to place-based topics? How do students use technology to communicate? How do students situate technology as part of the environment—do they see it is helping or hurting the environment (or neither)?

Hope, Possibility, and Critical Pedagogy in a Complex World

As I conclude this paper, I feel as though these thoughts are one beginning. There is much I still need to explore. Many of the tensions explored here feel infinite. But as I

end these thoughts for now, I reflect on a personally meaningful quote by Freire, in which he says, "It is in my permanent openness to life that I give myself entirely, my critical thought, my feeling, my curiosity, my desire, all that I am" (p. 119). Sharing these journeys with others will perhaps develop each of our critical consciousness in new ways and improve all of our lives as humans. While the pedagogy presented in this study is complex and with inherent tensions, I have hope that both I and others will be able to continue to explore the possibilities and impossibilities of critical pedagogy within socially critical environmental perspectives.

Summary

In this chapter, I discussed the insights as situated within each of the research questions, and examined how I addressed philosophical assumptions in the study, implications of the study, and suggestions for future research. Continuing to reflect on the insights, I found that some experiences were common and related for both teachers and students. In this chapter, I discussed the conclusions that students and teachers often have parallel or connected experiences especially as related to empowerment and that experience, values, beliefs, a sense of place, and feelings of empowerment are connected. These connections have implications for critical pedagogy practice in particular.

Related to the processes involved for teachers and students in designing an action project—I discussed that in addition to the activities the students and I developed inductively throughout the project, the development of the projects increased communication, cooperation, and tensions—both in the classroom and larger school community. This created a dichotomy of experiences in which we both found ourselves more connected and disconnected to the community of the school.

Related to literacy or other content skills students use or develop—I discussed students' development of interdisciplinary content skills and perceived action and knowledge beliefs. Students reported and showed growth in content skills specifically related to general, environmental, and technological literacy development. Students perceived the actions they took most often as indirect but sometimes as direct. The students' conception of the type of action may have an influence on their perception of the effectiveness of their action. In some cases (especially the eighth graders) showed that their perceived knowledge about environmental actions had increased after completing the projects.

I discussed how action and place-based learning are connected to required curricula for students in public school and included my view that different teachers perceive curriculum objectives differently. In this case, I found several areas where environmental action projects fit the objectives of local county curriculum. While other teachers interviewed expressed the belief that they thought environmental action projects were important and meaningful, they did not see the same connections to curriculum objectives that I did. Do teacher values and belief influence their interpretations of curriculum documents?

I discussed several areas as related to the overall research question--how do participants make sense of a learning experience in which students design and carry out an environmental action project in their community? Simply stated, I found that different participants (including myself) made sense of this experience in a variety of ways, from increasing their understanding of environmental issues and ways to action to making little gains in their understandings and development related to environmental action. I

attempted to discuss this finding and the overall experiences through looking at the connections between student and teacher experience in a critical pedagogy experience such as this. I discussed the idea that experience, values, beliefs, a sense of place, and feelings of empowerment are connected. Students and teachers often have parallel or connected experiences especially as related to empowerment. At the same time, different individuals may interpret these experiences in different ways. Through the experience, both students and myself worked through feelings related to empowerment and disempowerment. Related to roles of power and positionalities in the classroom, I discussed the idea that power plays out in many ways in the context of environmental action project and roles of power in the classroom are important in understanding the meanings students develop from the process of designing their own project.

Next, I discussed ways in which my philosophical assumptions were a part of the study. Axiological and rhetorical assumptions were particularly relevant to the carrying out and interpretations of this research study.

I also reviewed and discussed several implications related to the study, summarized below:

1. Environmental action projects can provide a context for students and teachers to learn interdisciplinary content knowledge, understand and develop personal beliefs, and learn ways to take action in their communities
2. This educational pedagogy has the potential to increase cooperation, communication, and tensions within classroom and school communities.

3. Students' participation in the development of environmental action projects may, but does not necessarily lead to feelings of empowerment or being able to make a difference in their community, as an individual or member of a group.
4. Teachers should be aware of how power plays out in their classroom in a context such as described here, how they use it, and how students respond to various types of power.
5. Strategies need to be in place to involve all students in all types of learning.
6. An implication for building students' feelings of power in the classroom is to provide activities and resources that increase their background knowledge and experiences on a topic.
7. An implication of this study is the complexity embedded in the development of empowerment. In this particular study, a higher number of students reported feelings of a group locus of control than an individual locus of control. This has implications in for others completing similar projects. An important possibility of working on environmental action projects is that students develop a stronger classroom community and strategies for working with others.
8. Environmental action projects can provide an open-ended interdisciplinary pedagogical model in which students not only learn strategies to take positive actions in their community, but also learn important content skills related to required curricula.

Based on my experience and learning in conducting my study, I presented a number of questions for future research. Recommended future questions for research that related to the overall development of the projects included:

1. How does the type of environmental action project students develop influence their perceptions related to personal empowerment?
2. Why do some students develop the skills and desire to take action, while others do not, in the same program?
3. How do teachers and students understand and manage conflict between cultural norms of school-based curriculum and personal belief systems?

Questions related to students understanding of their place within the environment and therefore their ability to enact change included:

1. How do students' original understandings and conception of the "environment" influence their choice of project and their overall experience developing these types of projects?
2. How can students learn to understand that they can influence the world around them in positive ways?

Questions related to the use of technology within the projects included:

1. What amount of technical knowledge is needed by teachers?
2. Why did students feel most comfortable choosing content topics they were familiar with, but motivated to try out new types of technology they had not used?
3. What implications does technology have on place-based education and topics of relevancy for students?
4. How are technical topics connected to place-based topics?
5. How do students use technology to communicate?
6. How do students situate technology as part of the environment—do they see it is helping or hurting the environment (or neither)?

While the pedagogy presented in this study is complex and with inherent tensions, I have hope that both I and others will be able to continue to explore the possibilities and impossibilities of critical pedagogy within socially critical environmental perspectives.

APPENDICES

Appendix A: Description of National Science Education Standards that support environmental action projects, specifically on stream study and restoration (National Research Council, 1996).

Standards	Descriptions
Teacher Standards	Teaching Standard A: inquiry-based science program
	Teaching Standard D: • use resources outside school • students design learning environment
	Teaching Standard E: • students help decide content and context of their work • students take responsibility for learning of others
Content Standards: Grades 5-8	Science as Inquiry: • Abilities necessary to do scientific inquiry • Understandings about scientific inquiry
	Physical Science: • Properties and changes of properties in matter • Motions and forces • Transfer of energy
	Life Science: • Structure and function of living systems • Populations and ecosystems • Diversity and adaptations of organisms
	Earth and Space Science: • Structure of the earth system (weathering, erosion, water cycle)
	Science and Technology: • Understandings about science and technology (tools for investigations, inquiry, and analysis)
	Science in Personal and Social Perspectives: • Personal health • Populations, resources, and environments • Natural hazards • Risks and benefits • Science and technology in society
	History and Nature of Science: • Science as a human endeavor • Nature of science
Program Standards	Program Standard B: science should be relevant to students' lives, emphasize student understanding through inquiry, be connected

	with other school subjects.
	Program Standard D: science programs require access to the world beyond the classroom

Appendix B: Possible Project Outline/Ideas: Local Stream Restoration

(Timeline: Dependent on scope of the project and decision-making of participants)
(Based on the "5-E Model" for science learning used in many public school districts, including in this study; Project developed through internship experience with Maryland Department of Natural Resources)

I. Engagement:
   A. Think-Pair-Share with Students: Water/Streams/Watershed: How does water play a role in your life? Why are streams important? What is a watershed? How can you help?
   B. Build a model of watershed to demonstrate how water, etc. runs into streams and the Chesapeake; reaction to the model
   C. Background on stream habitat and water quality; water and nitrogen cycles

II. Exploration: Trip to Local Stream
   A. Explain how scientists use different methods to determine whether a stream is "healthy" (what does it mean to be healthy?)
   B. Before/After Activity: students draw what they think the stream will look like before going and draw what it actually looked like after taking a short trip ("observation walk")
   C. Plan a trip to a local stream to collect data
      1. Explain how to use pre-developed data sheets
      2. Students develop their own data sheet they could use as well (work in groups and share as a class)
      3. Go to stream and collect data about habitat and water quality (similar to data sheets as used by Department of Natural Resources for Maryland's State of the Streams Project)

III. Explanation: Findings
   A. Review findings in groups and as a class
   B. Discuss/brainstorm what could be done to improve the stream
   C. Research restoration projects and impact on:
      1. biodiversity (animals and plants)
      2. different characteristics of streams (pools, glides, riffles)
      3. erosion/buffers
      4. native plants vs. invasive/exotic plants
   D. Decide on restoration projects as a class (maybe work in teams on different projects?) such as:
      1. butterfly gardens (increase habitat for animals)

2. improve grounds keeping: write letters—strip mowing, signs about picking up dog waste, add rain barrels with signs (explore the "why" behind these decisions)
3. improve instream habitat
4. plant native plants as buffers and to increase habitat
5. storm drain stenciling
6. educate others

IV. Extension: Restoration Projects

A. Students work in groups to develop restoration project(s) and materials
B. Students complete restoration projects in field or within school
C. Monitor the stream for improvement

V. Evaluation

A. Explain restoration project they completed to class or others
B. Write letters to local governments explaining what they learned, why it is important, what others can do
C. Students write a booklet explaining to another student/citizen or class how they could assess a stream and restore it
D. students continue to monitor the stream and provide reports

Appendix C: Qualitative Data Planning Matrix

Central question: What are the processes and effects of a teaching method in which students design and carry out an environmental action project in their community from the perspectives of the participants in the study?

What do I need to know?	Why do I need to know this?	What kind of data will answer the question?	Whom do I contact for accesss?	Projected timeline and procedures
What are the processes involved for teachers and students in designing an action project?	To understand the process of developing the projects	Interviews, observations, student work, teacher journals and lesson plans	Parents, other teachers	This would be throughout the study, especially in the early stages of planning
How did this experience of developing environmental action projects influence relationships in the classroom and school community?	To understand and explore the impact of the projects on relationships and community building	Interviews, observations, journals	Parents, community members	This will require mostly a before/after approach to look at changes in relationships
What are the points of difficulty when completing a community action project and what helps students overcome them?	To understand more about the process and what can make projects successful	Interviews, observations	Parents, teachers	Throughout study
What literacy or other interdisciplinary skills did students use or develop?	To understand the nature of students' learning and development	Interviews, observations, student work	Parents, teachers	Throughout study, especially towards end

Appendix D: Timeline for Study (Data Collection)

Activity	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June
Meet with school system, permissions	X										
Organize/reorganize file systems	X			X			X	X		X	
Interview students, teachers, parents, etc.										X	X
Classroom observation										X	X
Gather student work and journals										X	X
Write in researcher/teacher journal									X	X	X
Gather curriculum documents	X	X									
Transcribe interview data										X	X
Analyze interview data										X	X
Transcribe observations										X	X

Analyze student work and journals										X	X
Analyze curriculum documents		X							X	X	X
General report writing		X				X		X	X	X	X

Narrative Timeline

August—January

Getting Organized

At this initial stage, I will meet with administrators in the school system, as necessary, to ensure that I have the needed permissions for the research. I will also develop an organizational file system for the groups involved. I will gather any necessary curriculum documents, analyze them, and make plans specific plans for the curriculum indicators the environmental action projects seek to address. I will begin my researcher/teacher journal about these initial experiences.

May

Initial interviews and observations

At this point, I will conduct my first interviews and observations to look at a beginning point in the study. I plan to interview students, teachers, parents, and other community members as to their views about place-based environmental action projects. I will observe the classroom(s) I am working in and review student work. I will transcribe the interviews and observations and do some initial analysis. I will conduct "before" surveys. I will write about these experiences in my journal.

Intense fieldwork

This period will be the most intense for data collection and fieldwork. During this period, we will plan and begin to conduct our environmental action projects. I will conduct more interviews and observations, as well as gather student work, write in my journal, and engage in the data as I transcribe and begin to review it. We may not finish the environmental action projects during this period, but I will be able to analyze a great deal about the process of developing one.

June

Complete fieldwork, bring some closure to study

During this period, students will complete the action projects for the school year. They may or may not continue them into the summer, or for the next year. I will conduct final interviews, as well as observations, and collect more student work. I will conduct "after" surveys as well. I will continue writing in my journal. I will involve the students and community members in some of the data analysis.

Budget—Costs Approximate

Item	Approximate Cost over 11 months
Travel/driving to site	$200
Photocopying	$100
Print cartridges	$100
Video/audio tapes	$100
Other technical supplies/equipment	$200

Environmental/education supplies	$300
Telephone Bill	$100

Appendix E: IRB Proposal

1) Abstract

The purpose of this study will be to explore the development and effects of an environmental action project within a school community. This study will take the tradition of a case study that uses the framework of participatory action research (Kemmis and McTaggart, 2000). Through this study I wish to question how environmental education can serve as one context of democratic education that empowers students and teaches social responsibility. A central question guiding this study is: What are the processes and effects of a teaching method in which students design and carry out an environmental action project in their community? Subquestions include:

- How is action and place-based learning connected to traditional required curricula in public school, as well as state and national standards?
- What is student empowerment and how does it develop?
- What are the connections between student empowerment and student ownership?
- What types of power and roles are present in a classroom in this setting?
- What are the processes involved for teachers and students in designing an action project?
- What are the points of difficulty when completing a community action project and what helps students overcome them?
- What literacy or other interdisciplinary skills did students use or develop?
- How did the experience of developing environmental action projects influence students' participation in the rest of the school day?

Data will be collected through interviews with students, school staff, and community members, observations, and student work. The students in the study will be protected through confidentiality of all tape recording (code numbers) and names will be changed in transcripts. Participation will be optional and students will sign an assent form if they agree to participate in the study. Student participation in the study will not affect students' grades in the courses. Parents, community members, and school staff will also be provided with a consent form that explains the research project and the voluntary nature describing their possible participation in interviews. Parents will sign consent if they agree that their child can participate in the study, indicating that their identity will be protected and their participation is voluntary.

2) Subject selection

a. Students in 2 middle school classrooms and myself will be the subjects (participants) of the research. They are selected based on their enrollment in a seventh or eighth grade science class at Kingsview Middle School in Germantown, Maryland. Staff members will be asked individually and given the opportunity to participate voluntarily in the study.

b. The students selected are students in the two classes (one seventh, one eighth) I teach at Kingsview Middle School. Staff members will be selected based on the willingness to be interviewed about the study.
c. I chose to ask these students to participate in the study because I hope for the study to be participatory in nature (where I am also a participant as the teacher in the classroom). I will inform the students that I am studying my teaching and their experiences in the classroom, and I may be interviewing them about what they are learning at different times. I will also study their classwork, but their participation in the study will not create extra work outside of what is required in the regular class nor will it effect their grade in any way. I will also include student assent and parent consent forms. The subjects will not be selected for any specific characteristics, other than their enrollment in either seventh or eighth grade science classes that I am currently teaching. The classroom and school the study takes place in support goals of environmental education. The school is planning a "Green Day" to take place on April 28. This study may help meet some of the goals toward the development of this environmental awareness day.

3 Procedures

The actual instruction involved in this study will be partially determined by students. Students and myself will work together to decide what environmental community action project they think would be most valuable and necessary to work on. This study will then describe the processes and effects of the students' involvement in such a project. Environmental action projects meet a number of national standards such as the National Science Program Standards:

- Program Standard B: science should be relevant to students' lives, emphasize student understanding through inquiry, be connected with other school subjects.
- Program Standard D: science programs require access to the world beyond the classroom

Environmental action projects also meet Maryland State Standards in science for grades 5-8 such as:

- Apply scientific principles and/or concepts to understand a new situation.
- Apply concepts and processes of science to take and defend a position relative to science.
- Use the knowledge of science and available scientific equipment to devise a plan to solve a global problem.

An example of an environmental action project we might work on is the restoration of a local stream. An outline for the pedagogy of this type of project is given above (based on the "5-E Model" for science learning used in Maryland; developed through internship experience with Maryland Department of Natural Resources).

Data analysis

Qualitative data will include observations, interviews, and student work. Approximately twenty observations will occur in which the students participating in the environmental project will be videotaped and the videotapes will be transcribed. Videotapes will be kept at the researchers home until the end of the research project and then destroyed. Approximately twenty semi-structured open-ended interviews of students, parents, school staff, and other community members will also be both conducted and transcribed if consent is given.

Protocol and examples of interview questions include:
How has the class' environmental project influenced the community?
What actions do you participate in to help the environment?
Do you participate in any environmental activities in your life related to the school project?

Student classwork will also be analyzed for environmental action content. This qualitative and quantitative data will be analyzed for common patterns and themes related to the students' participation in the action projects. The overall qualitative data (interviews, observations, student work) will be analyzed using open coding procedures as well (Strauss & Corbin, 1998). If appropriate, the data will be further analyzed through coding around the axis of power (since power roles and empowerment are a common connection and fundamental to the research questions). A comparison of individual and mean student scores on an environmental survey at the beginning and end of the study will also be examined for those students willing to participate (Please see attached Environmental Survey). (All students in the class will participate in the surveys and other classwork; data will be used from students whose parents have signed consent. Please see attached Environmental Planning Sheet.) Please see the attached Timeline as well.

Risks and Benefits

There are no known risks to participants in this study. The benefits may be increased awareness of the positive effects of community involvement, student service, voice, and environmental improvement.

Confidentiality

Information from this research will be kept confidential. Students and other participants will not be identified by name in the transcripts or research report (names will be changed). Tapes will be stored by code number at the researcher's home. Electronic copies of transcripts will be stored on the researcher's computer. The researcher will be the only person with access to the data, both hard copies and electronic. The study will take approximately 6 months. Data will be stored in a personal file cabinet and on a computer hard drive at the researcher's home for 3 years

after the study. Hard copy data will then be destroyed via a shredder and electronic data will be erased on the hard drive of the researcher's computer.

Information and Consent Forms

I plan to distribute and collect both student assent forms and parent and staff member consent forms prior to beginning of the study. I will store them in my home until the completion of the study. Information provided to the subjects is disclosed in the attached assent and consent forms. None of the information is deceptive.

Conflict of Interest

No known conflict of interest exists for this study.

HIPAA Compliance

This study is not using protected health information nor are the researchers employed by the University Health Center.

Student Assent Form

Identification of Project/Title	*A Case study of the development of environmental action projects from the framework of participatory action research within two middle school science classes*
Purpose	*The purpose of this study will be to explore the development and effects of an environmental action project within a school community. A central question guiding this study is: What are the processes and effects of a teaching method in which students design and carry out an environmental action project in their community?*
Statement of Age of the Subject	*I state that I am in good physical health, and wish to participate in a program of research being conducted by Dr. J. Randy McGinnis (faculty advisor) and Kim Charmatz (PhD student) in the Department of Curriculum and Instruction at the University of Maryland, College Park.*
Procedures	*I will be studying my teaching over the next several months. I am asking for your permission to be in my study. Your participation in class is required, but your participation in the study is not required. Your participation in the study will in no way impact your grade in the course, and will not require work in addition to the normal coursework. Students will participate in the development of an environmental action project as part of their science course and in conjunction with the school's "Green Day" on April 28. Data will include observations, interviews, and student work. The classrooms participating in the environmental project will be videotaped approximately twenty times for one hour long periods, and these videotapes will be transcribed. Classrooms will be observed and videotaped during activities in which they develop ideas for an environmental action project. Semi-structured open-ended interviews, approximately one-half hour in length, of students, school staff, and other community members will also be conducted and transcribed. One interview question will be: How has the class' environmental project influenced the community? Student classwork, such as planning worksheets, will also be analyzed for environmental action content. Students will be given a survey before and after the completion of the project that includes the question:. Do you think you help the environment of Earth through your actions? This data will be analyzed for common patterns and themes related to the students' participation in the action projects.*
Confidentiality	*Information from this research will be kept confidential. Students and other participants will not be identified by name in the transcripts or research report (names will be changed). I will store tapes and student work by code number at my home. The study will take approximately 6 months. Data will be stored in a personal file cabinet at my home for 3 years afterward and will then be destroyed by a shredder.*
Risks	*Risks to participants are minimal. Participants may experience mild anxiety during an interview.*
Benefits, Freedom to Withdraw, & Ability to Ask Questions	*The benefits may be increased awareness of the benefits of community involvement, student service, voice, and environmental conditions. I am free to ask questions throughout the study. Participants also have the right to withdraw at any time and refuse to answer specific questions.*
Contact Information of Investigators	*Dr. J. Randy McGinnis, Benjamin Building, Rm 2226, University of Maryland College Park, MD 20742 301-405-6234* jmcginni@umd.edu *Kim Charmatz, 301-693-7491* Kcharmat@umd.edu
Contact Information of Institutional Review Board	*If you have any questions about your rights as a research subject or wish to report a research-related injury, please contact Institutional Review Board Office, University of Maryland, College Park, MD 20742; email irb@deans.umd.edu; 301-405-4212*
	Name of student _____ *Signature of student*_____ *Date*_____

Parental Informed Consent Form

Identification of Project/Title	*A Case study of the development of environmental action projects from the framework of participatory action research within two middle school science classes*
Statement of Age of Subject	*Parental Permission: I state that I am 18 years of age or older and give permission for my child to participate in a program of research being conducted by Dr. J. Randy McGinnis (faculty advisor) and Kim Charmatz (PhD student) in the Department of Curriculum and Instruction at the University of Maryland, College Park.*
Purpose	*The purpose of this study will be to explore the development and effects of an environmental action project within a school community. A central question guiding this study is: What are the processes and effects of a teaching method in which students design and carry out an environmental action project in their community?*
Procedures	*Students will participate in the development of an environmental action project as part of their science course and in conjunction with the school's "Green Day" on April 28. Data will include observations, interviews, and student work. The classrooms participating in the environmental project will be videotaped approximately twenty times for one hour long periods, and these videotapes will be transcribed. Classrooms will be observed and videotaped during activities in which they develop ideas for an environmental action project. Semi-structured open-ended interviews, approximately one-half hour in length, of students, school staff, and other community members will also be conducted and transcribed. One interview question will be: How has the class' environmental project influenced the community? Student classwork, such as planning worksheets, will also be analyzed for environmental action content. Students will be given a survey before and after the completion of the project that includes the question:. Do you think you help the environment of Earth through your actions? This data will be analyzed for common patterns and themes related to the students' participation in the action projects.*
Confidentiality	*Information from this research will be kept confidential. Students and other participants will not be identified by name in the transcripts or research report (names will be changed). I will store tapes and student work by code number at my home. The study will take approximately 6 months. Data will be stored in a personal file cabinet at my home for 3 years afterward and will then be destroyed by a shredder.*
Risks	*Risks to participants are minimal. Participants may experience mild anxiety during an interview.*
Benefits, Freedom to Withdraw, & Ability to Ask Questions	*The benefits may be increased awareness of the benefits of community involvement, student service, voice, and environmental conditions. I am free to ask questions throughout the study. Participants also have the right to withdraw at any time and refuse to answer specific questions.*
Contact Information of Investigators	*Dr. J. Randy McGinnis, Benjamin Building, Rm 2226, University of Maryland College Park, MD 20742 301-405-6234* jmcginni@umd.edu *Kim Charmatz, 301-693-7491* Kcharmat@umd.edu
Contact Information of Institutional Review Board	*If you have any questions about your rights as a research subject or wish to report a research-related injury, please contact Institutional Review Board Office, University of Maryland, College Park, MD 20742; email irb@deans.umd.edu; 301-405-4212*
	Name of parent _____ *Signature of parent* _____ *Date*_____

Staff member/Community member Informed Consent Form

Identification of Project/Title	*A Case study of the development of environmental action projects from the framework of participatory action research within two middle school science classes*
Statement of Age of Subject	*I state that I am 18 years of age or older, in good physical health, and wish to participate in a program of research being conducted by Dr. J. Randy McGinnis (faculty advisor) and Kim Charmatz (PhD student) in the Department of Curriculum and Instruction at the University of Maryland, College Park.*
Purpose	*The purpose of this study will be to explore the development and effects of an environmental action project within a school community. A central question guiding this study is: What are the processes and effects of a teaching method in which students design and carry out an environmental action project in their community?*
Procedures	*Students will participate in the development of an environmental action project as part of their science course and in conjunction with the school's "Green Day" on April 28. Data will include observations, interviews, and student work. The classrooms participating in the environmental project will be videotaped approximately twenty times for one hour long periods, and these videotapes will be transcribed. Classrooms will be observed and videotaped during activities in which they develop ideas for an environmental action project. Semi-structured open-ended interviews, approximately one-half hour in length, of students, school staff, and other community members will also be conducted and transcribed. One interview question will be: How has the class' environmental project influenced the community? Student classwork, such as planning worksheets, will also be analyzed for environmental action content. Students will be given a survey before and after the completion of the project that includes the question:. Do you think you help the environment of Earth through your actions? This data will be analyzed for common patterns and themes related to the students' participation in the action projects.*
Confidentiality	*Information from this research will be kept confidential. Students and other participants will not be identified by name in the transcripts or research report (names will be changed). I will store tapes and student work by code number at my home. The study will take approximately 6 months. Data will be stored in a personal file cabinet at my home for 3 years afterward and will then be destroyed by a shredder.*
Risks	*Risks to participants are minimal. Participants may experience mild anxiety during an interview.*
Benefits, Freedom to Withdraw, & Ability to Ask Questions	*The benefits may be increased awareness of the benefits of community involvement, student service, voice, and environmental conditions. I am free to ask questions throughout the study. Participants also have the right to withdraw at any time and refuse to answer specific questions.*
Contact Information of Investigators	*Dr. J. Randy McGinnis, Benjamin Building, Rm 2226, University of Maryland College Park, MD 20742 301-405-6234* jmcginni@umd.edu *Kim Charmatz, Benjamin Building, Rm 2226, University of Maryland College Park, MD 20742 301-693-7491* Kcharmat@umd.edu
Contact Information of Institutional Review Board	*If you have any questions about your rights as a research subject or wish to report a research-related injury, please contact Institutional Review Board Office, University of Maryland, College Park, MD 20742; email irb@deans.umd.edu; 301-405-4212*
	Name of participant _____ *Signature of participant* _____ *Date*_____

Name_____ Date_____

Environmental Survey

1. Do you think you help the environment of Earth through your actions?

Circle one: **YES** **NO**

2. Explain your answer from number 1, using real-life examples. If you circled YES, describe what you do to help the Earth (give any specific activities you do to help). If you circled NO, explain why you do not think you help.

_____

_____

_____

_____

_____

3. Do you think you could do more to help the environment of the Earth?

Circle one: YES NO

4. Explain your answer from number 3, using real-life examples. If you circled YES, describe what else you could do to help the Earth that you are not already doing. If you circled NO, explain why you do not think you can do anything else to help.

_____

_____

_____

_____

_____

4. Do you believe one person can make a difference in helping the environment?

Circle one: YES NO

5. Explain your answer from number 4, using real-life examples.

_____

_____

_____

_____

_____

Names:_____

Environmental Project Planning Sheet

1. What is the goal of your group's project?_____

_____

_____

_____

2. Why or how is it helpful to the community's environment?_____

_____

_____

_____

3. What materials do you need for your project?

   a. _____

   b. _____

   c. _____

   d. _____

   e. _____

   f. _____

   g. _____

   h. _____

   i. _____

   j. _____

4. What tasks or jobs are needed for your project? Each group member should sign out for at least one job in the chart below.

Job	Name of person to complete job	Materials needed to complete job	Date job should be completed

5. What other resources (such as books, environmental websites, or people) can help you complete your project?_____

_____

_____

6. On a separate sheet of paper, design a half page flyer that includes:

   a. A short description of your project (goals)

   b. Why your project is helpful to the community's environment

   c. How other people can be a part or contribute.

   d. A picture to show what your project will look like

Appendix F: Detailed Description of the Projects' Development--Student Activities

Qualitative Survey (Pre and post)

Name_____ Date_____

Environmental Survey

2. Do you think you help the environment of Earth through your actions?

Circle one: **YES** **NO**

2. Explain your answer from number 1, using real-life examples. If you circled YES, describe what you do to help the Earth (give any specific activities you do to help). If you circled NO, explain why you do not think you help.

_____

_____

_____

_____

_____

6. Do you think you could do more to help the environment of the Earth?

Circle one: YES NO

4. Explain your answer from number 3, using real-life examples. If you circled YES, describe what else you could do to help the Earth that you are not already doing. If you circled NO, explain why you do not think you can do anything else to help.

_____

_____

_____

_____

_____

7. Do you believe one person can make a difference in helping the environment?

Circle one: YES NO

8. Explain your answer from number 4, using real-life examples.

_____

_____

_____

_____

_____

Project Questionnaire (Seventh Grade)

Name_____

Study of Living Things: Earth Project

Overarching Enduring Understandings

- Patterns and relationships underlie the systems of the natural and physical world.
- Methods of scientific inquiry involve asking testable questions, making critical observations, conducting controlled experiments, and forming summaries and analyses that often led to further questions.
- The concepts of science are continually modified and expanded based upon new information.
- Science, technology, and engineering impact the course of history, society, culture, politic, economics, the environment, and individual lives.

1. What type of project that helps the Earth (and/or living things on Earth) would you like to work on (can be in the context of our school, local community, or larger world)?

_____

_____

_____

_____

2. What steps would we need to follow to complete your project idea?

_____

_____

_____

_____

3. How does your project help the environment of the school, community, or world? Why do you think it's a good idea?

Project Questionnaire (Eighth Grade)

Name_____
Earth Science: Earth Project: Initial Survey

Enduring Understanding:
Human activities impact the environment and the natural tendency towards balance.
Essential Question:
In what ways have human activities both helped and hindered the Earth's natural balance?
Essential Indicators:
1.8.21 Use the knowledge of science and available scientific equipment to devise a plan to solve a global problem.
1.18.18 Evaluate the application of scientific principles and/or concepts to understand a new situation.

2. What type of project that helps the Earth would you like to work on (can be in the context of our school, local community, or larger world)?

_____

_____

_____

_____

2. What steps would we need to follow to complete your project idea?

_____

_____

_____

_____

4. How does your project help the environment of the school, community, or world? Why do you think it's a good idea?

Possible project topics: Check Off Sheet (Seventh Grade)

Possible Projects Period 6 Name_____

The following are possible project ideas. Please choose an area you would like to work in by circling the number or letter you are interested in. If you have a new idea, please write it in the line below.

1. Planting activities (outdoor)
2. Improving recycling in school and local community
3. Educating others about issues related to earth (trees, recycling, etc.)
    a. Educate others in school and community
    b. Educate/work on project with younger students
    c. Create webpage
4. Fundraising
5. Environment and improving human health
    a. nutrition (investigation of school lunch/organic foods/new food pyramid?)
    b. effects of pollution on human health
    c. effects of pollution on waterways (like Chesapeake Bay)
6. Environment and improving animal life
7. Clean up day at school
8. Composting
9. Other/new idea:_____

Possible project topics: Check Off Sheet (Eighth Grade)

Possible Projects Period 4 Name_____

The following are possible project ideas. Please choose an area you would like to work in by circling the number or letter you are interested in. If you have a new idea, please write it in the line below.

1. Planting activities (outdoor)
2. Improving recycling in school and local community
3. Educating others about issues related to earth
    a. Educational videotape
    b. Bumper stickers
    c. Educate/work on project with younger students
    d. Create webpage
4. Clean up day at school
5. Solar energy/alternative energy project
6. Other—schoolyard/stream activity?
7. Earthquake/volcano tracking activity
8. Composting
9. Other/new idea:_____

Environmental Project Planning Sheet

Names:_____

Environmental Project Planning Sheet

1. What is the goal of your group's project?_____

_____

_____

_____

2. Why or how is it helpful to the community's environment?_____

_____

_____

_____

5. What materials do you need for your project?

k. _____

l. _____

m. _____

n. _____

o. _____

p. _____

q. _____

r. _____

s. _____

t. _____

6. What tasks or jobs are needed for your project? Each group member should sign out for at least one job in the chart below.

Job	Name of person to complete job	Materials needed to complete job	Date job should be completed

5. What other resources (such as books, environmental websites, or people) can help you complete your project?_____

_____

_____

7. On a separate sheet of paper, design a half page flyer that includes:

   e. A short description of your project (goals)

   f. Why your project is helpful to the community's environment

   g. How other people can be a part or contribute.

   h. A picture to show what your project will look like

Steps Needed

Name_____
Group project_____

Steps needed to complete project (deadline June 8/9; presentations June 9/10)
1. _____
2. _____
3. _____
4. _____
5. _____

Materials needed	Possible sources

Questions?

Earth Charter Activity

Name_____ International Earth Charter

Read the Earth Charter brochure with your group. Pay particular attention to the "principles" in the inside.

Which principle or principles do you think your project matches most closely in trying to make a difference? (If you see more than one, it is okay to list them.)

Circle the main principle you think your project matches below:

I. Respect and Care for the Community of Life
II. Ecological Integrity
III. Social and Economic Justice
IV. Democracy, Nonviolence, and Peace

Which numbered principle(s) (#1-16) does your project most closely fit? Name the small letter(s) (a-f) if you can too.

_____
_____
_____

Explain your choice using a description of your project and how you believe it fits the principle or principles.

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

On the back of this paper, draw a slogan and/or picture that you think would be a good representation of the Earth Charter or your project worldwide.

Background Research

Name_____ Date_____

Earth Project Background Research

Mastery Objective: Use scientific ideas to solve an authentic problem.

At this point, you should have an idea about what type of action project you would like to work on that improves environmental conditions. Next, you need to do some background research on the *topic* that will be the focus of your project.

Please answer the following questions, to help you get started, and then we will complete the research.

1. Project activity: Describe the activity or action that you are seeking to complete. (Example: Creating an educational videotape that others in the community and school can learn from.)

_____
_____
_____

2. Project topic: Describe what environmental topic your project will be about. (Example: The effects of lawn fertilizer on the local environment.)

_____
_____
_____

3. Project knowledge: Describe what kind of environmental information you will need to know to complete the project and share what you did with others. (Example: The types of fertilizers that are used in our area and their effects on the environment and people.)

_____
_____
_____
_____
_____
_____

4. Please list five questions related to your topic that you will research to complete your project. (Example: What are the names of fertilizers? How much fertilizer is used on average on lawns in the area? What chemicals make up the fertilizers? How do fertilizers affect life in backyard streams? How do fertilizers affect plants in yards and parks?)

_____

_____
_____
_____
_____

On the following pages, you will be finding and recording answers to these questions using websites and books. You will also record other important information that you find. Finally, you will decide how to use this information to guide your project.

The following websites are permitted for this research. If you know of and would like to use any additional sites, you will need to get teacher approval.

1. Any of the sites on the media center webpage (online encyclopedias, etc.)

2. Environmental Protection Agency: http://www.epa.gov
This page contains a list of topics under the heading "quick finder" that you can click on. You can also click on the link "For kids" on the left hand side, and scroll down the page and click on "for middle school."

3. Environmental Link: http://www.environlink.org
This page contains numerous resources by topic that you can click on to find out more information.

4. Environmental Education Link: http://www.eelink.net
This site contains "Class resources" on the left hand side and you can scroll down to see "environmental education student resources."

5. National Wildlife Federation: http://www.nwf.org
On the right hand side, you can click on "for kids and teens" and "education." This site contains mostly information on wildlife.

Question 1:_____
Related information:_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
Resource(s):_____
_____
Picture (if applies):

Question 2:_____
Related information:_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
Resource(s):_____
_____
Picture (if applies):

Question 3:_____
Related information:_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
Resource(s):_____
_____
Picture (if applies):

Question 4:_____
Related information:_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
Resource(s):_____
_____
Picture (if applies):

Question 5:_____
Related information:_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
Resource(s):_____
_____
Picture (if applies):

Additional important notes:
_____
_____
_____
_____
_____
Resource:_____
Picture:

Additional important notes:
_____
_____
_____
_____
_____
Resource:_____
Picture:

Additional important notes:
_____
_____
_____
_____
_____
Resource:_____
Picture:

Additional important notes:

_____
_____
_____
_____
_____

Resource:_____
Picture:

Please include a paragraph summary of the information you have found related to your topic below.

_____
_____
_____
_____
_____

How do you plan to use this information as part of your action project? Please describe *in detail* how you will use this information in your project below. Please use complete sentences.

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

What additional questions do you still have about your topic?

_____
_____
_____
_____
_____

Finally, what additional resources or materials do you still need to complete your project?

_____
_____

Overview of Earth Project Assessment

Complete surveys/questionnaires (formative) 10 points each
Due in class on day given

Complete background research packet (formative) 50 points
Due Friday, May 26, 2005

Complete action project and show product (summative) 50 points
Due Wednesday, June 8, 2005
(In celebration of Environmental World Day June 5!)

Project presentations to the class (summative) 50 points
Due Friday, June 10, 2005

Earth Project Rubric (Action) 50 points total

Evidence of action activity—your project helps improve the environmental problem or condition in some way	15 points
Background information about the topic—1 page description	15 points
Reflection on project—1 page describing what you learned doing the project and why you think it helped	15 points
References	5 points

Earth Project Presentation Rubric 50 points total

Describe what you did for your project activity, including how it helps	15 points
Describe background information on topic	15 points
Reflection on your project—what others can learn from what you did	15 points
Creativity, neatness, and references included	5 points

Your Project—Issues (Issue Analysis Activity)

Name_____ Date_____

Your Project—The Issues

The topic of your project involves some environmental *issues.* For example, the effect of pollution on water quality (or written as a question, what is the effect of water pollution on water quality?)

Below, list as many environmental issues below as you can, that relate to your project. Try to include a cause and effect for each issue (example of a cause is pollution, and an effect is water quality).

1._____
2._____
3. _____
4. _____
5. _____

People and groups of people are involved in each of these issues. Each of these people has their own beliefs and values related to the issues. (A belief is something that someone holds to be true. A value is the worth placed on something by someone.) Please choose the issue above that you think is most important and write a list of the people or groups involved, and what you think their beliefs and values are.

Issue:_____

Person or group	Belief	Value

At the end of this project, you have a good understanding of your topic and the issues involved. Below, list as many action strategies as you can that you might use to make a difference. These strategies can include activities you did for your project or other ones that you did not complete. Please include as much detail as you can to describe what you or someone else could do to complete these strategies. Please put a star (*) next to those strategies you believe would work the best.

Presentation Notes

Name_____ Date_____

Project Presentations

1. Name of presenters_____
Project action (1 sentence description)_____
_____
Project topic or issue (1 sentence description)_____
_____
How project helps balance of Earth or living things (1 sentence minimum)___
_____
_____

2. Name of presenters_____
Project action (1 sentence description)_____
_____
Project topic or issue (1 sentence description)_____
_____
How project helps balance of Earth or living things (1 sentence minimum)___
_____
_____

3. Name of presenters_____
Project action (1 sentence description)_____
_____
Project topic or issue (1 sentence description)_____
_____
How project helps balance of Earth or living things (1 sentence minimum)___
_____
_____

4. Name of presenters_____
Project action (1 sentence description)_____
_____
Project topic or issue (1 sentence description)_____
_____
How project helps balance of Earth or living things (1 sentence minimum)___
_____
_____

5. Name of presenters_____
Project action (1 sentence description)_____
_____
Project topic or issue (1 sentence description)_____

_____
How project helps balance of Earth or living things (1 sentence minimum)___
_____
_____

6. Name of presenters_____
Project action (1 sentence description)_____
_____
Project topic or issue (1 sentence description)_____
_____
How project helps balance of Earth or living things (1 sentence minimum)___
_____
_____

7. Name of presenters_____
Project action (1 sentence description)_____
_____
Project topic or issue (1 sentence description)_____
_____
How project helps balance of Earth or living things (1 sentence minimum)___
_____
_____

8. Name of presenters_____
Project action (1 sentence description)_____
_____
Project topic or issue (1 sentence description)_____
_____
How project helps balance of Earth or living things (1 sentence minimum)___
_____
_____

Appendix G: Example of Student Interview: Complete Transcript

Dhara (DK) Interview

Interview Note: DK seemed a little nervous at the beginning of the interview. I showed her the written survey I was going to give other students to give her an idea of the types of things we would talk about at the beginning (as I did with each of the students). She wanted to look over them.

DK: Say something like an answer to these questions?

DK: So are you just going to ask me these questions?

KC: Mmhmm. Is that okay? And you can think back to what you did on your website project? Just that kind of stuff. I remember your project was really interesting. So, just first, can you tell me a little bit about what you did, and what you remember?

DK: Okay. I didn't do the whole thing. I didn't make the whole website. So do I just say my part or everything about the website?

KC: Right, because you worked in a group. That's a good question. You can talk about either. Whatever you remember the most. As part of the group, you can talk about what others did too.

DK: I don't know what other people did.

KC: Okay, well you can talk mostly about what you did, and how you thought it fit in. . . .What was the site about? (freewebs.com/helpenvironment)

DK: It was about how to help the environment. Some of the topics were about how to prevent pollution, and about endangered animals. I did the Ethiopian wolf and the black-footed ferret. And someone, I think, did pollution.

KC: Okay, but you stuck with the endangered animals.

DK: I wasn't the only one doing endangered animals. Other people did the red wolf, and the Florida panther, and how to save them.

KC: I thought it was interesting that you guys choose endangered animals and pollution. You just picked that as two ways to help the environment?

DK: Yeah, they're not related but they still have something to do with the environment.

KC: Do you think endangered species and pollution are related at all?

DK: No. Well, pollution could kind of like damage endangered species. I don't know how.

KC: I thought it was interesting. I thought maybe you guys did that on purpose.

DK: Oh, no, we just tried. . .we couldn't think of anything else to help the environment, so we just decided on pollution.

KC: Okay. Do you remember at all why the animals you choose were endangered, or what was causing them to be endangered?

DK: Yeah, because loss of food supply and habitat. They don't have anything to eat. . .but they don't have any, wait, they don't have any prey, but they have lot of predators. That's the same thing with the Ethiopian wolf.

KC: Okay. How do you think you project helped the environment?

DK: We didn't literally do anything. But we made other people realize how bad endangered species are. We let other people know how they could help. And they could probably do something we can't.

KC: What would be an example you or other people could help? . . .
It's okay if you don't remember. . .

DK: There's an organization called recovery program, and they helped reproduce the black-footed ferrets. And so when they reproduced, there's more ferrets and then there's less chances for them to become endangered.

KC: Mmhmm. Okay. And you already talked a little bit about this, is there anything else you learned from completing the projects, your knowledge?

DK: Oh, we also did something about recycling. And how recycling would also help pollution, to become less. Because if you don't recycle, then you would need to cut down more trees, and that would cause more pollution. So, if you recycle, then you could just use the same paper over and over again, so you don't need to damage the environment by cutting down more trees.

KC: That's different than the endangered species part. Did you do anything to help the environment before completing the project, like in your own life?

DK: Yeah, I usually plant trees. Um, I go to this organization group, and usually we plant trees, around places, if there's any places to plant trees, we plant it there as much as we can.

KC: That's neat. Like what kind of places?

DK: Um, like fields, empty fields, that have nothing growing in them. We plant trees there.

KC: Wow. And you've been doing that for awhile?

DK: Yeah. Like for 6 months.

KC: You've been doing that the last 6 months?

DK: The 6 months before we did the project.

KC: What's the organization?

DK: Um, it's an Indian organization.

KC: Neat.

DK: I do it for SL hours.

KC: Is there anything you do differently after completing the project?

DK: Mm, well yeah. Like, before, if I had any extra papers that I didn't want I just trashed it. But now, every single paper, that I see, I recycle it.

KC: Do you tell other people also?

DK: Yeah, everyone in my house.

KC: Oh, okay. So you got your family recycling?

DK: Yeah.

KC: Paper or other stuff too?

DK: Mostly paper. And other stuff. Like plastic bags. If we get any plastic bags from the grocery store, instead of just trashing it, we reuse it.

KC: Interesting. I guess that is related to your project. Is there anything else in your life now, related to your project? Anything with animals you researched?

DK: Hmm. Nothing to do with the animals.

KC: Okay, you used what you learned about recycling, and that impacted your life.

DK: Mmhmm.

KC: Okay. Do you see any other connections between what you learned in the project and other classes that you're taking?

DK: Mm.

KC: Any other similarities with other courses you've taken?

DK: Classes in school? Can it also be classes not in school?

KC: Sure.

DK: Cause I go to this other science class, and we usually do scientific stuff there. And so, um, we talk a lot about recycling and pollution.

KC: Really? And that's outside of school?

DK: Yeah.

KC: That's neat. Is that the same group you do the tree planting with?

DK: No, it's a different group. But in the other group too, the science group, we sometimes do tree planting too.

KC: Neat. You started that before we started doing the projects?

DK: Yeah.

[interruption—previous teacher]

KC: So, you do this other thing outside of school? What's that program?

DK: Do you know NIST? It's an "Adventure in Science" class at NIST.

KC: Oh, okay. That's neat. So you learn specifically about pollution and recycling?

DK: No, it's anything about science. But most of the time, not most of the time, but sometimes, we talk how about pollution and recycling could effect the environment. We do projects about it.

KC: Wow, and have they been similar at all to what you did for this project?

DK: Yeah, we talked about endangered species. And we talked what do they do when they recycle, and how they recycle.

KC: And have you done any sort of active things?

DK: Yeah, we went to a recycle center to see how it's done.

KC: And have you done anything to actually help the environment, or taken any action?

DK: Mm, I don't think so.

KC: So it was more learning?

DK: Yeah.

KC: What advice would you give other students doing projects like this?

DK: Um, the best place is to start, like with recycling.

KC: Okay. . .

DK: With recycled papers. At least it's something.

KC: How about if other students needed to come up with their own project that would help the environment, what would you tell them, that could help them?

DK: Like to plant more trees? And plants. I have a big garden, and you don't plant trees there, but I plant plants and flowers.

KC: Okay, so you have some good tips on what others could do to help?

DK: Yeah.

KC: Okay, and what if another teacher was starting this project, and had never done it before, what suggestions would you give this teacher, to make it better?

DK: Um, I don't know.

KC: Okay, that's okay. You don't have to know. And I have another "imagine" question for you—say you are in high school next year, and you're taking an environmental science class, and the teacher asks you to design a project that helps the environment, how would you start, or what would you do?. . .It's okay. . what kind of activity would you want to work on? Something similar or different to what you did before?

DK: Something similar.

KC: Okay, building on the work you did on the website?

DK: Yeah.

KC: Okay, do you think you would want to do another website?

DK: Not really a website, but something to help, to make other people know of this. If they can't do anything, they can let other people know, and they can do something about it.

KC: Okay, that was kinda the idea behind the website idea?

DK: Yeah, because anybody could look at it.

KC: Right, good. How did you come up with the idea to do the website? I thought that was very creative.

DK: Because I've never done a website before. And I wanted to do something. . .like if I just did a poster, no one could look it; it wouldn't be accessible to everyone, I could just take it home and like, it would just lie there. If I put it on the website, then anyone who wants to look at it, can look at it.

KC: I did think that was really creative. How did you feel about designing your own project without me telling you what activity to do? How did that work for you? . . .Be as honest as you want.

DK: First, I didn't know what to do. But then I figured out I could do anything you want. . .as long as it was to help the environment. So, um yeah, I just decided to make the website.

KC: And, you might have already covered this, but how did you choose endangered species?

DK: Cause I've already done a project about them in sixth grade, and that was a small project. I didn't do anything big on it. So now I wanted to know more about them, like more elaborate research.

KC: Yeah, build on what you already know?

DK: Yeah.

KC: This has been very helpful. Is there anything else related to the projects, any other comments for me?

DK: No, sorry.

KC: That's okay. Don't be sorry, you've been incredibly helpful. Thank you for taking the time to meet with me.

Appendix H: Example of Teacher Interview: Complete Transcript

Interview with HW (8th grade science teacher/8th grade science team leader/new teacher mentor)

KC: I just wanted to ask you a few questions about the environmental projects we completed, like what we did for Green Day, and their place in the curriculum.

HW: The MCPS Curriculum?

KC: Sure, in general, and in the MCPS curriculum.

HW: In the MCPS curriculum, I don't know if environmental issues are addressed completely, they're considered supplemental, if at all. In fact looking over the indicators, I don't even know if environmental issues would be included. Just as an example, I'm reading one now, "describe how climate is affected by environmental factors" but it's not environmental issues. So they use the word environment, but it's not in the same context as I believe you're thinking about.

KC: So things like environmental action projects, similar the activities we did for Green Day, do you think there's anyplace for them?

HW: Um, I think it's needed, but according to the curriculum, it's not added to it. So it's something that either teacher skips a couple days worth of curriculum and puts it in because they feel strongly about it; 6th grade might be different because of the Chesapeake Bay unit, and I think that's totally an environmental issue. But they're looking at it through science, and they're learning about it, and it was written primarily because we live in MD, and the Chesapeake Bay is a big deal. But they added that as a unit, and that is addressing all different aspects of environmental issues. But as an 8th grade teacher, it's not in our curriculum anywhere. It might be a supplemental thing, a supplemental indicator, you know, how does the environment or how do humans affect the environment. I know there might be one in the geology unit, but it's totally supplemental. And supplemental according to the county means, I can tell you actually what they tell mean, about 50% of the time it might appear on an assessment, but it's not anything a teacher has to include, this would be something that would support the program, provide enrichment and extensions, and I'm quoting the county's document on that. So, it's not required by the teachers to teach it; let's put it that way.

KC: I read, I think it was an indicator, human activities affect the balance on earth. I wasn't sure exactly what they meant by that.

HW: Hold on one second, let me pull out the curriculum guide.

HW: There is a supplemental indicator: "Analyze how human activities can accelerate or magnify many naturally occurring changes, like erosion, air and water quality, population, and deforestation." For Earth science, it would have been supplemental, but I don't see the word balance.

KC: I thought there was perhaps an enduring understanding dealing with how human's activities affect the "balance" of earth. But it was unclear what students should get from it. It was pretty general. But anyway, you don't see environmental issues as a significant part of the 8th gr. Curriculum?

HW: No, I don't think it's a priority, you know just because it is supplemental, so that gives you, if you have a moment in your schedule that you can throw in. Or if you have, like Green Day sort of fell on us. It's kinda like well sure we'll put it in eighth grade because it suited 8th grade better than 7th. It would have probably best suited 6th grade based on their curriculum, because of the Chesapeake Bay unit, and their environmental issues that go with that unit. But out of 7th and 8th grade, the 8th grade because of studying the earth and atmosphere and we could vaguely tie it together with that.

KC: Right.

HW: It wasn't that clear. It's not an indicator, it's not a standard, it's not something we're required to teach. So it's not an essential indicator; supplemental, we just choose time to do it.

KC: Okay. I thought Green Day is an example of how students can be involved in their community. Can you think of any other examples of how students can be more involved in the community?

HW: Well they're required to do student service learning. So that idea that they would built stewardship and ownership for their community and learn early on that this is something, that in order to have a good community you need to be involved in it. If you do it through environmental things, that's like a bonus, I think. Most of the kids are well aware that they need to earn these student service hours. And some do it by helping the teacher and some do it by going out more in the community and finding something to do.

KC: How many hours do they have to have?

HW: They have to 60 to graduate from high school. They automatically get 30 from middle school, and that's getting 10 each year from doing certain activities in different disciplines. I think it's 10 from science in 6th grade with their ches. Bay unit, 10 in world studies in 7th grade, and 10 in English in 8th gr. doing some sort of community based project. They supposedly earn the hours through the activities they do and they have to do the activities on their own time. So the idea is whatever the assignment is, they are putting in at least 10 hours to complete the assignment. And then in high school they have to earn the additional 30.

KC: Just in general, what have been your most meaningful experiences that you've had with students?

HW: Probably involving things that didn't involve the essential indicators, like all the supplemental things are the most memorable things. Doing the Green Day thing, we had a lot of kids say in their English projects that they appreciate doing Green Day and they had fun with their friends where they were doing something helpful and good for the environment, but at the same time, it was something that they enjoyed. Let's see, outdoor ed., again memorable for the kids. Other meaningful things that didn't involve the curriculum (laughs), we took a large group of kids to the Grand Canyon and drove and flew into Alberquque and drove to the Grand Canyon and camped for 10 days. Almost 100 people did it, and that was memorable for everybody. I think working with small groups, you know 100 people isn't a small group, but I had 6 girls in the van that I drove, and you know, you get to know them, and understand what they want to do, and they start opening up to you. Taking kids to marine camp in Florida Keys. Took a group of 11th and 12th graders there. And again, totally environmental cause we walked through the mangroves. I think most memorable things are either small groups, outside, hands-on, involved. I'm sure they remember that more than they would remember, oh yeah, the essential indicators.

KC: Do you think these types of activities should be "required" or do you think they will always be supplemental because they could never really require something like this?

HW: But they could add it. I feel that some sort of activity, and I don't know how they could convince every teacher and the union to do it, but I think every kid, and maybe this is where outdoor ed comes into it, that everybody needs to have some sort of site experience where they're involved, it's all hands-on, something that's going to make a difference, something that's going to meaningful where they learn something, despite that they just think that they're having fun, when they look back on outdoor ed, they'll remember the fun part about being in the cabins, but as they grow up, they'll remember some other parts of it as well. So maybe that's where the idea, don't cut the program for outdoor ed, and it should be a sleep away experience, and it should be you know more than one day. I think that's probably important.

KC: So outdoor ed happened once in 6th grade?

HW: I don't think they can afford it every year. I'm sure it comes down to money and time. Cause you're taking almost a week out of their program, it's now written in as part of their curriculum, it's a requirement for 6th grade. But I don't that they could do that for every grade level. Would it lose its impact if they did it every year? I think it might.

KC: Perhaps what we did outside for Green Day is similar.

HW: I think so, I think this will be an ongoing project. Like to see if those trees we planted are still alive. . .

KC: The raingarden is looking good.

HW: I haven't even checked that out lately. . . I think Margie had some kids out there weeding it. And Jill's been watering it, since it's right out her back door. But I'm just wondering about those little trees out on the hill, will they get mowed over?

KC: There were some signs that we supposed to be put up. . .

THE MIDDLE SCHOOL ENVIRONMENTAL LITERACY INSTRUMENT

Seventh Edition - © March 1995

AN INTRODUCTION AND A TABLE OF CONTENTS

Development of *The Middle School Environmental Literacy Instrument* was initiated in the fall of 1993. It consists of a selection of important variables associated with ecological knowledge and with responsible environmental citizenship behavior. A portion of the instrument was adapted from one developed and validated by the Wisconsin Center for Environmental Education. Other portions were adapted from *The Environmental Literacy Instrument* © 1993 developed for use with an environmental curriculum on the National Diffusion Network. The instrument found in this edition is one that was revised using a national validity assessment conducted in December of 1993.

Because this instrument contains a number of non-traditional sections, the developers have included with it several documents which are listed below. Each has been color coded for easy reference.

CONTENTS

Questions concerning the development and/or use of this instrument should be directed to one of the following:

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THE MIDDLE SCHOOL ENVIRONMENTAL LITERACY INSTRUMENT: WHAT DOES THIS INSTRUMENT MEASURE?

7th Edition - March 1995

TEST NO. 1 AND TEST NO. 2

An Explanation of Test No. 1: Ecological Foundations and Issue Awareness

Part 1 of Test No. 1:

Part 1 of Test No. 1 measures the environmental issue identification skill of middle school students. Although knowledge plays a definite role in a student's ability to identify environmental issues, the underlying assumption of this instrument is that there is a definite skill associated with this task.

The scoring for Test No. 1 is based on a four-point scale. One point is given for a legitimate environmental problem/issue; two points are given if the issue statement contains a cause and a non-specific effect; three points are given if the issue statement contains a cause and a specific effect; and an additional point is given if a specific location is identified in the statement (see the Scoring Protocol for additional information on scoring Part 1 of Test No. 1).

Part 2 of Test No. 1:

Part 2 of Test No. 1 measures a basic foundation component - knowledge of ecological concepts. The developers have been very fortunate to be able to adapt a middle school ecological knowledge instrument from one developed under stringent research protocols by the Wisconsin Environmental Literacy Assessment Project at the Wisconsin Center for Environmental Education.

An Explanation of Test No. 2: Issue Analysis and Citizenship Action

Part 1 of Test No. 2:

Part 1 - Part 1 measures three things: (1) perceived knowledge of environmental action strategies, (2) perceived skill in the use of action strategies, and (3) a self-reported, six-month history of taking environmental actions.

Part 2 of Test No. 2:

Part 2 - Section 1 measures a student's ability to identify an issue statement for a particular issue-related scenario.

Part 2 - Section 2 measures a student's ability to perform an issue analysis of a given issue scenario.

Part 2 - Section 3 evaluates a student's ability to select the best citizen action choices for the remediation of the issue scenario.

THE MIDDLE SCHOOL
ENVIRONMENTAL LITERACY INSTRUMENT

STUDENT EDITION

Tests 1 & 2

Your Name: _____ **Gender: M** ____ **; F** ____

Teacher: _____ **School:** _____

Grade Level &/or Subject: _____ **Date:** _____

Demographics

More About You

Your Gender: M ____ ; F ____ **Your Age:** ____

Your Ethnic Group (Check One):

_____ African American;
_____ Asian American or Pacific Islander; _____ Hispanic American;
_____ Native American (American Indian/Eskimo/Aleut); _____ White American
_____ Other: _____;

State In Which You Live: _____

Type of Community In Which You Live (Check One):

_____ Urban _____ Suburban _____ Rural

Please give your BEST ESTIMATE of the extent to which your family APPRECIATES the natural environment. Circle one of the X's below.

X	X	X	X	X
No Extent	A Little Extent	A Moderate Extent	A Large Extent	A Great Extent

Please give your BEST ESTIMATE of the extent to which your family IS CONCERNED ABOUT environmental problems and issues. Circle one of the X's below.

X	X	X	X	X
No Extent	A Little Extent	A Moderate Extent	A Large Extent	A Great Extent

To what extent do you read about environmental problems and issues in newspapers or other publications? Circle one of the X's below.

X	X	X	X	X
No Extent	A Little Extent	A Moderate Extent	A Large Extent	A Great Extent

To what extent do you watch television programs about environmental problems and issues? Circle one of the X's below.

X	X	X	X	X
No Extent	A Little Extent	A Moderate Extent	A Large Extent	A Great Extent

THE MIDDLE SCHOOL ENVIRONMENTAL LITERACY INSTRUMENT

TEST NO. 2

ISSUE ANALYSIS AND CITIZENSHIP ACTION

Test No. 2 has two parts. These parts are a bit different from each other. Please follow all of the instructions carefully. It is very important for you to do your best on the different parts. You do not need to be afraid of your answers - just do your best.

Part I

How I Feel About Things and What I Do About Things

Directions: Each of the following items looks at different aspects about you and the environment. **Please be completely honest**. There are no right or wrong answers. You are asked to think carefully about each item before you circle the "X" that seems to be the most appropriate one. The "X" you choose should look like this: ⊗

1. Ecomanagement refers to those environmental actions in which people work directly with the natural world to help prevent or resolve environmental issues. Examples would be: (1) recycling glass and/or plastic, (2) building and putting up nest boxes for birds, and (3) cleaning up littered areas.

A. How **knowledgeable** do you think you are about **ecomanagement**? Circle one "X".

X	X	X	X	X
Not At All		Moderately		Greatly

B. How **skilled** do you think you are in your ability to use **ecomanagement**? Circle one "X".

X	X	X	X	X
Not At All		Moderately		Greatly

C. Circle the number of times have you done each of the following **ecomanagement actions** over the last six months?

	Number of Times					
1. Used alternative forms of transportation, for example, walking, bicycling, car pooling, taking mass transit.	0	1	2	3	4	5+
2. Taken steps to reduce the energy used for heating, cooling, and/or lighting.	0	1	2	3	4	5+
3. Taken steps to reduce water consumption.	0	1	2	3	4	5+
4. Recycled things like paper, glass, plastic, metals, or organic refuse.	0	1	2	3	4	5+
5. Picked up litter.	0	1	2	3	4	5+
Write in others as needed:						
6. Other: _____ _____	0	1	2	3	4	5+
7. Other: _____ _____	0	1	2	3	4	5+

2. Consumer action and economic action refer to those environmental actions in which people use monetary support or financial pressure to help prevent or resolve environmental issues. Examples would be: (1) not buying products with excessive packaging or (2) refusing to buy products from a company that has a poor environmental record.

A. How **knowledgeable** do you think you are about **consumer/economic action**? Circle one "X".

X	X	X	X	X
Not At All		Moderately		Greatly

B. How **skilled** do you think you are in your ability to use **consumer/economic action**? Circle one "X".

X	X	X	X	X
Not At All		Moderately		Greatly

C. Circle the number of times have you done each of the following **consumer/economic actions** over the last six months?

	Number of Times					
1. Purchased products packaged in reusable, returnable, or recyclable containers.	0	1	2	3	4	5+
2. Avoided buying products with excess packaging.	0	1	2	3	4	5+
3. Stopped buying products which can have harmful environmental effects (for example, toxic and dangerous pesticides).	0	1	2	3	4	5+
4. Stopped buying products from a company which has a poor environmental record.	0	1	2	3	4	5+
5. Boycotted environmentally harmful products.	0	1	2	3	4	5+

Write in others as needed:

6. Other: _____ _____	0	1	2	3	4	5+
7. Other: _____ _____	0	1	2	3	4	5+

3. Persuasion refers to those environmental actions in which individuals or groups appeal to others to help prevent or resolve environmental issues. Examples would be things like: (1) trying to get your family to begin saving energy by lowering the thermostat, (2) convincing a friend to get a cat sterilized, or (3) convincing your mom to recycle aluminum and glass.

A. How **knowledgeable** do you think you are about **persuasion**? Circle one "X".

X	X	X	X	X
Not At All		Moderately		Greatly

B. How **skilled** do you think you are in your ability to use **persuasion**? Circle one "X".

X	X	X	X	X
Not At All		Moderately		Greatly

C. Circle the number of times have you done each of the following **persuasion actions** over the last six months?

	Number of Times					
1. Talked to someone and encouraged him/her to support a positive environmental action.	0	1	2	3	4	5+
2. Distributed literature supporting a "pro" environmental position or action.	0	1	2	3	4	5+
3. Signed or distributed a petition encouraging a person, group, or company to take an action aimed at improving the environment.	0	1	2	3	4	5+
4. Encouraged an individual or a group involved in some kind of destructive environmental behavior to stop that activity.	0	1	2	3	4	5+
5. Wrote a letter to a person, group, or company encouraging them to stop an activity, or to take an action, for the purpose of improving the environment.	0	1	2	3	4	5+
Write in others as needed:						
6. Other: _____ _____	0	1	2	3	4	5+
7. Other: _____ _____	0	1	2	3	4	5+

4. Political action refers to those environmental actions in which people use political means (e.g., political processes, organizations, parties, or offices) to help prevent or resolve environmental issues. Examples would be things like: (1) writing to your senators to ask them to vote the way you think they should vote or (2) campaigning for someone who supports the environment.

A. How **knowledgeable** do you think you are about **political action**? Circle one "X".

X	X	X	X	X
Not At All		Moderately		Greatly

B. How **skilled** do you think you are in your ability to use **political action**? Circle one "X".

X	X	X	X	X
Not At All		Moderately		Greatly

C. Circle the number of times have you done each of the following **political actions** over the last six months?

	Number of Times					
1. Donated money or given time to support a candidate because of his/her environmental positions or voting record.	0	1	2	3	4	5+
2. Distributed a summary of a candidate's positions or voting record on environmental issues.	0	1	2	3	4	5+
3. Donated money or given time to a political party which takes a strong stance in support of environmental protection.	0	1	2	3	4	5+
4. Wrote a letter to elected official(s) encouraging them to take an action aimed at improving environmental quality.	0	1	2	3	4	5+
5. Ran for or served in any position with the intent of supporting environmental actions, (for example, student council or youth organizations).	0	1	2	3	4	5+
Write in others as needed:						
6. Other: _____ _____	0	1	2	3	4	5+
7. Other: _____ _____	0	1	2	3	4	5+

Part 2

AN EVALUATION FOR ISSUE ANALYSIS AND ACTION SKILLS

The Story: A QUESTION OF PROGRESS

Recently the city of Ironton experienced a problem. This problem dealt with a land-use management question. A developer talked to Mr. and Mrs. Tillman who owned a farm. He offered to buy the Tillman farm to build a mall.

The Tillman farm was inside the city limits. It was an ideal location for a mall. The developer was Mr. Hank Smith. Smith said he would pay one million dollars ($1,000,000) for the farm. The Tillmans knew that the farm was only worth about $50,000 as farm land. They decided to sell if Ironton's city officials would give permission. Ironton's officials had to approve selling farm land for business purposes.

Mr. Smith went to the city officials. He requested that he be given permission to build a mall using the Tillman farm land. He explained that the mall would bring millions of dollars to Ironton. It would also encourage additional development on that side of town. Also, many jobs would be created. The officials agreed to study Smith's request. They would act on this request at their next meeting.

The ***Ironton Daily News*** published Mr. Smith's request the next day. Reactions were immediate. Several groups disagreed with the proposal. Others supported it. They wanted the mall to be built.

The information above contains an environmental issue. Circle the letter in front of the statement that best identifies this environmental issue.

a. Should Ironton's city officials be involved in a land-use management decision?

b. Should city officials allow the Tillman farm to be converted to a shopping mall?

c. Should the city of Ironton build a mall on the Tillman farm?

d. Should the Tillmans be able to sell land worth only $50,000 for $1,000,000 (one million dollars)?

The County Agricultural Association opposed the mall. It believed that the area was losing too much farm land to commercial development. The local builders' union supported the mall. The union thought the development would provide jobs for its unemployed members.

The local Sierra Club argued against the mall. It was concerned that development would threaten the rare natural area located next to the farm.

The Tillmans talked to the ***Ironton Daily News.*** They told the reporter they wanted to sell their farm. They said that the money would be great for retirement. They also said that they should be able to sell their land because it was theirs. They could do anything they wanted with it.

There is an environmental issue here. There are numerous "players" and all of the players have *beliefs* and *values.*

A *belief* is something that someone or a group of people holds to be true. A *value* is the worth placed on something by someone or a group of people. *Values are closely related to beliefs.*

For example, your mother might *believe* that it is important for you to go to school. Her *belief* would be: "It is important for you to go to school." The *value* associated with this *belief* is an "educational" value.

Below, you will find a list of some of the key players. For each player, you are to list one *belief.* Also name the most important *value* present in that *belief.* One example is provided.

PLAYER	THE PLAYER'S BELIEF	THE VALUE
Example: Hank Smith	The mall would bring millions of dollars to Ironton.	Economic
The Tillmans		
County Agricultural Association		
Builders' Union		
Sierra Club		

Please go to the next page!

One month after the initial proposal, city officials decided to allow the mall to be built.

Assume that you were a citizen in Ironton. You discover that others feel the same way about this local issue as you do. Basically, you do not want the mall to be built on the Tillman farm land.

Below you will find eight action strategies that you might use to prevent the mall from being built. Select what you believe to be *the best two (2) action strategies.* Put an "X" in front of the *two action strategies* that you select. <u>Be sure you choose 2 and use 2 X's.</u>

_____ 1. Write to your U. S. Senators and ask for a federal law to be passed to prohibit the sale of the Tillman farm land.

_____ 2. Write to your state representative and urge him/her to write and get a law passed prohibiting the sale of the Tillman farm land.

_____ 3. Organize a group to hold a bake sale of cookies and cakes in an attempt to raise enough money to purchase the Tillman farm land for the same price that Mr. Smith offered.

_____ 4. Circulate a petition opposing the building of the mall and present this petition to Ironton's city officials .

_____ 5. Organize a group of citizens with the same position as yours to write persuasive letters to the Editor of the ***Ironton Daily News*** for publication.

_____ 6. Organize a group of citizens with the same position as yours and offer its services to the Sierra Club in the hope that a coalition of groups could influence city officials to reverse their decision.

_____ 7. Organize a group of citizens with the same position as yours and ask for a meeting with the Chamber of Commerce in which the group would threaten to boycott the mall if it is built.

_____ 8. Make an anonymous phone call to Mr. Smith threatening to sabotage the construction equipment if the mall development plan goes through.

END OF TEST NO. 2

The Middle School Environmental Literacy Instrument
Test No. 2
Scoring Protocols

7th Edition - March 1995

Part 1
How I Feel About Things and What I Do About Things

Scoring Directions for Part 1 - How I Feel About Things and What I Do About Things

Part 1 focuses on environmental action: a students perceived knowledge of and skill in using action strategies as well as a self-reported six-month history of environmental action. Part A represents the assessment of perceived knowledge and Part B represents the assessment of perceived skill. Part C is the six-month self-reported history of positive environmental behavior.

The scoring of Part 1 yields three (3) subscores. In all instances, scores for the scales for Parts A and B range from 0 through 4 reading left to right. "Not At All" gets a score of 0 and "Greatly" gets a score of 4, and so on.

The score for Part C is simply a tally of the numerical responses. The total score for the four action modes could range from zero (0) to 140. [If desired, each action category can be scored separately in order to yield a score for that particular action, e.g., persuasion, ecomanagement, etc.]

Part 2
An Evaluation for Issue Analysis and Action Skills

Scoring for Section 1. Issue Statement Component

If the student selects a. score two (2) points.

If the student selects b. score six (6) points.

If the student selects c. score four (4) points.

If the student selects d. score zero (0) points.

Scoring for Section 2. Issue Analysis Component:

Examples of a correct issue analysis follows. However, it is very important to note that the wording of the belief statements appearing here is only one way in which correct responses can be written. A belief statement incorrectly attributed to a particular player receives no credit. However, credit is given for the value associated with this incorrect response if the value is appropriate for that particular belief statement.

PLAYER	THE PLAYER'S BELIEF	THE VALUE
The Tillmans	**1.** *The money would be great for retirement.*	Economic
	or 2. *We should be able to sell the land because it is ours.*	Egocentric
Co.Agr. Assn.	*The area is losing too much agricultural land.*	Environmental/ Economic
Builders' Union	*Development will provide jobs.*	Economic
Sierra Club	*Development threatens the nearby natural area.*	Ecological/Env.

Scoring: Score 2 point for each correct belief and 2 point for each correct and corresponding value.

Total of 16 Points.

Scoring for Section 3. Action Plan Component:

Scoring for the Action Plan Component is based on the legitimacy and potential impact of the actions listed 1 through 8. Some actions are scored "0" for no points and the two most viable actions are scored 10 points each with other actions somewhere in between.

Point values for each action are as follows:

__0__ 1. Write to your U. S. senators and ask for a federal law to be passed to prohibit the sale of Mr. Tillman's farm land.

__2__ 2. Write to your Illinois state representative and urge him/her to write and get a law passed prohibiting the sale of Mr. Tillman's farm land.

__2__ 3. Organize a group to hold a bake sale of cookies and cakes in an attempt to raise enough money to purchase Mr. Tillman's farm land for the same price that Mr. Smith offered.

__10__ 4. Circulate a petition opposing the rezoning decision and present this petition to the Ironton Zoning Commission.

__5__ 5. Organize a group of citizens with the same position as yours to write persuasive letters to the Editor of the ***Ironton Daily News*** for publication.

__10__ 6. Organize a group of citizens with the same position as yours and offer its services to the Sierra Club in the hope that a coalition of groups could influence the Zoning Commission to reverse its decision.

__3__ 7. Organize a group of citizens with the same position as yours and ask for a meeting with the Chamber of Commerce in which the group would threaten to boycott the mall if it is built.

__0__ 8. Make an anonymous phone call to Mr. Smith threatening to sabotage the construction equipment if the mall development plan goes through.

<u>Scoring</u>: The learners are asked to select the best two (2) action strategies. If the learner selects more than two strategies, the learner's score is the sum of the two lowest point values associated with strategies selected. Maximum = 20 points.

The Middle School Environmental Literacy Instrument

7th Edition - March 1995

Scoring Sheet

Student: _____ Teacher Rating: _____

Teacher: _____ School: _____

Date: _____ Section: _____ Scorer: _____

TEST No. 1

		Score
Part 1 - Familiar Issues	24 Possible	_____
Part 2 - Ecological Foundations	17 Possible	_____

TEST No. 2

Part 1: How I Feel About Things and What I Do About Things

Part A - Knowledge	16 Possible	_____
Part B - Skill Level	16 Possible	_____
Part C - Behavior	140 Possible	_____
Total Score for Part I		_____

Part 2: Issue Analysis Test

Part 2 - Section 1: Issue Statement Component - 6 Possible

Total Score for Part II - Section 1 = _____

Part 2 - Section 2: Issue Analysis Component - 16 Possible

Total Score for Part II - Section 2 = _____

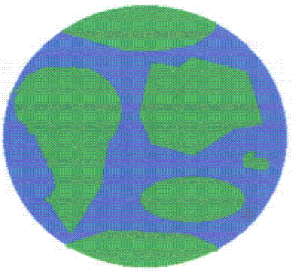
Part 2 - Section 3: Action Plan Component - 20 Possible

Total Score for Part II - Section 3 = _____

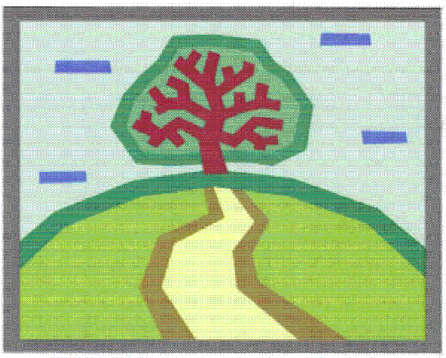
Total Issue Analysis Score _____

Appendix J: Examples of Student Created Bumper Stickers—Recycling

Keep the Earth Clean! Don't litter...
Reduce : Try to buy things that won't produce a lot of trash.
Reuse : Reuse things to save resources and save energy.
Recycle : It reuses many useful materials such as tin, plastic, and paper. They all can be reused in plenty of different ways in our world today.
So when you are throwing away paper, plastic, tin, metal, or any useful resource, think of the 3 R's!



Think of it!



There shouldn't be One Tree on a Hill!
Plant More Trees!

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