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ENVIRONMENTAL SENSITIVITY:

A CASE STUDY OF ENVIRONMENTAL LEARNING
THROUGH NATURE APPRECIATION

DISSERTATION

Presented in Partial Fulfillment of the Requirements for
The Degree Doctor of Philosophy in the Graduate
School of The Ohio State University

By

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*****

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2001

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ABSTRACT

Environmental sensitivity has been identified as the major entry-level predictor of environmentally responsible behavior. While researchers have investigated the common antecedents found in those individuals identified as possessing a high level of environmental sensitivity, less has been done to determine specific instructional strategies that might result in enhanced levels of environmental sensitivity.

This case study reported on an investigation in a secondary geography classroom intended to enhance participants' levels of environmental sensitivity while developing geographic understanding. Learners manipulated digital aerial photographs of the local region, and then engaged in several short outdoor field experiences on and around the school site in a process described as “walking on the images.” Learners also participated in a daylong excursion on the local watershed. Earth Systems understandings were integrated with major geographic themes and served as an organizer for geosystems instruction, both during the outdoor field experiences and in the classroom. Participants also used a Nature Appreciation model that integrated affective and cognitive elements of appreciation.

Learner response to the activities was analyzed using journals, cognitive maps, sketches, interviews, and audio recordings of classroom and field-based activities. An
Action Research model was used to produce recommendations first, for the personal practice of the researcher and, second, of possible interest to the larger educational community.

The results of the analysis indicate that short field experiences in a familiar setting may have a significant impact on individuals' appreciation of and concern for the local environment. Elements of Sense of Place Education seemed to have considerable influence. Learners also demonstrated the ability to apply geographic and Earth Systems concepts verbally, graphically, and in written reports. Results further indicated that aerial photographs, while of interest to learners, had less impact than anticipated. The study recommends several strategies to increase the effectiveness of remotely sensed images based on learners' response to their use.

Finally, the study considered the definition of environmental sensitivity itself as commonly used in environmental education. For the purposes of this work, it recommended the use of a more pedagogically applicable definition rather than the one more commonly used.
To my mother, Ruth
Whose belief both in education and in me made this work possible
ACKNOWLEDGMENTS

I offer my deepest thanks to my friend and advisor Dr. Rosanne Fortner, who invited me to Ohio in the beginning, supported me intellectually and emotionally over the long course of this endeavor and stayed with me to the final achievement of this goal. I also wish to thank Dr. Gary Mullins for the rigor of his questioning and the depth of insight he shared with me. I wish to acknowledge the contribution of Dr. Michael Beeth and thank him for his steady voice and calming influence. I also express my appreciation to Dr. Carolyn Merry whose teaching was in inspiration to me and whose shared knowledge of remote sensing contributed greatly to the conception of this work.

To my wife and companion, Susan Foley, I offer my boundless gratitude for her unflagging support during the course of this study. Only she will fully understand the sacrifices she made to keep home and family together while I worked on this project. I owe you everything. Emily and Kelsey, my lovely daughters, thank you as well for suffering the absence of your father for long periods of time, both real and virtual. I missed a part of your lives to achieve this goal. I hope the model of life long learning I tried to share with you was worth the time apart.

I would also like to acknowledge the contribution of my colleagues who supported my data collection and field-tested ideas along the way, Roger Adolph, Luella Allen, Derek Arena, Richard Chapman, John Durecka, Terry Stoneburner and especially Laura Jacobs. I offer a special and heartfelt thank you to my friend and fellow geographer, Sophia P. Linn. I thank her for the many hours she sacrificed to the tedious task of editing drafts, and more importantly, for questioning me to clarity, and constructively criticizing ideas and concepts. Her efforts markedly improved the quality of this work. If not I, than any reader of this document should thank her profusely.

Finally, I'm proud to acknowledge the contribution of Professor Bill Stapp, my first EE teacher and my mentor who is, now and forever, a part of the great Earth System he so deeply loved and cared for.
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TABLE OF CONTENTS

ABSTRACT ................................................................................................................... ii
DEDICATION ............................................................................................................... iv
ACKNOWLEDGMENTS .............................................................................................. v
VITA ............................................................................................................................... vi
LIST OF TABLES ......................................................................................................... xi
LIST OF FIGURES ........................................................................................................ xii
CHAPTER

1. INTRODUCTION ................................................................................................. 1
   Statement of the Problem .......................................................................................... 1
   Purpose of the Study .................................................................................................. 6
   Significance and Need for the Study ........................................................................... 7
   Limitations of the Study ............................................................................................ 8
   Definition of Terms .................................................................................................... 9

2. REVIEW OF THE RELATED LITERATURE ...................................................... 12
   Environmental Sensitivity ......................................................................................... 12
   Sense of Place ........................................................................................................... 18
   Nature Appreciation .................................................................................................. 21
   Remote Sensing .......................................................................................................... 22
   Action Research ......................................................................................................... 26
   Earth Systems Education ............................................................................................ 30
   Instructional Standards ............................................................................................... 33
APPENDICES

A. Academic Achievement Of Study Groups
   Based On A Four-Point Academic Scale ................................................. 153
B. Student Journal Example Page .............................................................. 155
C. Keyword Search ..................................................................................... 157
D. Post-Program Interview Data Summary Table .................................... 159
E. Communication Arts - Outdoor Experience
   Instructor Summary Report .................................................................. 161
F. Image Analysis – Data Collection Sheet .............................................. 164
G. Classroom Observation – Richard Chapman, Assistant Principal ...... 166
H. Classroom Observation – Louella Allen, Curriculum Director ......... 168
I. School Site Exploration Standards-Based Activity ......................... 171
J. School Site Exploration – Data Collection Form .............................. 176
K. School Site Presentation – Evaluation Rubric ................................. 179
L. Research Field Notes Example ............................................................ 181
M. Minden Bog Reflective Notes – Research Notes ......................... 183
N. Parental Permission To Collect Data Letter ........................................ 190
O. Learner Response Database Record ..................................................... 192

LIST OF REFERENCES .............................................................................................. 194
<table>
<thead>
<tr>
<th>TABLE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Proposed Changes In Emphases Called For By The National Science Standards.</td>
<td>36</td>
</tr>
<tr>
<td>2. Instructional Events from Which Data Was Collected</td>
<td>46</td>
</tr>
<tr>
<td>4. Five Themes Of Geography And Their Extensions (Source: National Geographic Society, 1994)</td>
<td>70</td>
</tr>
<tr>
<td>5. Academic Achievement of Study Groups</td>
<td>154</td>
</tr>
<tr>
<td>6. Post-program Interview Results</td>
<td>160</td>
</tr>
</tbody>
</table>
# LIST OF FIGURES

<table>
<thead>
<tr>
<th>FIGURE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Behavior Flow Chart: Major And Minor Variables Involved In Environmental Citizenship Behavior. (Source: Hungerford And Volk, 1990)</td>
<td>14</td>
</tr>
<tr>
<td>2. Exploded Diagram Of Ideal Instance Of Nature Appreciation (Source: Pepi, 1994)</td>
<td>22</td>
</tr>
<tr>
<td>4. Diagram Of Major Database Search Strategies</td>
<td>57</td>
</tr>
<tr>
<td>5. Regional Map: Port Huron And The Great Lakes Bioregion</td>
<td>61</td>
</tr>
<tr>
<td>6. Aerial Photograph of PHN Showing School Site Study Regions</td>
<td>64</td>
</tr>
<tr>
<td>7. Learner Collected Images From Field Experiences</td>
<td>84</td>
</tr>
<tr>
<td>8. Learner Created Sketch – Final Exam</td>
<td>92</td>
</tr>
<tr>
<td>9. Learner Created Sketch – Final Exam</td>
<td>93</td>
</tr>
<tr>
<td>12. Northern School Site, Infrared Photograph 40,000 Ft.</td>
<td>100</td>
</tr>
<tr>
<td>13. Northern School Site, Black And White Photograph 20,000 Ft.</td>
<td>100</td>
</tr>
<tr>
<td>14. School Site. 3000 Feet, With Student Written Caption</td>
<td>105</td>
</tr>
</tbody>
</table>
15. Initial Mental Map Of School Site, Set 1 .................................................. 119
16. Final Mental Map Of School Site, Set 1 .................................................. 119
17. Initial Mental Map Of School Site, Set 2 .................................................. 120
18. Final Mental Map Of School Site, Set 2 .................................................. 120
19. Minden Bog Field Experience: Stops And Towns .................................... 126
20. Learner Created Profile Of Glacial Moraine Traversed Enroute To The Minden Bog .......................................................... 128
21. Learner Created Route Map Of Minden Bog Trip On Remotely Sensed Image Of Michigan Thumb Bioregion ..................... 140
22. Initial Mental Map Of Black River, Set 1 .................................................. 142
23. Final Mental Map Of Black River, Set 1 .................................................. 142
24. Initial Mental Map Of Black River, Set 2 .................................................. 143
25. Final Mental Map Of Black River, Set 2 .................................................. 143
26. Initial Mental Map Of Black River, Set 3 .................................................. 144
27. Final Mental Map Of Black River, Set 3 .................................................. 144
28. Model Of Environmental Sensitivity ....................................................... 147
29. Student Journal Pages ............................................................................ 156
30. Learner Response Database Record ....................................................... 193
CHAPTER 1

INTRODUCTION

Statement of the Problem

Thomas Tanner (1980), who initiated research on environmental sensitivity, stated that if the goal of Environmental Education (EE) was “the maintenance of a varied, beautiful and resource-rich planet for future generations,” then its penultimate goal must be “the creation of an informed citizenry which will work actively toward the ultimate goal.” A look about with a practiced eye suggests that efforts to attain either goal have been far from successful.

One may reasonably argue that human activity is significantly impacting ecological life support systems throughout the planet (Orr, 1992). Park and Chang (1998) cite deforestation, hazardous waste, ozone depletion and threats to biodiversity as human induced problems of global concern. Most recently, the Report of the Intergovernmental Panel on Climate Change (UNESCO, 2001, p. 6) stated, “Emissions of greenhouse gases and aerosols due to human activities continue to alter the atmosphere in ways that are expected to affect the climate.” To address issues raised by this apparent pattern of harmful human activity, it seems essential to bring individual citizens to a deeper awareness of their membership in the larger biosphere of Earth and of the effects of
human activity on critical elements of that system.

Beyond awareness of environmental concerns, it is necessary to dramatically increase the number of human beings who, more or less regularly, engage in reflexive actions that the individual has determined to be beneficial to the continued health and well being of Earth and its interactive systems. It is appropriate, then, to ask how one might achieve such a goal. Public education would certainly be a natural beginning place.

A recent movement in science instruction, Earth Systems Education, suggests that the nature of current science education is inadequate for addressing our emerging understanding of the complex processes of whole Earth Systems. Proponents of an Earth Systems approach argue that the most effective path toward meaningful scientific literacy may be through a holistic approach that focuses on leading individuals to a deeper understanding of the interactions and connections among various Earth Systems (Mayer and Fortner, 1995).

Such an approach may have significant implications for environmental education as well. William Stapp, generally considered the father of environmental education, defined its goal as that of “producing a citizenry that is knowledgeable concerning the biophysical environment and its associated problems, aware of how to help solve those problems, and motivated to work toward their solution” (Stapp, et al. 1969). It will require a citizenry informed about the nature of Earth Systems interactions to effectively address environmental issues.

Environmentally Responsible Behavior (ERB) is the generally accepted term for such behavior. The United Nations-sponsored Intergovernmental Conference on
Education at Tbilisi in 1977 represents a watershed event in attempting to define ERB.

Using the objectives agreed to at that international conference, Hungerford and Volk (1990) offered the following definition:

*An environmentally responsible citizen may be defined as one who has (1) an awareness and sensitivity to the total environment and its allied 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 environmental problems [and/or issues], and (5) active involvement in working toward resolution of environmental problems [and/or issues].*

Recent research in environmental education has identified a number of factors or characteristics that seem to predict behaviors that may be characterized as "environmentally responsible" as defined above (Hines and Hungerford, 1984; Hungerford and Volk, 1990). Sia et al (1985-86) identified a set of parsimonious predictors of ERB, including

- Environmental sensitivity
- Perceived knowledge of environmental action strategies
- Perceived skill in the use of environmental action strategies

Hungerford and Volk (1990) separated the predictors of ERB into three groups

- Entry-level variable - those that tend to predict or are related to Environmentally Responsible Behavior.
- Ownership variables - those that make environmental issues of personal importance to individuals,
- Empowerment variables - those that allow individuals to believe they can affect positive change in the environment

This research looked closely at the entry-level variable *environmental sensitivity.*

Tanner (1980) first explored the conditions leading to increased environmental sensitivity
by interviewing individuals he identified as having displayed what he considered to be
extensional sensitivity to the environment. Tanner reported that the antecedents of
environmental sensitivity appeared to include

- Long-term exposure to (relatively) pristine environments,
- Strong role models, and
- Early childhood experiences in the out-of-doors.

Other researchers have consistently reported finding the same antecedents of
environmental sensitivity (Peterson, 1982; Votaw, 1983; Peters-Grant, 1986, Palmer,
1993; Chawla, 1998).

Peterson (1982) first defined environmental sensitivity as "a set of affective
attributes which result in an individual viewing the environment from an empathetic
perspective." Other investigators have used this, or similar definitions in subsequent
research (Sia, 1985-86; Ramsey and Hungerford, 1989; Roth, 1992). Hungerford and
Volk (1990) reported that environmental sensitivity is the single entry-level variable that
appeared to predict what they considered environmentally responsible behaviors.
Consequently, they suggested environmental education researchers seriously consider it
for further investigation. Underlining its importance, the Framework of Earth Systems
Understandings includes as the first understanding the statement that "Earth is unique, a
planet of rare beauty and great value" (Mayer and Fortner, 1995).

Given the apparent antecedents of environmental sensitivity, the prevailing
structure in formal school settings makes it difficult for public schools to contribute
significantly to its enhancement among learners. Current instructional practice generally
precludes most secondary learners from spending any time outside of traditional
classrooms, much less experiencing extended exposures to (relatively) pristine environments. Rigid timeframes, isolated curriculum, inappropriate instructional materials, and traditional assessment methods all work against implementing instructional strategies identified as potentially contributing to increased environmental sensitivity.

Still, an emerging possibility does exist to support the development of environmental sensitivity within the formal school setting. Powerful new technologies are becoming increasingly available to public schools. These include high-resolution satellite imagery, geographic information systems (GIS), and other image analysis tools. One possibility little considered is the affective potential of these advanced graphical Earth systems analysis tools. Environmental educators need to consider how to effectively apply these technologies toward achieving the goal of increasing environmentally responsible thought and action.

Increasingly, people have the opportunity both to see and manipulate images taken from above the surface of the Earth. These images embody what might be described as an "off the planet" experience. The images display colors, patterns, and distributions never before perceived by human eyes. Noted photographer Ansel Adams referred to aerial photography as a medium "unique to our time" from whose images we may gain "new realizations of the biosphere and its limitations" (Garnett, 1982).

It is possible that these remotely sensed images have potential to affect a shift in a viewer's perception of the Earth system as well as the viewer's perception of her place within that system. Time after time, we hear stories about people who have traveled beyond our planet's boundaries being transformed by the view of Earth obtained from
this novel perspective. There exist numerous examples of individuals' lives being transformed by this experience (Kelly, 1988). Most have expressed a deeper level of concern and commitment to the planet. Many have changed careers and lifestyles to engage in activities intended to protect Earth and enhance the quality of life for her inhabitants.

A number of researchers have suggested that the integration of a cognitive and affective exploration of environmental issues may result in heightened levels of environmental sensitivity (Park and Chang, 1998) and appreciation (Pepi, 1994). Pepi in particular suggests that this combination of knowing and feeling has the potential to lead to a shift in perception regarding the natural environment. This perceptual shift that Pepi calls “felt-significance” may well contribute to an individual's reflexive actions within and toward the natural environment.

**Purpose of the Study**

The purpose of this study is to:

- describe a series of short field experiences on or near the school site, including descriptions of the learner, the instructor, and the situation.
- describe the methods applied during these outdoor experiences intended to enhance participants' level of environmental sensitivity.
- report learners' responses to the experience.
- recommend alternative methodologies for the delivery of Earth Systems education in a formal school setting.
- propose appropriate revisions to the existing model of environmental education.

The study provides a detailed description of learners' response to the combination of instructional strategies employed in the study. These strategies included (1) frequent
short outdoor field experiences on or near the school site, (2) the use of remotely sensed images of those places, and (3) application of a specific model (Figure 2) designed to promote the learners' level of nature appreciation (Pepi, 1994). The deeper understanding gained from this study of the contribution of these methodologies to increased environmental sensitivity will enhance the effectiveness of environmental education in general and of Earth Systems education in particular.

**Significance and Need for the Study**

Previous research suggests that environmental sensitivity is fundamental to the development of individuals able to think critically about their actions in and toward the environment (Sia, 1985-86; Hungerford and Volk, 1990). At the same time, thirty years of professional observation suggests that formal school settings are unlikely to provide the conditions generally considered critical to the development of environmental sensitivity (Tanner, 1980; Chawla, 1998). Nor is it likely that significant numbers of young citizens will have the opportunity to experience the apparent antecedents research indicates will lead to increased environmental sensitivity.

In an effort to remediate this deficiency, this study integrated the use of remotely sensed images with a combination of affective and cognitive outdoor learning experiences on or near the school site. Powerful new technology systems allowing the display and manipulation of a variety of remotely sensed images of Earth systems are becoming increasingly available in public school settings. By combining these technologies with affective, as well as more commonly utilized cognitive learning strategies, this study explored new ways to use these tools to foster environmental sensitivity.
Limitations and Assumptions

Environmental learning is a complex activity. A goal of this study was to describe critically and carefully a holistic learning environment. It assumes that the major elements of that environment are the learner, the instructor, and the environment. Research methods were designed to provide a detailed description of each of these elements and the interactions among them.

The interpretation and analysis of data collected during this research relies on additional assumptions. First, the researcher assumed that the responses elicited from learners were a valid representation of their thoughts, feelings and responses to the events in which they participated. This assumption is based on the existence of an atmosphere of mutual trust and respect between geographer (instructor) and apprentice geographer (learner) as described by objective outside observers. After observing the class, Mr. Richard Chapman, assistant principal at PHN stated, “[The instructor’s] friendly encouragement, positive approach...and ready willingness to admit that he...does not ‘have all the answers’ quickly puts the students at ease and establishes an open atmosphere of exploration and growth.” An ambience existed in the research environment providing for unconditional acceptance of all learner responses, both positive and negative. For example, after observing the geography classroom, Ms. Louella Allen, curriculum director at PHN wrote, “(The) classroom felt unconfined, unrestricted, inviting a free exchange of ideas, the freedom to disagree and risk take.” It is further assumed that the triangulated data, including student journals, summary reports, drawings, and recorded classroom and field conversations, will provide sufficient depth
and breadth of information to address the questions raised in this research.

The assumption was also made that the researcher is able to deliver accurate, objective interpretation of text and graphics-based learner responses. This assumption is supported by thirty years of classroom practice, including interpretation and formal presentation to peers of student-generated work in a variety of content areas including Communication Arts, Computer Applications, Science, and Geography.

**Definition of Terms**

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<tr>
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<tr>
<td>Action Research</td>
<td>A form of self-reflective inquiry undertaken by participants in social (including educational) situations in order to improve the rationality and justice of (1) their own social or educational practices, (2) their understanding of these practices, and (3) the situations in which the practices are carried out (Kemmis 1982).</td>
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<td>Environmental Sensitivity</td>
<td>A set of affective attributes which result in an individual viewing the environment from an empathetic perspective (Peterson, 1982). A predisposition to take an interest in learning about the environment, feeling concern for it, and acting to conserve it, on the basis of formative experiences (Chawla, 1998).</td>
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<td>Environmentally Responsible Behavior</td>
<td>An environmentally responsible citizen may be defined as one who has (1) an awareness and sensitivity to the total environment and its allied 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 environmental problems [and/or issues], and (5) active involvement in working toward resolution of environmental problems [and/or issues] (Hungerford and Volk, 1990).</td>
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Event (learning)  A single learning experience. In this case, usually an outdoor experience or a classroom activity focused on a visual exploration of an outdoor location.

Geography  Geography is the study of the surface of the earth - its physical and human-made environments, and the people, plants, and animals that live on the earth. Geography is about space - earth space - and asks where things are. Geography investigates the character of space at the earth’s surface. (Geography Education Standards Project, 1994)

GIS  An integrated system of hardware, software, procedures, and human intellect designed to support the collection, management, manipulation, analysis, modeling, and display of spatially referenced data about Earth’s surface in order to solve complex planning and management problems. (Geography Education Standards Project, 1994)

Mental Map  A map that represents the mental image a person has of an area, including knowledge of features and spatial relationships as well as the individual’s perceptions and attitudes regarding the place; also known as a cognitive map. (Geography Education Standards Project, 1994)

Nature Appreciating Event  An instance in which thinking, feeling, and acting are integrated deliberately in order to obtain the richest experiences possible from natural objects and events (Pepi, 1994).

Perception  Awareness, or process of becoming aware, of objects or relations or qualities by means of sensory processes and under the influence of internal readiness and prior experience (Meredith, 1993).

Perception (Geographic)  An individual’s worldview based upon culture, life experience, gender, socio-economic patterns, education and the like. (Geography Education Standards Project, 1994)
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</tr>
</thead>
<tbody>
<tr>
<td>Remote Sensing</td>
<td>The acquisition of information from a distance whether using sight, sound or smell (Lillesand and Kiefer, 1994).</td>
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<td>Sense of Place</td>
<td>Refers to an experientially-based intimacy with the natural processes, community, and history of one's place (Sanger, 1996)</td>
</tr>
<tr>
<td>System</td>
<td>Collections of entities that are linked and interrelated, such as the hydrologic cycle, cities, and transportation modes. They appear to form a unified whole. (Geography Education Standards Project, 1994)</td>
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<td>Value</td>
<td>An enduring belief that a specific mode of conduct or end-state of existence is personally and socially preferable to alternative modes of conduct or end-states of existence (Rokeach, 1968: 160).</td>
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CHAPTER 2

REVIEW OF THE LITERATURE

This case study explored the role of a holistic learning environment in fostering environmental sensitivity in a public school setting. It reported participants' reflections related to outdoor field experiences on or near the school site while applying a specific model for nature appreciation. It also reviewed learners' responses to the use of remote sensing technologies in the classroom. Finally, the report looked at the potential alignment of these activities with major national standards in Earth Systems education, science, social studies, and language arts. The theoretical basis for this inquiry is found in the literature related to environmental education, nature appreciation, sense of place education, remote sensing, and Earth Systems education.

Environmental Sensitivity

The stated goal of environmental education (EE), as defined at the foundational United Nations sponsored Belgrade Conference in 1975, is "to develop a world population that is aware of, and concerned about, the environment and its associated problems, and which has the knowledge, skills, attitudes, motivations and commitment to work individually and collectively toward solutions of current problems and the prevention of new ones" (UNESCO-UNEP, 1976). The earliest attempts at environmental
instruction focused on increasing environmental knowledge with the belief that increased knowledge of environmental problems would lead to increased action taking. Initial efforts focused on simply transmitting environmental knowledge on the assumption that if individuals were aware of what actions demonstrated environmentally responsible behavior and why such action was important, citizens would begin to act in the prescribed fashion. This strategy failed to measurably increase what researchers defined as environmentally responsible behaviors (Zimmerman, 1996; Hines & Hungerford, 1984). Many factors operated to prevent action, at times even when intent was present. These included lack of skill regarding how to proceed, lack of knowledge concerning what issues and situations constituted true environmental issues, and perhaps most significantly, lack of desire to conform personal habits and behaviors to those more in keeping with protecting and improving the environment (Gigliotti, 1990; Iozzi, 1989; Ramsey, and Hungerford, 1989). Increased environmental knowledge, in fact, rarely resulted in any measurable change in positive environmental attitude or action. In fact, there is some evidence to support the notion that increased knowledge of environmental problems without increased skills in addressing the problems identified actually led to stronger negative feelings about the individual's ability to positively affect the environment (Lewandowski, 1986, Iozzi, 1989).

In light of the failure of the "knowledge to behavior" approach to environmental education, researchers began looking for alternative approaches. A number of researchers, led by Harold Hungerford, set out to identify a set of "predictors of environmental behavior." This research produced a list that included (1) knowledge of issues, (2) beliefs
concerning issues, (3) individual values, (4) individual attitudes, (5) locus of control, (6) environmental sensitivity, (7) knowledge of and skill in the use of environmental action strategies, and (8) knowledge of ecological concepts (Sia, et al, 1985-86).

In one critically important study, Sia (1985-86) carried out a statistical analysis of these variables on data collected from two distinct groups of subjects. One group consisted of members of the Sierra Club while the other was drawn from members of Elderhostel. This analysis produced a parsimonious set of predictors of environmentally responsible behavior – the smallest group of variables that accounted for the greatest amount of variance. These included (1) perceived skill in using environmental action strategies, (2) level of environmental sensitivity, and (3) perceived knowledge of environmental action strategies. Taken together, these variables accounted for nearly half of the variance in environmental behavior among the subjects of the study (Sia, 1985).

Hungerford and Volk (1990) further analyzed the relationships among these predictors and grouped them into three categories, identifying them as entry-level, ownership, and empowerment variables (Figure 1). Entry-level variables are those that appear to be prerequisites for responsible behaviors. Ownership variables are those that permit an individual to internalize particular environmental issues to make them one's own. Finally, the group of variables denoted as empowerment variables support a strong sense of efficacy among individuals. In some ways, this work took a decidedly behaviorist, even manipulative direction. Hines, et al (1986-87) suggested the following:

While the pathway represented...by knowledge, skills, and personality factors is the more desirable pathway by which to encourage environmentally responsible behavior, it may be more efficacious, in the case of certain environmental problems, to manipulate situational factors in order to produce the desired behavior changes. (emphasis added)
Some environmental educators objected strenuously to such an approach to environmental education (Robottom, 1987; Robottom and Hart, 1995; Jickling, 1992). They generally argued that such practices removed the 'responsible' from environmentally responsible behavior. Instead, Robottom and others called for greater emphasis on critical thinking and decision-making within the scope of environmental instruction.

Combining these two perspectives, one may state that the desired outcome of environmental education is the development of reflexive, informed decision-makers who
act in ways they determine to be beneficial to the environment. In considering how to
arrive at that outcome it seems worthwhile to begin by looking at what many consider the
antecedents of such behavior. Environmental Sensitivity (ES) is among those
characteristics described as one of the parsimonious predictors of ERB (Hungerford and
Volk, 1990; Sia, 1985-86).

Tanner (1980) first brought this concept to the general attention of the
environmental community. Tanner's work explored the life history of individuals who
exhibited a strong environmental ethic. He reported certain characteristic experiences
among individuals who demonstrated high levels of environmentally responsible
behavior. These included childhood experiences, significant contact with environmentally
responsible role models, and time spent in (relatively) pristine environments. Tanner was
attempting to discover the antecedents to environmental action taking and did not
operationalize the concept of environmental sensitivity. Peterson (1982), in work closely
paralleling that of Tanner (1980), defined environmental sensitivity as "a set of affective
attributes which result in an individual viewing the environment from an empathetic
perspective." While her work sought to discover antecedents of environmental sensitivity,
rather than of environmental action taking, she also found that youthful outdoor
experiences, and strong environmentally aware role models seemed to precede elevated
levels of ES.

Other researchers have found much the same antecedents among individuals who
have demonstrated a higher degree of environmental sensitivity (Palmer, 1993; Votaw,
1983; Peters-Grant, 1986 and Sward, 1996; in unpublished documents reported by
Chawla's (1998) synthesis of previous investigations related to environmental sensitivity indicates that, while the antecedents identified by Tanner and Peterson remain the most significant, additional influences are becoming apparent. Most notably, education now seems to be playing a greater role in developing sensitivity, especially among younger females (Chawla, 1998). At the same time, other researchers have found that negative influences, such as witnessing environmental degradation, especially in the local place, have been reported as an antecedent to increased ES (Hungerford and Volk, 1990; Chawla 1998).

Chawla (1998) further proposes reformulating the definition of environmental sensitivity as "a predisposition to take an interest in learning about the environment, feeling concern for it, and acting to conserve it, on the basis of formative experiences." This reformulation of ES, Chawla argues, avoids the cultural controversy of the meaning of empathy, which is most commonly defined as "the identification with or vicarious experiences of the feelings, thoughts, or attitudes of another" (Webster's Encyclopedic Unabridged Dictionary, 1989). One implication of such a definition must be that Earth itself is a living, feeling entity with which one could empathize. Whatever one's view on this position, Chawla argues, general acceptance of such an interpretation of ES must undoubtedly lead to unnecessary division among environmental educators. It certainly poses problems in attempting to integrate environmental education within the context of formal education.
Sense of Place

While a number of researchers have investigated the antecedents of environmental sensitivity (Tanner, 1981; Peterson, 1982; Chawla, 1998), little has been done to examine strategies intended to increase environmental sensitivity in formal school settings (Park and Chang, 1998). A potentially powerful strategy for increasing environmental sensitivity may lie in an increased emphasis on sense of place education. Sense of place refers to “an experientially based intimacy with the natural processes, community, and history of one’s place” (Sanger, 1997). Sense of place education utilizes experientially based explorations of the local scene and is intended to develop increased understanding and appreciation of critical natural systems operating within the environment of the local place. Others have addressed the importance of place education as well. For example, in Mapmaking with Children, Sobel calls for significant changes in social studies curriculum, placing increased importance on place education (1998):

A curriculum based on building a relationship between the structure of the local landscape and the shape of the children’s lives must replace our nonsensical focus on the long ago and faraway. We need a curriculum that aspires to ecological literacy – a deep understanding of the flora, fauna, water, culture, climate, and communities that children live in. Whether the class is in the hills of New Hampshire or the boroughs of New York, the initial emphasis should be on what is right outside the door.

Effective sense of place education does not require involved or distant field experiences, nor does it depend on the availability of pristine sites or wilderness. As Sanger (1996) states, “By taking students outside to experience whatever accessible natural processes exist around them, teachers can provide a crucial element in good education and sense of place.” A change in emphasis to a more place-centered
curriculum presents a number of implications relevant to the goals of environmental education in general and of increased sensitivity in particular. Orr (1992) identified several values associated with integration of place into education, two of which are particularly relevant to the current study.

First, he suggests, sense of place education fosters a combination of intellect and experience. This integration holds the potential for changing perception and leading to a deeper appreciation of the local place. Pepi (1994) extends this thinking when he makes the integration of cognition and affect the key element in his nature appreciation model. The culmination of such integration of thinking and feeling results in what Pepi describes as a moment of felt-significance. This moment represents a shift in perception regarding the event experienced, resulting in profound changes in beliefs, attitudes and behaviors.

Second, Orr suggests that formal place education has the potential to lead individuals to a better understanding of the art of “living well where they are.” Orr draws an important distinction between what he calls an inhabitant of a place and a mere resident. The latter is a temporary occupant, who lacks awareness of the surrounding habitat, and who requires nothing more than “cash and a map.” An inhabitant, on the other hand, dwells on the land, and is intimately acquainted with much of its life and life supporting systems. Inseparable, harming the habitat harms the inhabitant. Most importantly, perhaps, the inhabitant is cognizant of this fact. Orr concludes by stating, “The sum total of violence wrought by people who do not know who they are because they do not know where they are is the global environmental crisis.” (Orr, 1992).

And how does the traditional education system address this concern? “In nearly
every facet of education even under the rubric of EE, educators teach students that their relationship with their place is marginal, uninteresting, and unimportant…” (Sanger, 1997). Sobel (1998) refers to the “outside-in” approach to social studies instruction, in which the emphasis is placed on “abstract, long ago and faraway information.” He suggests that these strategies alienate children from their immediate surroundings. They send an inadvertent message that all important places are far away, and that the immediate surroundings are negligible and unimportant. Finally, Orr (1992) concludes that, “to a great extent, formal education now prepares its graduates to reside, not to dwell”.

A number of strategies have been suggested to support place education. Sanger (1996) suggests the value of an experience-based education that not only teaches about the land, but also communicates a valuing of the land resulting from field experiences beyond the classroom. He suggests that, using resources already available, it is possible to alter metaphors for understanding place, educate experientially, learn cooperatively, use local and relevant topics and examples as well as make connections involving the community. Sobel (1998) argues that projects should take place in neighborhoods, the broader community, and the local watershed. Orr (1992) also supports the need for instructional experiences outside the formal classroom, stating that, “Experience in the natural world is both an essential part of understanding the environment, and conducive to good thinking.”
Nature Appreciation

Perhaps most significant because of its specificity is the proposal by David Pepi for the adoption of a theory of nature appreciation. In *The Mechanics of Nature Appreciation*, Pepi (1994) describes a formal method for thinking about nature appreciation that reveals its parts and their relationships. The method he describes allows an individual, such as a teacher, to facilitate the process of nature appreciation as well as communicate the experience of nature appreciation to others. The theoretical framework he presents also serves as a tool to evaluate the qualitative level of appreciation expressed by others.

Pepi developed the model by first defining a nature-appreciating event, and then using that definition to identify specific instances of appreciating. Pepi obtained written records of such events, analyzed them for regularities, and developed a theory designed to improve the practice of nature appreciation. Pepi (p. 6) defined nature appreciation events as "instances in which thinking, feeling, and acting are integrated deliberately in order to obtain the richest experiences possible from natural objects and events." Using this definition, Pepi used such notable nature appreciators as Anna Botsford Comstock, John Muir and Henry David Thoreau as sources for written records of appreciating experiences for analysis. His formal analyses resulted in the identification of 15 elements, or regularities, potentially present in any nature appreciation event. Pepi divided these elements into those addressing the cognitive experience and those comprising the affective experience. Figure 2 illustrates the arrangement of the elements leading to the unifying experience Pepi defines as "felt-significance."
Remote Sensing

While it seems clear that experiential, place-based learning is a critical element in fostering increased environmental sensitivity, the structural limitations of the formal school setting works against such out-of-classroom experiences. However, it is possible that the effect of limited exposure to the local scene may be enhanced by integrating field
experiences along with remotely sensed images of the area under investigation in a process that may be thought of as either “walking on the images” or as an “off the planet experience” depending upon one's perspective.

Remotely sensed data include any information acquired from a distance whether using sight, sound or smell (Lillesand and Kiefer, 1994). This study is primarily concerned with visual data acquired through satellite sensors or photography. These types of data have only recently become generally available to scientists. Photographic imagery has been widely available since the 1940s; satellite images only since the early 1970s. Very recent advances in space imaging have led to the availability of satellite images of considerably higher resolution – 1 meter pixel resolution or better. Within the last few years these data have become available and affordable in K-12 education settings using standard classroom computers and public access to images.

Most of the literature related to its use in instructional settings has focused on the cognitive applications of remote sensing data (e.g., Fortner, 1992; Mayer & Fortner, 1995). Giardino (1986) describes how remotely sensed images of Texas and the southwest region were used in conjunction with one, three and four day field experiences to enhance geographic instruction at the university level. One noteworthy element of this research was the conscious decision to use hands-on field-based activities to assess learners' knowledge acquisition rather than more traditional test-based assessment. While not specifically addressing the issue of participant affective reaction to the experience, Giardino does mention that students were willing to pay fees of up to $150 to join the field trips and that some students actually repeated the field experience multiple times.
At the other end of the learning spectrum, children as young as the third grade in Alberta, Canada, demonstrated the ability to use and interpret remotely sensed images and aerial photography in multiple field trials in a variety of circumstances (Kirman, 1991). Kirman further demonstrated that it was possible to train teachers to interpret and use the images as teaching tools in learning environments. Meanwhile, secondary learners in British Columbia, Canada, used aerial images to investigate changes over time by interpreting a series of images going back some 50 years (Osmers, 1991). Image analysis skills and practice also contribute to the development of higher order thinking skills as a result of practice in measuring, analyzing and presenting results of investigations to others (Marks et al, 1996).

Some research is also beginning to address the synergistic possibilities of combining image-based virtual explorations with on-site investigations of scenes portrayed in remotely sensed images.

Satellite-generated images are a most useful tool to teach about environmental and cultural changes. The view from out in space gives students a whole new perspective from which they can view changes over time. The ability to observe the expansion or shrinkage of agricultural zones, forests, or wetlands combined with...on-site field trips...will prove to be a superb learning experience” (Osmers, 1991, p. 15).

Others have suggested that the power inherent in visualization techniques may be a “big idea” in (science) education if teachers and learners are able to alter their perception of remotely sensed images from that of being merely lecture aids to becoming a focal point for student investigation and inquiry (Barstow, 1997).

As important as remotely sensed images and visualization strategies may be as a cognitive tool, their power as tools for affecting perception and enhancing environmental
sensitivity may be even greater. Images of Earth whether taken from beyond Earth orbit or from high-flying kites seem to have a power to transform human thinking about the planet, its surface and its systems. More importantly, they seem to have a power to transform human thinking about the role and impact of human behavior on those systems. Perhaps it is the strange new perspective of looking down on the planet from above, or perhaps it is the unprecedented ability to see the vast extent of Earth and its systems, but humans from all cultures and physical regions of the world, when viewing Earth from space have expressed just such awe and wonder, often reporting that the sight of Earth from space has transformed their lives in powerful ways (Kelly, 1988).

Kelly also reports a fascinating phenomenon that apparently affects humans who view Earth from space. He notes that, in general, astronauts and cosmonauts express even the most complex thoughts in statements averaging 5 – 10 seconds. Yet when these same taciturn pilots and engineers viewed Earth from space for the first time, their emotional response to the sight lasted 42 seconds on average. He states further that “anyone who has seen Earth from space knows that it is an incomparable sight. It’s not just that the planet is piercingly beautiful when viewed from a distance; something about the unexpectedness of the sight, its incompatibility with anything we have ever experienced on Earth, or known, or practiced, elicits a deep emotional response” (Kelly, 1988). Ansel Adams, artist and photographer of the American landscape, expressed similar wonder regarding the power of aerial images of Earth, “The world from the air is, indeed, a new world, and ...recordings of it...are breathtaking....All are interesting and excite the imagination...We stand in awe of ‘the thing seen and photographed’....Photography has
returned miracles of observation to us and has broadened our concepts of the vast
universe of which we are a part” (Garnett, 1982).

One study, in particular, strongly emphasizes the affective quality of remote
images of Earth. Dambekalns (1996) describes an experiment she conducted with
secondary students in Pennsylvania in which she asked learners to create interpretive
visual images of place based upon remotely sensed images and aerial photographs using
fiber reactive dyes and silk as the medium. Participants produced a variety of
interpretations from the abstract to the literal, exploring such principles as perspective,
scale, abstraction and emphasis. In her conclusion Dambekalns (1996) states, “The
products were powerful visual statements, but more importantly, through the process the
students began to gain confidence in their ability to use data beyond a scientific
literalism….And for many, ran the unifying theme of wonder and reverence for the
diversity of geological form and biological mass on this planet.

**Action Research**

This study relied on the investigative strategies of Action Research. Action
research is a form of self-reflective inquiry undertaken by participants in social (including
educational) situations in order to improve the rationality and justice of (1) their own
social or educational practices, (2) their understanding of these practices, and (3) the
situations in which the practices are carried out (Kemmis 1982 in Robottom, 1987).
Traditional research has tended to create a separation between researchers and
practitioners in education. Researchers became the “experts” whose role was to decide
what constituted “best practice.” Educational practitioners were then expected to
implement the prescribed strategies. Robottom (1987) refers to this as the technocratization of education. Action research developed as an attempt to close this gap; to value the deliberative and reflective qualities of those involved in planning and implementation (Nixon, 1983). In particular, practitioners reflect critically on the relationship between their practice (the monitored action) and their subjective view of what is being practiced (the personal 'theory' that guides their practice). Action Research, then, is mediated by praxis, by practitioners' critical reflection upon their professional activities (Robottom, 1987).

A significant characteristic of action research is that it generally focuses on a specific practice in a specific classroom setting. Nixon (1983) points out that it is the specificity of the particular case that arouses and sustains interest in research. Action research holds that the study of a specific case of concern to the practitioner has greater viability than the study of representative samples, which forms the basis of more traditional educational research.

In general terms, the structure of an action research study follows a particular pattern of steps or stages. It begins with a feeling of dissatisfaction with some instructional practice or outcome, resulting in desire for change or improvement on the part of the practitioner. The next stage involves the development of a plan of action intended to remediate the perceived problem. This planning stage, according to Nixon (1983), involves both the planned intervention and a strategy for monitoring what occurs during this implementation. The recording method may include field notes, audio and video recordings, peer observations, student-recorded responses, or any combination of
these. The succeeding stages, implementation and observation, often occur simultaneously. The last stage, reflection, is critical. The practitioner-researcher must critically reflect on the experience to determine whether the outcome was an improvement over previous practice, and to decide what actions ought to be retained and which need to be modified as practice continues.

A critical characteristic of action research is the repeated cycle of these stages. Critical reflection without subsequent action is meaningless. Robottom (1987) states that “It is the action research spiral of successive cycles, rather than a single cycle of three phases, (planning, action, and reflection) that allows improvement in the rationality and justice of the practice itself, of the practitioners’ understanding of the situation in which the practices are carried out”. Figure 3 illustrates the nature of this cycle. Robottom points out it is the dialectical relationship between theory and practice that truly informs action research. Within the repeated spiral of planning, action, and reflection, action is suggested by theory and theory is modified in light of the results of action.

Going even farther, Robottom suggests that a double dialectic is at work within the context of action research. In addition to reflecting on the effects of personal theory in action, the researcher also engages in inquiries to the extent to which the structure and organization of the local setting constrains her actions and thoughts. The practitioner should also consider what institutional barriers were encountered; what beliefs and assumptions about teaching and schooling are evident in practice. It is within the context of this double dialectic that the researcher engages in the political and ideological struggle that can lead toward meaningful change and innovation (Robottom, 1987).
Inquiry questioning is disrupted by need to keep control in ways expected by class.

Record questions and responses on tape, keep personal notes for awhile

Inquiry developing but students more unruly. How to keep on track? Listening? Probing? What works?

Record on tape questioning and control statements. Note in diary effects on behavior.

Students think learning means recalling facts. How can I stimulate inquiry?

Shift questioning strategy to encourage student exploration of their own questions

Try questions that let students say what they mean.

Continue general aim but reduce number of control statements

Use less control statements for a few lessons.

Figure 3. Model of spiral pattern of the action-research model. (Source: Robottom, 1987).

Nixon (1983) makes a similar argument when he points out that at a time when increasing demands are being made on teachers in terms of professional expertise and commitment, their control over what is taught and how this is being curtailed by central
government prescription. Action research offers an opportunity for (environmental) educators to define their role as both participatory and critical.

**Earth Systems Education**

Earth Systems Education is an innovative approach to science education that, while sharing many of the goals and objectives of better known science reform movements, stands out in its effort to integrate instruction with a focus on the Earth System (Mayer and Fortner, 1995). The Earth Systems education movement emerged from a series of meetings of geoscientists, science education researchers, and K-12 instructional practitioners during the late 1980's and early 90's. These educators were concerned about the lack of emphasis on planet Earth as a focus of inquiry within the science reform movement at that time (Mayer, 1992). Those early meetings resulted in the development of a "Framework for Earth Systems Understandings. These seven fundamental understandings include:

Understanding #1  Earth is unique, a planet of rare beauty and great value.
Understanding #2  Human activities, collective and individual, conscious and inadvertent, are seriously impacting planet earth.
Understanding #3  The development of scientific thinking and technology increased our ability to understand and utilize Earth and space.
Understanding #4  The Earth system is composed of the interacting subsystems of water, land, ice, air, and life.
Understanding #5  Planet Earth is more than four billion years old and its subsystems are continually evolving.
Understanding #6  Earth is a small subsystem of a solar system within the vast and ancient universe.
Understanding #7  There are many people with careers that involve study of Earth's origin, processes, and evolution.
Significant areas of congruency exist between the Understandings and the fundamental geographic concepts that are the focus of the geography program examined in this research. For instance, Understanding #2 addresses the impact of human activity on the general health of the Earth system. This connects directly with the concept of Human/Environmental Interaction, the focus of significant national geographic education projects such as River Action 2001 (GeographyAction, 2001). Understanding #2 also aligns with the intended outcome of EE to increase instances of reflexive, environmentally responsible behavior. Understandings #4 and #5 are concerned with understanding and appreciating the interconnected subsystems of Earth, as well as the continual process of change occurring within those systems. Similar ideas and concepts are addressed by the geographic concepts of system and change.

Of greatest significance however, is the congruence of Understanding #1 and Pepi's model for nature appreciation. It is worth considering the subgoals of that understanding as well:

Understanding #1: Earth is unique, a planet of rare beauty and great value.

- The beauty and value of Earth are expressed by and for people of all cultures through literature and the arts
- Human appreciation of Earth is enhanced by a better understanding of its subsystems
- Humans manifest their appreciation of Earth through their responsible behavior and stewardship of its subsystems.

The Earth Systems approach to science education is unique among science reform movements in placing such a strong emphasis on aesthetics and appreciation for the inherent beauty of the home planet. The importance of such an emphasis is best summed up Victor Mayer, one of the founders of the movement,

By focusing on students' feelings toward the Earth Systems and on the way in which they experience and interpret them, students are drawn into a systematic study of their planet,
that is, into science. By bringing student attitudes and feelings into the science classroom, science becomes more fully and accurately a human endeavor, one that involves the total human being in the study of planet Earth and its surroundings. Students are able to draw upon a broad range of talents and interests — both right brain as well as left (Mayer, 1992)

This sense of connecting with the beauty of Earth, both intellectually and emotionally, is precisely in sync with the meaning/feeling axis presented in Pepi’s (1994) nature appreciation model. A significant synthesis may be possible by including the content (scientific associations) of the Earth systems model with the nature appreciation model of David Pepi.

At the same time, the recommended instructional methods of the Earth Systems Education model dovetail with the learning model employed in the geography program as described here. The Earth Systems educators generally advocate a constructivist approach to learning. As such, its proponents support and recommend the use of such strategies as (field-based) hands-on learning, student centered investigations, and cooperative learning (Mayer and Fortner, 1995). All these strategies are appropriate for the field-based, place-focused learning attempted in this study.

Moreover, Earth Systems advocates also make a strong case for the efficacy of remotely sensed images and aerial photographs of the Earth as a means of assisting learners in developing a conceptual understanding of the Earth system (Fortner, 1992). Fortner argues that the use of such images allow learners, regardless of age, to develop a world view that encompasses a deeper understanding of Earth as a system, and an awareness of the profound changes taking place within that system over time. She further states that this perspective can and ought to begin first at the neighborhood level, and extending beyond to encompass the planet as a whole.
**Instructional Standards**

Educational research and proposed new instructional interventions must address the issue of instructional standards if they are to have any hope of being seriously considered in the current climate of postmodern education. Nixon (1983) points out that at a time when increasing demands are being made on teachers in terms of professional expertise and commitment, their control over what is taught and how it is taught is being curtailed by central government. Clearly indicating which standards EE activities are addressing will certainly enhance their probability of being implemented. In fact, one of the strengths of EE is that it affords the opportunity to address multiple standards across multiple disciplines within a single instructional intervention. The opportunities for interdisciplinary learning possible within the context of EE present a ready avenue for actually addressing multiple standards simultaneously. It is worth noting that the National Science Standards specifically call for interdisciplinary application of the standards in the learning environment as noted in the following quotation from the standards document:

> Student achievement in science and in other school subjects such as social studies, language arts, and technology is enhanced by coordination between and among the science program and other programs. Furthermore, such coordination can make maximal use of time in a crowded school schedule. As an example, the National Standards for Geography include knowledge about landforms, as does the earth and space science standard. A combined geography and science unit is natural. Oral and written communication skills are developed in science when students record, summarize, and communicate the results of inquiry to their class, school, or community. Coordination suggests that these skills receive attention in the language arts program as well as in the science program.

A review of geography, science, communication arts and social studies standards indicate that the goals of EE in general, and of the observed program in particular, routinely address multiple standards across multiple disciplines.
National Geography Standards

An examination of the National Geography Standards (Geography Education Standards Project 1994) indicates that the activities associated with this research have the potential, at least, to address elements of all 18 standards. The following 12 standards are directly addressed by the proposed instructional strategies.

Element One: The World in Spatial Terms

**Standard 1:** How to Use Maps and Other Geographic Representations, Tools, and Technologies to Acquire, Process, and Report Information From a Spatial Perspective

**Standard 2:** How to Use Mental Maps to Organize Information About People, Places, and Environments in a Spatial Context

Element Two: Places and Regions

**Standard 4:** The Physical and Human Characteristics of Places

**Standard 5:** That People Create Regions to Interpret Earth’s Complexity

Element Three: Physical Systems

**Standard 7:** The Physical Processes That Shape the Patterns of Earth’s Surface

**Standard 8:** The Characteristics and Spatial Distribution of Ecosystems on Earth’s Surface

Element Four: Human Systems

**Standard 12:** The Processes, Patterns, and Functions of Human Settlement

**Standard 13:** How the Forces of Cooperation and Conflict Among People Influence the Division and Control of Earth’s Surface

Element Five: Environment and Society

**Standard 14:** How Human Actions Modify the Physical Environment

**Standard 15:** How Physical Systems Affect Human Systems

Element Six: The Uses of Geography

**Standard 17:** How to Apply Geography to Interpret the Past

**Standard 18:** How to Apply Geography to Interpret the Present and Plan for the Future

The complete set of standards are available at:

Likewise, the work proposed here addresses the National Science Standards in a significant way. Of the seven science standards, the two listed below are directly addressed.

STANDARD E: As a result of activities in grades 9-12, all students should develop
• Abilities of technological design
• Understandings about science and technology

STANDARD F: As a result of activities in grades 9-12, all students should develop understanding of
• Personal and community health
• Population growth
• Natural resources
• Environmental quality
• Natural and human-induced hazards
• Science and technology in local, national, and global challenges

The complete National Science Education Standards are available at:
http://www.nap.edu/readingroom/books/nses/html/

Of even greater significance is the call within the National Science Education Standards for systemic change in the American educational system. It is worth examining the following list of proposed changes and noting the implementation of many of them within the geographic/Earth Systems program detailed here.
The National Science Education Standards envision change throughout the system. The program standards encompass the following changes in emphases:

<table>
<thead>
<tr>
<th>LESS EMPHASIS ON</th>
<th>MORE EMPHASIS ON</th>
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<tr>
<td>Developing science programs at different grade levels independently of one another</td>
<td>Coordinating the development of the K-12 science program across grade levels</td>
</tr>
<tr>
<td>Using assessments unrelated to curriculum and teaching</td>
<td>Aligning curriculum, teaching, and assessment</td>
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<tr>
<td>Maintaining current resource allocations for books</td>
<td>Allocating resources necessary for hands-on inquiry teaching aligned with the Standards</td>
</tr>
<tr>
<td>Textbook- and lecture-driven curriculum</td>
<td>Curriculum that supports the Standards, and includes a variety of components, such as laboratories emphasizing inquiry and field trips</td>
</tr>
<tr>
<td>Broad coverage of unconnected factual information</td>
<td>Curriculum that includes natural phenomena and science-related social issues that students encounter in everyday life</td>
</tr>
<tr>
<td>Treating science as a subject isolated from other school subjects</td>
<td>Connecting science to other school subjects, such as mathematics and social studies</td>
</tr>
<tr>
<td>Science learning opportunities that favor one group of students</td>
<td>Providing challenging opportunities for all students to learn science</td>
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<tr>
<td>Limiting hiring decisions to the administration</td>
<td>Involving successful teachers of science in the hiring process</td>
</tr>
<tr>
<td>Maintaining the isolation of teachers</td>
<td>Treating teachers as professionals whose work requires opportunities for continual learning and networking</td>
</tr>
<tr>
<td>Supporting competition</td>
<td>Promoting collegiality among teachers as a team to improve the school</td>
</tr>
<tr>
<td>Teachers as followers</td>
<td>Teachers as decision makers</td>
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Table 1. Proposed changes in emphases called for by the National Science Standards. Items addressed by the EE strategies employed in this program are italicized.
National English Language Arts Standards

Standards supported by the National Council of Teachers of English provide additional opportunity for integrated instruction. The written record of events and the presentation of findings of students engaged in the explorations of the local scene address at least 7 of the 12 standards endorsed by the NCTE.

4. Students adjust their use of spoken, written, and visual language (e.g., conventions, style, vocabulary) to communicate effectively with a variety of audiences and for different purposes.

5. Students employ a wide range of strategies as they write and use different writing process elements appropriately to communicate with different audiences for a variety of purposes.

7. Students conduct research on issues and interests by generating ideas and questions, and by posing problems. They gather, evaluate, and synthesize data from a variety of sources (e.g., print and nonprint texts, artifacts, people) to communicate their discoveries in ways that suit their purpose and audience.

8. Students use a variety of technological and information resources (e.g., libraries, databases, computer networks, video) to gather and synthesize information and to create and communicate knowledge.

11. Students participate as knowledgeable, reflective, creative, and critical members of a variety of literacy communities.

12. Students use spoken, written, and visual language to accomplish their own purposes (e.g., for learning, enjoyment, persuasion, and the exchange of information).

A complete list of the English Language Arts standards are available at: http://www.ncte.org/standards/standards.shtml
National Social Studies Standards

Finally, an examination of the National Social Studies Standards, as presented by the National Council of the Social Studies, demonstrates significant connectedness to many of the social studies standards. Of the ten standards, this program addresses the following four in significant ways.

2. Time, Continuity and Change
Human beings seek to understand their historical roots and to locate themselves in time. Knowing how to read and reconstruct the past allows one to develop a historical perspective and to answer questions such as: Who am I? What happened in the past? How am I connected to those in the past? How has the world changed and how might it change in the future? Why does our personal sense of relatedness to the past change? This theme typically appears in courses in history and others that draw upon historical knowledge and habits.

3. People, Places and Environments
The study of people, places, and human-environment interactions assists students as they create their spatial views and geographic perspectives of the world beyond their personal locations. Students need the knowledge, skills, and understanding to answer questions such as: Where are things located? Why are they located where they are? What do we mean by "region"? How do landforms change? What implications do these changes have for people? In schools, this theme typically appears in units and courses dealing with area studies and geography.

4. Individual Development and Identity
Personal identity is shaped by one's culture, by groups, and by institutional influences. Students should consider such questions as: How do people learn? Why do people behave as they do? What influences how people learn, perceive, and grow? How do people meet their basic needs in a variety of contexts? How do individuals develop from youth to adulthood? In schools, this theme typically appears in units and courses dealing with psychology and anthropology.

8. Science, Technology and Society
Modern life as we know it would be impossible without technology and the science that supports it. But technology brings with it many questions: Is new technology always better than old? What can we learn from the past about how new technologies result in broader social change, some of which is unanticipated? How can we cope with the ever-increasing pace of change? How can we manage technology so that the greatest number of people benefit from it? How can we preserve our fundamental values and beliefs in the midst of technological change? This theme draws upon the natural and physical sciences, social sciences, and the humanities, and appears in a variety of social studies courses, including history, geography, economics, civics, and government.

The complete set of National Social Studies Standards is available at: http://www.socialstudies.org/standards/stitle.html
Standards are, and will continue to be, a critical element in education. Any call for implementation of innovative instructional strategies, including environmental education, must demonstrate how it addresses this significant instructional component. The applicable standards listed above demonstrate clearly the powerful interdisciplinary nature of EE in general, and of the investigated environmental education strategy in particular.
CHAPTER 3

GENERAL METHODS AND PROCEDURES

Purpose of the Study

The purpose of this study was to describe in detail and reflect upon learners' response to a series of short outdoor field experiences on or near the school site. It wondered, specifically, what patterns of response emerge when learners view aerial photographs of the local scene and then walk purposefully on the same landscape. The intent was 1) inform the instructional practices of the teacher-researcher, and 2) investigate more effective and generalizable strategies for implementing Earth Systems education practices in a formal school setting. The major elements of this investigation included:

- describing a series of short field experiences on or near the school site, including descriptions of the learner, the instructor, and the situation.
- describing the methods applied during these outdoor experiences intended to enhance participants' level of Environmental Sensitivity.
- reporting learners' responses to the experience.
- recommending alternative methodologies for the delivery of Earth Systems education in a formal school setting
- proposing appropriate revisions to the existing model of environmental education
A case study reported by Owens, et al (1976 cited in Patton, 1990) of a pedagogically similar instructional program involving experienced-based career education (EBCE) offered a rationale that was easily paraphrased to support conducting an intrinsic case study in the current situation:

(a) The program under study is process-based. It is the philosophy of the program that the medium is truly the message, i.e., there is no environmental sensitivity content as such. Experiential learning (outdoor field experience) is used to provide an opportunity for learners to reflect critically and sensitively about the natural world if they choose to do so....The case-study approach zeroes in on the process of learning. Its primary focus is the student experiences in the learning situation. It describes the learner, the facilitator, the situation, and the resulting interaction.

(b) Because formal environmental sensitivity education is so new (or non-existent) and definitive descriptions are not available, case studies provide empirical definitions of environmental sensitivity education.

(c) The holistic nature of the case study approach fits well with the constructivist instructional approach. It does not reduce the learning processes to independent, isolated parts, but describes the Gestalt as it traces learners' progress, frustrations and challenges throughout the program.

The importance of this study lies in the uniqueness of its perspective. A review of the literature indicates that the body of research related to environmental sensitivity has focused primarily on attempts to discover the antecedents of sensitivity in non-formal environments (Tanner, 1980; Chawla, 1998 and others). Meanwhile, with few exceptions (Dambekalns, 1997) the literature related to instructional uses of remote sensing tools has examined cognitive rather than affective implications. The present study produced a comprehensive record of the actions and reactions of participants over the course of the virtual explorations as well as those that occurred on the locations pictured in the images. Analysis of this record will lead to a deeper understanding of these interactions and to
more comprehensive and effective strategies for integrating Earth Systems education concepts in a formal school setting.

Action Research

This study relied on the investigative strategies of Action Research as described by Hart (1993) and Robottom (1987). In this case, an individual practitioner felt dissatisfied with the current practice of geography education and sought alternative strategies. These new strategies included the following:

- Relatively frequent, short outdoor field experiences on or near the school site. These excursions involved the application of a series of affective and cognitive learning strategies intended to enhance environmental sensitivity. These strategies included:
  - application of a nature appreciation model.
  - digital manipulation of remote imagery of the landscape.
  - integration of Earth Systems methods and content in the standards-based geography curriculum.

- Practicing a visualization strategy attempting to integrate field experiences with exploration of the remote sensing data. This strategy, referred to alternatively as 'walking on the images' or an 'off the planet experience' depending on perspective, was also intended to enhance learners' sensitivity to the environment.

The practitioner produced a detailed record of each learning event, as described below, using a combination of audio recordings and reflective notes written shortly after each critical event (Table 2). He also kept a record of student writings and drawings produced as part of the event. Some of these were cognitive activities and some metacognitive student reflections consisting of journal writing and extended summaries. This information was then collapsed and analyzed. Using these data, the practitioner reflected on the impact these new strategies appeared to have on participants' thinking as
expressed in the case record. The results reported below indicate the outcome of just one of multiple cycles of planning, observation, and revision in the process of understanding more fully the instructional situation being described.

**Study Groups**

Two different groups of students were involved in the study. Each group consisted of the members of a one-semester, secondary geography class. Each class met for a total of 18 weeks. The first group consisted of the fall geography class, the second group met during the winter term. In both instances, the researcher was the classroom teacher.

The fall class began with 29 learners. 13 were females and 16 were male. There were ten 12th grade students, 11 11th grade students, and eight 10th grade students. The winter study group consisted of 27 participants. Of these, 13 were female and 14 males. Within this group, there were two 12th grade students, four 11th grade students, 13 10th graders and eight 9th grade students. Appendix A details the academic achievement of each group viewed as a unit.

Activities generally took place in reverse order between the two groups. Due to environmental constraints related to the Michigan climate, the fall group began the geography experience with outdoor activities, moved on to explorations of the Great Lakes Bioregion and finished the semester with regional explorations on a global scale. The winter class carried out the activities in the reverse order, ending the semester in the spring with field-based experiences. With the field-based experiences being rich in socioeconomic data is available, the group spanned a range of income and education, including children from professional as well as blue-collar
families. There were some obvious differences between the groups. The first group consisted of a considerably higher percentage of junior and senior level students. There was also a range of academic achievement within the groups, although both tended to have a higher percentage of learners who might be characterized as "aspiring to the standards." The mean grade point of participants in each class were 2.25 and 2.46 and ranged from a low of .8 to a high of 3.6. A more detailed academic analysis is available in Appendix A.

**Learning Events**

A learning event is defined as a single learning experience. In this case, it was usually an outdoor experience or a classroom experience focused on a visual exploration of an outdoor location. Learners engaged in a number of critical events as brief as 20 minutes and as long as a full day. Some of these took place inside the classroom, some at outdoor locations. Classroom activities involved viewing and manipulating remotely sensed images and photographs using a variety of computer tools. Short outdoor field experiences included excursions on and around the school site; trips to the Black River Canal bordering the school site; and to the Howe Drain, a small county drain approximately a quarter mile from the school site.

Each group of learners engaged in two day-long excursions. Both groups experienced a field trip to the Minden Bog, a raised peat bog habitat rare to southern Michigan. The bog is also the headwaters of the local watershed. The fall class also experienced a daylong excursion to Stag Island, a small Canadian island in the St. Clair River to visit a tall-grass prairie restoration project. The winter class took a daylong field
trip to the local museum to visit a Tibetan exhibit including a major sand painting created by a group of visiting Tibetan monks. This trip also included a walking tour through the historical downtown area of Port Huron to observe the urban landscape, including a part of the urban reach of the local watershed. A complete list of learning events is included in Table 2.

All of these excursions took place at locations represented in remotely sensed images that learners explored before the field experiences, a procedure that may be described as "walking on the images." The process consists of consciously placing one's self on the landscape represented in the images viewed previously from the perspective of the themes and extensions of geography. This technique, when coupled with a specific set of strategies for nature appreciation (Pepi, 1994), is intended to support a change in the participants' level of environmental sensitivity.
<table>
<thead>
<tr>
<th>Event</th>
<th>Time (In Minutes)</th>
<th>Location</th>
<th>Group</th>
<th>Major Component</th>
</tr>
</thead>
<tbody>
<tr>
<td>Five Themes/ Nature Appreciation</td>
<td>50</td>
<td>Classroom</td>
<td>Both</td>
<td>Presentation w/ Aerial Photos</td>
</tr>
<tr>
<td>School Site Images</td>
<td>50</td>
<td>Classroom</td>
<td>Both</td>
<td>Exploring the Images</td>
</tr>
<tr>
<td>East Woodlot/ Boulevard Walk</td>
<td>20</td>
<td>Outdoors</td>
<td>Both</td>
<td>Touch/smell (Valuing)</td>
</tr>
<tr>
<td>Circumnavigation of the school site</td>
<td>20</td>
<td>Outdoors</td>
<td>Both</td>
<td>Comparing Cultural/Natural</td>
</tr>
<tr>
<td>East Woods Trail Walk</td>
<td>50</td>
<td>Outdoors</td>
<td>Both</td>
<td>Silent Listening (Valuing)</td>
</tr>
<tr>
<td>West Tree line Walk</td>
<td>50</td>
<td>Outdoors</td>
<td>Fall</td>
<td>Finger Framing (Valuing)</td>
</tr>
<tr>
<td>Howe Drain Walk</td>
<td>50</td>
<td>Outdoors</td>
<td>Winter</td>
<td>Exploring the Neighborhood</td>
</tr>
<tr>
<td>School Site Presentation</td>
<td>300</td>
<td>Classroom</td>
<td>Fall</td>
<td>Student Created Presentations</td>
</tr>
<tr>
<td>River Reaches Presentation</td>
<td>100</td>
<td>Classroom</td>
<td>Both</td>
<td>Virtual tour w/ Aerial Photos</td>
</tr>
<tr>
<td>Minden Bog Presentation</td>
<td>50</td>
<td>Classroom</td>
<td>Both</td>
<td>Student Created Bog Tour</td>
</tr>
<tr>
<td>Minden Bog Excursion</td>
<td>300</td>
<td>Outdoors</td>
<td>Both</td>
<td>Geographic/system Skills</td>
</tr>
<tr>
<td>River Reach Exploration</td>
<td>500</td>
<td>Classroom</td>
<td>Both</td>
<td>Constructivist Investigation</td>
</tr>
<tr>
<td>River Reach Presentation</td>
<td>150</td>
<td>Classroom</td>
<td>Both</td>
<td>Student Presentations</td>
</tr>
</tbody>
</table>

Table 2. Instructional events from which data were collected
Remote Sensing Tools

The study group met in a computer facility containing Windows 95 workstations with sufficient power and memory to run all software used in the investigations. Learners generally worked in pairs or triads for analysis activities. Digital images available for observation and manipulation included:

- A high altitude infrared aerial photograph centered on the school site captured from an altitude of 40,000 ft.
- High altitude black and white photographs of the school site taken from 20,000 ft.
- A set of low altitude images of the school site captured at altitudes varying between 1500 and 3000 ft. This set of images contained, but was not limited to, the following:
  - Several views of the school site including many features of interest, such as the neighborhood surrounding the school
  - Similar views of the school captured four years apart showing significant changes in the school building and grounds over time.
  - View of the neighborhood near the school site showing changes and development occurring nearby.
- A set of digital topographic maps representing all areas investigated and explored by participants.

Learners were able to view and manipulate these images using a number of different computer tools, including photo editors, presentation software and word processors. Image manipulation took a number of different forms. Using ArcView and Photo Editor, learners were able to 'zoom in' on areas of interest in the photographs and look more closely at details. ArcView and PowerPoint tools were also used to mark routes and regions using lines and polygons. These altered images were then used with PowerPoint
to present reports and findings to others. The image manipulation and analysis tools available to students are listed below:


Participants also had access to digital scanners and cameras as necessary.

**Learner Preparation**

Before conducting any field experiences, participants received an introduction to a fundamental set of concepts and skills relevant to the geographic content of the course. Learners were also introduced to a model of nature appreciation with which to discuss and describe observations and experiences related to the remotely sensed images as well as the field experiences that took place “on the images.” These included the following:

- Fundamental Themes of Geography (Geography Education Standards Project., 1994)

Earth Systems Understandings were addressed in conjunction with the geographic themes and nature appreciation model. There is significant congruity in both content and philosophy between the two perspectives. Specifically, the geographic concept of “system” is deeply embedded in Understanding #4, which addresses concepts related to the interacting Earth subsystems of water, rock, ice, air, and life. The concept of “change” is intimately connected to Understanding #5, which addresses changes within the Earth system on both a geological and ahuman time scale. A more comprehensive view of this shared perspective is presented in Table 3.
<table>
<thead>
<tr>
<th>Earth Systems Understandings</th>
<th>Appreciation</th>
<th>Geography</th>
<th>Geographic Themes and Extensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earth is unique, a planet of rare beauty and great value.</td>
<td>Idealization</td>
<td>Place</td>
<td>Place is concerned with the cultural and natural characteristics of a particular location or region.</td>
</tr>
<tr>
<td></td>
<td>Appreciating Concept</td>
<td>Perception</td>
<td>Perception, how one views a situation, varies with experience, education, knowledge, and other factors.</td>
</tr>
<tr>
<td></td>
<td>Value Claims</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Feelings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Human activities, collective and individual, conscious and inadvertent, affect Earth systems.</td>
<td>Criteria</td>
<td>Region</td>
<td>Human/environmental interaction and the ecological perspective.</td>
</tr>
<tr>
<td></td>
<td>Cultural Associations</td>
<td></td>
<td>Region represents a tool useful for organizing information in a way that helps people learn about the world.</td>
</tr>
<tr>
<td></td>
<td>Villain</td>
<td>HEI</td>
<td></td>
</tr>
<tr>
<td>The development of scientific thinking and technology increases our ability to understand and utilize Earth and space.</td>
<td>Scientific Association</td>
<td>Geo Skills</td>
<td>Geography Education Standards, 1994</td>
</tr>
<tr>
<td></td>
<td>Valuables</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Theories/Principles</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The Earth system is composed of the interacting subsystems of water, rock, ice, air, and life.</td>
<td>Denoted Regularities</td>
<td>System</td>
<td>Systems describes a collection of linked and interrelated human or physical entities that influence one another and appear to form a unified whole.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Movement</td>
<td>Movement is concerned with the exchange, flow, and spread of human and physical systems across space.</td>
</tr>
<tr>
<td>Earth is more than 4 billion years old, and its subsystems are continually changing.</td>
<td>Appreciating Concepts</td>
<td>Change</td>
<td>Change traces modifications in places, patterns, and systems over time.</td>
</tr>
<tr>
<td></td>
<td>Pattern</td>
<td></td>
<td>Patterns represent the arrangement of how objects are distributed in space.</td>
</tr>
<tr>
<td>Earth is a small subsystem of a Solar system within the vast and ancient universe.</td>
<td></td>
<td>Scale</td>
<td>Scale addresses the notion that issues may be viewed from a local to a global perspective. Choice of scale affects how people observe and understand problems and issues.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Location</td>
<td>Location and the spatial perspective represent concern with where things are and why.</td>
</tr>
<tr>
<td>There are many people with careers and interests that involve study of Earth's origin, processes, and evolution</td>
<td>Record of The Event</td>
<td>HEI</td>
<td></td>
</tr>
</tbody>
</table>

Table 3. Matrix illustrating congruity of Earth Systems Understanding, geographic concepts and nature appreciation components.
Field Experience Preparation

Before, during, and after each field experience, learners engaged in a series of specific learning events intended to focus attention and critical thinking on the region under investigation. These were constructivist in nature, providing opportunity for learners to build a personal knowledge base and to report what the learner learned rather than attempting to replicate what the instructor knew.

The image exploration activities were intended to focus attention on the study site, and to raise levels of interest and curiosity. Learners were encouraged during these visual explorations to apply geosystem concepts as described in Table 3 by, for instance, identifying examples of movement, or regions or systems in the images.

The outdoor experiences placed a major focus on being in the place and 'on the photographs.' The goal was to provide a fresh perspective of a familiar place. These experiences allowed the instructor frequent opportunities to emphasize examples of geosystem concepts such as those explored earlier using the images. Learners received guided practice in doing the same. Opportunities to explore principles embedded in ES Understanding # 1--viewing Earth as a place of rare beauty and great value--frequently presented themselves. Most importantly, these trips provided many opportunities for the facilitator to act as a model nature appreciator and environmentally responsible citizen.

The site analysis that followed provided time for reflection and internalization of the experience. It also produced a written record of the event, necessary for nature appreciation and useful for research analysis. The general procedure is described below.
**Image Exploration**

1. Participants describe the region to be explored (prior knowledge).
   Brainstorm a list of words that describe your impression of the site.
   List the five that most describe your perception of the site.

2. Draw a picture that summarizes your feelings about the site.
   Include a caption with the picture.

3. View aerial images of the site.
   Use the two images that focus most closely on the site.
   Use the zoom tools to explore the images.
   Use the draw tools to mark on the images.

4. Participants record impressions while looking at the images.
   What interests you the most about the images?
   What surprises you?

**Outdoor Field Experience**

5. Instructor/Guide discusses site, points out highlights and features such as types of plants,
   land use considerations, and examples of human/environmental interaction.

6. Instructor/Guide points out applications of geographic concepts and Earth Systems
   understandings, as well as appropriate references to elements from nature appreciation model.

7. Instructor/Guide encourages learners to make observations related to themes,
   understandings and appreciating elements and share these with the group.

8. Participants make frequent observations using multiple senses including vision, smell,
   hearing and touch. They record notes related to geographic concepts as well as criteria
   for nature appreciation, and keep track of their location by means of a sketch map of the
   route followed.

9. Instructor/guide points out relationships between aerial image and ground truth.

10. Instructor/Guide engages learners in valuing strategies, such as silent listening or
    “framing” scenes and objects with outstretched hands.

**Site Analysis**

11. Learners record a “quick writing” journal entry in which they brainstorm a list of
    thoughts, feelings, or impressions from the field experience.

12. Later, learners produce a longer, more reflective written summary of the field experience
    relating the experience to geographic principles and nature appreciation elements.

13. Upon completion of the field experience, learners produce a final map of the field
    experience showing the route followed and areas of special personal interest or
    experience. The final map contains a short written description of the experience from the
    participant’s perspective.

14. Learners use aerial images to retrace the field experience and to produce reports and/or
    presentations reflecting the cognitive and affective elements of the field experience.
Field Experience Sites

The following describes the sites where field experiences took place in the course of the investigation.

Howe Drain.
This is a small, channelized county drain located approximately a quarter mile west of the school site. Exploring this site required learners to walk through a mixed income residential neighborhood.

Minden Bog.
Located approximately 80 miles north of Port Huron, the bog is the headwaters of the Black River. This trip constituted the major excursion among the field experiences. It involved a day-long outdoor field experience that included stops at the Lake Huron shore, the bog, and several stops along the river downstream from the headwaters.

Port Huron Urban Center.
Port Huron is a small regional center with a population of approximately 35,000. The urban center is situated at the confluence of the Black and St. Clair Rivers. The historical town center has buildings dating back to the early 1800s, many of which have been restored as part of a central city revitalization project. There are many issues to consider related to the river(s) and urban-environmental issues.

School Site
Participants explored the area in the immediate vicinity of the school building. Areas of interest included parking lots, grassy areas near the building, a small wooded area containing Oak, Sassafras, Wintergreen and Bracken fern, among other plant species. Learners engaged in multiple field trips exploring various aspects of the school site. Field experiences ranged from 20 minutes to one hour in duration.
**School Vicinity**
This field experience ranged farther from the school building itself while remaining on the school’s 30-acre site. It included an approximately quarter-mile walk along a wooded trail that skirted the school site’s eastern boundary and a heavily wooded area of the local cemetery. The trail leads to a large canal connecting Lake Huron and the Black River. This canal forms the southern border of the school site. The field trip also involved exploration and discussion of playing fields, drainage ditches and weedy places around the school grounds.

**Stag Island**
Stag Island is a small Canadian island located in the St. Clair River a few kilometers from the school site. As part of the remedial action plan for the St. Clair River Area of Concern, habitat restoration programs were implemented on the island. These have resulted in the planting of tall grass prairie on dredge spoils at the southern end of the island. The northern end of the island is populated with summer homes.

**Data Collection Strategies**
A variety of data collection strategies were employed to arrive at the most detailed, accurate description of events possible. These included a variety of researcher-collected data as well as self-reporting on the part of the participants. The various data collection methods are described in detail below.

A detailed record of learning events both inside the classroom/lab and during outdoor experiences. The intent was to describe each event completely and clearly. This detailed record also included researcher observations of learners responses and reactions to various events. These data were useful in describing the learner, the instructor, and the
situation. Since the researcher was actively involved in the learning experience as the primary instructor, it was not possible to collect extensive field notes during instruction. However, the researcher did produce a set of reflective summaries. These consisted of written recollections recorded as soon as practicable. Sometimes this occurred immediately after an event, sometimes several hours to a few days later. Frequently, thoughts and observations were tape-recorded as events unfolded. As a way of validating these observations, participants were asked to write detailed descriptions of each field experience and to keep a log describing activities that took place while working with the remotely sensed images. On occasion participants also had the opportunity to respond to the reflective summaries. Appendix M is a representative example of researcher reflexive notes.

*Written learner responses to a variety of activities* involving analysis and interpretation of the remote images and the field experiences involving them. Written responses included both "quick writing" journal entries and written responses to particular events or experiences as well as more reflective, considered responses in the form of evaluation questions written and considered through multiple drafts over several days. This information provided the most important resource in understanding and describing how students responded to the learning events under consideration. Appendix B shows a typical journal page with instructor comments.

*Mental maps* provided another important indication of participants' response to outdoor field experiences. Participants produced a mental map of each region under investigation before the exploration began, and again, at the conclusion of the investigation. The
mapping strategy was similar for all study sites. Before undertaking any field experiences, each learner was provided a sheet of clear, unlined paper and asked to "brainstorm," or list in rapid fashion, everything that came to mind when they thought about the region under consideration. Those who became "stuck" were assisted in developing new lines of thought. Students were then asked to sketch a map of the study site. Learner requests for additional information were answered with comments like, "I want you to draw a map of (the study site)," or "When you think about (this place), what do you see?" Learners were assured that whatever map they produced would be acceptable. The only criterion was to produce a map that showed the region as they viewed it. One example of a student created mental map is shown in Figure 15.

**Graphical responses** produced by participants related to field experiences and interaction with the image sets. Graphical representation of ideas, feelings and experiences were collected whenever appropriate. These data were gathered by asking participants to draw pictures recording their responses to events, together with a short caption interpreting or explaining the drawing. These representations of ideas along with their captions helped provide a more complete picture of learners' responses and reactions to each learning event. An example of a learner's drawing is shown in Figure 8.

**Post-instruction interviews** were conducted with a convenient sample of 15 learners. These interviews were conducted between 12 and 18 months after their participation in the geography program. In these interviews, participants were asked to respond to questions about geographic concepts, remotely sensed images, nature appreciation, and field experiences. Appendix D summarizes the analysis of those interviews.
Data Analysis

In conducting qualitative research of the type described here, the issue of validity is of critical importance. It is necessary to provide credible checks against researcher bias, which may distort the significance of qualitative data. Lather (1986) proposed several strategies aimed at assuring the trustworthiness of qualitative data. Data collection and analysis strategies were designed to address these goals.

The entire collection of written learner responses was collapsed and entered in a Microsoft Access database for content analysis. The raw data included approximately 50 student journals, two sets of final course evaluations (semester exam), and several sets of summary reports. All learner references to the key events or concepts were recorded. Where doubt existed about the relevance of a particular passage, it was included. 235 individual records were entered (Appendix O). Each record was assigned multiple keywords, allowing records to be retrieved from multiple searches. The keywords used for conducting searches and organizing data were based on the individual elements in Pepi's (1994) Nature Appreciation Model, The Themes of Geography, as well as key Earth Systems understandings such as system and change. The keyword list also included additional relevant terms, such as "aerial image," "remote sensing" and "Sassafras." A complete list of keywords is included in Appendix C. The data were also searchable by 'location of event' (school site, Minden Bog, Howe Drain), as well as 'data source' (notebook, reflective writing, formal assignment, final exam). It was also possible to search by any word or phrase that might appear in the body of the record. For example, all
passages in which the learner used the term "boring" could be located. Figure 4 below provides a schematic view of the most important search strategies used.

These data were organized and reorganized using the keywords in a search for patterns and themes within the data. These might include patterns of behavior or responses related to sensitivity, constructivist learning, geographic thinking, nature appreciation, or metacognition. Special attention was paid to the emergence of unexpected or unanticipated patterns or ideas as well as for counter indications of expected patterns of thought or behavior. Some examples of patterns that emerged included such things as the high number of positive responses to the silent listening valuing activity, the powerful response to smelling Sassafras (the “froot loop” tree) as well as the less then enthusiastic response on the part of many students to the use of aerial photographs.

![Diagram of major database search strategies.](image)

**Figure 4. Diagram of major database search strategies.**
In addition to the database, the case record included fourteen audio CDs containing recordings of interviews, relevant instructor presentations in the classroom, and recordings made during field experiences. The CDs, together with additional audiotapes, total approximately 15 hours of recorded conversations. The case record further consists of learner generated sketches and maps, including text-based explanations and descriptions of the graphics, written evaluations of projects and activities, exam responses, and student-generated presentations. Finally, the record includes extensive reflective summaries of activities and events written by the researcher.
CHAPTER 4

DETAILED PROCEDURES AND LEARNER RESPONSES

Case Study Report

The goal of qualitative research is illumination, understanding and extrapolation (Patton, 1990). With that outcome in mind, this case study report presents a detailed synthesis of the case record. The study attempts to accurately describe the nature, look, and feel of the learning environment in which the study took place. It examines, from the participants' perspective, the specific elements that comprised the learning environment as well as the elements that constitute the nature appreciation model used to structure the outdoor experiences. The report presents a summary of learner responses to a series of outdoor field experiences on and near the school site, as well as their reaction to the use of remote sensing products both in preparing for outdoor experiences and in reporting their field experiences to others.

The overall intent is to provide the reader with as deep an understanding as possible of the situation in which, and to which the participants were responding in carrying out the activities on the local site. This detailed description relies heavily on the words, reflections, and products created by the participants in the study. Pseudonyms have been substituted for the real names of all participants.
The narrative addresses the following elements:

A. The Physical Setting
   • Community
   • School site
   • School
   • Classroom

B. The Learning Environment
   • Students
   • Instructor
   • Content
   • Process
   • Evaluation

C. Nature Appreciation Model

D. Remote Sensing Experiences

E. Outdoor Field Experiences
   • On the School Site
   • Beyond the School Site

The Physical Setting

The Community

Port Huron is a Great Lakes region community of approximately 35,000 people located at the confluence of the Black and St. Clair Rivers at the southern terminus of Lake Huron. The city size has been stable for the past 30 years. Port Huron is an international crossing between the United States and Canada. Unlike many of the suburban “bedroom” communities located nearer the metropolitan Detroit area to the south, Port Huron remains an independent, isolated, somewhat conservative community.
Recent developments are beginning to change the character of the community in significant ways. Two major interstate highways, I-94 and I-69, meet at Port Huron. The latter is often referred to as the NAFTA (North American Free Trade Agreement) Highway, as it is intended to eventually extend uninterrupted from Canada to Mexico. Both passenger and commercial crossings at the International Blue Water Bridge are increasing rapidly, significantly increasing the flow of goods and ideas through the community. In response to this increase, Canada and the United States collaborated to construct a second span of the Blue Water Bridge connecting the two countries.

Figure 5. Regional map: Port Huron and the Great Lakes Bioregion.

Recently, major commercial development has occurred in the Port Huron area. A considerable portion of this development has occurred north of Port Huron in the immediate vicinity of Port Huron Northern High School. A significant milestone in this development was the completion of the Birchwood Regional Shopping Mall in 1991 at a
location one mile north of the high school site. This has led in turn to the rapid strip
development along US 25, the major state route leading from Port Huron north along the
Lake Huron shoreline. The map in Figure 4 indicates the location of Port Huron within
the Great Lakes region.

The city and surrounding community are attempting to address several significant
environmental problems. The St. Clair River at Port Huron is one of 43 Areas of Concern
within the Great Lakes Basin. These areas were identified and designated as part of the
1978 Great Lakes Water Quality Agreement between the United States and Canada. They
represent a commitment on the part of both countries to clean up the most polluted sites
within the Great Lakes Basin. While significant progress has been made to remediate the
problems identified within the watershed, an international Remedial Action Plan
committee is actively working to address further concerns related to the river. This group
consists of representatives from both the United States and Canadian side of the St. Clair
River.

The city of Port Huron has an antiquated combined sewer and stormwater system
that regularly spills significant quantities of untreated stormwater and raw sewage into
both the Black and St. Clair Rivers. The Michigan Department of Environmental Quality
recently ordered the city to complete a sewer separation project over the next 15 years.
Separation, and how to pay for it, has been a highly charged and hotly debated issue
within the community for several years. A related issue involves the periodic closing of
area beaches due to high fecal coliform counts, resulting from contaminated agricultural
runoff and overworked and failing septic systems.
Port Huron is generally divided demographically along an east-west axis roughly determined by the Black River. This axis divides the community into northern and southern regions. The north side of Port Huron is generally perceived to be the economically and politically advantaged section of the community. The northern and eastern edges of the city extend along the lakeshore, where one finds many large and expensive homes. The south side of Port Huron is generally perceived as the poorer section of the community. It is more industrialized and offers fewer amenities such as shopping and dining opportunities for local residents. A larger percentage of the residential population is composed of renters rather than property owners. As a whole, it is less politically active and less financially secure.

The School Site

Port Huron Northern High School (PHN) is located on a 31-acre site, almost all of which is devoted to school buildings, parking areas and athletic fields. Several regions are of special interest to the Geography program. These are areas where novice geographers conducted explorations and investigations focused on geographic content while applying nature appreciation concepts. These include:

*North Boulevard.* North of the school building is a grassy boulevard wooded with a mix of Red and White Oak. The first excursions on the school site involved exploring this region. Learners heard the names of the various trees found there and were encouraged to feel the patterns and textures of bark, while also applying geosystems concepts such as region, system, and movement.

*East Woodlot.* Directly east of the building is a narrow strip of woodlot separating the school from the County Juvenile Detention Center. This strip of woods consists of mixed
hardwoods, primarily Red and White Oak with an understory of Sassafras, grasses and a variety of woodland plants. It is similar to the boulevard, except the under story is growing wild and unmowed.

Figure 6. Aerial photograph of PHN showing major study regions.

_Tennis Courts._ Southeast of the building is a set of recently constructed tennis courts. These are clearly visible in the most recent aerial photograph of the Northern site. Construction of these courts required the removal of a considerable number of trees. The courts stand out as a major landmark in the aerial photo interpretation projects.
Woodland Trail. Directly east of the courts is the beginning of a wooded trail that extends south approximately a quarter of a mile along the edge of the school site to the Black River Canal.

Black River Canal. The Black River canal forms the southern boundary of the school site. The canal is a manmade channel connecting Lake Huron to the east with the Black River to the west. It was constructed in 1912 to bring fresh water from the lake to flush raw sewage from the Black River. The connection between Lake Huron, the Black River, and the local community, the canal constitutes a system that generally captured the imagination of students. A major feature of the school site, it is clearly visible in the high altitude photographs and serves as a major landmark.

The School

Northern is a modern suburban high school located on the northern boundary of the city. Opened in 1965, it is one of two large high schools serving the community. Its sister high school, Port Huron High, is located on the south side of Port Huron. A third, alternative high school with a much smaller population than either of the traditional schools, is also located on the south side of the city.

During the 1998-99 school year when this study was undertaken, the school population was approximately 1,650 students with an instructional staff of about 100 members. The ethnic distribution of the population was approximately 85% Caucasian, 10% African American, and 5% other minorities.

While the administration was generally open to change and, in fact, supportive of innovation in teaching practice, there were several structural impediments to new approaches to learning. The school followed a traditional schedule consisting of six class
periods of 55 minutes each. Extending the length of any single class period required prior notification of all affected teachers. This could be done occasionally, but not regularly. The majority of learners were bused to school each morning. Students left on scheduled buses at the end of each day. While many upper class students drove personal automobiles to school, they also participated in scheduled extracurricular activities, such as sports, yearbook, band, and related activities at the end of the school day. Likewise, a significant number of students held after school jobs. These activities generally precluded planning field experiences beyond the regular school day.

Cost and availability of authorized transportation constituted another structural impediment. School buses for extended field experiences are costly and in limited supply. Excursions need to be scheduled well in advance, leaving little opportunity for spontaneity. A number of strategies were used to address the cost constraints of fieldwork vital to this project. The Port Huron Area Public School system supports a countywide water quality-monitoring program. Funds from this project were available to support a biannual field experience to the headwaters of the local watershed (Minden Bog). The school administration was able to subsidize the cost of transportation for other field trips, lowering the cost to participants to a few dollars per person. Trips within the local community made use of public bus transportation that, compared to school buses, was relatively inexpensive.

Most importantly, a significant number of field experiences were planned within walking distance of the school site. Students returned permission slips allowing them to participate in walking field trips anytime during the course of the semester. This allowed for the possibility of spontaneous excursions within walking distance of the school site.
These short trips focused on systems and environmental interactions occurring within the local community.

The Classroom

The geography course met in a non-traditional classroom, known as the Business Lab. The oversize classroom contained typical office furniture rather than standard classroom desks. Ten computers robust enough to run ArcView GIS were available. Computer tools constituted an important instructional and cultural element in the classroom. Most work was completed using technology-based tools, a significant difference from general practice and experience.

The Learning Environment

Students

Geography is a one-semester elective class that attracts learners from grades 9 through 12. The course is not required for an "endorsed" or "academically rigorous" program at Northern. As a result, learners involved in such programs rarely elect the geography course because there are few, if any, elective opportunities available in their schedules. Students who do elect the class are generally not proactively seeking a geography experience. Rather, they are attempting to fulfill uncompleted social studies requirements for graduation. Typical responses to the query "Why did you elect this course?" include: "My counselor suggested I take it"; "I don't know"; "It just showed up on my schedule"; or "You mean this is Geography?"

Instructor

Tanner (1980) and others have indicated that one critical element in developing environmental sensitivity is an environmentally conscious role model. In the case of the
current project, the instructor would be the most likely candidate to fulfill that role. In this particular instance the instructor has a strong background in environmental education and extensive experience in multidisciplinary instruction.

A social studies instructor for 27 years, the instructor holds an undergraduate degree in English and History and has taught both. He holds advanced degrees in Environmental Science Education and Geography, and has some limited experience as a science instructor. At the time of the research, he had recently completed extensive coursework related to Earth Systems Education content and practice. In addition, the instructor has been involved in computer education since 1985.

Given the accepted precedents of ES, as well as the emphasis on affective elements of learning demanded by the goals of this study, the attitude and deportment of the instructor may be of greater significance than academic preparation. The instructor in this case has consistently demonstrated high levels of enthusiasm, as well as a high degree of empathy for both learners and the environment.

Two building administrators observed the instructor in the context of this research project and recorded their impressions. Mr. Richard Chapman, Assistant Principal for Instructional Development at PHN, stated:

(The instructor's) friendly encouragement, positive approach to any dilemma, and ready willingness to admit that he is not "the expert" and does not "have all the answers" quickly puts the students at ease and establishes an open atmosphere of exploration and growth.

Students, feeling unthreatened by the "authority figure," relax and begin to participate more freely in the quest for answers. Many, who have until now felt disengaged from classroom instruction, begin to actively participate both individually and in teams, often interacting and collaborating with students with whom, in a different setting, they would rarely converse. (Appendix H)
Ms Louella Allen, Curriculum Director at Northern, reported these observations:

Master geographer compliments novice geographers as he shows samples.

- "A fabulous piece of cartography...."
- "Tammy, you are wonderful!!"
- "Whoever did the acorn picture, that was a fabulous idea. Brad did that."

Additional comments in way of summarizing/capturing the experience

- Teacher as learner
- Teacher as risk-taker
- Teacher as performer
- Teacher exudes energy
- Teacher as model
- Teacher willing to turn class over to students
- Technology in action (Appendix I)

These observations suggest that the instructor was both a knowledgeable, environmentally literate role model, as well as a teacher who engendered trust and encouraged exploration and risk-taking among his students.

Content

The content of the course focused on the investigation of geographic problems and issues related to human/environmental interactions and Earth systems. To assist learners in approaching problems from a geographic perspective, the course centered on mastery through application of a rubric for geographic thinking referred to as the Themes of Geography. In addition to the fundamental themes, geographers have identified a set of extensions that support a more interdisciplinary investigation of issues of interest. Learners regularly refer to these themes in their writings, presentations and exhibitions.
### Themes of Geography

<table>
<thead>
<tr>
<th>Location:</th>
<th>Location describes where a place is in space, either absolutely (i.e. latitude and longitude) or relative to another place in space (i.e., South of Port Huron).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Place:</td>
<td>Place consists of the physical and human characteristics, both tangible and intangible, that are found at a particular location.</td>
</tr>
<tr>
<td>HEI:</td>
<td>Human/Environmental Interaction describes the two-way interactions between humans and the environment.</td>
</tr>
<tr>
<td>Movement:</td>
<td>Movement explores patterns of movement of animate and inanimate objects along the surface of the Earth.</td>
</tr>
<tr>
<td>Regions:</td>
<td>Regions constitute the basic unit of study of geography. Regions can be quite small or quite large depending on the requirements of the problem under investigation.</td>
</tr>
</tbody>
</table>

### Extensions

| Patterns:     | Geographers look for patterns (or lack of pattern) in the distribution of things in space.                                                                                                               |
| Scale:        | Geographers view problems and issues from a variety of scales, from the local to the global.                                                                                                               |
| Change:       | Geographers are always interested in changes that occur in places, locations, movement, interactions and regions. The cause and nature of these changes constitute a major part of geographic inquiry. |
| Systems:      | Systems constitute a convenient way to consider complex interlocking patterns. Systems investigations provide a clear avenue for integrating science and geography. |
| Perceptions:  | Clearly, each individual's view of the world and geographic problems is dependent upon his or her own culture, life experience, education and understanding. |

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Table 4. Five Themes of Geography and Their Extensions (National Geographic Society, 1994)
Of particular relevance to this instructional approach is the Framework for Earth Systems Education (Mayer and Fortner, 1995). Its importance rests in its high degree of congruity with the general goals of geography and the specific aims of this program. Its stated objective of unifying and integrating science education around the study of Earth systems is also significant. The integration of geographic content with Earth Systems concepts helps to produce an environmental education approach with a higher probability of implementation within the standards-based formal education system. The complete Understandings are listed below.

Understanding #1: Earth is unique, a planet of rare beauty and great value.
- The beauty and value of Earth are expressed by and for people through literature and the arts.
- Humans appreciation of planet Earth is enhanced by a better understanding of its subsystems.
- Humans manifest their appreciation through their responsible behavior and stewardship of its subsystems

Understanding #2: Human activities, collective and individual, conscious and inadvertent, affect Earth systems.
- Earth is vulnerable, and its resources are limited and susceptible to overuse or misuse.
- Continued population growth accelerates the depletion of natural resources and destruction of the environment, including other species.
- When considering the use of natural resources, humans first need to rethink their lifestyle, then reduce consumption, then reuse and recycle.
- Byproducts of industrialization pollute the air, land, and water; and the effects may be global as well as near the source.
- The better we understand Earth, the better we can manage our resources and reduce our impact on the environment worldwide.

Understanding #3: The development of scientific thinking and technology increases our ability to understand and utilize Earth and space.
- Biologists, chemists, and physicists, as well as scientists from the Earth and space science disciplines, use a variety of methods in their study of Earth systems.
- Direct observation, simple tools, and modern technology are used to create, test and modify models and theories that represent, explain, and predict changes in the Earth system.
- Historical, descriptive, and empirical studies are important methods of learning about Earth and space.
- Scientific study may lead to technological advances.
- Regardless of sophistication, technology cannot be expected to solve all of our problems.
- The use of technology may have benefits as well as unintended side effects.
Understanding #4: The Earth system is composed of the interacting subsystems of water, rock, ice, air, and life.

- The subsystems are continually changing through natural processes and cycles
- Forces, motions, and energy transformations drive the interactions within and between the subsystems.
- The Sun is the major external source of energy that drives most system and subsystem interactions at or near the Earth’s surface.
- Each component of the Earth system has characteristic properties, structure, and composition, which may be changed by interactions of subsystems.
- Plate tectonics is a theory that explains how internal forces and energy cause continual changes within Earth and on its surface.
- Weathering, erosion, and deposition continuously reshape the surface of the Earth.
- The presence of life affects the characteristics of other systems.

Understanding #5 Earth is more than 4 billion years old, and its subsystems are continually changing.

- Earth’s cycles and natural processes take place over time intervals ranging from fractions of seconds to billions of years.
- Materials making up Earth have been recycled many times
- Fossils provide the evidence that life has evolved interactively with Earth through geologic time
- Evolution is a theory that explains how life has changed through time.

Understanding #6 Earth is a small subsystem of a Solar system within the vast and ancient universe.

- All material in the universe, including living organisms, appears to be composed of the same elements and to behave according to the same physical principles.
- All bodies in space, including Earth, are influenced by forces acting throughout the solar system and the universe.
- Nine planets, including Earth, revolve around the Sun in nearly circular orbits.
- Earth is a small planet, third from the Sun in the only system of planets definitely known to exist.
- The position and motions of Earth with respect to the Sun and Moon determine seasons, climates, and tidal changes.
- The rotation of Earth on its axis determines day and night.

Understanding #7: There are many people with careers and interests that involve study of Earth’s origin, processes, and evolution.

- Teachers, scientists, and technicians who study Earth are employed by businesses, industries, government agencies, public and private institutions, and as independent contractors.
- Careers in the sciences that study Earth may include sample and data collection in the field and analyses and experiments in the laboratory.
- Scientists from many cultures throughout the world cooperate and collaborate using oral, written, and electronic means of communication.
- Some scientists and technicians who study Earth use their specialized understanding to locate resources or predict changes in Earth systems.
- Many people pursue avocations related to planet Earth processes and materials.
Process

Methodologies promoted by Earth Systems Education advocates (Mayer and Fortner, 1995) were routinely used to structure learning experiences. These included frequent group-based activities and investigation of problems realized in the lives of the learners. The general methodology was inquiry-based constructivist learning. Broad topics of investigation were defined. Within the parameters of that investigation, individual students or groups of students identified areas of interest for further exploration with the aim toward answering specific questions raised by the learners themselves.

Classroom discussions were intended to be a multi-directional interchange of information, thoughts and ideas rather than lectures delivered to an audience, after Fortner (1992). Participants were considered novice investigators and apprentice geographers. Within the classroom environment they held status equal to the instructor, meaning that ideas were freely accepted and alternative suggestions considered and explored.

To capture some of the feeling of the classroom, Ms. Louella Allen, curriculum director at Northern attended several geography classes and recorded her professional observations. The following excerpts are from her report (Appendix I)

- This classroom has all the elements of a learner-centered learning environment with real-life experiences and authentic assessment, a place where learning as well as the learner are valued.
- Classroom felt unconfined, unrestricted, inviting a free exchange of ideas, the freedom to disagree and take risks.
- There was an ambiance of mutual respect for fellow geographers and master geographer
- Learner given choices
Evaluation

Learners frequently reported results of investigations in the form of presentations containing maps, images and research findings. These reports were generally delivered to an audience “larger than our class.” Learners themselves defined the meaning of that phrase. Interpretations included inviting entire classes to attend presentations, inviting selected individuals including personal friends or building administrators. Occasionally, public officials were invited to attend. Some students also presented research findings at an annual student congress held in conjunction with the county water quality monitoring program.

Learners were routinely provided a rubric tailored to each investigation intended to guide the apprentice geographers toward inclusion of critical elements such as geographic themes and nature appreciation elements. However, within those broad limits learners were free to design presentations that met their own criteria and answered questions of interest to themselves. Louella Allen, curriculum director at Northern, recorded the following observations after viewing student presentations. According to Ms. Allen, presentations:

• Were unique and individual to the geographer's interests
• Were tied to the geographic themes
• Invited response/participation from audience

Learners were frequently asked to produce written responses to activities and explorations. These writings were of two major types, quick writings and deliberated
response. Quick writings include journal entries, short written summaries, and captions on maps, graphs, and sketches.

Deliberated responses constituted longer, more deeply considered responses. These were generally word processed and often revised one or more times with instructor guidance. This guidance frequently included a deliberate effort to engage learners in metacognitive analysis of the activities in which they had participated as well as of their own work. For example, at the conclusion of each major project or presentation, learners were asked to reflect on the meaning and importance of the learning experience. Often, learners were asked to respond to specific metacognitive questions such as:

- What aspect of this project was of greatest interest to you and why?
- What suggestions would you make for revising the project to increase its effectiveness?
- What impact did the use of infrared images have on your understanding of the area of study?
- Did the use of computers on this project enhance or detract from your mastery of the material?

**Nature Appreciation Model**

Pepi’s (1994) nature appreciation model, *The Mechanics of Nature Appreciation* (Figure 2), served as a critical organizing structure intended to assist individuals toward experiencing an “appreciating event” of the highest quality possible. Pepi’s *Mechanics* provide a tool for thinking about nature appreciation that reveals the individual elements of an appreciating event and the relationships among them. The framework supports individual efforts to engage in critical appreciation and serves as a means of communicating the process of appreciation to others. Efforts such as Pepi’s to formally enhance appreciation directly address issues included under Earth Systems.
Understanding #1, which states, "Earth is unique, a planet of rare beauty and great value" (Mayer and Fortner, 1995). It also provides a powerful tool for supporting instructional strategies intended to enhance environmental sensitivity. The theoretical framework may also be used to qualitatively evaluate the degree of appreciation expressed by individuals.

Pepi defines nature-appreciating events as "instances in which thinking, feeling, and acting are integrated deliberately in order to obtain the richest experiences possible from natural objects and events" (1994, p.6). He further suggests that nature appreciation itself involves consciously and deliberately integrating knowing and feeling during an appreciating event. This integrated experience has the potential to produce a shift in perspective toward the event in particular and the natural world in general. Pepi refers to this shift, which he states is the ultimate goal of nature appreciation, as a moment of "felt-significance." This altered perception of the environment, Pepi suggests, may lead to changes in values, attitude and behavior.

Learners in the geography program were introduced to Pepi's appreciating model through a formal presentation and discussion of the elements of the model. Each learner was also provided a printed version of the model, which was included as part of the student journal. The initial presentation was frequently reinforced through subsequent references to these elements, especially, though not exclusively, during field experiences. Learners were encouraged to refer to the model when recording impressions in journal writings, as well as during more formal writings such as summary reports and final evaluation responses.

The model, as Pepi describes it, is loosely based on Gowin's axiological vee (having to do with values) rather than the more widely known epistemological vee
(having to do with knowing). It represents an exploded diagram illustrating the 15 individual elements of an ideal appreciating event. The interactions among these cognitive and affective elements hold the potential to produce what Pepi calls "felt-significance," a moment in which feelings and meanings merge.

In the following paragraphs, each of the 15 elements will be analyzed in the context of the instructional program. Where applicable, the text will be supported with responses to events recorded by participants in journal writing, summary reports and written responses to evaluation questions. Selected statements are intended to be representative learner responses. The analysis begins with the meaning (cognitive) components on the left side of the vee and then proceeds up the right branch describing the feeling (affective) elements.

The event is the core element in an appreciating instance. By definition, it requires that someone experience some place. In the case of this research, the events under consideration consisted of the various outdoor learning experiences on and around the school site. These were explicitly described to the learners as opportunities to practice nature appreciation, as well as investigate Earth Systems from a geographic perspective.

While an event is occurring, appreciators consciously apply some or all of the elements of the vee to the experience. Since participants in this project were, largely, novice appreciators, learners often required a prompt to consider any particular experience in light of the appreciating elements. Likewise, it was considerably easier, in most instances, to discuss the lower elements of the vee, as these are considerably more concrete and easier for novices and reluctant appreciators to grasp. Ultimately, the more
appreciating elements an individual is able to apply to a given event, the more deeply he may be assumed to be appreciating the environment.

Denoted regularities refer simply to the notion of naming something. Denoted regularities become the jargon of the connoisseur, shorthand for describing things and events to others who are knowledgeable in a particular field. It may be assumed that the more elements of the environment that an explorer can name, the more deeply she understands the event. In written and oral responses, learners frequently demonstrated the ability to recall denoted regularities. For example, the following passage is from a student journal entry written after the first excursion on the school site. The instructor pointed out interesting plants around the site, and encouraged learners to closely examine, to touch, and to smell various plants. Note that the writer also names geographic principles. These also constitute examples of denoted regularities of geographic understanding.

9/16/98
Today we went outside for a fire drill. We then walked over to the east side of the building and explored the trees. We discovered that there are Red Oak and Sassafras trees. (5 small sketches showing acorns, leaves, and a root beer mug) I enjoyed learning about trees, because I know a lot about them.

9/21
Today we talked about the school site. I learned about patterns and region of the school site. I didn't really like to talk about the school grounds

9/23
Today we walked outside and looked at the trees. We collected acorns, leaves, sassafras, oak, and maple. I learned what kind of vegetation there is outside around the school

Pepi further points out that nature appreciators imbue observed objects with added meaning by learning what is already known about objects of interest and discovering how
other people have used and appreciated them as well. He refers to this form of knowledge as *Scientific and Cultural Association*. This level of knowing seemed relatively easy for many learners to grasp and express in written observations:

**School site** 6/2/99
We took a walk outside and made a complete circle around the school. I learned that you can make tea out of sassafras leaves (cultural association) and that when it's rainy and windy it's cold.
*Ann A.*

**Minden Bog** 5/18/99
We left school very early and started down lakeshore and we discussed the contributaries (sic intended distributaries?) going into the lake (scientific association). Our first stop was at Sanilac Roadside Park. That's where I learned that the boulders in the water are some of the oldest boulders in the world (scientific association). Also that the fish give off oil when they die. And I learned the different kinds of rocks like igneous and metamorphic and sedimentary rocks (scientific association).
*Art O.*

Closely connected to the denoted regularities of an event are the *Criteria* by which the event is evaluated. As Pepi (1994) states (p 7) "...regularities tell us what to look at, criteria tell us what to look for." Criteria need not be explicitly stated, but may be implied by the regularities denoted. In the case of school site excursions, it may be that learners were specifically looking for new trees to identify or patterns, regions, and systems to study. The ability to recognize exemplar models demonstrates practice of criterion application.

**Journal** 9/24
What we did was walk the school site past Juvenile Hall, through a trail that lead us to the canal walked along the canal and discovered some pretty plants.
I never even really knew there was a canal behind the school. Also I expected the canal to look dirty like the Black River.
I found it interesting the trail walk and the canal itself. I found the canal pretty its color really...bringing out all the plants beauty.

Anna G.

Summary Report 10/16/98

We seen a bunch of little living creatures such as grasshoppers, ants, and butterflies. We found out about the different kinds of trees like Maple, Pine, and Oak. They were very colorful and pretty because it was the beginning of the fall season.

Mary L. & Ann H.

Appreciating concepts are a means of casting an object or event in the most favorable light possible, even if truth is sometimes ignored in doing so. Appreciating concepts often take the form of a metaphor as a means of describing or explaining complex systems. Calling an intimate friend “sweetheart” would constitute an appreciating concept. In the realm of nature appreciation, or in the context of the class activities, one might speak of the “sweetly singing river.” The following passage shows one example of a learner using an appreciating concept to describe his experience on the Minden Bog. He is able to view the bog as “an undiscovered place” and a “place free from evil.” It should be noted that, overall, the case record produced few examples of appreciating concepts.

Summary Report 1/25/98

Our next stop was the Minden Bog. I really liked it. Although it looked pretty dead out there. It was like an undiscovered place that has just been found recently. Mr. Lew as my guide took us through it and explained everything thoroughly. He explained the Pepli and the plants that were out there. It was like we were searching for something but couldn't find it. We got to the mound of the Bog and looked out. It was really something, a big open land free from evil. On our way back we stopped and sat on the ground very quietly. Everyone was quiet not one person said a word. Which is usually a change for our class Mr. Lew. But I could hear birds that normally you don’t hear in the city.

Barry T.
Principles and theories constitute the lens through which any individual views the world. It is the organizational structure within which one arranges the individual “facts” of experiential learning. Whether consciously or unconsciously, all observers are making use of some personally held principles and theories in somehow organizing observations. Principles and theories are the structures we use to make sense of the observation. Indeed, such theories and principles dictate which elements of the event the observer will record.

There are a number of instances in the case record that indicate learners were applying principles and theories in their observations. The following passages may even indicate that some learners were becoming more consciously aware of, or even modifying principles of acting and knowing as a result of their reflection on the field experiences.

School site 10/16/98
On the trip and while making the slide show we discovered the beauty of the wildlife and plant life around the school.
We believe that people need to take better care of their environment.
Ann R. and Clara F.

School site 10/16/98
...but after being in your class only a month, I could tell someone the Black River Canal is 8 one mile long. I’d go as far as to say that under 2,000 souls ever on the Earth could tell you that the Black River Canal is about 30 ft. Across at the Bottom. I highly doubt someone from...Madagascar would know that interesting tid-bit of information, nor care, but I do care.

Now, If in a conversation about trees, I could say that Sassafras is used in Root Beer - know what I’m talking about, sound somewhat intelligent and that feel’s good.

I’m sitting here at 12:11 am writing this. Thinking back to the trip AND my newfound knowledge, EVEN at 12:11 a.m. I still don’t find myself bored, yet proud of my accomplishment....
(underlining by author)
Al O.
Idealization, according to Pepi, “consists of asking how the object or event under consideration might be even better than it is.” Engaging in this process of applying ideals to reality has the potential to focus and enrich the actual experience. In the course of this project, little was done to directly address issues related to idealization. Nonetheless, there is some evidence that learners were, at least on occasion, addressing this component of appreciation.

Minden Bog 6/14/99
The Minden Bog was the most interesting field trip I’ve been as far back as I can remember. I got to see where the Black river started, I thought it to be a lot different.
I think that from my understanding at the Bog where the river starts can really use a good cleaning. I think if somebody took a little time to clean it, it will look a lot better.
I also thought it would look a lot bigger.
Barry T.

Minden Bog 10/25/98
Peat lands cover roughly 5 to 8 percent of the world's land surface, so I think why harvest on the bog? There are many other resources available. Since this is causing such a big problem, just go somewhere else. I'm going to try to relate this to Pepi by saying that Michigan Peat Co. is the villain in the situation, and if they would just go away and leave the bog alone, that would make the situation better.
Warren P.

While not all students included direct references to the cognitive elements of the Pepi model the comments included do generally capture the general tone of the experiences. Professional experience suggests that it would be reasonable to assert that more than half of the participants were engaged at least some of the time with cognitive aspects of appreciation during the field experiences.

Where the left side of the vee addresses issues related primarily to thinking and knowing, the right side of the vee addresses appreciating elements having to do with
feelings and value claims. The first of these affective elements is the *Record of the Event*. Pepi states that, to engage in value inquiry, the immediate experience is not enough. It is necessary to maintain a set of objective records of the event under consideration. This record allows the appreciator to review and recall the experience in a thoughtful and considered manner.

Learners used a number of strategies to maintain a (detailed) *record of events*. These included regular journal entries as well as more extended writings either summarizing or evaluating experiences after the fact. One especially important strategy used to form a record of the event included the use of digital images collected by learners while in the field. These images served multiple purposes. Most importantly, collecting the images represented a strategy for encouraging the photographer to look closely at the scene around her. The following excerpts from student writings and interviews, while not conclusive, indicate the potential of this activity to affect the perspective of the photographer.

*Journal 6/3/99*

Today we went outside and walked down a trail to the canal. We saw many plants including some beautiful flowers. I liked the hike but we needed more time. I got to use the camera and took pictures of the flowers and of the canal. I liked the experience and I liked going outdoors.

*Ben D.*
Q. What do you remember from any of the field experiences that we took?
A. When we went to the bog.
Q. That's one of them, yes.
A. And, we sat under those pine trees. And, we sat and listened to things around us. And, I don't know.
    Just looking at stuff and taking pictures. I was the picture person.
Q. You were the picture person? And, what do you remember about taking pictures?
A. That I was the one who got to go up real close.
Q. Do you remember any things that you took pictures of?
A. No.
Q. Have you ever found yourself actually looking at things since like you were taking pictures?
A. Yeah, but I think I kind of always did that.

The resulting images were also available for later review and reflection. They were often used in presentations and papers as a means of sharing the experience with others. Below are samples of student-collected images from various field experiences.
Valuables are any tools or devices whose use enhances the quality of the appreciating event. Binoculars, notepads, cameras or a field guide (animate or inanimate) all constitute valuables. The remotely sensed image collection (virtual field experience) used before and after the real-time explorations of places in an effort to enhance the field experience represents an important example of a valuable. In this study, learners frequently used digital cameras as a tool to support creation of a permanent record of the event for later review and presentation.

School site 10/1/98
Today we went on the computer with our partner and looked at the photographs taken yesterday. I learned a little more about what others saw out there and what they photographed. These picture were to help with our PowerPoint presentation. I liked looking at these because it was interesting to see in a photo what we saw personally.
Dee V.

Valuing Techniques are strategies employed to maximize the feeling response to an object or event. Using the camera to encourage close-up examination of plants and flowers is an excellent example. Others stressed the use of sense perceptions not often considered in secondary instructional settings. For example, students were asked to touch various textures of tree bark and note differences and similarities. The use of smell, such as experiencing crushed Sassafras leaves and wet peat moss, was regularly employed. Where safe and appropriate, learners were encouraged to taste edible plants, such as Wintergreen. Other valuing techniques focused on changing perception by, for example, forming a “window” with one’s fingers and then viewing the scene of interest through this new frame of reference.
One valuing technique to which learners responded especially strongly involved a strategy called “silent listening.” During this process, learners were simply asked to remain silent for two or three minutes and engage in focused listening of the environment. Learners were asked to record the results of the experience and to compare the results from various locations.

**Summary Report** 6/6/99

We sat for three minutes in silence, I could hear in birds, crickets, water, wind, and the traffic on the road. This was a lot different from the Minden Bog trip where it was all silent except for the wind and a few birds. There was a lot of different things different about these two places. Over all I thought that these was a fun trip to go on. I learned a lot about different things and learned more about the school.

Phillis S.

**Minden Bog** 6/14/99

And we also sat for three minutes in silence, which was also a great experience because we got to listen to the sounds that surrounded us...

Helen B.

**Minden Bog** 6/14/99

When we listened for three minutes under the Jack Pine I didn’t hear much but I got an idea of what the point was.

Dan S.

**School site** 6/6/99

I still learned more the second time because we had another 3-minute silence; the things I heard were the cars and trucks moving down the roads. I thought and felt that the experience teaches quite a bit about geography.

Jack P.

**School site** 6/6/99

The trip about the school site was very exciting and educational. On our trip we stopped and were silent for three minute to see what we could hear. We did this at the Minden to, but here we heard more mechanical objects such as lawn mowers. At the Minden basically all we heard was animal sounds and the rustling trees.

Heather N.
Feelings, in Pepi’s model, include emotions such as enjoyment, liking, and fearing as well as simply sensations. An important aspect of nature appreciation involves paying attention to feelings that attend appreciating moments. Feelings can be appropriate as well as inappropriate, as when an individual reacts with revulsion or fear to a harmless insect. Learners were encouraged to express feelings related to field experiences and often did so.

**School Site 6/6/99**
The high point of the exploration was when we saw that Heron. I have never seen one of those in my whole life. I once read a book about a blue Heron but never actually seen one. That was very exciting.

Jason D

**Minden Bog 11/2/98**
We just stopped at this park that overlooked the lake. I learned it was dedicated to the dead seamen lost during the storm of 1913. This stop, this place was exhilarating.

Just explored the bog. It was a very beautiful, quiet place. I found it very intriguing at first but got tired of it a little later.

I also learned that a bog isn’t all black soot? Plants. It has all sorts of colorful plants that brought out the beauty of it.

I felt ok on the trip, it was a good experience.

Anna G.

**Value Claims** represent an objective evaluation of the value of the natural world. Such claims represent the act of valuing things or events that, due to their qualities, warrant valuing. Pepi cites Gowin & Green (1980) in describing six forms such claims can take. The table below lists these. Where Pepi used examples based on the Douglas squirrel, this list takes the liberty of applying the value claims to field-based learning.
Value Claim | Example
--- | ---
Intrinsic | Field trips are good
Instrumental | Field trips are good for learning
Comparative | Geography field trips are more fun than science field trips
Ideal | The field trip couldn’t have been better
Decision | We ought to take more field trips
Virtue/Function | The Minden Bog field trip was a good trip (i.e., as field trips go, this was a good one).

Learners regularly made claims that could be interpreted as belonging to the categories listed above. The first example shows an intrinsic value claim, i.e., “I enjoyed the field experience, and therefore it is good.” At the same time it indicates an instrumental value claim in suggesting that learning took place and it also makes a decision claim by suggesting we ought to take more trips like this one.

**Final Exam 6/14/99**
I enjoyed going to the Minden Bog, it was a great field trip (intrinsic). The experience was great and I would not mind going on that field trip again. This activity did give me a greater sense of the Black River and what it was all about (instrumental). We visited many places and learned about them. And we also sat for three minutes in silence, which was also a great experience because we got to listen to the sounds that surrounded us...

I really thought that going to the Minden bog was a great experience and I think that you should continue to take your future learners on this field trip (decision).

Hellen B.

The following passage illustrates an intrinsic, an idealization and a decision value claim.

**Final Exam 6/14/99**
My trip to the Minden Bog was very worth it (intrinsic). On the way there I noticed many plants, and trees… I climbed a tree and had 3 minutes of silence. I could hear the birds, but especially the wind.
I enjoyed the overall experience, and hope to join more expeditions (idealization) next year (decision)."  
Tess T.

This student’s summary contains both an instrumental and an ideal value claim in that the writer indicates an awareness that the goal of the trip ought to be learning, and that the ideal of learning can be best achieved (idealized) by being with the expert guide. The suggestion that the bog would be enhanced if no mining occurred likewise demonstrates an ideal value claim.

Minden Bog 5/18/99
I started walking in front of you and realized it was much better with a guide. So I went to find you. We (met at) the Jack pine. Thanks to you I found out it was the oldest tree there and that it recovers from fire faster than any other tree.

Then we started walking again and finally making it to the end. I could notice the mining and it looks 10 times worse than before. I think the bog would be a better place if (it had) never been mined. Art O.

Finally, not all value claims are or ought to be positive. The following passages demonstrate value claims of a different sort.

Summary Report 11/25/98
My response to the field trip on November 3, 1998 is that I was not very impressed with the bog. The bog to me seemed boring and was not like a swamp that I thought it would be. The bog was desolate and very quiet. It was relaxing being out at the bog... Overall the trip was worthwhile, because I learned some interesting things about the bog. Like how big it was and how it was formed. Al T.

Summary Report 11/25/98
I thought that the Minden Bog trip was unusually boring. The bog wasn’t what I thought it was going to be. It was all dry and barren. I liked the three minutes we spent silently at the bog. It was a real experience. Lou B.
Another value strategy proposed by Pepi is that of **Ranking**. He suggests its use as a means of increasing the precision of value claims. He further points out that the strategy, while potentially useful, is seldom used by nature appreciators; perhaps, he speculates, because of their tendency to view the actual as the ideal. Learners in this program used ranking strategies on occasion. For example, learners did rank a list of characteristics they compiled on the school site. A small sample of this appears on the drawing of the school site included in Figure 15.

The uppermost element on the right side of Pepi’s vee diagram is that of the **Villain**. In the nature appreciation model, it is used to describe “a person, agent, or activity that threatens the valued object or event.” The villain by definition is always human, or of human origin. It is never a part of the natural world. For example, the company mining peat at the Minden Bog (thereby permanently altering the habitat) might be described as a villain, but natural changes would not, regardless of the degree of change in the environment they might bring about. One example cited by a student involved the Michigan Peat Co. It is interesting to note that no student ever spoke of a villain regarding changes that occurred on the local school site, including expansion of the parking areas and sports facilities.

**Final Exam 1/25/99**

I learned that the Michigan Peat Co. wants to continue harvesting peat on the bog. Many feel that the bog should not be harvested anymore because the bog needs to be saved. I think that the Michigan Peat Co. is a villain (Pepi). This is because the Peat Co. is a threat to the Minden Bog. I personally feel that the Peat Co. should not be allowed to harvest the bog anymore. Since the Minden Bog is such an irreplaceable and unique place to this area, I would hope that it would be preserved and that it will continue to be there for many years.

*Dee V.*
The ultimate goal of the appreciation model is what Pepi calls a moment of felt-significance. It occurs when meanings (the right side of the vee) and feelings (the left side) merge within the experience of the event. Pepi, cites Meland (1953) in describing such a moment as a unifying of intellect and sensations that “brings the conscious organism to its maximum degree of sensitivity.” This is critically important because, according to Pepi, once such a moment is achieved, values, attitudes, and behaviors are likely to change. As a result, “environmental activities and programs that bring about experiences of felt-significance are likely to achieve what Tanner (1980) has called the penultimate goal of environmental education (i.e., the creation of an informed citizenry willing to work actively for the maintenance of a healthy planet).” A moment of felt-significance under any circumstances would be rare. In the context of a typical American high school culture, one might expect such an event to be non-existent. Yet, American high school students produced the following sketches after just a few weeks of involvement with the instructional model detailed above. They suggest some degree of change in sensitivity toward the environment.
You said that the more curves the older it (the river) is.
We have both learned to respect and care for nature, and how to tell how old rivers are.
We think more highly of nature.

You have taught us how to think more like a Geographer.

We think more of the whole world. Instead of just where we live. Also of different scales and map projections. We have to think about something and it is worthwhile and not solely for the practice of thinking skills.
My drawing may be a little confusing but it shows how my thoughts have improved since I took this Geography class. The drawing before the arrow shows my thoughts before the class and the one after the arrow shows my thoughts afterward.

In the before drawing, there is a picture of the world. It looks to anyone who will see it like a bunch of blobs and that is how I saw it myself before. It really has no detail. The eye above the world is only half-open and the rays coming down from it represent my view of the world and my surroundings. By the picture, you see that I was not taking in the full view of the world and I did not pay attention to the details that were so beautiful around me.

In the after drawing, my picture of the world is in more detail. The continents are shaped and named. My eye above this world is open wide and the rays coming down take in the whole world and, with it, many details.

Overall, My drawing shows that as a result of your class I take in all the aspects of what I see. When I think about what I see, I think of all the details I can remember. My eyes and my mind are now open to many more things.
Remote Sensing

As noted previously, remotely sensed images of Earth appear to hold a high degree of fascination for human observers. The use of remote sensing tools in this project was intended to increase learners’ engagement with and appreciation for the local landscape. It was thought that the unique perspective offered by the aerial views, when coupled with actual field experiences “on the images” might support a shift in perception. Like the nature appreciation model, the process of exploring and analyzing the images has both an affective and a cognitive component. The images supported an increased awareness and appreciation for the local landscape; they were also subjects for analysis and interpretation.

The use of aerial photographs and remotely sensed images addresses multiple national standards across several knowledge domains. For example, the first national geography standard calls for learners to be able to “Use Maps and Other Geographic Representations, Tools, and Technologies to Acquire, Process, and Report Information From a Spatial Perspective.” The extended description of this standard reads in part:

Geographic information is compiled, organized, manipulated, stored, and made accessible in a great many ways. It is essential that students develop an understanding of these ways so they can make use of the information and learn the skills associated with developing and communicating information from a spatial perspective. (Emphasis added)

The study and practice of geography require the use of geographic representations, tools, and technologies. Geographic representations consist primarily of maps and also include globes, graphs, diagrams, aerial and other photographs, and satellite-produced images.

Use of remotely sensed images and aerial photographs, as well as the use of technology-based information skills also addresses Earth Systems Understanding #3,
which states, “Scientific thinking and technology increases our ability to understand and utilize Earth and space.” Some of the key elements of that Understanding are:

- Biologists, chemists, and physicists, as well as scientists from the Earth and space science disciplines, use a variety of methods in their study of Earth systems.
- Direct observation, simple tools, and modern technology are used to create, test and modify models and theories that represent, explain, and predict changes in the Earth system.
- Historical, descriptive, and empirical studies are important methods of learning about Earth and space.

The availability of these data are becoming increasingly important in addressing both global and local issues related to Earth systems. Scientists and others concerned about the quality of life on Earth are coming to rely more and more on these technologies. It is critically important that future decision makers are familiar with the capabilities of this new technology and are capable of applying it appropriately.

The “Visualizing Earth” project at TERC, a national instructional technology research center, represents one important research effort currently addressing such issues in the field of geographic visualization. These questions are among the issues related to inquiry-based learning being pursued as a part of that research effort (Barstow, 1997).

- What images are most engaging for students?
- What questions do students ask when they explore the visualizations?
- How can teachers most effectively balance “guidance” and “discovery?”

The research reported here seeks to contribute to the search for answers to these same questions. Two different approaches were used in introducing image sets of the local scene to learners. Each took a different approach to the “guided” versus “discovery” question. In the initial attempt, learners worked in small groups at computer workstations and explored images using an instructor-developed ArcView project. Learners viewed
images on the computer screens, while the instructor offered suggestions and directed
inquiry. The alternative strategy engaged learners in a more guided exploration of the
same images and photographs using a teacher-centered presentation and guided
discussion of the images in a whole group setting.

In each case, the goal was the same. The intent was that learners would use these
images to begin thinking about the local landscape from a geosystems perspective. What
aspects of the images seemed to engage learners’ curiosity? What did they notice in the
pictures and what questions did they have about the scenes they were seeing? Did
viewing the region from the perspective of the aerial images appear to alter perception of
the region in any discernable way?

Transcripts of classroom activities and written learner responses are used to
derscribe student reaction to the photographs. The first illustrates the small group
approach while investigating aerial photographs of the school site. As learners begin the
exploration, they are somewhat at a loss concerning what they ought to be doing.

T:  (After viewing the images) We're going to walk on that picture.
S1:  When?
T:  Right now. Well, in 15 minutes.
S2:  We're going outside?
T:  We're going outside.
T:  So, I want you to find out...find out where we are right now...zoom in. Use your
tools. I want you to play with this a little bit.
S1:  You haven't told us to do anything yet.
T:  I want you to explore the image...so if I say, explore the image.
S1:  Nobody knows where we're at.
S3:  We're over here (indicating a location on the photograph).
T:  Good, so zoom in a little bit. You even go back a little bit. I just want you to
explore a little bit. We're going to walk around the building. I just want you to
make some observations.
After a period of confusion and disinterest lasting five or six minutes, learners began to focus on the pictures and attempted to make sense of what they were seeing. Students began to see individual elements in the images and to look more closely and deeply at the photographs.

S: Mr. Lew, What is this?
T: Good, what is that?
S2: It's a baseball diamond
T: All right, there are a couple of things you can do here. What if you created a polygon theme and started to indicate different regions. You're supposed to be looking at this image from the perspective of a geographer. You could look at movement, regions; You could look at places and locations....
S: (student interrupts with observation) This picture is old.
T: Wonderful...
S: There's no soccer field, there's no track...
T: Good, so we could look at the concept of change. If you made a new view and looked at the (most recent) image of Northern...
S: Hey, is the auxiliary gym even on here?
T: Good, now you're starting to ask geography questions. Are you finding anything interesting?

Students generally began to notice that the initial photograph was taken sometime in the past. They began to notice changes that had taken place on the school site, comparing their own experience with the information displayed in the image. The following passages indicate the similarities in the lines of inquiry pursued by the individual groups.

S3: The barns in a different place, there's a garage on the, on where the auxiliary gym is now...
S1: It's the old track, no soccer field... no bleachers...
T: All right, what kinds of feelings or impressions do you get by looking at the school from this elevation? It is meaningful to you at all?
Several students in unison: NO!
T: O.K. That's fair enough.
S1: Hey, why? You can see everything
T: All right!
A different group of learners had this conversation while viewing the images.

S1: This is a long time ago
S2: How long ago?
S1: They had the tennis courts for a while haven't they?
S2: Like two years, three years...
S1: 'cus I know, when we run the track we have to run right past it.
S2: I know, like when we run the perimeter we come out like way up here and have to run through here. But they demolished all of this.
S1: Yah, it must be pretty old because the tree, and the soccer field....
S2: must be five years...
S1: I don't think...
S2: The track's red now...
T: Tell me something about what you think of viewing the school from this perspective
S1: It's from a long time ago.
S2: Yah
T: All right, but looking at it from above, looking down
S2: It looks small
T: All right, it looks small
S3: It looks bigger

T: Is it an interesting view or an uninteresting view?
S1: It's a good view
T: anything else you'd like to say? What was it you noticed about the library roof.
S1: It was black (white in the new images)
S3: We ain't got no three stories. That's first story, that's second, that's third...we ain't got no three stories.
T: All right, those are good things to remember. We'll go outside and make some observations.

98
Figure 10. Northern High School, 1992. Note the extent of the wooded area at the southeast corner of the building.

Figure 11. Northern High School, 1996. Note changes in the woodlot and addition of tennis courts. An auxiliary gym has also been constructed on the southwest corner of the school.
Figure 12. Northern, 40,000 ft. Infrared photograph with Northern circled at center. Vegetation is red, built areas and bare soil is light blue.

Figure 13. Northern, 20,000 ft. Black and white aerial photograph with Northern circled at center. Canal connecting Black River and Lake Huron is clearly visible.
Students wrote journal entries and summary reports detailing their individual response to the images. The following entries are representative of the types of reactions students recorded after working with the aerial photographs. The first three passages were written by the same individual and illustrate a fairly typical reaction to the images over time. The journal entry was written immediately after the image analysis activity described above. The summary report was written at the conclusion of the school site investigation. The third summarizes the author's experience after a similar activity involving images of the Black River watershed.

Journal 9/22
In class today, we looked at slides of Port Huron and of Northern. When we looked at the slides of Northern I noticed different things and wondered how long ago the pictures were taken. When I ranked the pictures from which was most engaging, I come up with: northern1, Northern3, Northern2
Dee V.

Summary Report 10/16/98 Schoolsite
I thought that the aerial images were very interesting. The aerial images of Port Huron Northern brought up some interesting questions in my mind. Since the photographs were taken during different years, there were some obvious differences. In one picture, there was no auxiliary gym or tennis courts. Also, in one of the later pictures, they had added on to the parking lot
Dee V.

Journal 10/23
Today we went on the computer with our group. We looked at the images of the Black River and of our reach. I learned what our reach looked like and I enjoyed doing this because I like to look at the pictures. After a while though, it got a little boring.
Dee V.
The most frequently mentioned observation of students was their interest in observing change over time represented in the photographs. The following comments are representative.

**Journal 10/16/98**
What interested us the most about the images was how much information they provided and how detailed they were. What surprised us was how much we learned from them. We found some of them boring but some of them were interesting. Like we found the aerial views of the school interesting due to the differences we found on them. Comparing them with what the school has today. The elements we found interesting was how we got to see the school from different views instead of seeing it face to face, we can see from a higher view.
Barry T., Marion H. and Anna G.

**Summary Report 10/16/98**
The things that interested me most is to compare pictures before and after of the school site. It shows human environmental interactions. You see the development of the tennis courts, track, aux. Gym and the expansion of the parking lot. My question that raises in my mind is when were most of these pictures taken.
Val C.

An alternative strategy was used when introducing the images to the second group of learners. Rather than allow students to explore the images independently, the class met together while the instructor presented the images and directed discussion. The following transcript demonstrates the nature of the conversation as learners viewed the images together.

*(Infrared image of school site from 40,000 ft.)*

T: When you look at this picture what do you see.
S1: Lots of vegetation
T: All right S1 says lots of vegetation. And how do you know that?
S1: Because all the red is vegetation
T: OK, because all the red is vegetation. And how do you know that?
S2: Because you told us.
T: All right because I told you.
T: What do you see in the picture...?
T: All right, let's do it this way. Identify a location in the picture and raise your hand when you've done it.
T: Identify a location. I'm waiting... Do you need to come up and look closer?
T: All right, leave your hand up if you want to say what location you found.
S3: The canal?
T: All right, good! Where do you see the canal?
T: Tell me which way to go, north, east, south, or west?
(Follows student directions)
T: Right there? OK, you're calling that the canal?
S3: No, I meant the Black River.
T: OK, that's the Black River, excellent. There's the Black River.
T: All right, just so we can move along a little bit, there's the Black River Canal, if you've found the canal, then of course, you've found Port Huron Northern No! (Several students in unison, expressing mild surprise)
T: OK, which way is Northern from the canal, north or south?
S: North.
T: North of the canal. So as it turns out, right there is the Port Huron Northern School site
T: So, you're going to get a chance to look at this in much more detail in a few minutes.

The dialog with students continues as the instructor displays additional, increasingly larger scale images of the school site.

(School site from 20,000 feet)
T: All right, what do you see in this picture?
S: The river, the lake, a lot of roads...
T: All right, the river, the lake, a lot of roads...how about the canal
S: Yah,
T: Where is it? All right, if we've found the canal, what else have we found?
S: Northern
T: Northern is right here.
S: How far north does that map go?
T: Jot that down! Did everybody get that?
T: The question was, "how far north" ....is that how you said that....
S1: Yes...
T: "does that image go"
T: ...and let's see if I can show you that....

(School site from 3000 feet)
T: O.K., so what are you looking at now?
S1: The school
T: All right, an aerial view of the school
S1: How old is that picture?
T: Excellent! Write that down
T: I mean it. Write it down. It will be very important to me.
   Write the question down
T: How old is this picture. Excellent question.
   I can tell you this picture was taken in either 1992 or 1993. I took the picture
   myself flying in a small airplane over the school site.
T: All right, so this is Port Huron Northern High school.
   What else do you see in this picture?
S: Lots of vegetation.
T: Lots of vegetation. Surprisingly lot of vegetation. Well, I shouldn't say that. Do
   you find it surprising?
S2: No
T: ...the amount of vegetation around the school site
S: Yea, I guess, no.
T: Do you want to look at this picture any more?
S: Not particularly
T: How many of you find this picture interesting to look at?
S2: I find it intriguing to look at.
T: All right, just for the record, most students raised their hand... Try this; raise
   your hand if you DID NOT find the picture interesting to look at? All right,
   nobody raised their hand for that.
S3: I did.
S4: Which way is north?
T: Ok, which way is north? Who can tell us which way is north?
S: That way (pointing in correct direction)
S2: Can you see M-25?
T: Can you see M-25 in this picture? I want the question recorded. Can you see M-25
   in this picture?
S: Um, Yes.
S2: Maybe
S: Not quite M-25, but.... almost the same thing...Pine Grove...it's the same thing isn't
   it.
T: Come up here and show us what you see that you think is M-25
S: No!
T: All right, fine.
T: All right, here is, because I'd rather you get into these pictures rather than me,
   here is the K-Mart plaza, and that of course, is M-25. So the answer to the
   question is yes, you can see M-25.

Learners were guided toward discerning patterns and finding evidence of systems
in the images. There are indications that at least some participants did so. For instance,
one group of students produced the following document. It includes an aerial photograph
of the school site and a caption illustrating what the group saw in the picture.
We see the buildings and the roads and the trees. The house is in a pattern. One of the systems is the roads, they are interlocking. The trees are also systems we found. The buildings are also systems we found. One of the buildings was in its own region. That building is Northport and one of the senior citizens housing. Another of the patterns is the private housing and another senior citizens home. It has its own region. One important system we found is Howe drain.
Finally, there are indications in the post-experience interviews that the aerial images had some long-term impact on learners. Seven of the 15 students who were interviewed a year or more after their geography experience were able to recall at least some of the photographs and make thoughtful observations about them. The following selections are representative responses to questions about learners' recollections of the aerial photographs of the study sites.

Q. Do you remember pictures of the school site and things like that?
A. Yeah, I do. I remember there was one that showed like an aerial of the school and the canal in the background. That was a really good picture because it showed detail of the school itself.

Q. Did it make you think any differently about the school site?
A. It made me feel like the school was a lot bigger than it actually looks from the inside. It also showed how big the surrounding area of the school is.

Ray Venn

Q. Do you remember looking at the aerial images of the school site?
A. Yeah, I look at it all the time on the Husky home page, too.
Q. What do you think about when you look at it on the Husky home page?
A. I think it's a lot bigger than it actually -- I mean, it's a lot smaller than it seems. Because I'm out there playing football like almost every day, and it seems that it goes on forever, but when you look at it from the aerial view, it's just like so small. And the one that we looked at in class, I wonder if we looked at an older one, too. There was a lot more wooded area.

Art O'Fax

Q. What do you remember about looking at the aerial photographs of the school site?
A. That they were kind of old and the old track was on it, and we didn't have the tennis courts, and stuff was different.
Q. Did you find that they gave you any insight or perspective from looking at them?
A. It showed me how it was about five years ago.
Q. Do you remember the experience of "walking on the pictures"?
A. Yeah, I remember going out to the canal, walking around the football field, walking back in the woods.
Q. Do you think seeing the pictures enhanced the field experience?
A. Yeah, you could tell where you were and how things were different and how they changed and the different features and everything.

Will E. Makit
**Outdoor Field Experiences:**

The most critical element in this research project consisted of the actual outdoor field experiences. The nature appreciation model and the use of remotely sensed images, described earlier, were intended to heightening the impact of the field experiences. The most important of these were the school site explorations and the Minden Bog field trip. The former consisted of a series of short outdoor experiences on the school grounds, the latter a daylong excursion by school bus to the headwaters of the local watershed. For the purposes of reporting each will be described as a single event, with student responses from both groups reported together to support the narrative.

**The School Site**

Participants in the program were first introduced to the Five Themes of Geography and their extensions by means of a presentation that included aerial photographs of the school site and examples relevant to the local community. The presentation highlighted the concepts of “system” and “change,” two critical elements of the Earth Systems approach to understanding Earth.

Learners were also introduced to the nature appreciation model. All class members received written explanations of the geographic themes and a diagram of the Pepi model. Although encouraged to do so, there is little evidence, either observational or in the written record, that learners referred to these documents with any frequency. The outdoor field experiences were intended as the primary method for transmitting the skills and concepts related to both geographic understanding and nature appreciation.

Before undertaking any outdoor field activities, learners completed the brainstorming and mental-mapping activity described earlier (p. 58). Of the maps
produced, the overwhelming majority showed just the school building proper or the building and the parking lot. The few maps that did show an extent beyond the parking lot placed some additional emphasis on sports fields. None of the initial maps showed the canal or the wooded area to the east of the school building. The following map captions serve as a general indication of student perception of the school site.

- "When I think of the school, I think of the parking lot filled with vehicles."
- "This is the outside athletic sports. I drew this because I am very athletic in this school."
- "I don't have any feelings about the school site. I come, I learn, and go home. That's about it."

The initial outdoor field experiences involved short explorations of the school site in the immediate vicinity of the school building. These consisted of a series of short walks beginning in the immediate vicinity of the school building. The primary goals of these initial outdoor experiences were to practice the skills of learning outside the confines of the traditional classroom, and to begin practicing the application of geographic and nature appreciation skills.

The group first explored a wooded strip on the east side of the school. The vegetation there consists of a canopy of mature Red Oaks with an under story of Sassafras. Ground vegetation is composed of a variety of plants, the most noteworthy being Bracken Fern and Wintergreen. The area is rough, unmowed and somewhat "natural." Designated student parking borders it on the west side. The eastern boundary is the county juvenile detention center. Several well-worn pathways traverse the region. These paths were created by students exiting the school grounds, generally for the purpose of unsupervised social gathering.
The second location explored was a boulevard of mixed oaks and maple directly in front of the school building sandwiched between a staff parking lot and an important two-lane thoroughfare. The grass beneath the trees here is kept mowed.

The third short field experience involved a circumlocution of the entire school building. This walk contrasted vegetated areas with paved regions. It also focused on school community-based human interactions with the environment, such as trash bins, the smokestack, and automobile traffic to and from the school.

After manipulating and studying the image sets as described above, learners went into the field to physically explore the areas that had just been viewed in the images. This process was described earlier to the group as “walking on the pictures.” The outdoor experiences provided opportunity to practice applying many elements of the Pepi model of nature appreciation. The easiest and most commonly used included denoted regularity (naming things), scientific and cultural associations, maintaining a record of the event, using valuables (such as digital cameras, tape recorder, writing tools, etc.) and valuing techniques. Below is an excerpt from the instructor’s reflective notes describing what occurred on the trip.

After noting these changes (in the photographs) we went outside and walked around the school site. We started on the east side of the school where we smelled sassafras, (valuing) noted the dominant and subdominant tree species (denoted regularities) and discussed the characteristics of Bracken Fern (rain gutter design to collect water and thwart competition.) (scientific association)

We then walked across the parking lot and down the length of the boulevard (from east to west) noting the trees (Red and White Oak, Silver Maple) and how some trees had been marked for removal but spared as a result of a custodian’s intervention (action taking). The weather during the trip was quite mild (temperature in the low 70’s) but the sky was heavily overcast, there was some wind and a few sprinkles of rain. Many of the students complained about
the weather conditions and wished to return to the classroom as quickly as possible. The entire outdoor segment took about 20 minutes.

While walking about on the school site, the instructor acted to direct student attention and thinking toward the elements of nature appreciation as they explored the area under study. The following examples are transcribed from the audio recording made during one of the outdoor field experiences.

T: So, look you have two very different barks there. So have you stopped and touched it?
S: All the other ones, but not this one
T: All right, but touch it...don't just...
S: I don't know what this one is?
T: Are you curious to know?
S: Yes, because....
T: All right, take a small sample of the leaves in such a way that it won't harm the tree, I have the keys (identification guides), and then compare the difference with the barks, and by the way, did anyone notice the lichens growing here. They are a very interesting combination of algae and fungus....
S: Is it ok to touch them?
T: Sure, go ahead
S: They look like tiny little four leaf clovers
T: That's wonderful, good.
T: and are we making some observations?
S: Yes, we found some acorns
T: Good, bring those with us. And do you know what kind of tree they come from?
S: Yes, an acorn tree (laughter)
T: Do you know what kind of tree they come from?
S: An Oak Tree?
T: Yes, an Oak tree, good, good.

Note that the instructor makes an effort to demonstrate unconditional acceptance of learner responses. There is no incorrect response and the instructor responds in a positive fashion to whatever suggestions the learner makes. Both the acorn remark above and the leaf response below may have been attempts to test the instructor's willingness to listen to learner responses after asking for them. In both cases the conversation led to meaningful discussion of denoted regularities.
T: Does anyone know what I have right here?
S: A leaf
T: Good! That's a good start. Being able to call it a leaf is a step in the right
direction. To the extent that you will be able to say more about it, your
connoisseurship will be higher. So step one will be able to say it's a leaf. Can you
say anymore about it without even knowing what kind of leaf it is?
S: It's green
T: Excellent. We can talk about the color, anything else? Can you say anything else
descriptive about the leaf?
S: It looks like a W
T: All right, it looks like a W would be one way to describe it, and because we're a
little bit short of time, and I want to show you some of the techniques we can
use, this is lobed.
All right, so if you can describe the leaf as being lobed, you know something about
leaves, so that both of these plants have that feature in common. This is a lobed
leaf as well. All right, this turns out to be Wild Grape.... a vine and not a tree. Oh,
look here's wild carrot, which was one of the plants we saw on the prairie. All
right, so you've got that here. Oh and here's Goldenrod. Now listen, to the extent
that you can name it Goldenrod you are talking about a denoted regularity.... all
right, can anyone name a different type of Golden Rod?
S: Stiff Golden Rod
T: Excellent. This is not Stiff Golden Rod (A prairie plant we had seen on an earlier
field trip) although I can't tell you what it is.

During the outdoor activities learners were encouraged to carry class notebooks
and to record thoughts, feelings and observations along the way. Most often these
responses were recorded after the field experiences, either immediately upon returning to
the classroom or at the beginning of the next class session. The following passages from
student writings exemplify the range of learner response to the outdoor experiences. The
journal passages seem to indicate that the respondents have practiced at least some
elements Pepi (1994) considers vital to a meaningful nature appreciation experience.
Journal 10/1/98
Today in class we went outside and observed things. I learned about Sassafras, that it is used for root beer, and the Red Oak. I didn’t see much point in it but I did like it better than being inside the classroom. (Denoted Regularity, Cultural Association)
Dee V.

Journal 10/1/98
Today we went outside and quickly glanced at the 30 X 30 meter pixel of land and saw sassafras and Oak trees among others.
I wonder how old the trees are in the bulivard. Were they there before the school was built or were they planted while the school was built? (Denoted Regularity)
May F.

As is to be expected, not all learners enjoyed the outdoor experiences equally.

These examples of learner responses are typical of responses generally unfavorable to the experience. Note, however, that even in a less than positive response, learners expressed ideas indicating that they were engaged in learning and appreciating while in the field.

Journal 6/3/99
Walking around the school site was so stupid. I mean some things I never noticed before, but it was ok
We walked outside, it started to rain, and don’t you think when it rains it smells like worms?
Tess T.

Journal 6/3/99
I didn’t like looking at the trees. It was dumb and I already know what the school site looks like. There is no sign out by the road in the picture. And the road was open in the back. We went outside which I did not enjoy. I wore summer clothes because I thought it was warm out. I liked the flowers. Then it started to rain
Kay O.

Following the series of short field experiences, learners participated in a longer, 50 minute excursion to the perimeter of the 31 acre school site. It featured a walk down a nearly half mile long wooded pathway leading from the school building to the Black River Canal. The canal forms the southern boundary of the school grounds, and is clearly
visible in the aerial photographs of the site. It is the predominant water feature on the
school site. The canal connects Lake Huron on the east with the Black River to the west.
It was originally constructed in 1912 to bring fresh water from the lake in order to flush
raw sewage out of the urban reach of the Black River during periods of low flow. More
recently, the canal was rechannelized in 1992 to support sport boating. As part of that
process the banks were stripped bare of vegetation. The following passage from the
instructor’s log provides an indication of his perception of the learning experience.

Today we took an extended walk on the school site. We walked through the
woods on the East side of the school, then along the path through the woods
back to the canal. We stopped along the way to notice a number of blooming
plants and grasses (denoted regularities). Three students used digital
 cameras to record elements of interest along the way (valuables/valuing
techniques). At the canal we stopped to discuss when and why the canal was
constructed (cultural association).

Learners seemed interested generally in the walk. Some fooling around,
climbing on fallen trees, some stone throwing at the canal. Lots of interest
along the trail, interest in the canal, some interest in the little rough spot in
the southwest corner. Both photographers climbed the fence to get better
shots along the Howe confluence. (I provided class with two digital cameras
and assigned two students to be in charge of them. They were to take
whatever pictures appealed to them, and to take pictures as requested by
other class members.) Valuing Technique: Formed hands together to
construct a "viewing frame" to look around (did this at the Southwest corner.
"Captured" a large poplar tree living on the south bank of the canal as well as
other objects.

As with the previous walk, learners were introduced to the denoted regularities of
a number of common plants, among them, Cherry, Poplar, Virginia Creeper and
Fleabane. When opportunities to discuss scientific and cultural associations presented
themselves, such as describing how Sumac tea is made, or how Daniel Boone once
hollowed out a 60-foot poplar tree to take his family farther into the wilderness, such
moments were acted upon.
T: If you look around this site, what can you name? All right, look around and if there is something you can name, raise your hand. Don't say anything out loud; give everybody an opportunity to think. What can you see that you can name? Can anybody name any of the trees that you see? Don't say anything out loud; raise your hand if you can name any of the trees you see. All right, leave your hand up if you will say out loud what you are thinking... anyone know what the tall trees are called?

S: Those are Oak

T: All right, beautiful. Listen to me carefully. To the extent that you can say, "They are tall beautiful trees," that is good. To the extent that you can say, "They are tall beautiful trees Oak trees," indicates you have a denoted regularity, that you can name the object.

As part of the record-keeping requirement of effective nature appreciation, learners were encouraged to maintain a written record of their experiences. The following selections indicate individuals’ responses to the outdoor experiences. A selection of representative entries is presented below to illuminate learner perception of the field trip.

Summary Report 10/16/98
On September 24th, 1998 our geography class took a field trip to explore the school site. We went through the northern woods to the canal and Howe drain. On the trail we saw many different kinds of plant life and a few examples of wildlife. Seen the beautiful colors of autumn on the leaves of the different kinds of plants. The canal itself was very pretty, being a light colored blue due to the clay on the bottom. We walked along the canal to an area that had taller plants and was right next to the Howe Drain. Then we cut through the field to go back to the school. We saw how short the grass was compared to the trails and along the canal. Mr. Lew spoke of some kind of bird nesting in the field during the summer and winter.
Dan M., Tammy W. and Heather M.

We walked along the canal and Lew pointed out an old Oak Tree, it was also called a wolf tree. Then we looked at other vegetation like the Horsetails, and Sumac, which you can make Sumac tea with.
Anyway that's about all I have to say
Lynn C.

The following two entries are especially noteworthy in that they both mention that the author was completely unaware that a feature as prominent as the Black River Canal
even existed on the school site. This was not an uncommon situation among the students in the study groups. Perhaps as many as half the students were either unaware of the feature or had never visited the canal.

Journal 6/6/99
Yesterday we took a walk around the school site. This exploration was a pretty good learning experience. I never even knew that there was a trail that went through the woods all the way to the canal. The high point of the exploration was when we saw that Heron. I have never seen one of those in my whole life. I once read a book about a blue Heron but never actually saw one. That was very exciting. (Value Claims, Feelings)
Dan S.

9/2
What we did was walk the school site past Juvenile Hall, through a trail that lead us to the canal walked along the canal and discovered some pretty plants.
I never even really knew there was a canal behind the school. Also I expected the canal to look dirty like the Black River.
I found it interesting the trail walk and the canal itself. I found the canal pretty its color really pretty, bringing out all the plants’ beauty. (Criteria, Feelings)
Anna G.

During the school site field experiences, learners were offered the opportunity to practice several valuing techniques. These included touching various textured tree barks, smelling crushed Sassafras leaves (frequently referred to by students as the “fruit loop tree”), engaging in a short period of “silent listening”, and “framing” objects in a view box formed with the fingers. While most participants enjoyed the experiences, some students found them silly and, perhaps, a bit unsettling.
We did a valuing technique: we listened silently for three minutes. I heard the canal flowing and an occasional chirp. Then later we put our hands into a shape and looked at the trees across the canal. I didn't really get that value technique.

Ben D.

Yesterday we took another little field trip. We walked along the same path, through the woods, to the canal. When we got to the canal we closed our eyes and were silent for 3 minutes. I heard motors running, bugs buzzing and birds chirping. I also noticed it was hot (around 90ish) but breezy.

The tree minute listening experience didn't do much, I basically heard the same thing was (sic) the wind and bugs. Overall the walk was a good experience and I'm glad we did it.

Dan S.

At the same time, learners on field experiences were practicing the application of geographic concepts and, by extension, Earth Systems Understandings. In particular, this entailed an emphasis on looking for systems within the environment under exploration as well as looking for examples of human/environmental interaction in the built environment. The instructor frequently demonstrated the applicability of geographic themes and extensions and encouraged the group to couch observations in geographic terms. Some evidence that learners acquired the ability to do so independently is contained in the following passages.
sidewalks and the drain. Location is viewed by the drain, and change is viewed by the rebuilding of the bridge over the drain. Roads and sidewalks are used for movement and are also a system of transportation.

Ann R. and Anna G.

Summary Report 10/16/98
We have learned many different things from our school site walk.
Some of the things were about the five things of Geography. The human/environmental interaction part was the trail that we walked upon. The location part was the canal. The movement part was when we were walking the interesting trail. The place part was the houses on the bank of the trail. The regions part was the whole walk.
In conclusion; Nichole learned a lot of new things about the five themes of Geography. And enjoyed it very much. She likes learning new things. She thinks that being in the surroundings helped her to focus on geography more.
In conclusion Trisha as well learned the five themes of Geography. She also thinks that the school site was very educational. Learning about the school site and geography and actually being in the surrounds helped me learn more.
Ann H. & Anna L.

Of particular interest was the degree to which some learners demonstrated the ability to accurately apply the concept of system to the world around them. While this is a difficult concept to assimilate, the responses included below indicate that some learners, after just a few short field experiences, were able to apply the concept to a variety of perceived systems. While it may be true that the application is somewhat forced and artificial, being able to say the term is the first step toward internalizing the concept.

Summary Report 10/16/98
Another field trip I enjoyed going on was the field trip to the Howe drain, it was interesting knowing the different systems and patterns that we see every day but never really think about, like the sidewalks and roads are considered systems, or the buildings can be considered patterns. Or the fact that the whole field trip was based around one large system called the Howe drain, because it does connect to places all over so I'd call it system. I really enjoy these field trips and I hope we keep taking them. Ron A. Way
Some of the first ideas or concepts that I found useful were the five themes of geography. I found them useful because when you talked about them I knew what you were talking about... I found that you could apply the five themes when we had field trips to Stag Island and the school site. The five themes of geography will help me as we go onto other areas of the world.

Other items of importance I have learned are when you ask geographical questions on a certain regions or specific locations. I begin to think about what is going on around me. For example, before we took a field trip to the Howe Drain, I did not care too much about it or what it did. Now I am interested in the drain, because I have been swimming in polluted water. In addition to this, I learn from the Times Herald that the people that should be looking after these kinds of conditions really do not care. They said in the paper that the water does not need to be tested. After students from the local high school had tested the water and found human waste in the drain, I think it becomes the responsibility of the community and health department to correct the situation. Val C.

At the conclusion of the school site field experiences, learners were again asked to draw a map of “Port Huron Northern High School” from memory. Almost without exception, significant changes appear in these new maps. They now frequently represent the “natural” areas of the school grounds, most often the wooded area southwest of the school building as well as the Black River Canal. Frequently, the revised mental maps contain information delineating the routes students followed during field experiences, and occasionally represent the types of trees and animals encountered. Overall, the maps indicate that, as a group, learners’ perception of Northern has expanded to include many more natural features. There are indications that learners are more deeply appreciating the regions surrounding the school from a geographic and systemic perspective. Below are a series of mental maps drawn before and after the outdoor field experiences on the school site.
Figure 15. Mental maps of the school site, initial

Student caption on the initial map states “I pick to show my top 5 items because I think they're important. The outline of the building is important because that takes up the most space and besides the trees has been there longer than anything else.”

Figure 16. Mental map of school site, final

In the final map, perception of the school site has expanded to include the "natural areas" as well as the building itself. Also note the inclusion of a bird along the canal.
Figure 17. Mental maps of the school site, initial

Student Caption: I drew about all of the trees and grass at Port Huron Northern. Also I got into some detail in the parking lot. I had some interest in it.

Figure 18. Mental Map of the School Site, Final Version

This map indicates a much simpler version of the original map, still emphasizing the parking lot, football field and track. The major water features on the south and west have been added. Note the duck in the canal.
The Minden Bog

The Minden Bog is a raised peat bog at the headwaters of the Black River, Port Huron’s local watershed. It formed atop a glacial end moraine about 10,000 years ago. While common in northern Michigan, raised peat bogs are quite rare in the southern part of the state. There is considerable controversy surrounding the region since part of the bog is reserved as public lands and part is being actively mined for peat. The mining operation has adversely affected the water table throughout much of the bog extent. Litigation involving the mining company, the State of Michigan and the Environmental Protection Agency is ongoing.

The geography class journeys to Minden each year as part of a countywide water quality-monitoring program. The trip itself is a daylong excursion by school bus to the headwaters of the Black River. The exploration begins with a thirty-mile drive along the southern Lake Huron shoreline, following the glacial moraine that separates the Black River watershed from Lake Huron. Learners are lead to view the lake and the bordering communities from a geographic perspective with an emphasis on natural and human systems encountered along the route. Some of these include the Great Lakes system itself (how are the lakes connected), the series of intermittent streams flowing into the lake from the moraine, the road system, and the system/pattern of human habitation both along the shoreline and the farm communities of the interior.

The Minden Bog field experience represents an extended version of the school site exploration. The field experience provides an opportunity to apply geographic concepts, Earth Systems Understandings, and nature appreciating concepts in a larger, more complex environment. A major objective of the excursion is to provide learners an
opportunity to view their entire watershed as an extended system. By visiting the river at several locations, for instance, learners may be able to discern the connections between the various parts of the natural system and to see how they interact with, and affect one another. At the same time an attempt was also made to make clear for learners the pattern of human interaction occurring throughout the watershed. To this end the river was divided into three major reaches:

- **Agricultural River; from Minden Bog to Croswell.**
  The upper reach of the river is surrounded by agricultural use. The entire reach is channelized and dredged to improve drainage from associated farmlands.

- **Wild River; from Aikins Rd. to Wadhams Bridge.**
  The middle reach is mixed residential and agricultural with a significant portion of the river basin preserved for public use as state game lands. Located on this reach is the small farm community of Croswell, a major gravel mining operation, and a Boy Scout camp. More than any other part of the river, this reach remains in a (more or less) natural condition.

- **The Urban River; from Wadhams Rd. to the Mouth in Port Huron.**
  This section is largely residential/urban. The vegetation is generally mown grass to the banks of the river. There are a number of small parks and two golf courses located on this reach of the river.

An especially significant element of the Minden field experience is its potential to be what Kaplan (1993) refers to as a ”restorative experience.” A restorative experience, according to Kaplan, has the characteristic of creating within an individual a “wakeful, but restful state.” While the particular circumstances of any restorative experience may vary widely, all share the presence, to some degree, of common properties. These properties include:
Being Away: The requirement that the environment be different than the ordinary. You must have really gone somewhere not usual.

Extent: "...involves a pattern of stimulation that is extended in time and space." The space involved must be large enough to move around within it.

Fascination: This property requires that the explorer finds the space "inherently interesting and engaging."

Compatibility: Compatibility is the combination of having purposes appropriate for the environment and having in the environment what is needed to achieve the intended purpose.

The bog expedition has the potential to meet all of these criteria. It is reasonable to speculate that such a tranquil, yet alert, mental state might support the occurrence of that moment of heightened awareness that Pepi (1994) refers to as a moment of "felt-significance." Such a moment, when meaning and feeling are integrated, is the desired outcome and ultimate goal of a nature-appreciating event.

As with the school site, learners were asked to produce a mental map of the watershed before any information or exploration of the watershed began. These maps were saved, and the exercise repeated after the investigation concluded. In a manner similar to that used in the earlier explorations, learners were introduced to the watershed investigation using a set of aerial photographs representing the study area at a variety of scales. The image set included a series of infrared photographs showing the watershed from an elevation of 40,000, a number of photos taken from an elevation of 1500 to 3000 feet, as well as a collection of ground photos taken at many of the same locations captured in the aerial photographs. These images were used to deliver a "virtual field trip" beginning at the headwaters and traveling downstream to the mouth of the river.
Immediately prior to the planned outdoor field experience, learners also viewed a PowerPoint presentation on the topic of the Minden Bog itself. This student-constructed presentation included aerial images of the bog, topographic maps, diagrams, and ground photographs. The following passages from student journals give some indication of learner reaction to pre-trip activities.

Journal 10/22
Yesterday in class we finished looking at the slides on the Black River. I found them interesting. The one where the Black River meets the St. Clair river was really neat because the water of the river was blue and the other was brown. The sediment flowed into the St. Clair River caused it to settle on the top.
May F.

Journal 10/20
What we did was go through the slides that showed the river, the bog What I learned was there is an ELK River connected to the Black River. And that the Black River extends a long distance.
I thought the slide show, personally, was very boring, very boring, it kind of needed more pizzazz more interesting facts.
Anna G.

Journal 10/20
The slide presentation wasn’t all that. No matter how excited you get, I still can’t get interested. I don’t really want to go to the Bog, because the last trip was boring. I’m sick of the computers not working!
Three main reaches of the river
1. agricultural
2. Urban
3. Wild River section
Agricultural begins at Minden City, ends at Atkins Rd. North of Croswell
Wild River - Starts south of Fisher Rd ends at Wadhamas Rd.
The aerial photographs are mildly interesting because they are from a different perspective.
Warren P.

Journal 5/18/99
Today Lew had us view a PowerPoint presentation put together by
Tammy, a learner, of the Minden City Bog. The photos were excellent. It gave us an idea of what to expect when we visit the bog on Thursday. I'm really excited about our trip. My dad often hunts deer at Minden City swamp and this will give me a chance to experience the environment he enjoys so much.

Renee D.

Journal 5/18/99
We looked at a PowerPoint project put together by Tammy that was about the Bog that we will be going to. It was interesting because you said that pictures aren't really what it looks like in some ways.

Art O.

Journal 5/18/99
Today Mr. Lew showed us a presentation of the Minden bog. It was interesting and showed some good pictures.

Jill E.

The narrative that follows describes the actual outdoor field experience. The 1998 trip took place on November 12th, on a cool and rainy day. The 1999 trip took place on May 20th, a warm and sunny day, with the temperature reaching into the 70's. For the purpose of this narrative, both trips will be combined into a single journey with supporting citations taken from both trips. Figure 19 shows the watershed and towns along the route.
Two adults and approximately 30 students departed Northern at about 8:15 a.m. for an excursion to the Minden Bog – headwaters of the Black River (scientific association). The bog lies about 80 miles northwest of the school (movement). The first leg of the journey involved traveling north along the Lake Huron shoreline. The first stop along the route was at the Sanilac County Roadside Park, a few miles south of Port Sanilac. The park itself sits on a high sand bluff some 20 to 30 feet above the water. From here, students observed the lake, where a number of glacial erratics are visible in the water. Many expressed surprise and interest in the steep sand bluff. Their interest precipitated a discussion of the glacial forces that created the beach and deposited the boulders. The group descended a steep trail to the shoreline where learners explored the beach and gathered interesting rocks and artifacts. Learners reviewed the various types of
rocks (sedimentary, igneous, and metamorphic) and how each was formed (scientific association) and attempted to identify and classify many of the rocks found along the shore.

Considering that many of these students have lived in a Lake Huron shoreline community most of their lives, their reaction to the shoreline stop was unexpected. Many students appeared somewhat amazed by the bluff and were quite taken with the quality of the place. While not all learners included comments about the shoreline in their written responses, the following observations seem to be generally representative of the group response to the site. In general, they appeared to be fascinated and intrigued with the place, as well as genuinely engaged in attempting to understand the processes that created it.

**Summary Report 5/21/99**
The beach we stopped at was geographically interesting because I never saw a cliff near a beach in Port Huron because the elevation is lower in Port Huron.
Jack P.

**Summary Report 5/21/99**
Our first stop was at Lakeport. We got out of the bus and looked at the lake and we saw the rocks from the glacier moraine, which are from Canada. It was the highest cliff I have ever saw in Michigan.
Stan B.

**Summary Report 11/25/98**
Our first stop was very neat. We looked out at Lake Huron. It was just awesome seeing the lake from a different view.
Barry T.

**Journal 11/2/98**
We just stopped at this park that overlooked the lake learned it was dedicated to the dead seamen lost during the storm of 1913. This stop, this place was exhilarating.
Anna S.
We left school very early and started down lakeshore and we discussed the contributaries going into the lake. Our first stop was at Sanilac Roadside Park. That's where I learned that the boulders in the water are some of the oldest boulders in the world. And I learned the different kinds of rocks like igneous and metamorphic and sedimentary rocks. What I found most interesting was the bluff, was very tall and steep and it looked muddy and unstable.

Art 0.

The next leg of the field trip required traversing the glacial moraine that lay just west of the lakeshare. In the days immediately preceding the field experience, class members helped prepare an analysis of the elevation they would encounter along Route 46, the east/west highway they would traverse from the shore of Lake Huron, up over a glacial moraine, and then down onto an ancient lakebed. Students measured the elevation points using a digital topographic map and used that information to create a line chart. The resulting graph produced a profile of the moraine over which the bus would travel.

Figure 20. Learner created profile of glacial moraine traversed enroute to the Minden Bog.
Each learner received a copy of the elevation chart of M-46 showing the profile of the highway as it crosses the moraine and a topographic map of the area. Later, as the bus driver called out the odometer reading at each mile, the group observed the landscape and compared it with the map. Students expressed interest in the activity and it provided a powerful opportunity for students to practice and develop scientific thinking, a concept deeply imbedded throughout the content standards. The activity helped learners visualize the landscape and to consider it from the perspective of a geologic timescale, a perspective critical to Earth Systems Education. Moreover, such a perspective constitutes a significant scientific association, deepening learners' appreciation of the landscape.

Several learners summarized this experience.

**Journal 5/19**

*today, we talked about the trip to the Minden Bog. We made a graph of the elevation of M-46. I learned how to make a graph in Arcview. I think that was neat.*

Ben D.

**Summary report 5/21/99**

*M-46 - What I learned from this was that the big elevation increase was a glacial moraine. Considering how big the moraine was, the glacier must have been enormous.*

Jack P.

**Summary report 5/21/99**

*Finally we got to Port Sanilac and we started to drive up M-46 as you looked up the road you could see the rise in the road from the deposit of soil from the glacier moraine. The glacier moraine must have been awesome to see something two miles thick. It is interesting that something could get that big and could move.*

Stan B.

After traveling approximately 50 miles over a variety of glacial landforms and
crossing the channelized river several times, the group arrived at the eastern boundary of
the Minden Bog. Geographers crossed the Black River over a small footbridge and
entered the bog. A number of students expressed surprise at the small size of the river at
the headwaters. Their reaction indicated that they expected the river to begin full sized
and completely formed. The concept of the river becoming larger as it traveled
downstream seemed, for many students, to be outside their general understanding of a
river system. The importance of experiential learning in correcting this misconception
cannot be underestimated. Witnessing this change in the system seemed a powerful
appreciating experience for many.

Summary report 5/21/99
I never thought that where the Black River started, it would have almost no source of water! It was nothing that I expected. I thought that it would be a river with nasty brown water in it. The only water that I saw was very little in the ditches.
Kay O.

Summary report 5/21/99
After the trip I have a new view of the river now I know where it starts. I thought it (would) start bigger but it was very small at the beginning.
Stan B.

As we entered the bog the majority of the group rushed ahead down the trail. A
small group remained with the instructor as he talked about the natural history of the bog.
These students expressed genuine interest, surprise and curiosity about the bog and the
life forms living in it. About halfway along the trail the two groups came together.
Informed that it was necessary to continue to the end of the trail, there were general
complaints that they had seen (and walked) enough. However, as they began to listen to
the commentary about the bog, they grew noticeably more engaged. In fact, those
students who had been following the conversation from the onset of the walk encouraged the others to listen more carefully to the conversation.

Journal 5/18/99
I started walking in front of you and realized it was much better with a guide. So I went to find you. We met at the Jack pine. Thanks to you I found out it was the oldest tree there and (it) recovers from fire faster than any other tree.
Art O.

Summary report 5/21/99
At first I thought the adventure was going to be dumb. I will admit that I complained about the walking. If I had walked behind you I would have more information about the surroundings. After a while you caught up to us and I noticed more of the plants, and flowers as you pointed more and more out.
Tess T.

The group stopped to rest in a Jack Pine copse, a small cluster of trees on the generally treeless bog featuring an unusually large Jack Pine whose age has been estimated to be at least 100 years old (appreciating concept). We sat as a group and discussed the fires of 1871 and 1881 that had most likely burned over this area and might be responsible for the Jack Pine's presence (Historical Association). We also discussed the spread of younger pines in the area as well as the generally drying conditions now present in the bog as a result of the mining operation (scientific association).

Gradually, without prompting or direction, students began to note characteristics of the place in which they found themselves. They noted the wet conditions of the bog beneath the needle litter in the copse, examined Jack Pine cones, devised (with prompting) an experiment to bake the cones to determine at what temperature they would open, collected samples, and pointed out interesting insect cysts in the vegetation (scientific association). These conversations provided opportunity to discuss geographic
concepts and related Earth Systems Understandings applicable to the ecological system they were experiencing. For example, students compared the characteristics of different places within the bog while also considering the different subsystem interactions that might be occurring within those same places.

Before continuing on, the group engaged in a three minute "silent listening" activity. During the listening activity, learners generally reported hearing a number of bird songs and a noticeable change in the wind. Such activities, while addressing the issue of nature appreciation (valuing technique, feelings), also supports increased appreciation for the intrinsic beauty of the Earth System, the focus of the first Earth System understanding. The following passages from student summaries offer some indication of the significance of the activity to the development of learner appreciation and sensitivity.

**Summary report 5/21/99**
When we sat down at the Jack Pine I thought that the 3-minute sit was a great idea. When I climbed up in the tree I thought this is going to be so boring. My opinion changed after everything was quiet. It was like a movie all of a sudden the birds seemed louder, and the wind was blowing.
Tess T.

**Summary report 5/21/99**
After walking down the trail always we stopped and listened to the stillness of the bog. We climbed a tree while doing this, which was neat because you could hear the wind and animals that were making sounds. I thought that this was peaceful.
Phillis S.

**Summary report 5/21/99**
About the three-minute thing, I thought it was just a waste of time- but I liked being able to rest a bit.
Kay O.

**Summary report 5/21/99**
Before long we were back at the Jack Pine and we talked awhile
then decided to sit silently for three minutes. Many people were unable to sit still and silent. I was up in the Jack Pine with a few other kids and many of the ones in the higher branches were throwing bark and such down. I really felt like I was really nothing compared to our earth this tree was older than I will ever be and we are up in it messing up the branches and bark although it was fun I lost the feeling I was something more than what I realized I am. We left the trees and continued the walk to the start of the Black River...We reached the farthest that we were going and turned around. As we were walking back time passed so quickly.
Mason J.

After the experiences at the Jack Pine, the group continued on to the end of the trail where a small mound of peat provided a simultaneous view of the natural and the mined bog. This experience gave students an opportunity to observe and evaluate a highly relevant, and current example of human environmental interaction affecting an important subsystem (the local watershed) that was part of the students' personal universe. The following writings reflect some of the feelings this experience engendered among learners.

**Summary report 5/21/99**
When we finally reached our destination of the large mound of peat moss and viewed the mined bog and the natural bog the difference was remarkable.
Renee D.

**Journal 5/18/99**
Then we started walking again and finally making to the end. I could notice the mining and it looks 10 times worse than before.
I think the bog would be a better place if the never been mined (idealization).
Art O.

**Summary report 11/25/98**
The peat is a valuable resource because of its agricultural properties. This fact has led to the mining of the peat by means of sucking it up. But before this process was started the remaining water had to be removed from the bog. So they dug a drainage ditch. This allowed all the water that would otherwise be absorbed
by the bog and released slowly to go directly out of it. This is a problem for the lower reaches as it may lead to flooding...I feel that this is a place that should (be) preserved.

After I have visited the bog and have had a guided tour by someone who knows about and cares about the bog, I too have developed feelings about it.
Denny G.

After completing the hike across the bog, the field experience continued by bus through the heart of the watershed. It included stops at several places where the road crossed the river. Of particular significance was a stop just below the confluence of the Elk River, a major tributary of the watershed. The purpose was to explore individual elements of the system and to see how these parts connected to form a whole. At the final stop in Croswell, a small farm community adversely affected by the river channelization upstream, students had an opportunity to cross the markedly wider river on a suspension footbridge. Learners were able to witness for themselves the significant changes the river was undergoing as it made its way toward its mouth in Port Huron. Both during the excursion, and afterwards in debriefing sessions with maps and photographs, learners had an opportunity to relate their personal experiences in the watershed to the aerial images of the places they had been.

The following excerpts are from summary reports of the field experience. An analysis of the writing reveals frequent expressions that may be interpreted as examples of geographic concepts, Earth Systems Understandings, and nature appreciation concepts.

*Summary report 5/21/99*

The actual exploration of the Minden Bog was an incredible experience. The Jack Pine mother tree was absolutely incredible (appreciating concept). The shelter it offered beneath its branches gave us a break to the monotony of walking under the sun (criteria). I enjoyed the three minutes of silence we endured while sitting under the Jack Pine tree. It gave us an opportunity to listen to the
natural sounds of the environment (valuing technique).

Renee D.

Summary report 11/25/98
Then we finally approached the Bog, which was nothing I expected it to be. I was expecting a swampy messy ugly place. But instead the beauty of all the colors of the plants had thrown me off (value claim). I haven't seen so many different plant species in my life, which was very exciting (appreciating concept). Another new fact I picked up was that we were actually walking on dead plant material (scientific association). That also was really neat. The plant species that stood out to me would be the Tamarack tree, because it was everywhere. Tamarack was small and yet it was big too, this right here is one of the denoted regularities. Which I found was very interesting. We also went to a mound and used the binoculars with Dan Ryan to scope out what was going on across the field seeing tractors load something in a dump truck (valuable).

Anna G.

Summary report 5/21/99
I thought that this trip was very interesting because we got to visit a bog that some day may be gone one day (feelings). I didn't know that Minden Bog was the only bog that was in the lower part of Michigan (scientific association). I learned a lot about the Black River and how it runs. I saw how they dredged the river in some spots so the water could flow faster. This also helped farmers growing crops by the river by allowing them to drain some water out so they can water their crops (cultural association).

Phillis S.

The following responses are especially noteworthy in that they include entries written by the same student several weeks apart. The twin passages indicate something of student thinking and reflection about the experience over an extended period of time.

Journal 5/21/99
We seen many different parts of Black River and compared the depth and width of the river and all the other rivers that we seen (criteria). We also saw how irrigation helps and hurts the river and everything around there (scientific association). We saw many sources of river stoppers such as dams and upward hills. The farther you get to the beginning of the river the narrower it is I learned a lot and also had fun too.
Hugh M.
The Minden bog taught me a lot about the watershed throughout the Black River. I basically learned a lot about certain spots but not the whole thing at once. I learned a lot about the beginning of the river and all the way home to the school and everywhere in between. We learned a lot about the land and everything around us in the meantime.

Hugh M.

Summary report 5/21/99
Even though I could have missed my bus, this field trip will always be one that I will remember and cherish (appreciating concept). It not only was interesting but it was fun to. Every thing in the bog was beautiful and so not the city (appreciating concept). I loved it and would love to go again next year. I also think that every one of the geography learners should take the opportunity and go on the Minden trip. If they don’t take this trip they are missing a lot of interesting things, because you are not just sitting in the class learning about it, you can actually see these things.

Heather N.

Final exam 6/14/99
Our Minden experience was the coolest trip ever (ideal value claim). We got to see neat wild life and plants. Also we were walking on peat moss. The one plant that I remember was the Jack Pine, because it can only grow after a fire.

Heather N.

As one might expect, not all responses to the field experience were positive. Although, in most cases, even though learners begin by expressing unhappiness or disappointment with the outdoor experience, they conclude with a positive observation. The following passages represent negative reaction to the bog experience.

Summary report 11/25/98
My response to the field trip on November 3, 1998 is that I was not very impressed with the bog. The bog to me seemed boring and was not like a swamp that I thought it would be. The bog was desolate and very quiet. It was relaxing being out at the bog. Overall the trip was worthwhile, because I learned some interesting things about the bog (virtue value claim). Like how big it was and how it was formed.

AI T.
summary report 11/25/98
I thought that the Minden Bog trip was unusually boring. The bog wasn't what I thought it was going to be. It was all dry and barren. The trip was worthwhile, even though I don't think much of it now, it will mean something to me in the long run.
Lou B.

final exam 6/14/99
This trip didn't really give me a greater sense of the Black River, because to be honest with you, I didn't really care too much at the Bog. I found it more interesting comparing it with the school site. And because you were my civics teacher I had already been on a school site walk. For example the Bog consisted of peat and not very many trees, but lots of tall grass and different plants. Here there was an abundance of trees, dirt and more commonly known to me, plants.

One thing they both had in common was the Black river went through both. After we left the Bog and we stopped at different reaches of the Black River I had a little bit of a better understanding of the Black River Route.
Ann A.

Finally, the following report is a complete, unabridged summary report that encapsulates the field experience from one student’s point of view. It illustrates many of the goals and objectives of the program.

Summary Report 5/21/99
May 20, 1999 are class went to the Bog. We left at 8:15 in the morning, in my mind when we left I was thinking to myself what the hell was I getting into we were heading out to the middle of nowhere.

We stopped at a park and looked at the lake, we had to climb down a hill to get to the lake. We came at the right time because a man that takes care of the grass came down to the lake and talked to us the only thing that caught me was how he knew so much about everything, He told us about how the water is so low. He also told us about the oil in the water was from the dead fish. Then we went back up to the park and that where you handed out the maps and then we left. We stopped at a little town were we went to a store and got something to drink which you weren't to happy about. That's when it hit me that I was really scared that I was going to have a bad time because we were out in the middle of nowhere.
I liked the maps that showed us what we were going to see mile by mile; I liked it because the land changes in every mile were interesting. We got (to the bog) and I was bored at first but when a few of us stop and waited for you to caught up and that's when it got interesting we got off trail and looked at this stuff that was really soften it felt like a pillow I forget what it was called. Then we stop at some droppings from animals; you then started to dig in it. It was interesting to see what the animals eat still I would never do that myself. We also looked at some plants that only grow there

The class stopped and waited for us, then we walked to the Jack Pine Tree. We sat there for a few seconds and talked, then we had to sit and just be quiet for a min or two we just sat there. I really enjoyed it I learned that it is a lot more quiet in the woods and more peaceful out there then in the city where it is never quiet.

We continued walking to the end, but (by) that time I was sick of walking so the rest of the trip was a blur to me. We walked back to the bus and started for home on the way we stop at a stream or something but I didn't get out, then we stopped at the swinging bridge. We got to go on and start to swing it. We talked for a while then got back on the bus for home. I really don't recall driving through all that stuff because I just wanted to get home, it was getting late then we got back to school and I went home

Barry T.

On the day following the trip, those who went to the bog worked in teams to produce a route map on a large, desktop sized composite infrared image of Michigan's Thumb Bioregion. Learners had access to a construction kit consisting of the laminated image, state road maps, county maps, and watershed maps. In addition, the instructor met at least once to consult with each team to offer expert advice. The following transcript provides some sense of the conversations that took place during these consultations.

T: Carsonville is right here.

   All right, so we crossed the river, and we turned right here. And this is where the landfill was...then we went a little farther and then I said we're crossing the river again. Then we went straight up here...this is Palms right here...

T: This is the little creek we crossed on the metal trestle bridge, so this corresponds to the real world....

S1: Is that where the little barn is?
T: Yes! Yes, that's it. Preston just asked me if this little stream was by the barn, so he knew what he was talking about. Excellent. All right, now, when we came back...we turned right at that sawmill.

S1: Yah, I do.

T: OK.

T: OK, so, it someplace over here on this side of the river. All right, and you have to kind of study...you'll have to kind of study, I mean you'll have to get a county map, and a road map, and this map and try to figure out where it is on this map. All right. And just have some fun with it. It's supposed to be fun. It's not supposed to be a chore, its supposed to be kind of cool to try and compare the maps...and it will give you a sense, because clearly you had no idea where you were, right?

S2: I had some idea...

Ti OK, you had some idea...you'll have a better idea by the end of today.

S3: I don't even know what the Minden Bog is yet. I missed a bunch of days before we went.

S2: It's the headwaters of the Black River.

Ti Say that again, louder.

S2: It's the headwaters of the Black River.

Ti: That was unsolicited, she really knew! She knew she was at the headwaters, that's really exciting! Now, while we're talking about that, Do you have any kind of sense, I mean, being at the headwaters of a river, did that mean anything to you?

S2: I just thought it was cool.

T: Why did you think it was cool?

S4: We wasn't in school (group laughter)

S1: I don't know, it was just neat being out there, like nature from a different perspective. I never really thought about it or anything.

T: Oh really, and have you thought about it since we got back?

S1: Somewhat.

T: Well, if you think about it anymore will you let me know?

S5: I tried to explain it to my dad, but I didn't know what it was.

Despite the provided tools and the expert assistance, students showed a surprising lack of recognition of where they had been. Drawing their route on the maps seemed to be a difficult task for many learners. The completed maps, while generally accurate, still contained significant errors. For instance, placing the route on the wrong side of the river was a common error. Figure 21 illustrates the type of maps learners produced during this activity.
Figure 21. Student Route Map of Minden Bog Trip on Remotely Sensed Image of Michigan Thumb.
Mental Maps

On the other hand, the accuracy of learners’ mental maps of the watershed improved significantly. As with the school site investigation, learners completed the Minden Bog/Black River Watershed experience by repeating the cognitive mapping activity with which they began. The resulting maps constitute a fascinating look at changing perceptions of the watershed in spatial terms. Figures 17 through 22 present a set of representative cognitive maps drawn before and after the watershed investigation. In the initial maps, most learners drew a watershed that began and ended either at no discernable place, or else approximately at the boundaries of the urban region…the region of greatest familiarity to them. The primary landmarks most frequently represented in the maps are the bridge crossings located in the central city. In maps constructed after the field experience, more than half showed a significantly more detailed of the watershed. Some learners produced complex dendritic patterns to represent the watershed. Many others now show both the source and mouth of the river in roughly correct geographic locations. These maps generally indicate that learners have acquired a deeper understanding of the watershed as a system.
Figure 22. Initial map of the Black River
A sketch map of the Black River. The first was drawn before investigating the river.

Figure 23. Initial map of the Black River
The second, after a day-long field experience to the Minden bog.
Figure 24. Initial map of the Black River
This map includes the location of the cartographer's home, although cut off from the rest of the river. This feature occurs regularly among novice maps.

Figure 25. Final map of the Black River.
Note the change in perspective associated with the change in scale with each map. Many more features that impact the river, such as the golf course and boat facility are shown.
Figure 26. Initial map of the Black River.
The initial map focuses on the major road crossings within the city of Port Huron, a common feature of many initial maps produced by geography students.

Figure 27. Final map of Black River.
This map indicates a much greater awareness of the extent of the watershed. It shows both the source at the Minden Bog and the mouth of the river at its confluence with the St. Clair River.
CHAPTER 5

DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

This study sought to provide a detailed description of an instructional program intended to enhance participants' levels of environmental sensitivity. Using geographic and Earth Systems content, it sought to integrate both cognitive and affective learning. These activities took place within a formal school setting. This research looked most closely at instructional events using a combination of remotely sensed images and outdoor field experiences at the locations depicted in the images, a process described earlier as 'walking on the photographs.' The primary objective of the research was to inform instructional practice as it related to enhancing environmental sensitivity.

Learners' responses to these events were recorded using several triangulated data collection strategies. The case record included learners' written responses, sketches, and mental maps as well as audio tapes of classroom and field experiences. In addition, several objective observers provided written summaries of their classroom observations. Finally, 15 students were interviewed more than a year after their participation in the program ended. All of this information was collapsed, organized, and sifted for patterns of behavior and response. Based on this analysis, the researcher drew conclusions about which elements of the events appeared successful and which needed to be adjusted and refined. The results of that analysis are reported below.
One major objective in presenting conclusions and recommendations is to identify instructional strategies for further investigation and implementation that may be of interest to the larger education community. Sanger (1998) in a personal communication, suggested that, rather than a simple summary, a useful conclusion ought be an “occasion to show how education can reflect and engender (sensitivity)…giving educators both the rationale and the method of doing that in the most flexible and generalizable way….”

With that advice in mind, an attempt will be made to present these findings that are of value to this specific research, but may also be applicable across a broader spectrum of instruction as well.

The first finding to emerge from this investigation is that the definition of environmental sensitivity, as applied in this program, ought to be reconsidered. ES was initially defined by Peterson (1982) as “a set of affective attributes which result in an individual viewing the environment from an empathetic perspective.” The environmental education community has generally accepted this definition, which has been cited by numerous researchers (Sia, 1984; Ramsey and Hungerford, 1989; Hungerford and Volk, 1990; Roth, 1992).

More recently, Chawla (1998) offered an alternative definition of environmental sensitivity as “a predisposition to take an interest in learning about the environment, feeling concern for it, and acting to conserve it, on the basis of formative experiences.” This definition is considerably more applicable in the context of formal learning environments. It will serve as the organizing structure for reporting additional recommendations and conclusions derived from the research, and will be the basis for extending this research in the future. Figure 28, below, presents a graphical
representation of Chawla’s definition together with the core elements of this research.

The key concepts of this definition include interest in learning about, feeling concern for, and acting to conserve the environment. While these elements are synergistic, this study looked most closely at strategies intended to support interest in learning about the environment. As a result, this will be the focus of most the following conclusions and recommendations.

Figure 28. Environmental sensitivity is a predisposition to take an interest in learning about the environment, feeling concern for it, and acting to conserve it, on the basis of formative experiences. (Louise Chawla, 1998).
Interest in the Environment

The first element of environmental sensitivity as defined by Chawla (1998) requires “a predisposition to take an interest in learning about the environment...based on formative experiences.” This research examined two formative experiences intended to encourage participants to develop a deeper interest in learning about the environmental around them:

- participation in short field experiences on or near the school site
- exploration of remotely sensed images of the areas under investigation.

The following conclusions about the effectiveness of the instructional strategies employed are based primarily on the post-experience interviews conducted 12 – 18 months after participation ended. Appendix D summarizes the analysis of those interviews. They also rely on personal observation of the instructional events as they occurred (Table 2), as well as reflection on the entire case record as presented here.

Several interesting patterns appear in the delayed responses. Most notable is the high number of participants who described field experiences as the most memorable event in their recollection of the geography program. Nine of the 15 interviewees mentioned field experiences in this way. It should also be noted that seven students listed ‘away’ trips such as the one to the Minden Bog as their favorite experience, while only three listed the school site excursions as being their favorite. Regarding the remotely senses images, seven of the 15 interviewees were able to recall at least some of the photographs explored during the course and to offer thoughtful observations about them. These same students were also asked for their recollections about the major organizing
structures used in the program: the geographic themes and the nature appreciation model. Seven students were able to recall at least two of the geographic themes, while one learner was able to recall only a single appreciating concept.

**Outdoor Field Experiences**

There are strong indications, both in the responses of learners during the program, and from those interviewed a year later, that outdoor field experiences had the greatest impact on participants' level of interest in learning about the environment. It seems particularly significant that so many of the students interviewed after more than a year mentioned the outdoor events as the most interesting and memorable of the course.

The case record as a whole supports the observation that most learners responded in a strongly positive manner to opportunities to learn outside the classroom. More importantly, there are indications in the record that these experiences often had a positive effect on learners expressed interest in the environment. Based on these findings, opportunities are being sought to increase the frequency of outdoor experiences for all students. One way to expand the the number of field experiences while still addressing mandated standards will be to implement more structured, multi-disciplined activities. Several examples of appropriate strategies are included below:

- Identify a natural area near the school to study in depth. The GLOBE program ([www.globe.gov](http://www.globe.gov)) offers a highly structured protocol for conducting such an investigation. GLOBE has also been cited by Moore and Huber (2001) as a model program for integrating environmental education and standards based learning.

- Investigate and report examples of interrelationships and systems that exist on the school site. Significant collections of prepared instructional materials for such investigations are available. *Activities for the Changing Earth System* (1993), provides numerous examples.
Remote Sensing

This research project also made extensive use of remote sensing tools with the intention of stimulating interest in learning about the local environment. The indications from the case record and the results of the final interview data suggest that the images, while less important an influence than the outdoor experiences, did capture the imagination of some learners and pique their interest in learning more about the scenes depicted in the photographs. In addition, seven of the 15 students who were interviewed a year or more after their geography experience were able to recall at least some of the photographs and make thoughtful observations about them. However, significant numbers of students also expressed indifference to or loss of interest in the images over time. As the images do seem to hold considerable promise as a tool to increase interest in learning about the environment, improved strategies designed to place learners more deeply “inside the photographs” may be required to maximize the impact of the remotely sensed data. Several revised strategies are currently under investigation:

- Ask learners to physically trace specific routes on either digital or paper copies of the images and to locate and identify specific places and regions along those routes. These might include routes traveled during outdoor activities or routes to local landmarks on or near the local site.
- Ask learners to identify and record specific examples of geographic themes on the photographs, focusing on the identification of systems.
- Ask small teams of learners to interpret individual aerial photographs of the local site and present their findings to the larger group. This may be done most effectively while literally standing at the location depicted in the image. This strategy may be thought of as “talking on the pictures.”
- Provide a printed copy of aerial photographs for learners to carry with them into the field. Frequently ask learners to locate themselves on the photographs and on the land.
Conclusion

This document has sought to look critically at a set of strategies designed for a formal school setting and intended to result in enhanced sensitivity for the environment. These strategies relied heavily on the application of constructivist learning strategies, short, outdoor field experiences on or near the school site, the use of remotely sensed images of the areas under investigation, a formal model for nature appreciation and instruction in the application of a set of geosystems concepts.

In summary, it appeared that outdoor field experiences, some as short as 20 minutes, had the greatest influence on participants' interest in learning more about the regions they investigated. The use of aerial photographs of the study sites, even when manipulated using computer tools, had less effect, although still captivated learners' interest to some extent.

Though the action research model used here addressed issues related to one researcher's individual practice, it also supports efforts to narrow the gap between individual action and theoretical models. This research has raised a number of issues that bear further study. These include:

- What impact do learners earlier formative experiences such as previous experiences in (relatively) pristine environments, strong environmental role models, and past experiences have on their response to the proposed program?
- What is the impact of gender and androgyny (the minor entry level variable) on the development of environmental sensitivity in a formal school setting such as described above?
- What are the implications for instruction of studying the local environment first and extending acquired skills and insights to the bioregional and global scale? What occurs when the opposite sequence is followed?
What questions do learners ask when viewing remotely sensed images and what sorts of remotely sensed data hold the interest and engagement for them? (Data Collection Instrument, Appendix F)

What strategies are available to evaluate changes in levels of environmental sensitivity resulting from participation in programs such as the one described here?

Learners in the public school setting come to the classroom with varying degrees of environmental sensitivity, resulting from a wide variety of formative experiences — early childhood experiences, association with strong role models, and exposure (or lack of exposure) to pristine environments, the “traditional” predictors of environmental sensitivity. An environmentally responsible teacher may be able to enhance learners’ sensitivity by providing additional, and more frequent, opportunities for all students to experience their environment in tangible and meaningful ways. This qualitative case record appears to support the supposition that such events may result in a greater degree of interest and concern for the well being of the world in which we live. There appears to be justification for studies of this type intended to refine and extend its efforts. This additional effort would provide opportunity to compare multiple strategies intended to enhance environmental sensitivity in formal school settings. Such comparisons could, in turn, allow the synthesis of the best instructional strategies available and provide the greatest impetus to effective environmental learning. As Gray (1985, p. 92) has suggested;

“If we want ecological understanding in the future, we must take a long and thoughtful look at our schools, for they impart a large component of a society’s unspoken philosophy and shape the cultural values and identities for decades to come.”
APPENDIX A

ACADEMIC ACHIEVEMENT OF STUDY GROUPS BASED ON A FOUR-POINT ACADEMIC SCALE
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Table 5. Combined Academic Achievement of Study Groups Based on a Four-Point Academic Scale
APPENDIX B

STUDENT JOURNAL EXAMPLE PAGE
- September 11, 1998
  Today in class we went outside and observed things. I learned about Sagamore, that it is used for root beer, and the red oak. I didn't see much point in it, but I did like it better than being inside the classroom.

- September 18, 1998
  Today in class we worked on our concept maps and looked at some of the Sagamore maps that people did for their reports. I learned about how others saw Sagamore and the route compared to how I saw it. I liked looking at those and I would like to see more on the computer.

- September 21, 1998
  Today in class we brainstormed about what we thought of what we think of Sagamore. Then we drew a picture of it. I learned about how I really see the school myself. I thought this was a little boring, but also I think it was good because it helped me to know what I think of my school.
APPENDIX C

STUDENT RESPONSE DATABASE:
FIELD NAMES AND SEARCH TERMS
### Student Response Data Base: Field Names and Search Terms

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<td>smell</td>
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<td>smell</td>
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<td>interaction</td>
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<td>thinking</td>
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<td>topo map</td>
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<td>Minden bog</td>
<td>valuing experience</td>
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<tr>
<td></td>
<td>movement</td>
<td>valuing technique</td>
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<td>villian</td>
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<td></td>
<td>pattern</td>
<td>weather</td>
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<tr>
<td></td>
<td>Pepi</td>
<td>world projections</td>
</tr>
<tr>
<td></td>
<td>perception</td>
<td></td>
</tr>
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</table>

### Data Source

- **Data Source**
  - fence
  - field experience
  - field trip
  - geographer
  - geoperspective
  - geothemes
  - geothink
  - gis
  - historical association
  - Howe Drain
  - human characteristics
  - human interaction
  - human/environmental interaction
  - idealization
  - images
  - interaction
  - learning
  - lexicon
  - location
  - map
  - metacognition
  - Minden bog
  - movement
  - nature
  - nature appreciation
  - pattern
  - Pepi
  - perception

### Activity

- **Activity**
  - criteria
  - cultural association
  - denoted regularities
  - digital
  - dissatisfaction
  - environmental interaction
  - feelings
  - fence
  - field experience
  - field trip
  - geographer
  - geoperspective
  - geothemes
  - geothink
  - gis
  - historical association
  - Howe Drain
  - human characteristics
  - human interaction
  - human/environmental interaction
  - idealization
  - images
  - interaction
  - learning
  - lexicon
  - location
  - map
  - metacognition
  - Minden bog
  - movement
  - nature
  - nature appreciation
  - pattern
  - Pepi
  - perception

### Final Exam

- **Final Exam**
  - field experience
  - schoolsite
  - scientific association
  - sense
  - sense of smells
  - silent listening
  - sketch map
  - sketches
  - smell
  - symbol pad
  - system
  - task management
  - teaching style
  - technology
  - textbook
  - thinking
  - topo map
  - valuable
  - value claim
  - valuing
  - valuing experience
  - valuing technique
  - villian
  - watershed
  - weather
  - world projections
APPENDIX D

POST PROGRAM INTERVIEW RESULTS
## POST PROGRAM INTERVIEW RESULTS

<table>
<thead>
<tr>
<th>Name</th>
<th>Group</th>
<th>Recalled</th>
<th>+ Themes -</th>
<th>+ Images -</th>
<th>+ Appreciate -</th>
<th>Field Experience</th>
<th>Most Memorable</th>
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<tbody>
<tr>
<td>Ray V.</td>
<td>winter</td>
<td></td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>Bog</td>
<td>Field Trips</td>
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<tr>
<td>Ann R</td>
<td>winter</td>
<td>patterns*</td>
<td>x</td>
<td>x</td>
<td></td>
<td>Bog</td>
<td>Field Trips</td>
</tr>
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<td>Joe K</td>
<td>winter</td>
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<td></td>
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<td>computers</td>
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<td>x</td>
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<td>Computers/Field trips</td>
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<td>Will M.</td>
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<td>x</td>
<td>x</td>
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<td>Bog</td>
<td>Field trip/Combining</td>
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<td>Mason J.</td>
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<td>H/El place</td>
<td>x</td>
<td>x</td>
<td></td>
<td>Bog</td>
<td>Field trip/Combining</td>
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<td>location place</td>
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<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td>Field trips</td>
</tr>
<tr>
<td>Ben D.</td>
<td>winter</td>
<td>regions</td>
<td>x</td>
<td></td>
<td></td>
<td>School site</td>
<td>Field trips</td>
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<td>fall</td>
<td>location movement</td>
<td>x</td>
<td>x</td>
<td></td>
<td>School site</td>
<td>Hands on</td>
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<td>Justin C.</td>
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<td></td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sadie W.</td>
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<td></td>
<td>x</td>
<td>x</td>
<td></td>
<td>Stag Island</td>
<td>Field trip</td>
</tr>
<tr>
<td>Mary T.</td>
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<td>H/El movement</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td>Spanish</td>
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<tr>
<td>Dee V.</td>
<td>fall</td>
<td></td>
<td>x</td>
<td>x</td>
<td>x (villain)</td>
<td>Stag Island</td>
<td>Field trips</td>
</tr>
<tr>
<td>Kay O.</td>
<td>winter</td>
<td></td>
<td>x</td>
<td>x</td>
<td></td>
<td>Bog</td>
<td>Field trips</td>
</tr>
</tbody>
</table>
"The Mechanics of Nature Appreciation":
An article by D. Pepi
And an instruction idea by A. Lewandowski
As presented by L. Jacobs

What We Did.

In the fall of 1998, my class and I embarked on an experiment in nature appreciation and writing. I teach advanced composition at Port Huron Northern High School and I teamed up with my fellow special education colleague, S. Frederick-Sutter, pairing my class with her basic writing class. After sharing with the class the Pepi "V", I instructed my class that they would pair up with another student and find something in nature to write about; preferably something, which not only interested them but also gave them pause for thought. They were to record the object or event using a digital camera then write a descriptive paragraph (which could very well be lengthened at a later date). The writing needed to include things like a topic sentence, support for this point, active language, and two - four instances of figurative language.

The next thing I involved my class in was an introduction to nature given by Mr. Lewandowski. This involved a walk from our classroom through the nearby forest ending at Black River which is also located nearby. Mr. Lew had running dialog about the assortment of trees, plants, and wildlife. We also as a class practiced a few exercises in nature just out of our classroom doors. For example, I had students examine a tree found in our school’s courtyard. I asked them to first describe the tree, look at the tree from several angles, and then write about what they saw, felt, and imagined about the tree. They were to do the same at a place of their own choosing outside of school. Third, I let the class explore on their own. The partners wandered freely between the classroom and the canal. Some just sat and recorded their thoughts; others clicked digital images for later use. Finally, our class had several writing days using our pictures, our "V", and our thoughts about what we saw, felt, and imagined.

I also had students keep a journal of what they did, what they learned, and what they thought about it all. I had them place an emphasis on their copies of the "V", and it was there I found them making connections and revelations about exploring nature. They spent more time dialoging about memories the nature held for them as well as what different things suggested to them.
What We Learned.

What began as a lark and not at all an "English" activity turned into a rewarding experience for a great many students. First, we learned surprising things about the nature most of us took for granted. The trees and flowers held secrets that gave the students pause and caused them to reflect. Next, the "V" gave students food for thought about things which most of the time they took for granted. Not only did the class record the obvious details about say, the canal, but the meanings and feelings about the event. This allowed them to appreciate what they looked at so much more. I as a teacher was struck by the connotations (the memories and dreams) students paired with the denotations (what the thing actually looked like). Each pair recoded the event then stretched and expanded what they saw with their feelings and their ideals for what they saw. Everyone used some of the Pepi "V" to obtain a deeper appreciation of what they experienced.

We also learned that others experience the same things differently. My students learned so much from the special education class. Many things have a different meaning from a different point of view. I remember one pair viewing a leaf. Upon turning the leaf over, the students found that what was a green, fuzzy carpet on one side became a cluster of bugs on the other. My student quickly dropped the leaf exclaiming "yuki!" while the special ed. student marveled at the teeming insect "playground". This gave different value claims on the shared event. I remember that this group eventually wrote a story about a "bug paradise" exercising what they observed (event) with an idealization of what could be imagined.

What I Thought About It.

When beginning this exercise, I had two objectives. One was to introduce students to essential skills regarding writing (i.e. organizing thoughts around a topic and providing support for this topic) and two provide an experience in which students could better appreciate the world around them. I feel both objectives were achieved. The Pepi "V" fit easily into a logical essay format. In both cases, students must identify an event then follow with description, feelings, and prediction—the very points Pepi delineates in his nature appreciation approach.

I feel the students not only enjoyed this exercise, but learned something of value. Their samples of writing turned out as varied as nature itself. I found it interesting that many of the journals contained reference to the "villain" or two. The students seemed to easily navigate between the different levels specified in the "V". All in all, this was a successful exercise. It was enjoyed by the students, and I very much enjoyed reading the results.
APPENDIX F

IMAGE ANALYSIS
DATA COLLECTION SHEET
Aerial Image Rank Ordering Activity
You have just viewed and explored these images. Please reflect on what you have seen in the pictures. Record any questions, thoughts or feelings the images raised in your mind as you viewed them. Finally rank order the images on the basis of which ones you found most engaging or interesting.

<table>
<thead>
<tr>
<th>Origin</th>
<th>Thumbnail</th>
<th>What questions does this image raise in your mind as you view/recall the original</th>
<th>Rank Order</th>
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<td>School site, 20,000 ft Black/white</td>
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<td>Lakeshore, 3000 ft.</td>
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<td>School site, 3000 ft.</td>
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<td>School site, 1500 ft.</td>
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<tr>
<td>School site, 1500 ft.</td>
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</table>
APPENDIX G

CLASSROOM OBSERVATION
RICHARD CHAPMAN, ASSISTANT PRINCIPAL
The Instructor

The class is facilitated by Mr. Al Lewandowski, a seasoned instructor of some 30 (?) years. I use the word "facilitated", as Mr. Lewandowski's style is not so much that of "instructor" as it is a blend of "maniacal leader" and "spiritual/educational guide."

Careful organization coupled with an openness to spontaneity and the intuitive ability to grasp the "teachable moment" result in an atmosphere of constructive confusion which, to the unenlightened observer, may at times, appear to border on chaos.

In fact, the air is consistently sparked with the enthusiasm of engaged learners, students interacting with technology, with each other, and with their "instructor". At any given moment, the roles may shift, resulting in a constant interplay of teacher/technology/learner, with "Mr. Lew", as often as not, taking the role of enthusiastic learner along with other student learners.

Mr. Lewandowski's friendly encouragement, positive approach to any dilemma, and ready willingness to admit that he is not "the expert" and does not "have all the answers" quickly puts the students at ease and establishes an open atmosphere of exploration and growth.

Students, feeling unthreatened by the "authority figure", relax and begin to more freely participate in the quest for answers. For some, this is a first-time experience, and it is a joy to see the light appear in their eyes as they come to understand the opportunity being presented to them. Many, who have until now felt disengaged from classroom instruction, begin to actively participate both individually and in teams, often interacting and collaborating with students with whom, in a different setting, they would rarely converse.
APPENDIX H

CLASSROOM OBSERVATION
LOUELLA ALLEN, CURRICULUM DIRECTOR
Observations of a Geography Class  
September 25 and October 5, 1998  
Port Huron Northern High School

Notice I didn't refer to this 3rd hour class as Mr. Lew's class. Nor will I refer to the participants as students. Instructor and students are fellow geographers.

Geographers appear to be grouped as they wish

Master geographer compliments novice geographers as he shows samples.

"I'm very impressed with Vizdross, not that she did any better than any one else, but she put the bus in here. She has two people with no heads. That's curious.

Displaying each drawing and positively commenting on particulars per drawing, piqued the attention of geographers and helped instill pride.

"A fabulous piece of cartography entitled 'Psychedelic Journey' or subtitled 'My Slightly Twisted View of the Field Trip.' Designed by a geographer with leather jacket, earrings and earrings."

"Tammy, you are wonderful."

"Whoever did the acorn picture, that was a fabulous idea. Brad did that."

"Brace yourself." We applauded when he lit up the region.

"Do minerals, great minds, Tammy."

"We're really on the cutting edge on what can be done with this stuff."

"Beautiful picture through the window of the ferry."

Writing is integral to the geographer and to the course

Master geographer, "if you wrote something, I wrote you back."

Mrs. Landon's students were asked to give feedback regarding presentations in writing.

"When you go back, I would ask you to write 3 to 5 sentences about what you liked or didn't like about each presentation."

To a visitor, the use of professional jargon was informative, adding to the authenticity of the experience

Cartographic technique

Interaction with fellow geographers always positive

Geographer, "I'm not going to be here next week."

Master geographer, "Fine, I don't mean fine, but we'll deal with it later."
Environment
Visitors not only welcomed, but expected (presentation must be given to a group larger than original geographers)

- Audience of 2nd graders
- Mrs. Landon's students
- Mrs. Davenport
- Mr. Renner A biology class

Here was an ambiance of mutual respect for fellow geographers and master geographer

An open invitation for humor, comic relief
The freedom to make a mistake without censure "I screwed up," Master Geographer
Seize the teachable moment by spontaneously conducting a mini workshop for those interested
Student given choices

Open window invited warm breeze. Classroom felt unconfined, unrestricted, inviting a free exchange of ideas, the freedom to disagree and risk take.

Power Point Presentations
Unique and individual to the geographer's interests
Tied to the geographic themes
Sound enhanced the presentation
Invited response/participation from audience "There was a cricket in a bush. Can you find it?" "There are two plants in this picture. Can anyone tell me what they are?"
Interesting story from the geographer who talked about his grandfather working for BMJ Engineering
A 1966 graduate of PHN, I was especially intrigued by the demonstration of the changes that have taken place during the past 38 years.
I need to learn how to use power point to update and enhance my presentations.

Additional comments in way of summarizing/capturing the experience
Teacher as learner
Teacher as risk-taker
Teacher as performer
Teacher exudes energy
Teacher is animated
Teacher as model
Teacher willing to turn class over to students
Technology in action
Teacher did not require that every student be feigning attentiveness (the turn around, sit straight in your chairs and look at me syndrome). I was pleasantly surprised to observe that even when students appeared to not be listening and/ or involved, they really were as was evidenced by interjections into the discussion.

This classroom has all the elements of a student-centered learning environment with real-life experiences and authentic assessment, a place where learning as well as the learner are valued.

Thank you. My experience with you inspired me to become a fellow geographer.

Louella Allen
Curriculum Director
Port Huron Area Public Schools
APPENDIX I

SCHOOL SITE EXPLORATION
STANDARDS BASED ACTIVITY
I. **TITLE:** Exploring the School Site: Applying geographic concepts to the local scene

II. **AUTHOR:** Al Lewandowski, Michigan Geographic Alliance (alew2@bigfoot.com)

III. **SUBJECT:** Geography

IV. **GRADE RANGE:** middle school; high school; early college

V. **GENERAL EDUCATION GOAL:** The main goal of this project is to provide learners with opportunity to apply fundamental geographic concepts (five themes) to a familiar site and situation

**SPECIFY OBSERVABLE BEHAVIOR OBJECTIVES:**
Upon completion of this project, learners will be able to:
1. Demonstrate an understanding of five themes of geography
2. Apply the themes accurately to the local scene (schoolsite).
3. Collect, organize and analyze information related to the characteristics of a place
4. Produce a mental map of a place/region

VI. **GEOGRAPHY STANDARDS ENGAGED:**

**Activity: Walk About on the school site**

**Standard 5**
That people create regions to interpret Earth's complexity

**Standard 12: Human Systems**
The processes, patterns, and functions of human settlement

**Standard 1: The World in Spatial Terms**
How to use maps and other geographic representations, tools, and technologies to acquire, process, and report information from a spatial perspective

**Michigan State Standards**

**Standard 11.2 Human/Environment Interaction**
All students will describe, compare, and explain the locations and characteristics of ecosystems, resources, human adaptation, environmental impact, and the interrelationships among them.

**Standard 11.4 "Regions, Patterns, and Processes"**
All students will describe and compare characteristics of ecosystems, states, regions, countries, major world regions, and patterns and explain the processes that created them.
VI. **TIME REQUIRED FOR COMPLETION:** Two to three class periods

VII. **MATERIALS USED:**

*PowerPoint presentation:* Five Themes of Geography
*Data Collection Sheet:* Exploring the School Site: A Geographic Perspective

VIII. **PROCEDURES:**

1. **Ask each learner to draw a mental map of the school on a clear sheet of 8 X 11 inch paper. Hold this draft as a pre-assessment activity and repeat at the end of the exploration. Compare the two maps by scanning the documents and viewing**

2. **Review five themes of geography and extensions (see PowerPoint presentation) with a special emphasis on Location, Place, and Region.**

3. **Lead a group brainstorming activity listing “characteristics of the school site”. It should be easy to generate a list of 25 – 50 items. Either collectively or in small groups, sort the list using the five themes as organizing centers. If the list is provided in a spreadsheet format such as Excel, the information can be easily sorted by category. Inspiration, a concept mapping program available at www.inspiration.com is an excellent digital mapping tool.**

4. **Share highlights of a few concept maps/brainstormed lists with the whole group as time permits. Focus presentation on the concepts of Natural (physical) and Cultural (human) characteristics of place.**

5. **Conduct one or more short field experiences on the school site. See detailed field trip recommendations below.**

6. **Conduct post-walk debriefing, including; sketch map, brainstormed/organized lists, rank ordering activity. See detailed suggestions below.**

7. **Repeat steps 3 – 4 Alternatively: provide half the teams with the state outline map and half with the river map and complete steps 3 – 4.**

8. **Discuss the differences in perception that resulted in regional differences using the two maps**

9. **Discuss the concept of a Bioregion (see PowerPoint presentation)**
ASSESSMENT: Convert some or all of the maps to transparencies or scanned digital images. Show representative maps to the group and non-judgmentally discuss the content in light of the concepts of place, region, pattern and system.

1. Emphasize examples of natural and cultural phenomena in the maps.

2. Note inclusion of expected map elements; Title, Compass, North orientation, etc. as well as other interesting elements discovered in the maps.

3. Point out that these maps are simple representations of students’ mental images of reality and as such cannot be considered either “right” or “wrong”. They are, however, interesting phenomenon to investigate.

ENHANCEMENTS:

1. Beginning with the sketch map, learners may construct correct cartographic representations of the school site. Maps would include appropriate elements such as compass, title, legend, etc.

2. Brainstormed lists may be rearranged in poetic or artistic arrangements.

3. Ask participants to brainstorm thoughts, feelings, and ideas related to the walk. Rank order the five ideas that learners found most; surprising, interesting, troubling, etc. Produce a graphic representation (picture, collage, sculpture, etc.) of the idea and include a brief caption explaining the illustration.

4. Expand the brainstorming/analysis activity to include the concepts of tangible and intangible characteristic. Ask learners which characteristics could be; touched, tasted, smelled, heard, or seen. Explain that any characteristics that remain are intangible. Some examples would include; friendly, frightening, boring, exciting, inviting, old fashioned.

5. Using an aerial photograph(s) of the school site, ask teams of learners to locate places or regions on the photograph that illustrate geographic themes and concepts as indicated on the poster, Geography: Five Themes to Help Understand the World and its People. Record examples directly onto the poster. Share results with the larger group. 
   (poster available through the Michigan Geographic Alliance 800-279-1423)
Field Trip Recommendations

Inform students that the class will be taking a tour of the school grounds, which we will now view from the perspective of a geographer. In this instance, with particular emphasis on the concepts of place, region, pattern, and system.

Remind participants they will be constructing a mental map of the field trip upon returning to the classroom. Distribute the data collection form if you will be collecting observations in the field.

Lead group to selected locations around the school site. [Sample: parking lot; quiet, shady spot; near busy road; a place with strong odors (trash containers, kitchen area, etc.)]

At each location direct learners to use various senses to examine the site:

- Feel objects in the place (Tree bark, building surfaces, etc.)
- Smell/locate source of any strong or unusual aromas.
- Listen for sounds of environmental interaction
- Observe/proposal regional boundaries

At one or more stops, point out that location becomes a place as soon as we begin to consider its natural and cultural characteristics.

Place is Space Endowed with Meaning

- Point out that place becomes a region as soon as we begin to consider boundaries.

Returning to the classroom

- Ask participants to make a quick sketch map of the field trip and complete the data collection sheets. This may be done independently or cooperatively as the situation dictates.
- Some organizing strategies to try:
  - Categorize all the regional characteristics as either natural or cultural
  - Rank Order the identified regions using such criteria as most: puzzling, troubling, curious, pleasant, unpleasant, in need of change, favorite, least favorite, etc.

Share results with the large group.
APPENDIX J

SCHOOL SITE EXPLORATION DATA COLLECTION FORM
Exploring the School Site: 
A Geographic Perspective

Location: Position on the Earth’s Surface, either absolute or relative to some other location
Identify three locations on the school site where we stopped to make observations. Record both their absolute location as well as location relative to the flagpole in front of the school.

<table>
<thead>
<tr>
<th>Site</th>
<th>Absolute Location</th>
<th>Relative location</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
</table>

Place: The physical and human characteristics of any location (space endowed with meaning)
As we explore the school site, be alert for both physical and human characteristics of the site. These characteristics may also be defined as tangible and intangible – those that can be recorded with the senses and those that can only be measured with the mind. Record some of each in the spaces provided. Place an (H) for human or a (P) for physical after each characteristic.

<table>
<thead>
<tr>
<th>Tangible</th>
<th>Intangible</th>
</tr>
</thead>
<tbody>
<tr>
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</tr>
</tbody>
</table>

Regions: Areas displaying unity in selected characteristics
As we travel around the school site, observe the many different regions we travel through. Record at least five on the following lines:

<table>
<thead>
<tr>
<th>Region</th>
<th>Defining Characteristic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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<tr>
<td></td>
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<tr>
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</tr>
</tbody>
</table>
Human/Environmental Interaction: Human influence on the environment and visa versa
As we explore the site, look for examples of human/environmental interaction. Determine who benefits most from the interaction: Humans or the environment.

<table>
<thead>
<tr>
<th>Interaction</th>
<th>Benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<tr>
<td></td>
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</tbody>
</table>

Movement: Humans interacting on the Earth. Includes movement of people, things, ideas
As we travel about the schoolsite, observe instances of movement. Include at least one example of each type of movement listed above. Try to find a new category not listed above as well.

<table>
<thead>
<tr>
<th>Transport Vehicle</th>
<th>Object or Concept</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

Cognitive Map: Your internal, or mental map, of the area under consideration.
Draw a clear, and detailed representation of the site we visited as you remember it. Label at least three of the fundamental themes of geography as represented in your map.
APPENDIX K

SCHOOL SITE PRESENTATION EVALUATION RUBRIC
<table>
<thead>
<tr>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
<th>Level 4</th>
<th>Level 5</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>School Site</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reference to school site, but no artwork included</td>
<td>Refers to school site, and includes some digital images of the site</td>
<td>Refers to school site and includes digital information about the school site</td>
<td>Contains meaningful digital information about the school site at a variety of scales</td>
<td>Meaningful data as well as insightful observation related to school site</td>
</tr>
<tr>
<td><strong>Geographic Content</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disconnected and unrelated ideas; reference to geographic concepts is vague and unfocused</td>
<td>Organized (thematic) description of the school site, few references to appropriate themes and concepts.</td>
<td>A clear description of the school site in geographic terms, with specific examples and connections to themes.</td>
<td>A clear geographic description of the school site; includes self in the analysis. Personal relation to the environment</td>
<td>An insightful interpretation of the school site from the geographic perspective, using the data provided.</td>
</tr>
<tr>
<td><strong>Presentation Quality</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Difficult to understand, tangents, and other errors</td>
<td>Generally consistent line of thought, but not always clear and flowing</td>
<td>Almost completely consistent line of thought, clear and flowing</td>
<td>Easy to understand; clear and logical presentation</td>
<td>Clear, concise, and insightful analysis of the program and its appropriate uses</td>
</tr>
<tr>
<td><strong>Interest Level</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fails to hold the evaluator(s) interest</td>
<td>Parts of the presentation are interesting</td>
<td>Generally interesting presentation</td>
<td>Entertaining and captivating presentation</td>
<td>Exciting, bravura presentation. Audience disappointed to see the presentation end</td>
</tr>
<tr>
<td><strong>Group Participation</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>One or more members of the group not involved in the presentation</td>
<td>One or more members have only a very minor role in the presentation</td>
<td>All members participate, but one or two members carry most of the presentation</td>
<td>All members equally share the burden of presenting.</td>
<td>All members of the group deliver compelling, exciting, and informative performances.</td>
</tr>
<tr>
<td><strong>Nature Appreciation</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fails to mention nature appreciation skills at all</td>
<td>Refers to appreciation skills indirectly or incorrectly</td>
<td>Demonstrates knowledge of specific strategies for nature appreciation (Pepi model)</td>
<td>Applies one or more appreciation skills in recording/reporting field observations</td>
<td>Applies appreciation skills correctly and is aware that she is doing so. (metacognition)</td>
</tr>
</tbody>
</table>
APPENDIX L

RESEARCHER FIELD NOTES
EXAMPLE
September 25, 1998

Friday
Introduced team to the school site knowledge kit, built from the following:
Returned pre-activity school site map after sorting them into three categories; building only, building and immediate surroundings, building and outlying regions.
Showed scanned images of world class site maps. These were completed by geography learners several years ago. (Appendix Nth)
Showed Learner presentation of Stag Island trip, a powerpoint presentation consisting of provided and acquired images of the field trip to stag Island. Was presented to two biology classes earlier by learners.
Showed teacher developed ArcView project showing route of schoolsite walk and accompanying regions done with lines, points, and polygons on a base image of the school site taken from 20,000 ft.
Showed members how to easily view our collection of digital images taken on the field experience by chad and Heather.

Instructed learners to develop a project that explored one region from the perspective of "Place", "Region". I place less emphasis on including the concept of Pattern. I have also been implicitly and a bit explicitly introducing the concept of scale especially when referring to the various altitudes from which the images have been acquired (between 300 kilometers and a few centimeters).

I made a point of pointing out one or two outstanding images. I specifically noted the picture showing a human hand holding a half dozen acorns shot at macro level. One interesting incident...I pointed out one interesting picture of the path through the woods taken from the water pumping station (south end, near canal.) The photographer captured a beautiful shot of the path with some of the cyclone fence included. I suggested the photo could be improved by cropping out the fence. The photographer objected that he had intended to shoot the photo that way, in order to capture the true nature of the place.

I worked with several groups of learners - learning to find the image sets on the L (network) drive and download them, view them in powerpoint previewer, etc. Some have begun constructing presentations. The two learners planning to deliver a presentation and field trip to 2nd graders explored strategies a little further today. (I mentioned their project as an excellent example of "presenting to an audience larger than our class" earlier in the class.

I specifically mentioned several elements of the Pepi V as well. Specifically, I mentioned the idea of record keeping, and that the image collections, voice recordings, and samples and specimens constituted the record of the event. I mentioned valuables (tools for appreciating) and well as reviewed the valuing techniques we have practiced to date; Texture Touching, (feeling objects such as tree bark and a variety of leaves from fuzzy soft (staghorn summac) to pristly and hard, such as oak leaves, canadian thistle, etc.) and Finger Framing (forming a frame by touching thumbs and index fingers of opposing hands and viewing the environment through the frame (scale also comes into play as you zoom in and out by moving your hands near and away.)

On the cognitive side, we have discussed on multiple occasions the significance of being able to distinguish and name specific elements of the environment. These include trees, plants, birds, cloudtype, etc. I have briefly mentioned the notion of Counseourship in this context. (see Pepi)
APPENDIX M

MINDEN BOG REFLECTIVE NOTES
RESEARCH NOTES
The Map is not the Territory
The Minden Bog Field Experience - May 20, 1999

A Reflective Summary of the Excursion
A. Lewandowski
May 23rd, 1999

Two adults and 21 students left Northern about 8:15 a.m. on Thursday, May 20th for our excursion to the Minden bog - headwaters of the Black River. (Scientific Association). The Bog is about 80 miles by river from the school. (Movement) The day was sunny and bright; temperatures eventually reached the low seventies. There was a light east wind blowing. Ideal conditions for a day outdoors, especially with students unused to daylong field expeditions and often ill dressed for even slightly adverse conditions.

In preparation for the trip we had, as a class, viewed a slide presentation of the Black River (available for viewing at: http://husky.port-huron.k12.mi.us/wlscw/) we saw the slides some two or three weeks prior as we began our river work. In the days immediately preceding our departure we conducted an analysis of the elevation of route 46, the east/west highway that will take us from the shore of lake Huron, up over a glacial moraine, and then down onto an old lakebed. We had measured the elevation points using digital topographic maps and then created a line chart using Arcview

Our first stop along the route was at the Sanilac County Roadside Park, a few miles south of M-46. Here we looked at the lake, where a number of
glacial erratics are visible in the water. The park itself sits on a high sand bluff (20 - 30 feet). The weather being ideal and the group being energetic we descended a steep trail to the beach. There, students explored the beach, threw rocks into the water and found interesting rocks and artifacts on the shore. Many expressed surprise and interest in the steep sand bluff, having never seen a cliff like it before. We discussed the glacial forces that created the beach and deposited the stones; we reviewed the various types of rocks (sedimentary, igneous, and metamorphic) and how each was formed (SA). We attempted to identify and classify many of the rocks found along the shore.

Coincidentally, the man who happened to be mowing the lawn in the park and showed some students an easier way to the beach stopped to talk with us. He pointed out differences in the shoreline resulting from the especially low water conditions existing at this time, pointed out where a sandbar lay just off shore, (patterns/systems) and identified the carcasses of several dead fish. Students generally reported enjoying the conversation with a local expert.

Finally, we sat together at a table in the park. I distributed a copy of the elevation chart of M-46 showing the profile of the highway as it crosses the moraine. We arranged with the bus driver to call out the odometer reading each mile and we would observe the countryside at each mile mark. I think the activity was quite interesting and really helped students to visualize the regional topography. At least one student (Jeff Soladay) wrote knowledgeably about the traverse in his summary paper. The busdriver also expressed deep interest in the process. At Ruth Rd. We turned north, crossing the Black RV on both legs of the 90-degree turn. We also passed and discussed the impact of a large regional landfill along the way. We made an unscheduled stop at Deckerville, a small farming community, and students had an opportunity to visit a small store and notice the small town atmosphere. At Palms, an even smaller community, we turned west and repeated the experience of descending from the moraine and ended our motorized segment of the journey at the eastern edge of the Minden Bog.

We crossed the Black River on a small footbridge and entered the bog. A number of students expressed surprise at the small size of the river at the headwaters. They apparently expected the river (and by extension all rivers) to begin full born and completely formed. The concept of the river growing as tributaries add to its flow seemed quite outside their understanding of
river systems. Once on the bog, I stopped to show two students how to use the digital cameras we had brought with us...one student was to focus on macro images of the plants while the other on creating a general record of the event using digital still and short movie images. Meanwhile, most of the group moved ahead of us down the trail. Some 5-7 students remained with me as we walked and talked about the plants and the natural history of the bog. These students expressed genuine interest, surprise and curiosity about the bog and the lifeforms living in it. About half way down the mile and a quarter trail we encountered the rest of the group returning. I informed them that we needed to continue to the end of the trail in order to see where the peat mining was affecting the condition of the bog. At first there were general complaints that they had seen (and walked) enough. As I began to describe plants and history of the bog I perceived a general interest among the group. In fact, those students who had been with me from the onset of the walk encouraged the others to listen to the presentations. One especially noteworthy event was my introduction of the science of scatology to the group. We found a number of sets of dried animal feces along the trail. I pointed these out and introduced the science of scatology whereby one examines the scat for bits of bone and pieces of fur to determine what the animals have been eating. This exhibition elicited strong responses from students, at first of general revulsion, but later with some degree of interest in the process at least on the part of some students. I think this powerful emotional response to a form of information collection has the potential to act as a strong change agent simply because of the strong emotional response as well as the novelty of the experience for most learners.

We stopped to rest in the Jack Pine Copse...a small cluster of trees on the generally treeless bog featuring a giant Jack Pine tree at least 100 years old. We sat as a group and discussed the fires of 1871 and 81 and likely burned over this area and might be responsible for the Jack Pine's presence (Historical Association) We also discussed the spread of younger pines in the area resulting from the seeds of the mother tree as well as the generally drying conditions now present in the bog as a result of the mining operation (scientific association.) We noticed the wet conditions of the bog beneath the needle litter in the copse, examined jack pine cones, devised an experiment to bake the cones to determine at what temperature they would open, collected samples, noted interesting insect cysts in the vegetation.

Finally, we did a three minute "silent listening" activity as an example of a
valuing technique. Asking students to sit quietly with their eyes closed and
their minds open is always a testing experience. The concept is quite foreign
to students and inevitably results in a good deal to tittering and acting out
behaviors. In this instance a number of students asked if they could climb
into the Jack Pine tree whose branches reached all the way to the ground and
provided an excellent climbing opportunity. I consented, and a number of
students climbed into the tree. We began the activity and students responded
very well to the activity. The tape shows that the group remained quite
silent, although the video reveals some students engaged in silent horseplay
and mocking behaviors. During the silence we heard a number of bird songs
and a noticeable change in the wind occurred. Generally, students have
reported that they enjoyed the experience and gained information/insight
from it.

After the experiences in the copse we continued on to the end of the trail
where we could climb a small mound of peat with a flattened top intended as
a survey platform and view the natural bog and the mined bog
simultaneously. Afterwards, we hiked the mile and a quarter back to the bus
and departed for our excursion down the river.

We retraced our route down to M46 and then turned south on Church Rd.
This led us to a crossing of the Black River 1/4 mile south of 46 on an old
iron bridge. After two miles we turned east and crossed the Elk River (a
major tributary of the Black) on a modern cement bridge and then to another
crossing of the Black River just below the confluence of the Black and the
Elk. We disembarked from the bus and observed the river from the bridge.
The river here is channelized for drainage and I was able to point out the
lack of natural vegetation on the banks, complete lack of shade on the river
as well as clear examples of undercutting and slumping. Right below us was
a very clear example of a stream eddy. At least one student included a
reference to these phenomena in her written summary. Our next stop was at
Aikins Rd. where the channelization of the river ends. We stopped on the
bridge and I pointed out that by looking north one could observe the
channelized river and turning 180 degrees and looking south on could see
the natural bank vegetation.

We arrived in the farm community of Croswell and disembarked at the
locally famous Mother-in-law Swinging Bridge. This is a cable suspension
footbridge across the river leading from the town to the City Park on the
west side of the river. A sign above the bridge says, "Be Kind to your mother-in-law". We walked across the bridge, observed the bank vegetation and spent a few minutes in the park. A number of students mentioned how much they enjoyed this experience. I would suggest this also helped to connect the trip to previous knowledge as most participants had visited the bridge as some time in their lives. Perhaps this will have a longer-range effect as they recall the bog/river experience as they bring their own children to the park in years to come. Also in Croswell, we visited the lowhead dam built on the river at the south end of town in 1895 as a means of encouraging the location of a sugar refinery in the community at that time. The factory continues to be the main economic base for the community to this day. (Historical association)

The Black River may be roughly divided into three main reaches:

- Agricultural River; from Minden Bog to Croswell
- Wild River; from the Gravel mining operation on Fisher Rd to Wadhams Bridge.
- The Urban River; from Wadhams to the Mouth in downtown Port Huron

All of our explorations to date were in the upper reach. I wanted to end the trip with at least a view of the Wild River. We headed west out of Jeddo. This led us, by a winding, hilly route, over the Black River in view of a (hundred foot?) heavily wooded gravel bluff with the river winding below. We then followed a twisting, hilly gravel road west and south of the crossing that crossed the Silver Creek in two locations. This road led us to Comstock Rd. And a second crossing of the Black River at Comstock Hills. This constitutes a rugged, (especially in a yellow schoolbus!), scenic transverse of the wildest (least tamed?) section of the watershed. The local scout camp (350+ acres?) is located along Silver Creek and the Black River. Unfortunately, participants were more focused on returning to school on time to catch regularly, more conventionally routed, yellow buses. This anxiety on the part of everyone likely distracted from a full appreciation of its beauty. On the other hand, the situation led to group collaboration between me, the bus driver, and the students concerning the best (read quickest) route back to school. I should note that the final choice (and undoubtedly best) was negotiated between Jeanie our driver and Debra Studer, classroom assistant for an autistic learner.
Regardless, the experience shows that we need to make a trip independently to each of the reaches in order to adequately explore the watershed and develop an appreciation of its complexity (systems). We also failed to collect data. We came prepared to conduct a state developed stream assessment survey. However, as it was, we barely had time to see a representative survey of river habituate. (I assume learners are, at least, more familiar with the urban river than either of the other reaches.) The bog serves nicely on the first trip. Stream bank Survey and/or chemical testing would be a great scientific component on a trip to the Wild River Reach.

As a follow up activity on the day after the trip I asked students to work in teams of three and produce a route map on a laminated, two page newspaper spread depicting the Thumb of Michigan on a satellite image showing vegetation. I provided the laminated maps, state road maps, county maps, watershed maps and personal consultation with each group. I was quite surprised at the seeming lack of student recognition of where we had been. Drawing the maps seemed to be quite a difficult task for most students. The resulting maps, while generally accurate, still contained significant errors such as showing the route on the wrong side of the river, coming "sort of" close in both shape and location to the actual route followed. My perception is that student found this activity both interesting and enlightening. I've not gotten any formal report from students but will in the next few days.

Now, I need to collect and reference the curriculum benchmarks and standards addressed by this project.
APPENDIX N

PARENTAL PERMISSION TO COLLECT DATA
January 26, 1999

Dear Parent,

My name is Al Lewandowski. I teach a geography class at Northern. As a teacher with 25 years experience, I'm always interested in learning more about learning. Currently, I am conducting an educational research project in my classroom. This project is part of my graduate program at Ohio State University. I am interested in discovering more about how learners view their local environment. As part of this work, we will be taking a number of short walks around the school site. Occasionally we may consider a bus or similar transportation for a longer trip. All of the activities will take place during the regular school day, and parents are cordially invited to participate.

As part of the process, I will be collecting some information from learners. I will collect responses to a survey of environmental values at the beginning and end of the semester. I will also make written and recorded observations during class periods.

Occasionally I will interview one or more of the class members individually or in small groups. I plan to audio tape the interviews for later study. Participation in the project is completely voluntary. If you have any questions, please feel free to contact me at 984-2671, ext. 364. I have voice mail and will return your call as soon as possible. And please, feel free to visit us at any time. Meanwhile, I would appreciate your signing this letter and returning it to me so that I can verify that you have seen it.

Sincerely,

Al Lewandowski, Instructor
Port Huron Northern High
984-2671 ext. 364

Dr. Rosanne Fortner
Ohio State University
614-292-1078

Parent or Guardian Signature
APPENDIX O

LEARNER RESPONSE
DATABASE RECORD EXAMPLE
The things that interested me most is to compare pictures before and after of the school site. It shows human environmental interactions. You see the development of the tennis courts, track, aux. Gym and the expansion of the parking lot. My question that raises in my mind is when were most of these pictures taken?

The things that surprised me were to compare the old school pictures to the new school pictures. I was surprised to see how many trees are gone now since the tennis courts are there. In addition the expansion of the parking lot. I really like to see the Track being built; I have to run on the Track this spring. It will be a lot softer than the old track.

The specific parts that I liked about the images were the change in the school site during the last few years. I liked exploring the parts of the school that changed over time, the Indian grass is still the same towards back of the school property. I look at it last in 1997. My partner and I found these pictures and aerial photographs valuable, we used them in our PowerPoint presentation of the school site. The pictures were useful to show the class a 2-scale exemple of the school site.

Keywords: serial images, geohemes, change, environmental interaction, change

Construct: construction kits

Figure 30. Learner Response Database Record.
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