Place-Based Pedagogy in the Era of Accountability: An Action Research Study

By
Peter C. Saracino

Submitted in Partial Fulfillment
Of the
Requirements for the Degree
Doctor of Education

Supervised by:
Dr. Raffaella Borasi
Dr. April Luehmann

Margaret Warner Graduate School of Education
University of Rochester
Rochester, New York

2010
Table of Contents

ACKNOWLEDGMENTS  

ABSTRACT  

CHAPTER 1: INTRODUCTION  
1.1. Overview  
1.2. Statement of the Problem and Goals of the Study  
1.3. Theoretical Framework of the Proposed Study  
1.4. Action Research as the Chosen Methodological Approach  
1.5. Overview of Study Design  
1.6. Preview of Key Findings and Contributions of the Study  

CHAPTER 2: LITERATURE REVIEW  
2.1. Introduction and Overview  
2.2. Accountability Education: Critique and Implications  
  2.2.1 Accountability, Standards and High-Stakes Testing  
  2.2.2. Positive Aspects of Accountability and High-Stakes Testing  
  2.2.3. Negative Implications of a Reliance on High-Stakes Testing  
  2.2.4. Negative Aspects of Uniformity  
  2.2.5. Narrowing of Instruction  
  2.2.6. Effects on Student-Teacher Relationships  
  2.2.7. Philosophical Costs  
2.3. Place-Based Education and its Theoretical Underpinnings  
  2.3.1 The Influence of the Progressive Education Movement  
  2.3.2 Constructivist Influences  
  2.3.3 The Place-Based Education Paradigm  
  2.3.4. Connections of Place-Based Education with Constructivism  
2.4 Using Artifacts in the Science Classroom  

CHAPTER 3: DESIGN OF THE STUDY  
3.1. Introduction and Overview  
3.2. Action Research as the Chosen Methodology  
3.3. Research Questions and Overview of the Study Design  
3.4. Description of the Context of the Study  
3.5. Participation Recruitment and Selection  
3.6. Detailed Plan of the Intervention  
3.7. Data Collection Plan  
  3.7.1. Teacher Log  
  3.7.2. Student Reflective Journals  
  3.7.3. Students’ Answers to Survey Questions  
  3.7.4. Audiotapes of Focus Group Sessions  
3.8. Data Analysis  
3.9. How This Study Reflects the Key Principles of Action Research  


cell values:

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACKNOWLEDGMENTS</td>
<td>5</td>
</tr>
<tr>
<td>ABSTRACT</td>
<td>7</td>
</tr>
<tr>
<td>CHAPTER 1: INTRODUCTION</td>
<td>9</td>
</tr>
<tr>
<td>1.1. Overview</td>
<td>9</td>
</tr>
<tr>
<td>1.2. Statement of the Problem and Goals of the Study</td>
<td>11</td>
</tr>
<tr>
<td>1.3. Theoretical Framework of the Proposed Study</td>
<td>14</td>
</tr>
<tr>
<td>1.4. Action Research as the Chosen Methodological Approach</td>
<td>15</td>
</tr>
<tr>
<td>1.5. Overview of Study Design</td>
<td>16</td>
</tr>
<tr>
<td>1.6. Preview of Key Findings and Contributions of the Study</td>
<td>18</td>
</tr>
<tr>
<td>CHAPTER 2: LITERATURE REVIEW</td>
<td>20</td>
</tr>
<tr>
<td>2.1. Introduction and Overview</td>
<td>20</td>
</tr>
<tr>
<td>2.2. Accountability Education: Critique and Implications</td>
<td>21</td>
</tr>
<tr>
<td>2.2.1 Accountability, Standards and High-Stakes Testing</td>
<td>21</td>
</tr>
<tr>
<td>2.2.2. Positive Aspects of Accountability and High-Stakes Testing</td>
<td>21</td>
</tr>
<tr>
<td>2.2.3. Negative Implications of a Reliance on High-Stakes Testing</td>
<td>23</td>
</tr>
<tr>
<td>2.2.4. Negative Aspects of Uniformity</td>
<td>23</td>
</tr>
<tr>
<td>2.2.5. Narrowing of Instruction</td>
<td>24</td>
</tr>
<tr>
<td>2.2.6. Effects on Student-Teacher Relationships</td>
<td>25</td>
</tr>
<tr>
<td>2.2.7. Philosophical Costs</td>
<td>26</td>
</tr>
<tr>
<td>2.3. Place-Based Education and its Theoretical Underpinnings</td>
<td>26</td>
</tr>
<tr>
<td>2.3.1 The Influence of the Progressive Education Movement</td>
<td>26</td>
</tr>
<tr>
<td>2.3.2 Constructivist Influences</td>
<td>27</td>
</tr>
<tr>
<td>2.3.3 The Place-Based Education Paradigm</td>
<td>29</td>
</tr>
<tr>
<td>2.3.4. Connections of Place-Based Education with Constructivism</td>
<td>35</td>
</tr>
<tr>
<td>2.4 Using Artifacts in the Science Classroom</td>
<td>36</td>
</tr>
<tr>
<td>CHAPTER 3: DESIGN OF THE STUDY</td>
<td>41</td>
</tr>
<tr>
<td>3.1. Introduction and Overview</td>
<td>41</td>
</tr>
<tr>
<td>3.2. Action Research as the Chosen Methodology</td>
<td>43</td>
</tr>
<tr>
<td>3.3. Research Questions and Overview of the Study Design</td>
<td>44</td>
</tr>
<tr>
<td>3.4. Description of the Context of the Study</td>
<td>46</td>
</tr>
<tr>
<td>3.5. Participation Recruitment and Selection</td>
<td>46</td>
</tr>
<tr>
<td>3.6. Detailed Plan of the Intervention</td>
<td>48</td>
</tr>
<tr>
<td>3.7. Data Collection Plan</td>
<td>52</td>
</tr>
<tr>
<td>3.7.1. Teacher Log</td>
<td>53</td>
</tr>
<tr>
<td>3.7.2. Student Reflective Journals</td>
<td>54</td>
</tr>
<tr>
<td>3.7.3. Students’ Answers to Survey Questions</td>
<td>54</td>
</tr>
<tr>
<td>3.7.4. Audiotapes of Focus Group Sessions</td>
<td>54</td>
</tr>
<tr>
<td>3.8. Data Analysis</td>
<td>55</td>
</tr>
<tr>
<td>3.9. How This Study Reflects the Key Principles of Action Research</td>
<td>59</td>
</tr>
</tbody>
</table>
APPENDICES

A  Background Documentation
A.1.  Map of Ponds  164
A.2.  Student Lab  166
A.3.  List of Possible Concepts/Artifacts  170
A.4.  Reflective Journal Rubric  173
A.5.  Explanation of Water Quality Tests  174
A.6  Lesson Plans Document  176

B  Data Collection Tools
B.1.  Journal Prompts  179
B.2.  Survey Questions  181
B.3.  Teacher Log Prompts  183
B.4.  Focus Group Questions  184

C  Data Analysis Tools
C.1.  Data Analysis Plan  185

D  Data Summary and Samples
D.1.  Element Frequency Capture Chart  189
D.2.  Survey Summary Data  192
D.3.  Selected Journal Response Summary Data  195
D.4.  Negative Feedback Summary Data  196
ACKNOWLEDGEMENTS

I would like to recognize several individuals who have supported and encouraged me on my doctoral journey. Without their steadfast help, it would have been impossible to complete this dissertation and accompanying degree. Each has my undying gratitude!

To begin with I would like to thank Ms. Barney Peterson, a friend and fellow teacher who introduced me to the notion of place-based education at a workshop in Colorado a few summers ago. Her love for the approach was truly contagious as evidenced by the focus of this dissertation.

I would next like to thank Dr. April Luehmann, my academic advisor and a member of my dissertation committee. Her continued support and unwavering encouragement were a source of inspiration and convinced me I was still young enough for such a journey. I would also like to thank the two other members of my committee, Dr. Rafaella Borasi and Dr. James Makinster. Both offered invaluable insight, timely direction, and important advice in navigating the world of educational research.

Next, I would like to thank my fellow cohort members and companions on this journey - Ellen, John and Vince. Their friendship, support and humor are living proof of the truth of the saying that “no matter how far or heavy the load, sweet is the journey on friendship’s road.”

I would also like to acknowledge my deepest gratitude to my wife, Joanne, and my children, Bridget, Tony, Jake and Eli. It was a challenging three years full of classes, papers, travel, deadlines and absences. Without their constant love, support and encouragement, it would have been impossible to complete this dissertation and degree.

Lastly, I would like to express my heartfelt thanks to my good Pal, Jesus. His undying encouragement of my dreams, belief in my talents, faith in my ability to finish and continued
Presence along the way has raised me up so I can stand on mountains. Wherever my journey next leads, I am certain this constant Companion will be there to tread the way beside me.
Abstract

Today’s most common method of teaching biology—driven by calls for standardization and high-stakes testing—relies on a standards-based, de-contextualized approach to education. This results in “one size fits all” curriculums that ignore local contexts relevant to students’ lives, discourage student engagement and ultimately work against a deep and lasting understanding of content. In contrast, place-based education—a pedagogical paradigm grounded in situated cognition and the progressive education tradition of John Dewey—utilizes the community as an integrating context for learning. It encourages the growth of school-community partnerships with an eye towards raising student achievement while also drawing students into the economic, political, social and ecological life of their communities. Such an approach seeks to provide students with learning experiences that are both academically significant and valuable to their communities.

This study explores how high school science teachers can capitalize on the rich affordances offered by a place-based approach despite the constraints imposed by a state-mandated curriculum and high-stakes testing. Using action research, I designed, implemented, evaluated and refined an intervention that grounded a portion of a Living Environment high school course I teach in a place-based experience. This experience served as a unique anchoring event to contextualize students’ learning of other required core topics.

The overarching question framing this study is: How can science teachers capitalize on the rich affordances offered by a place-based approach despite the constraints imposed by a state-mandated curriculum and high-stakes testing? The following more specific questions were explored within the context of the intervention:
1. Which elements of the place-based paradigm could I effectively integrate into a Living Environment course?

2. In what ways would this integration impact students’ interest?

3. In what ways would this integration impact students’ perceived academic performance?

4. What are the costs of implementing this approach on the teacher?

Data sources included my teacher log, writings from students’ reflective journals, student answers to survey questions and student responses to focus group interviews. Using qualitative research methods, I triangulated the data from these multiple sources in an attempt to address each of the research questions. This process included identifying key analytic and explanatory themes that guided my subsequent readings and interpretations of the data. The patterns that emerged guided the search for other connections and interrelationships and formed the basis of my final analysis.

This study demonstrates that I was able to successfully integrate selected elements of place-based education into my Living Environment course at least to some degree. As such, it confirms the feasibility of effectively incorporating key elements of the place-based paradigm into a high-stakes high school science course. My findings also support the literature’s claim that embracing a place-based approach can pique students’ interest in significant ways and therefore generate a higher level of student engagement that allows students to feel more confident about their learning. Findings also confirm literature articulating the beneficial use of artifacts while broadening such use to include ecology classes. Lastly, the study suggests the gains achieved in integrating a place-based approach more than outweigh the inevitable costs and challenges associated with its implementation.
CHAPTER ONE
INTRODUCTION

1.1 Overview.

This dissertation study explores how key elements of a place-based paradigm can be integrated in a high-stakes high school science course. The goal is to propose a concrete alternative to the limited science learning experiences offered many students today. Such limitations often arise from the pressures created by high-stakes testing and the desire for greater accountability at all levels of the educational system. Using action research as the research paradigm, I have designed, implemented and examined an intervention by grounding a portion of a course I teach in a place-based experience. This experience served as an anchoring event to contextualize students’ learning of other required topics within the course. I conducted this study in all three sections of the NYS Regents’ Living Environment class I was assigned to teach in the fall of 2009. This context is a prime example of a course constrained by a highly prescribed curriculum concluding with a high-stakes test which students must pass in order to receive Regents credit for the course.

In this first chapter, I provide an overview and introduction to the proposed study. I first articulate the problem addressed and the study’s goals. I then identify both the theoretical framework which informs the study and my reasons for choosing action research as a methodological approach. A brief overview of the study’s design is then provided, including the research questions that have both informed this design and guided my data collection and analysis. I have also included a brief description of the intervention and identified the main sources of the data I have collected. The chapter concludes with a preview of key findings.
In Chapter Two, I review the relevant literature that informed my study. The chapter is divided into three sections. In the first section, I summarize the extensive research findings that suggest that an overemphasis on accountability can have far ranging negative impacts on pedagogy, curriculum and student-teacher relations. In the second section, I review literature on the alternative approach that I propose to use: place-based education. In the third section, I present research findings that have informed the intervention’s design with respect to the use of artifacts in science classrooms.

Chapter Three provides a detailed description of the research design. I begin with a more in-depth discussion of the basic tenets of action research and its appropriateness for answering the questions addressed in this study. I then identify my research questions and describe the intervention as well as the methods of data collection and analysis used to address these questions. Also included are descriptions of my recruitment of participants and a rationale for key design decisions.

In Chapter Four, I provide a comprehensive presentation and interpretation of the findings particular to each research question. I conclude with an examination of some surprising discoveries that resulted from my attempt to integrate the place-based approach into my practice.

In Chapter Five, I identify the actions that have resulted from this study and discuss its implications for my future practice. I conclude by offering a few alternatives for the next stage of the action research cycle that I would like to eventually pursue.

In Chapter Six, I summarize the genesis, context and purpose of my study. Then, I present a summary of my findings along with a brief analysis of their limitations. Next, I discuss the contribution these findings can make to the field of science education and their broader
implications for classroom curriculum and pedagogy. I conclude with a brief discussion of areas where additional research would be fruitful.

Finally, the Appendices contain forms and documents that support this study. They are included to make my data sources and their analysis clearer for the reader. Included here are documents related to the design of the intervention (Appendix A), data collection tools (Appendix B), my data analysis plan (Appendix C), and finally, charts, and other data summaries referred to in the text (Appendix D).

1.2 Statement of the Problem and Goals of the Study.

As documented in Chapter Two, many believe the implementation of high-stakes testing has had far-reaching negative effects on educational curriculum, pedagogy, student-teacher relations, and even school climate (Airasian, 1993; Clark, 2007; Eisner, 1995; Gibbs & Howley, 2000; Hursh, 2008; Koretz, 1988; Koretz, 2008; Nichols & Berliner, 2005; Ohanian, 1999; Settlage & Meadows, 2002; Smith, Gregory A. 2002a; Smith, Gregory A. 2002b; Sobel, 2005; Vogler, & Virtue, 2007; Westra, 2003). Myriad research studies suggest that current state and federal policies emphasizing such testing not only fail to improve student learning, but can also prevent the development and implementation of pedagogical practices that would do so (Airasian, 1993; Clark, 2007; Hursh, 2008; Koretz; 2008; Nichols & Berliner, 2005; Settlage & Meadows, 2002; Vogler, & Virtue, 2007; Westra, 2003). For example, accountability legislation has created a degree of uniformity in school programs (Ohanian, 1999) and in an effort to comply with such legislation, schools and districts have aligned their curricula with both state-adopted standards and the published objectives of competency tests (Smith, 1991). But is such uniformity and its reliance on the results of high-stakes testing practical or even desirable? Literature suggests that such strategies can be counterproductive with respect to both
pedagogical practices and educational outcomes (Airasian, 1993; Clark, 2007; Eisner, 1995; Gibbs & Howley, 2000; Hursh, 2008; Koretz, 1988; Koretz, 2008; Nichols & Berliner, 2005; Ohanian, 1999; Settlage & Meadows, 2002; Smith, Gregory A., 2002a; Smith, Gregory A., 2002b; Sobel, 2005; Vogler, & Virtue, 2007; Westra, 2003). In Chapter Two, I explore a number of important concerns raised by those who contend that there is an overemphasis on accountability in education today. Such objections have been voiced on a number of grounds including personal, intellectual, moral, ethical, curricular, pedagogical, relational, developmental, and even fiscal (Hursh, 2008; Koretz, 2008; Koretz, Linn, Dunbar and Shepard, 1991; Nichols & Berliner, 2005; Rothstein et. al., 2008; Settlage & Meadows, 2001; Smith, 1991; Sobel, 1995; Volger & Virtue, 2007).

In view of these concerns, it is heartening to know that educational paradigms exist that challenge such an approach to education and embrace different educational agendas. Place-based education is one of these. Place-based education is an approach that uses a young person’s community as the context for the school curriculum (Sobel, 2005). Rather than limit a student to a small core of predetermined, accepted knowledge, place-based education strives to root a broadly focused curriculum in the day-to-day realities of students’ lives (Gibbs & Howley, 2000). In this way, a young person’s political, social, economic and ecological “communities” become an integrating context for learning. Such a strategy seeks to foster the growth of school-community partnerships with an eye towards raising student achievement and facilitating their engagement with issues and problems the community may be facing. In the process, students can discover the satisfaction that comes with being stewards of a community’s resources and can also acquire valuable critical thinking and problem-solving skills (Gruenewald & Smith, 2008; Sobel, 2005). Proponents of the approach also claim that by connecting academic content to real-
world experience, place-based pedagogy can also provide opportunities for students to gain real meaning from their educational experiences (Gruenewald, 2003a; Smith, 2002b; Sobel, 2005; Bartsch, 2001; Clark, 2007).

Examples of place-based interventions that have facilitated such engagement with community issues include: student involvement in restoring former mill sites, decimated coastal economies and the quality of the air (Gruenewald & Smith, 2008). The creation of such exciting and relevant learning opportunities is a frequent consequence of the school-community synergy that can be produced by the place-based approach (Gruenewald & Smith, 2008, Sobel, 2005).

This synergy can also challenge students to use their giftedness to make contributions that enrich the lives of others (Smith, 2002b). In Portland, Oregon, for example, middle school students have built raised garden beds for homeless people and created a small park in a low-income neighborhood (Smith, 2002b).

Because it draws on local phenomena as the source of students’ learning experiences, place-based education is inherently suited to local populations and situations of any kind (Smith, 2002a). The approach can be relevant anywhere and to anyone because it can be shaped to respond to the unique political, economic, social and ecological realities of the students who practice it (Bartsch, 2001; Gruenewald, 2003a; Sobel, 2005).

I believe that an overemphasis on accountability and an overreliance on the results of high-stakes tests impose some significant constraints on time and curriculum and affect a teacher’s practice in negative ways. Therefore, it is crucial for teachers to discover creative ways to incorporate some aspects of the place-based approach into their daily practice. In doing so, they can begin to realize some of the many benefits that can come from attending to “Place”.
Hence my desire to explore the practicality of integrating elements of this unique approach to science education within a high-stakes high school science course I teach.

1.3 Theoretical Framework of the Proposed Study.

The educational approach informing this study—place-based education—draws much of its inspiration from the progressive tradition championed by John Dewey. The inspiration for this tradition is powerfully captured in the following quote and discussed in more detail in Chapter 2:

> From the standpoint of the child, the great waste in the school comes from his inability to utilize the experiences he gets outside the school in any complete and free way within the school itself; while, on the other hand, he is unable to apply in daily life what he is learning at school. That is the isolation of the school, its isolation from life [italics mine].

> When the child gets into the school room he has to put out of his mind a large part of the ideas, interests, and activities that predominate in his home and neighborhood. So the school, being unable to utilize this everyday experience, sets painfully to work on another tack and by a variety of means, to arouse in the child an interest in school studies.

(Dewey, as cited in Smith, 2002a, p. 586)

As we shall see, the place-based approach seeks to overcome the disconnect between school and community by grounding students’ learning in the world surrounding them.

Place-based education also relies heavily on a constructivist approach to education. Constructivism emphasizes the importance of connecting learning to previous knowledge and experience, and also espouses authentic problem solving in real situations (Driver, Asoko, Leach, Mortimer, and Scott, 1994; Saunders, 1992). With its emphasis on authentic learning, integrated curriculum and practical problem solving, place-based education embraces this approach to
teaching and learning as well (Gibbs & Howley, 2000; Theobold & Curtiss, 2000). As demonstrated in Chapter Three, my intervention incorporated and promoted a number of features that both Dewians and constructivists suggest make for sound educational practice and academic success.

1.4 Action Research as the Chosen Methodological Approach.

My study focuses on new ways to guide students in the exploration of science content with an eye toward inviting their engagement with and success in understanding the material. Therefore, it calls for using action research as a methodological approach. Action research is especially appropriate because it provides a valuable framework within which to explore key elements of one’s practice with an eye toward interpreting, modifying and improving them (Mills, 2007). Action research is also a process that is systematically evolving, changing both the researcher and the situations in which s/he acts (Kemmis & McTaggart, 1988). Ultimately, one strives to improve one’s educational practices by altering them and learning from the consequences of that change.

Although my research focuses primarily on a few key elements of my practice (i.e., encouraging student interest, enhancing perceived academic performance), it was also conducted with an eye toward improving curriculum, pedagogy, and instructor. Therefore, it fulfills the basic requirements of the action research paradigm as described by Mills (2007). Finally, my study was also designed to allow participant input via the use of students’ voices and involvement (see Chapter Three for examples). Such involvement helped fulfill the requirement that action research be participatory in nature (Kemmis & McTaggart, 1988). Thus, both the study’s design and intent facilitated the achieving of these important outcomes espoused by action research practitioners.
1.5  **Overview of Study Design.**

The proposed study is informed by the following overarching question: How can science teachers capitalize on the rich affordances offered by a place-based approach despite the constraints imposed by a state-mandated curriculum and high-stakes testing? This question was explored in the context of a specific intervention: using certain elements of a place-based education within the confines of a Living Environment high school course I teach that is regulated by a statewide curriculum and concludes in a high-stakes test. As previously stated, I designed, implemented, studied, evaluated and refined this place-based intervention using action research as the methodological approach.

The study was informed by the following more specific research questions:

1. Which elements of the place-based paradigm could I effectively integrate into a Living Environment course?

2. In what ways would this integration impact students’ interest?

3. In what ways would this integration impact students’ perceived academic performance?

4. What are the costs of implementing this approach on the teacher?

I implemented the intervention in all three sections of the Living Environment course I taught at the Marcus Whitman high school in Rushville, New York in the autumn of 2009. Within the confines of this course, I examined the ecological health of a local natural area (a ponds complex) utilizing a hands-on, experiential, project-based and locally focused (i.e., place-based) approach as part of the first unit in the course (General Ecology). This included a day-long visit to the ponds where students collected data that they could later use to help determine the overall health of this aquatic ecosystem. While at the ponds, we also collected environmental
“artifacts.” These included samples or specimens of both living and nonliving things (plants, water samples, rocks, animal remains, etc.), as well as data and photos. These souvenirs later served to connect this initial experience of Place with our exploration of content we encountered later in the curriculum. The use of such artifacts was intended to jog students’ intellectual, emotional and cognitive memories of that initial place-based experience long after we had left the ponds.

True to the place-based approach, I facilitated students’ initial exploration by enlisting the expertise of various community agencies. I also challenged my students to share their findings with the larger community. This resulted in the creation of a musical slide show presentation that has been placed on the school’s website. This sharing requirement was designed to add to the educational meaningfulness of the experience (Tompkins, 2005). It was also intended to help students experience their ability to contribute to a wider community and have that contribution used and valued by that community (Gruenewald & Smith, 2008; Sobel, 2005).

In the spirit of action research (Mills, 2007; Kemmiss & McTaggart, 1988), the participating students were encouraged to participate in ongoing reflection as we collectively tinkered with the best ways to incorporate the initial experience of Pond Day into our unfolding classroom learning.

Data was collected from the following data sources:

- **Teacher log:** As the class instructor, I kept a log throughout the intervention using a specially designed semi-structured form (see Appendix B.3). This log served to document (a) my thinking and decision making related to using elements of place-based education and artifacts in the course; (b) observations made about specific lessons and students; (c) success
encountered with implementing particular place-based elements into a lesson or the overall unit; (d) any costs associated with using the place-based approach and/or artifacts.

- **Student journal excerpts:** These included students’ reflective journal answers written in response to teacher-provided prompts (see Appendix B.1 for specific prompts).

- **Student survey responses:** These included students’ answers to specific survey questions used to gauge the effect of certain aspects of the approach on things like interest and perceived academic success (see Appendix B.2).

- **Student Answers to Final Focus Group Questions:** These included students’ answers to end-of-intervention focus group questions (see Appendices B.4).

  Through a qualitative analysis of the collected data, I identified themes and insights that helped to address each of my research questions (as explained in more detail in Chapter Three). I also used the suggestions of students and fellow teachers to refine both Pond Day and the way its lessons/artifacts have been utilized in my Living Environment classroom.

### 1.6 Preview of Key Findings and Contributions of the Study.

This study confirms the feasibility of effectively incorporating key elements of the place-based approach into a high-stakes science class despite the costs inherent with implementing such an approach. It reveals the powerful ways in which a place-based approach to science education can pique students’ interest and lead them to a deeper engagement in the learning process, which in turn can lead to a higher level of student confidence with respect to their academic tasks.

This study also provides evidence to suggest that attending to place can produce other significant benefits including:
• Fostering of meaningful connections between students and the communities in which they live;
• Creating the opportunity for students to become stewards of and contributors to these communities;
• Engaging students who tend to struggle academically; and
• Expanding an educator’s arsenal of teaching and learning strategies and ultimately energize his/her practice.

These findings represent important information for science educators interested in the feasibility of successfully integrating the place-based approach into a course with a mandated curriculum that concludes in a high-stakes test. These results may encourage those who desire to engage students more meaningfully, but chafe at the limitations that the rigors of a high-stakes course impose on their time, imagination and creativity. My suggestions for further research may also interest the broader community of researchers, teacher educators, and administrators by encouraging them to discover additional ways to provide students with meaningful, locally-focused educational experiences, despite the constraints of accountability-based education.

With its emphasis on meaningful experiences, local relevance, and direct participation, perhaps the place-based approach can reveal a new grammar of schooling—one that strives to connect students more deeply to the community in which they live (Gruenewald & Smith, 2008).

In conclusion, my findings suggest that by attending to Place one can successfully engage students in standards driven, curricular goals while also increasing their interest and inspiring academic success. In the end, I hope my successful efforts at using Place as a springboard for engaging students in science content will encourage other educators to do likewise.
CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction and Overview.

This literature review is organized and presented in three major sections. In section 2.2, I present an overview of accountability education. I document the need for this study by summarizing the extensive research that suggests that the present standards-based, assessment-driven, high-stakes testing environments in which many are forced to teach can have negative effects on pedagogy, curricula and student-teacher relations. Such results support the need for, and value of, my particular efforts to develop an alternative strategy for approaching science content within these environments. In section 2.3, I present a number of research findings related to one such alternative approach: place-based education. I begin with an examination of the theoretical underpinnings of the place-based approach revealing its origins in the educational thought of John Dewey and a constructivist paradigm. I then present a literature-supported definition of place-based education and examine the ways in which existing research suggests its suitability as a viable alternative to the current focus on standards, accountability and high-stakes testing. This section supports my motivation to explore how at least some elements of this creative pedagogy could be integrated into science courses as a way to counter the current overemphasis on accountability education. I conclude the chapter with a brief look at the literature that informs and supports the use of artifacts as educational reminders that connect students to content and prior experience. I do this because I believe the use of such artifacts could provide a creative way of returning a “Place” to our classrooms while also serving as an important mechanism for helping students to remain connected with it.
2.2 Accountability Education: Critique and Implications.

2.2.1 Accountability, Standards, and High-Stakes Testing. In order to understand the constraints and costs associated with implementing some key elements of place-based education in a high-stakes science course, it is important to first be aware of the pressures teachers of such courses are likely to experience. As indicated previously, we live in a time where there is strong support for public policies that use test results to compel changes in the behavior of those involved in education - including students, teachers and school administrators (Nichols & Berliner, 2005). Many politicians and average citizens believe that education can best be improved by attaching consequences to tests. These tests were born from a national desire for increased standards and a greater accountability of the educational enterprise (Settlage & Meadows, 2002). The result is that standards-based reform has become an essential aspect of states’ plans for school improvement (Massell, Kirst & Hoppe, as cited in Kannapel, 2000). Unfortunately, this reform has also led to widespread standardized testing (Settlage & Meadows, 2002).

Standardized testing is not new. What is new, however, is linking test results to important consequences like student promotion and graduation, bonus pay for school personnel, promotion/non-promotion of faculty, future employability of teachers and administrators, a school or district’s reputation and even reconstitution of a school (Nichols & Berliner, 2005). Also at stake are potential reductions in federal or state funding (Koretz, 1988). Because of this connection with potentially negative consequences, these tests have come to be characterized as “high-stakes” (Nichols & Berliner, 2005).

2.2.2 Positive Aspects of Accountability and High-Stakes Testing. Many consider high-stakes testing an appealing reform strategy. They find great merit in the guarantee of...
accountability for teacher and school performance that the results of standards-based, high-stakes tests seem to promise. Such accountability, they claim, has rarely been seen in past educational reform efforts (Eisner, 1995). They contend that the increased role of standards and assessments has also brought a semblance of order and control to an educational system that many see as weak and ineffectual (Airasian, 1993). They maintain the United States can now have the national educational agenda it never had before (Eisner, 1995). Such an agenda will produce happy parents and students fully aware of legitimate educational expectations. It will also provide the employees needed for America to become number one in the global economy (Eisner, 1995). The necessity of increasing educational and economic productivity has also been linked with national discussions on the need to decrease educational inequality and improve the objectivity of assessments (Hursh, 2008). Testing and accountability have been justified on the grounds that their very inclusiveness ensures that all students—regardless of race, ethnicity or income—have an opportunity to learn (Hursh, 2008). Educational policymakers are also quick to remind us that the educational and economic success of every student is vital to the very economic success of our nation (Hursh, 2008). Such beliefs and contentions appear to have assured that the accountability movement and high-stakes testing will be with us for the foreseeable future.

Any attempts at educational innovation must acknowledge that, for better or worse, we now live in an era of educational reform characterized by established standards and greater accountability. This philosophy currently dominates educational reform activity across the nation via state legislation and the extensive use of achievement testing (Kannapel, 2000). Once used simply as an indicator of achievement, such testing has become the primary measure of accountability (Koretz, 1988). According to David Koretz (1988), “the judgments of teachers
and building administrators, which ideally reflect many diverse indications of students' performance, have been replaced in substantial part by students’ scores on a single test” (p. 198). Test scores have become the common evidence for educators and educational policy makers needing to supply proof of educational “progress” to their superiors, constituencies, and legislatures (Koretz, 1988).

2.2.3 Negative Implications of a Reliance on High-Stakes Testing.

A number of conceptual and empirical research studies suggest that the implementation of high-stakes tests with their potentially negative consequences has had far-ranging effects on educational curriculum, pedagogy, and even school climate (Airasian, 1993; Clark, 2007; Eisner, 1995; Gibbs & Howley, 2000; Hursh, 2008; Koretz, 1988; Koretz, 1992; Koretz, 2008; Koretz, Linn, Dunba & Shepard, 1991; Ohanian, 1999; Settlage & Meadows, 2002; Sobel, 2005; Vogler, & Virtue, 2007; Westra, 2003). Several authors have argued that current state and federal policies emphasizing high-stakes testing not only fail to improve student learning, but also prevent the development and implementation of pedagogical practices that would do so (Airasian, 1993; Clark, 2007; Eisner, 1995; Gibbs & Howley, 2000; Hursh, 2008; Koretz, 1988; Koretz, 2008; Ohanian, 1999; Settlage & Meadows, 2002; Sobel, 2005; Vogler, & Virtue, 2007; Westra, 2003). An examination of a number of these concerns is enlightening.

2.2.4 Negative Aspects of Uniformity. Universal educational standards and competency-based testing, strengthened by law, have created a degree of uniformity in the school programs that students encounter (Ohanian, 1999). In an effort to comply with such legislation, schools and districts have increasingly aligned their curricula with state-adopted standards and/or with the published objectives of competency tests (Smith, 1991).
But is such uniformity practical – or even desirable? Many educators (e.g., Eisner, 1995) object to the very notion of uniformity. They argue that abandoning the need for one standard for all students in each field of study is not to give up the aspiration to seek high levels of educational quality in both pedagogical practices and educational outcomes; rather, it may help to better respond to differences in the development, aptitude, interests and goals among the students with whom we work (Eisner, 1995; Gruenewald, 2003a; Ohanian, 1999; Smith, 2002a; Sobel, 2005, Volger & Virtue, 2007; Westra, 2003).

2.2.5 Narrowing of Instruction. Another negative consequence of high-stakes testing is an undesirable narrowing of instruction and a neglect of untested subjects or topics (Koretz, 2008; Koretz, Linn, Dunbar and Shepard, 1991; Settlage and Meadows 2002; Smith, 1991; Volger and Virtue 2007). Due to their high-stakes nature, the amount of instructional time teachers spend in preparing for such tests tends to be directly proportional to the severity of the stakes attached to the them (Settlage & Meadows, 2002; Volger and Virtue, 2007). For example, Smith’s (1991) study of elementary teachers found that not only were subjects like social studies, science, writing, project work, and critical thinking projects slighted, but also teachers tended to slight topics within these areas that the test did not cover. In a study of the influence of current standards-based reform on science education policies and practices within urban schools, Settlage and Meadows (2002) discovered that test preparation often drove the science curriculum. This was especially true for schools under academic probation. The authors’ conversations with exemplary urban science teachers reveal that “in one Alabama school, for instance, test preparation had become the de facto curriculum; courses did not simply emphasize the test taking skills required to pass the test – that was the only thing being taught” (Settlage &
Meadows, 2002, p. 118). Such narrowing of focus also tended to reinforce traditional methods of
direct instruction, particularly in low-income districts (Smith, 1991).

2.2.6 Effects on Teacher-Student Relationships. Perhaps the most disturbing concern is
the effect of high-stakes testing on teacher-student relations. It has been argued that high-stakes
testing programs can corrupt and distort the people in the educational system (Koretz, 2008;
Nichols & Berliner, 2005; Settlage & Meadows, 2002; Smith, 1991). In this way, standards-
based reform becomes an alienating force that places students and teachers at odds with each
other. In discussing the impact of standards and testing on curriculum and instruction, Volger
and Virtue (2007) maintain that “for teachers and likely many others, the threats and sanctions
that accompany mandated high-stakes testing have a profound impact on how they perceive and
interact with their students” (p. 56).

There are a number of issues to consider. The first is that of responsibility. The high-
stakes attached to testing programs can result in a good deal of anxiety on the part of teachers
who often feel they can control neither the characteristics of the students assigned to them nor
these students’ willingness to perform well on the tests (Smith, 1991). A related issue is that of
student motivation. For example, teachers of older students frequently complain of students
refusing to take tests seriously thus having no incentive to put in the effort needed to do well on
them (Smith, 1991). To make matters worse, students often sense this anxiety. They resent
teachers for what they perceive as a lack of professionalism and begin to view them as simply
cogs in a large educational accountability machine (Settlage and Meadow, 2001). Viewed in this
light, some policies engendered by standards-based reform can quickly become an alienating
force between teachers and their students (Settlage & Meadows, 2001).
2.2.7 **Philosophical Costs.** A relentless focus on standards, accountability and the results of high-stakes testing can have its philosophical costs as well. Many fear a loss of educational imperatives that are as equally important. This fear is nicely captured by Eisner (1995) who maintains that such an insistent focus on results:

“...distracts us from paying attention to the importance of building a culture of schooling that is genuinely intellectual in character, that values questions and ideas at least as much as getting answers right. It distracts us from trying to understand how we can provide teachers the kind of professional opportunities that will afford the best among them opportunities to continue to grow through a lifetime of work” (p.11).

2.3 **Place-Based Education and its Theoretical Underpinnings.**

In the following section, I first explore the connection between the progressive education movement and the development of place-based education, as the place-based approach draws much of its inspiration from this progressive tradition. Next, I outline key tenets of constructivism and examine their connection with the place-based approach. Then, I conclude with a research-based description of the place-based model itself.

2.3.1 **The Influence of the Progressive Education Movement.** To understand the theoretical underpinnings of place-based education, we first need to examine the educational thought of John Dewey. Place-based education draws much of its inspiration from the progressive tradition in American education he founded. Dewey argued for using the local as an integrating context in education. His Chicago-based laboratory school (1896-1904) championed the notion of using the neighborhood and community as a framework for the school’s curriculum (Theobold & Curtiss, 2003). The school advocated an approach that was student-centered and maintained that the interests, needs and desires of students should dictate the curriculum
(Theobold & Curtis, 2003). It emphasized learning by doing, and supported activities that would help students make personal connections with their immediate reality—usually by engaging young people in real-world activities and real-world problem-solving (Sarkar & Frazier, 2008). Because of his belief that growth, learning and knowledge come through an individual’s personal interaction with their world, it emphasized firsthand experience with that world (Theobold & Curtis, 2003). Finally, it was students and not content that became the ultimate focus of teaching.

To this day, elements of Dewey’s philosophy continue to thrive in place-based pedagogical practices (Clark, 2007; Gruenewald & Smith, 2008; Smith, 2002a; Sobel, 2005; Theobold & Curtis, 2003). These elements are seen when place-based practitioners attempt to overcome that disconnect between children’s lived experience and school learning. They are revealed when practitioners embrace the belief that the curriculum begins with the learners’ interests and abilities. They are made known wherever teachers use local phenomenon as a context for learning. They are witnessed when educators explore subject matter that is socially significant. They are disclosed when education engages learners in solving real problems that directly impact their lives. They are witnessed whenever teachers forgo the role of expert and instead don the mantel of facilitator, guide and broker of community resources. Lastly, they are revealed whenever and wherever teachers help their learners grow in their ability to be of service to the communities in which they live (Gruenewald & Smith, 2008; Sobel, 2005; Theobold & Curtiss, 2003).

2.3.2 Constructivist Influences. The constructivist view and its implications for science pedagogy are easily traced in the place-based paradigm. A brief examination of the beliefs underlying the constructivist perspective clearly reveals these connections.
In constructivist theory, students create meaning via their interaction with the world around them. Through such interactions, and the meaning-making that ensues, students create cognitive maps, or schemas—beliefs, understandings and explanations about the world in which they live (Saunders, 1992). Such schemas empower the learner to utilize his/her past experience to decode information they are currently encountering. This occurs as the learner tries to make sense of this new information within the context of the world view s/he has constructed from experience (Saunders, 1992). If the new information agrees with the learner’s current worldview the schema remains intact. However, if it is in disagreement with that worldview, conflict, frustration and confusion may follow.

To resolve this conflict a learner can deny the existence of the new information or reject it as invalid, revise their schema accordingly, or simply refuse the responsibility to understand the new information (Saunders, 1992). Such resolution is further complicated by the fact that discarding or restructuring one’s schema does not come easily. Learners can often ignore new sensory data and doggedly cling to their schema (Eylon & Linn, 1988). In the constructivist view, true learning only occurs when one’s schema has been changed via the resolution of this disequilibrium (Driver, Asoko, Leach, Mortimer, and Scott, 1994).

The fact that such mechanisms for meaning-making are constructed by the learner’s own cognitive apparatus has powerful implications for education. Having been created in the mind of the learner, they cannot be modified by the teacher. A teacher can merely facilitate the reorganization of such personal theories by the use of well-designed situations that challenge these prior conceptions and create a disequilibrium which encourages the reorganization of the personal theories to be more consistent with the learner’s experience (Driver, Asoko, Leach, Mortimer, and Scott, 1994). Such situations include providing students with repeated,
exploratory, inquiry-oriented behaviors (making observations, collecting data, making measurements), that center on a unique events or phenomena (Saunders, 1992). Such strategies help students incorporate the new information into their existing cognitive maps, and ultimately help them view their world in a more valid way. From the viewpoint of a constructivist, such restructuring is interpreted as meaningful learning (Saunders, 1992).

Such a view has profound implications for science education. As Walter L. Saunders (1992) suggests:

Science learning is the acquisition of meaning, not the mere rote memorization of information, but rather cognitive restructuring in a direction such that one’s internal world is more consistent with one’s empirical data about the external world. Such restructuring clearly implies that learners need abundant sensory experiences with their external world and opportunities for reducing disequilibrium (p. 138).

Saunders then goes on to suggest constructivist instructional strategies that can boost meaningful learning in science classrooms. These include: hands-on, investigative laboratory activities; learning opportunities that facilitate active cognitive involvement (development of explanations, interpretations and conclusions about phenomena under study); use of group work; and assessments that encourage the use of higher-level cognitive abilities (Saunders, 1992).

With its emphasis on a hands-on approach, authentic learning embedded in everyday situations, and practical problem-solving, place-based education clearly embraces this constructivist approach to knowledge acquisition (Gibbs & Howley, 2000).

2.3.3 The Place-Based Education Paradigm. Certain characteristics distinguish place-based education, regardless of where it is practiced. As its name implies, place-based education emerges from the particular attributes of a place (Gruenewald, 2003a; Sobel, 2005). The
pedagogical focus thus becomes the surrounding political, social, economic and ecological phenomena of students’ lives (Greunewald, 2003b; Smith, 2002a; Sobel, 2005). Students are encouraged to engage these realities in constructive and meaningful ways; they are also challenged to make contributions to their improvement (Gruenewald & Smith, 2008; Sobel, 2005).

In the place-based model the questions and concerns of the learner play a central role in determining curriculum (Smith, 2002a; Sobel, 2005). Meanwhile, teachers strive to act as co-learners and guides rather than the dispensers of pre-packaged knowledge. Their goal is to help students become creators of knowledge rather than consumers of knowledge created by others (Smith, 2002b).

In the place-based approach, learner involvement with the community is essential. School-community barriers are frequently crossed as students collaborate with citizens, agencies, local businesses and even the government to solve real-life issues meaningful to all concerned (Clark, 2007; Gruenewald & Smith, 2008; Sobel, 2005; Theobald & Curtiss, 2000). This connecting of academic content to real-world experience provides opportunities for students to derive real meaning from their studies. Organizing canned food drives for a local food bank, for example, can open students’ eyes to the need in their own neighborhoods. Students become empowered as they experience their ability to meet that need (Gruenewald & Smith, 2008; Smith, 2002b; Sobel, 2005).

Rather than limit a student to a small core of “acceptable” knowledge, place-based education strives to root curriculum in the broader scope of the students’ day-to-day realities (Gibbs & Howley, 2000; Sobel, 2005). One place-based effort in Keene, New Hampshire, for example, helped students learn how to compost food waste from the school lunch program. The
wastes were used in the school gardens (Sobel, 2005). In another example, Texas high school students combined fish farming and hydroponics in an effort to recycle wastes from a local pig farm (Sobel, 2005). Ultimately, the place-based approach seeks to form individuals capable of participating fully in the political, social, economic, cultural and ecological realities that surround them (Gruenewald & Smith, 2008; Smith, 2002a; Sobel, 2005).

The place-based paradigm also embraces a unique definition of academic success. While remaining mindful of academic content, it also seeks to validate and value the contributions students can make to the health and viability of the communities in which they live (Gruenewald & Smith, 2008; Smith, 2002b; Sobel, 2005). Such a philosophy is much broader and more empowering, than the “learn to earn” approach so common in many educational settings today.

Perhaps most importantly, the place-based paradigm can offer rewards more meaningful than grades. In the process of using learning experiences that arise from local realities, students can begin to see themselves in a new way (Gruenewald & Smith, 2008; Smith, 2002a). In helping to create a community garden for example, middle school students in Wareham, Massachusetts have begun to recognize their ability to contribute to the well-being of other people (Bartsch, 2001). Involvement in authentic work also enhances student engagement and performance (Smith, 2002b). Such engagement makes education more meaningful and helps students feel more connected to the places where they live. Authors David Gruenewald and Gregory Smith (2008) nicely capture this sentiment in asserting that:

When course work is conjoined to the life of the broader community…….students grasp the power that comes when knowledge and collective endeavors are linked in this way. In
such settings students do not need to ask why they are leaning; they know the answer to that question as they work on tasks that benefit others (p. XVIII).

The place-based approach challenges the traditional rhetoric of schooling that is often driven by standardization, the need for accountability, and the testing of mass-produced knowledge (Clark, 2007). It eschews decontextualized learning objectives that often have little bearing on students’ lives. Rather, it seeks to increase student engagement and understandings through a multidisciplinary approach that is hands-on, relevant and capable of contributing to the well-being of students’ communities (Gruenewald, 2003a). Unlike standards, testing, and pedagogies that teach to tests, place-based education tries to explore content in a way that connects young people to purposes greater than themselves (Gruenewald, 2003a). In addition, it enables them to become valuable and active members of their communities. In this way, it also offers the hope that students can develop what Paulo Freire (1993) calls a “critical consciousness which would result from their intervention in the world as transformers of that world” (p. 54). In the process, it can become a potent force for the individual empowerment of the students who practice it. By employing instructional strategies that utilize meaningful, local issues as a framework for academic content and by challenging students to constructively engage with the political, social, economic, and ecological realities of their own communities, place-based education seeks to affirm, support, encourage and empower them to lead meaningful and productive lives (Gruenewald, 2003a; Theobold & Curtis, 2003).

Empirical evidence suggests that the place-based approach can make a difference in students’ academic achievement and lives. In a national study of forty schools using the environment as an integrating context (EIC), the State Education and Environment Roundtable (SEER)—a cooperative of educational agencies from sixteen states working to improve student
learning via integrating the environment into K-12 curricula and school reform efforts—found that using the school’s surroundings and community as a framework for learning proved a more effective learning strategy than a more traditional, compartmentalized approach (Liberman & Hoody, 1998). Using evidence from site visits, interviews, survey results, and gains on both standardized test scores and GPAs the authors found:

- better outcomes on standardized measures of academic achievement in reading, writing, math, science and social studies (in one Dallas, Texas School, for instance, the passing rate of fourth graders from the 1996-97 class, the first to learn through EIC approaches, surpassed by 13% those of students in the previous year’s class);
- a lowering of discipline and classroom management problems (in a Minnesota high school, the study found that EIC students had 54 percent fewer suspensions than other ninth graders, while a high school in Kentucky reported that such students had an eleven percent higher rate of attendance than other students);
- heightened engagement and enthusiasm for learning;
- an increased sense of pride and ownership in accomplishments (Liberman & Hoody, 1998).

The study’s overall conclusion was that using EIC significantly improved student performance throughout the curriculum and enriched the overall school experience (Libermann & Hoody, 1998).

Another study commissioned by the National Environmental Education and Training Foundation (NEETF) and conducted by the North American Association for Environmental Education (NAAEE) documented similar results. The investigation was a collection of case studies focusing on Texas, North Carolina, Wisconsin, Florida, and Kentucky schools that chose
to use environment-based programs to heightened engagement in the learning process and make students’ overall school experiences more meaningful (Glenn, 2000). Many of these schools were racially diverse with many of their students coming from low-income neighborhoods. The results are impressive and include (Glenn, 2000):

- improved reading scores (100 percent of the students in a Milwaukee, Wisconsin elementary school passed the Wisconsin Reading Comprehension Test compared with only 25 percent of the total Milwaukee public school population);
- improved math scores (4th grade elementary school students in Ashville, North Carolina, achieved a 31 percent point increase in math achievement in just one year);
- improved science and social studies scores (students engaging in environmentally-based studies almost always exceeded those of students in traditional programs on state and national social studies and sciences tests);
- a greater ability on the part of the students to make connections and transfer their knowledge from familiar to unfamiliar situations;
- students learning science by doing science;
- a decline in classroom discipline problems (Glenn, 2000).

In the face of the very real constraints that accountability and high-stakes testing impose on both time and curriculum, such findings may help convince wary science teachers of the importance of discovering creative ways to incorporate some elements of the place-based approach into their daily practice. The ultimate goal of this study is to demonstrate that such integration is possible, practical and capable of producing a number of very positive outcomes even in a high-stakes high school science course.
2.3.4 Connections of Place-based Education with Constructivism. As mentioned previously, the place-based paradigm embraces the tenets of constructivist thinking. The following examples clearly reveal the constructivist underpinnings of the place-based approach:

- A constructivist approach emphasizes a consideration for previous knowledge and experience; it also espouses authentic problem solving in real situations (Saunders, 1992). The place-based penchant for contextualizing the learning in local settings replete with authentic and meaningful problems that draws on students’ prior experience nicely parallels this central tenet of constructivism (Sobel, 2005; Theobold & Curtis, 2000).

- The constructivist approach acknowledges the importance of relevance to student learning (Saunders, 1992). Echoes of this precept can be seen in the place-based desire to provide students with opportunities to experience, concretely and immediately, the relevance of their efforts to on the communities in which they live (Gruenewald & Smith, 2008; Sobel, 2005).

- Constructivism espouses the need for deep understanding rather than shallow, factual knowledge (Saunders, 1992). Intimations of this constructivist principle can be seen in the place-based attempt to engage students in in-depth investigations into the world in which they live (Smith, 2002b; Theobold & Curtiss, 2000).

- Constructivism also acknowledges the importance of students having many and varied interaction with their peers (Saunders, 1992). The place-based approach echoes this particular belief in its strategy of having students collectively work to improve the quality of the communities in which they live (Sobel, 2005).

- Finally, constructivism argues that children should be provided with opportunities to develop as critical thinkers who construct meaning from educational experiences
(Saunders, 1992). This important tenet can be seen played out in the place-based attempt to use rich and varied local environments as the context for learning. Exploring such exciting and creative contexts can serve to enhance the construction of deep meaning and understanding on the part of students (Gruenewald & Smith, 2008; Sobel, 2005; Theobold & Curtiss, 2000).

These parallels reveal the strong and well-accepted theoretical foundation for constructivist strategies embedded within the place-based approach.

2.4 Using Artifacts in the Science Classroom.

We have seen that place-based education is a pedagogical approach rooted in the ideals of the progressive education movement and constructivist theory. Implementing such an approach calls for learning activities that are project-based, experiential, inquiry-based, interdisciplinary and locally focused. As discussed in Chapter 3, my intervention attempted to incorporate some of these aspects into my high-stakes science course. However, another contention central to this investigation is the idea that teachers can “cheat” both time and curriculum by returning a portion of the place to one’s classroom by collecting and using artifacts. These are physical, mental and emotional reminders (including actual data and photos) from the actual location one has used to contextualize other learning experiences in the course. As such, artifacts are used as mediating tools to connect students to the original place and their prior experience of it. In this way, characteristics or aspects of the actual place can continue to be a potent mechanism for exploring content subsequently encountered in the course. In this way, “Place” can continue to be a potent teacher long after students have visited it.

The literature suggests great benefits to using artifacts in the mediation of learning and in the construction of knowledge. In fact, Cole and Engestrom (1993) suggest that mediation
through artifacts is the central distinctive characteristic of being human. John-Steiner and Mahn (1996) explain that artifact use is a key aspect of knowledge construction because the use of such devices can help us internalize knowledge. These artifacts include: language and mnemonic devices, works of art, writing, schemes, diagrams, maps, mechanical drawings, paint brushes, the computer, and even calendars (John-Steiner & Mahn, 1996). According to Vygotsky (1981), the use of artifacts can transform the learning process in very basic ways. In his view, artifacts not only serve as aids to help us internalize the knowledge we seek to learn, but also fundamentally shape and transform the very processes we use to acquire knowledge (Vygotsky, 1981).

It has been challenging to locate studies in the literature that document the use of artifacts in the science classroom; however, there are some good examples in the field of social studies. For instance, in an article discussing his creative use of artifacts to enrich his teaching of social studies, Ronald Vaughan Morris (2000) maintains that artifacts are wonderful mechanisms for linking student interest with the topic under study. In the article, Morris (2000) describes several historical artifact kits that teachers can create and then provides suggestions for their use. Along the way he explains the many benefits that accrue to their use, including their ability to:

- stimulate student interest and curiosity;
- make concrete and relevant concepts that can be abstract, remote and complex;
- help students focus on the topic at hand by providing them with something concrete that they can see and touch;
- serve as springboards for students’ questions;
- move students from the role of passive listeners to that of active investigators;
- facilitate students’ practice in the role of an historian;
- dispel misconceptions about subject matter;
• serve as a sensory encyclopedia through which students kinesthetically explore the
connection between an artifact and the subject matter;
• provides students with a tactile experience that helps them visualize other times and
places and brings history into the realm of their understanding;
• help students recognize and analyze symbols as the symbol (artifact) acts as a shorthand
version of information. (Morris, 2000).

In a more recent article dealing with artifact use to teach ancient history in an elementary
classroom, Morris (2002) adds these benefits to his already impressive list:
• organize and developing limited content to focus on key understandings;
• generate student discussion and thinking about the topic;
• help students to construct their understanding of concepts;
• help elicit knowledge students bring to school;
• link students emotionally [italics mine] with the past;
• help students who use analysis, synthesis and evaluation to gather information from
artifacts to develop thinking skills they use in both social studies class and in their life;
• serve as windows to examine culture, evidence, connections, and thinking skills.

In another article about the use of artifacts to complement and enrich social studies
curriculum, Labbo & Field (1999) share a teaching strategy for integrating the curriculum and
supporting elementary school children's formation of social studies concepts they call a Journey
Box. These boxes are containers that hold photographs, artifacts, literature, informational texts,
entries from travel journals, and maps; all combined to tell a first-hand story of a particular time,
place, and culture (Labbo & Field, 1999). The artifacts used are manmade objects (clothing,
jewelry, tools, food, weapons, transportation, household items, folk art, toys,) that reflect the
material, artistic, or educational culture of the society under study (Labbo & Field, 1999). The journey boxes allow students to take the very same journey a teacher has previously taken. Analyzing the contents gives students the opportunity to interpret, respond to, and understand social studies concepts (Labbo & Field, 1999).

The list of benefits Labbo & Field (1999) derived from their strategy rivals that attributed to Morris. They include the ability to:

- build elementary school students' background knowledge, motivate learning, and broaden narrow textbook views;
- encourage topic-related vocabulary development, foster higher-order thinking skills, and integrate literacy with social studies instruction;
- connect information across multiple data sources (including texts, images music and experience);
- provide immediate access to information and allow students to comprehend historical, geographic, or cultural concepts spontaneously and directly;
- help children use visual details to draw inferences and form hypotheses;
- foster productive habits of mind such as finding and keeping focus, thinking fluently and flexibly, cooperating and collaborating, and searching for patterns;
- create a contextual framework that enriches students' understanding of content ((Labbo & Field, 1999).

While these lists are extensive, the sources are in agreement and the message is clear: artifacts can serve as potent mechanisms for making that which is abstract, remote and complex more tangible, immediate and obvious (Morris, 2000). In this way they can act as powerful links between a physical object and the world of ideas and concepts they embody. They can also
facilitate the development of a number of important cognitive skills while adding to the overall richness of the educational experience.

As I began this study, I expected that a similar application of artifacts in the science classroom could produce comparable results. With regards to my study, I hypothesized that the use of such devices could continue to provide students with “place-based” experiences long after they have left an actual location. The demands of time and curriculum might prohibit us from re-visiting an actual place, but using artifacts could allow us to overcome these limitations by triggering important connections and facilitating student engagement with and understanding of additional content. In Chapter 4 we shall discover how my suspicions were confirmed.
CHAPTER THREE
DESIGN OF THE STUDY

3.1 Introduction and Overview.

This chapter presents a detailed account of the research design of this dissertation study. First, I discuss the basic tenets of action research to illustrate how this methodology informs my study. Next, I describe the study’s context, including my role as a researcher and my method of participant recruitment and selection. A detailed plan of the intervention at the study’s core is then presented, followed by the plans I made for data collection and analysis. I conclude with a brief discussion of how the study meets the tenets of action research articulated at the chapter’s beginning.

3.2 Action Research as the Chosen Methodology.

Kemmis & McTaggart (1988) describe action research as research typically arising from an educational concern grounded in one’s practice. One first identifies the concern, and with input from others, determines possible ways to address it. This leads to the development of a broad educational question that defines the area in which the practitioner intends to focus their improvement strategy. Once the question is defined, the researcher plans an intervention to address and improve the current situation. Sound plans are forward-looking, flexible enough to adapt to unforeseen circumstances, critically informed to be effective over a wide range of circumstances, and designed to empower the researcher to transcend present constraints and act more effectively in the situations they encounter (Kemmis & McTaggart, 1988). The researcher then implements a plan of improvement that is bound by prior practice, yet it seeks to improve and transcend it (Kemmis & McTaggart, 1988).

In the next stage of the process, one observes the effects of their action. The aim is to evaluate the outcome with the ultimate goal of informing future actions. Observing, in this
sense, however, requires some forethought. Because the observation process is intended to provide a documentary basis for subsequent reflection, it is important to give thought before one acts! One also wants to consider the kinds of evidence needed to adequately evaluate one’s actions. Remembering that the main purpose is to provide a sound basis for critical reflection, one then focuses on the action, the effects of that action, and the context within which it occurred (Kemmis & McTaggart, 1988).

The final step in the process is reflection. At this juncture, one considers the effects of the action and any issues that arose during implementation. Next, one reflects on the evidence obtained with an eye toward gauging the value of the change and suggesting any future improvements. This evidence is also used as a basis for further planning, subsequent critically informed action, observing, reflecting, and so on. From this description, one begins to see the cyclic nature of the entire enterprise. In fact, properly executed action research reflects a succession of such cycles with each critically informing the planning and implementation of the next (Kemmis & McTaggart, 1988).

The above explanation illustrates this methodology’s value as a useful framework to explore key aspects of one’s practice. In my study, areas of concern that warranted closer inspection included the following: the practicality of integrating place-based elements into my practice; the intervention’s effect on student interest and perceived academic performance; and determining the obvious and hidden costs of such integration.

The study was also designed to allow for participant input. This is a crucial aspect of action research. Inviting input on matters crucial to the study’s success creates a reflective process that is empowering to students (Anderson, Herr & Sigrid-Nihlen, 2007). It sends a message that their voices matter and encourages the formation of partnerships where teacher and
students learn and work together to develop a set of common expectations. According to Anderson, Herr & Sigid-Nihlen (2007), “this mutual vulnerability and reflexivity, with implications for change on the part of both the teacher and the students, set the stage for all to strategize together on what might best help them improve the learning process” (p. 69). Inviting involvement in this way can also create a high level of student buy-in into the intervention. Such involvement also helps fulfill the requirement that action research be participatory in nature. Equally important is the fact that students, teacher and practice often become better for having formed the partnership.

Finally, action research is conducted on one’s own work. It is done with an eye toward improving what one does, including how one works for and with others. We critically scrutinize our practices, not only to interpret them, but also to change and improve them. It is a process that is systematically evolving, changing both the researcher and the situations in which s/he acts (Kemmis and McTaggart, 1988). Ultimately, we strive to improve our educational practices by changing them and learning from the consequences of that change.

3.3 Research Questions and Overview of the Study Design.

The study I planned and executed aligns well with the core tenets of action research articulated above. The focus of my study was my own practice with the intent of improving the ways I could transform it to effectively engage and educate young people. Student input was invited as we collaborated on ways to strengthen its impact. As I carried it out, the study served to affect my students, my practice and myself in ways that were educationally and personally affirming. More specifically, the design of this study was informed by the following overarching question: How can science teachers capitalize on the rich affordances offered by a place-based approach despite the constraints imposed by a state-mandated curriculum and high-stakes
testing? As mentioned in Chapter One, this question was explored through the lens of four main research questions:

1. Which elements of the place-based paradigm could I effectively integrate into a Living Environment course?
2. In what ways would this integration impact students’ interest?
3. In what ways would this integration impact students’ perceived academic performance?
4. What are the costs of implementing this approach on the teacher?

Using action research as the methodological approach, I designed, implemented, evaluated and refined an intervention that grounded a portion of the content of the Living Environment course I teach in a place-based experience. This experience was intended to serve as a unique anchoring event that would also contextualize students’ learning of other core topics. Ultimately, I hoped to capitalize on a number of affordances offered by the place-based approach in order to increase student interest and enhance their academic confidence. Along the way I also examined the cost of implementing such an approach on myself as well as my students.

3.4 Description of the Context of the Study.

My study took place within the three sections of the 9th grade Living Environment course I was assigned to teach. I chose this course because it provided an excellent opportunity to study both the practicality and value of an alternative educational approach within a high-stakes environment. The 9th grade Living Environment course has a state-mandated curriculum and a high-stakes test at its conclusion. New York State standards determine the key ideas, concepts, themes and skills to be taught (see Appendix B.5). Therefore, it offered the perfect setting in which to integrate certain elements of creative science pedagogy and then discern the impact of
this integration—both on the students and my practice. While informing my own practice, my study’s results could also serve to enlighten other educators facing similar constraints.

The course was offered in a school district in Western New York. The intervention and data collection occurred during the first semester of the 2009-2010 school year. The district is a rural district in the Finger Lakes region of upstate New York. It is comprised of approximately 156 educators and 1484 students. The district houses two elementary schools, one middle school and one high school. Two of these schools are designated as Title One schools (having 53% or greater student population of free and reduced lunch buyers). The ethnic breakdown of the district’s student population is: 97% white; 1% African American; 1% Latino; and 1% Asian or Native Hawaiian or Other Pacific Islander. In terms of socio-economic status, 48% of students enrolled in the district are on free and reduced lunches.

My intervention took place at the high school level. The high school has a total population of 533 students. Specifically, my study included approximately 63 students taking the three sections of Living Environment I was teaching. It should be noted that in the past this course has been normally reserved for sophomore students, or juniors who have failed as sophomores. For the first time in school history, in the fall of 2009 all incoming freshman were required to take this course.

I brought to this research study a wealth of experience including a long career (26+ years) as a science educator. Attending inquiry-based workshops for four consecutive summers in Colorado had provided me with a good deal of experience in exploring alternative educational models. A five-year collaboration with the Cornell University Science Partnerships program had also given me valuable experience in conducting interventions designed to explore both the nature of science and the scientific method across a broad spectrum of scientific disciplines.
(including botany, astronomy, meteorology, and entomology). In addition to this, my attendance at a place-based workshop during the 2009 spring semester introduced me to a number of important contributors (in theory, research and practice) to the field of place-conscious education. These included author/educators David Gruenewald of Washington State University, Pullman, WA; Greg Smith of Lewis and Clark College, Portland OR; David Sobel, of Antioch/New England Graduate School, Keene, NH; and Julie Bartsch, the Rural School and Community Trust, Boston MA. Thus, I was uniquely positioned—in background, knowledge and, experience—to attempt to blend principles of an alternative educational model into the elements of my everyday practice and then discern the fruits they bear.

Selecting this context influenced a number of parameters including: the nature of the content I could explore; the appropriate artifacts I could collect; the type of community agencies I could involve; the types of outlets/audiences for the dispersal/sharing of our results; the age of student exploring that content; and the academic ability of these students.

3.5 Participant Recruitment and Selection.

Participants included students enrolled in the three sections of the Living Environment course I taught. I anticipated the gender of the subjects would reflect the gender breakdown of the current freshman class (52% male students and 48% female students), the age of the subjects would range from 13-17 years of age, the Race/Ethnicity of the subjects would reflect the breakdown of the district (as reported earlier), and 100% of these students would have English as their primary language. The 63 students enrolled in my three classes ranged in ages from 14-18 years old. Of these, 6 students chose not to participate in the study. Of the 57 students who participated, 27 were freshman (14 boys and 13 girls); 27 were sophomores (19 boys and 8 girls); one was a junior (boy); and 2 were seniors (one male and one female). 100% of these students had English as their primary language and 100% were of Caucasian decent.
I invited all students in the three classes to participate in the study. There was no inclusion or exclusion from this study based on gender, age, ability or ethnicity. All subjects had the capacity to understand informed consent in English. During the first week of school, I explained the nature of the intervention and offered an invitation to participate via an information/assent form. I then distributed this letter to each potential subject, read it to them, and checked for understanding. At this time, I also attempted to address any questions or concerns they had. In addition, I reminded them that their participation was voluntary and that they would still be able to participate fully in their normal coursework whether they participated or not in the study. After all questions/concerns had been addressed, I invited potential subjects to sign the information/assent letter. I then distributed a parent/guardian permission form, read it aloud, and then checked for understanding. Then, I addressed any questions or concerns potential subjects had. Students were then instructed to take this permission letter home to their parent(s)/guardian(s) for a signature of approval. Potential subjects were given five days to decide if they would participate.

Since the intervention at the core of this study consisted of lessons and assignments that were part of regular instruction, all students in the three classes participated in these experiences. Students, however, were given the choice of whether or not they wanted to participate in the research (i.e., whether they would participate in those aspects of the data collection that were not part of regular classroom instruction and whether I would use data related to their work for my analysis). Therefore, participation in this study was voluntary. Subjects could cease participation at any time during the study without any impact on their grades or status in the class. Only 6 of the 63 students taking the class declined participation in the study. Audio-taping took place in order to provide accurate data, but I removed any identifying material from final
reports. To insure confidentiality subjects’ names were omitted in the reporting of any data from this study.

3.6  **Detailed Plan of the Intervention.**

The first unit in the regents-level course in Living Environment is Ecology. My plan to cover the required material was to focus on the ecological health of an aquatic freshwater ecosystem using the following elements of the place-based approach: teacher as facilitator and guide; lessons emerge from the particular attributes of a place; students derive meaning via a connection to real-world experiences; providing opportunities for interactions with peers; in-depth investigation of a local issue; fostering school-community partnerships; engage students in authentic work; connect students to the communities in which they live (see Appendix D. 1). In this section, I will report on my original plan for the intervention. In Chapter Four, I will provide an account of how this plan actually played out and how my students responded to it.

I planned on beginning the intervention with an in-class discussion of the nature and purpose of the intervention, and our respective roles in it. We would then continue with an in-class examination of content related to the general ecology unit. Our goal was to explore the essential questions, fundamental concepts and major understanding set forth in the New York State Department of Education teaching standards for a Living Environment course (see Appendix A.6). Questions to investigate included: what are the interrelationships among organisms; what are some abiotic components of ecosystems; how do abiotic factors affect living systems; what are the necessary components of a self-sustaining ecosystem; what are essential compounds of a healthy ecosystem and how are they cycled through ecosystems; (see Appendix A.6). Per these state standards, I allotted approximately six to seven weeks to examine the required content.
Next, we would move on to an in-class exploration of biotic and abiotic factors that affect a pond’s freshwater aquatic ecosystem. The class would examine ways to use this information to determine the current status of the ponds overall health. We would also gather information about the types of organisms (trees, macroinvertebrates) living in and around ponds so as to be able to eventually compare that to the physical data from the actual ponds. Content to be covered (and parameters to be measured on Ponds Day) would include dissolved oxygen concentrations, temperature, pH, phosphate and nitrate concentrations, alkalinity, species type, and size of both upland and lowland tree populations, and type and quality of macroinvertebrate populations present (see Appendices A.2). Also covered in class would be various data collection methods for the taking of samples. Students and I would also co-construct a list of possible “artifacts” to be collected on our visit to the ponds, and I would assign roles for collecting them (see Appendix A.3).

As part of this important foundation-laying segment, I planned to have visits from representatives of local agencies who would be helping in our study. Edith Davey, educator with the Ontario County Soil and Water District, would visit our classes to provide a primer on fresh-water pond ecology, macro-invertebrates natural history and identification, and the role these organisms play as indicators of water quality. On a subsequent visit I planned on having her introduce students to the various components of our local watershed. Ron Davis, educator with Birds of Prey, would be our next guest. Ron’s role would be to introduce students to a number of avian predators that make the ponds their home. Lastly, Sheila Meyer from the Finger Lakes Institute would visit class to help us explore the concept of invasive species. During her visit, I planned to have her inform my students as to the important community contribution they could make by allowing their data to become a part of her study on the water quality of area streams.
With this foundation laid, I set out to plan the actual field trip to a local place. The intervention would include a day-long visit to a local natural area, Comstock Ponds (3 nearby ponds owned by the school district). While there, students would engage in the actual collection of data that would eventually allow them to gauge the overall health of the ponds. They would also collect environmental “artifacts”—samples, specimens, and reminders of both living and nonliving things (plants, water samples, soil samples, etc.)—as well as data and photos. These would later serve to connect this initial experience to the study of content we would subsequently encounter in the curriculum including concepts in general ecology and human impact on the environment. More specifically, artifacts would be collected with an eye toward embodying the following units/concepts: biotic; abiotic; interactions; populations; communities; limiting factors; carrying capacity; food chains; food webs; tropic levels; predator/prey; parasite/hosts; symbiotic relationships; competition; various natural cycles; invasive species; biodiversity; human impact on the environment; requirements for living things; photosynthesis; cellular respiration; and many photos of students measuring parameters and collecting data and artifacts. Upon our return to the classroom it was my intention to continually examine and reference these ecological souvenirs in an effort to inform and understand current material. This was intended to ground our coursework in the students’ initial place-based experience of that local, natural place as well as jog students’ intellectual, emotional and cognitive memories of that experience. While the limits imposed by time and curriculum would prevent us from returning to the ponds, we could at least return pond reminders to our classroom so that “place” could continually inform our exploration of subsequent content.

As a follow-up to our field experience, I planned to explore the data collected on sight including water quality data, tree population data, macroinvertebrate species encountered,
photos, actual physical artifacts, etc. We would then discuss the implications of data and experience including: which ponds support more diversity; rate pond quality (eutrophic vs. oligotrophic); what macroinvertebrate species tell us about pond health; abiotic factors that may influence the nature and health of plant communities present; what are the linkages between abiotic and biotic factors present at the ponds. Once analyzed, we could discuss some possible ways of sharing of findings with the broader community. In addition to sharing our water-quality findings with the Finger Lakes Institute, we could also consider other ways to report to the broader community including writing an article for the local paper or district newsletter, presenting our results on the local radio station, at a school board meeting, or a meeting of a local organization, and even creating a website (Tompkins, 2005). This sharing-component was intended to add to the educational meaningfulness of the experience and also to help students experience their ability to become contributing members of the wider community they are a part of. Along the way, I also hoped they would also experience that the wider community had come to value the unique contribution these students had made.

Throughout our exploration of ecology concepts I planned to continually reference our Pond Day/knowledge/artifacts to inform our study of the material at hand. For example, when exploring the interplay of the biotic with the abiotic I thought we could examine the undersides of fir needles collected at the ponds. Under magnification, these undersides clearly show rows of stomata where the tree exchanges gases with the atmosphere. When exploring human impact on the environment I thought we could use artifacts (actual or photo) that demonstrated any evidence of both positive (bluebird nesting boxes) and negative (discarded cans and bottles) examples of human impact at the ponds.
Artifact use was also designed to encourage the development of students’ critical thinking skills in that I could continually challenge them to make linkages between the significance of what they have experienced and collected in the field and what they now encountered in their classroom studies. In the spirit of action research, the participating students would not be passive participants on whom research is being conducted but rather be encouraged to participate in ongoing reflection as we collectively tinkered with the best ways to incorporate the initial experience into our unfolding classroom learning.

At crucial points in the study I would ask students to respond to journal prompts which challenged them to explore their thoughts, feelings, impressions and insights gained from having engaged science content in this fashion (see Appendix B.1 for list of actual journal prompts and moments assigned). These 150-250 word responses served a number of purposes. To begin with, they provided students with a chance to hone their writing skills—an opportunity often missing in science classes. Secondly, they challenged students to provide thoughtful and descriptive reflections about their experiences and hopefully provided them an opportunity to discover the value of them. Thirdly, based on the quality of their responses, students received points which were factored into their overall grade for the marking period (see Appendix A.4 for an example of grading rubric). Lastly, I planned to collect and use the entries as a data source to explore the intervention’s affect on student interest and perceived academic success.

3.7 Data Collection Plan.

I addressed my research questions through the collection, analysis and interpretation of four data sources:

1. Teacher log including daily field notes and observations following specific prompts (see Appendix B.3).

2. Students’ answers to journal prompts in student reflective journals (see Appendix B.1).
3. Students’ answers to end-of-intervention survey questions (see Appendix B.2).

4. Transcriptions of selected audio-taped focus group sessions exploring students’ perceptions of the intervention (see Appendix B.4).

I planned to collect data at predetermined points within the two and one half month intervention. All data sources were chosen with an eye toward gaining information, insights and examples of the extent to which I had been able to successfully incorporate elements of a place-based approach and the impact of the intervention on student interest, academic achievement and costs to teacher and students. More information about each key data source follows.

3.7.1 Teacher Log. I planned to use the lesson plans I created as I taught the ecology unit as artifacts I could eventually analyze. I intended to use these plans to first identify key ideas of the unit which we needed to cover. I would then identify which of these ideas I was able to address using elements of place-based education (including artifacts from Pond Day). Plans would also be used to describe: the activities we engaged in and the positive and negative aspects of each; the costs incurred; any perceived student interest; personal teacher comments and observations; my plans for the next class. I also planned to identify what specific place-based element(s)/artifact(s) I was able to use in each class. Essentially, I created a list of the key activities we covered in each class along with a note as to which ideas were covered using a place-based pedagogy/artifact and which were not (see Appendix B.3 for a list of prompts). This information was intended to serve a four-fold purpose. First, it could help me answer Research Question Number One (identifying the place-based elements/artifacts I was able to integrate into a high-stake environment). Secondly, it could help me answer Question Number Four by tracking the costs associated with trying to integrate any particular element. Thirdly, it could provide data from my own observations regarding students’ interest and academic gains to
complement data collected directly from students. Lastly, I could also rely on these data to refine my approach to future lessons so as to best incorporate place-based pedagogy into them.

3.7.2 Student Reflective Journals. This data source is comprised of students’ answers to journal prompts which focused on particular aspects of the intervention. I intended to use these answers to explore the interventions effects on student interest, perceived academic success and students’ perceived costs of the intervention. Journal responses could serve as a useful data source for addressing Research Questions Two, Three, and Four. I intended to provide specific writing prompts before and/or after significant junctures in the intervention (i.e., after our initial day at the ponds, after community presenters had visited the class and after crucial classroom sessions when artifacts were employed to teach subsequent content (refer to Appendix B.1 for a list of each prompt and when it was assigned).

3.7.3 Students’ Answers to Survey Questions. I planned to conduct a survey at the intervention’s conclusion. Survey questions were geared toward determining the effect of this experience on students’ interest, perceived academic performance and cost (see Appendix B.2). These data could then be used to help determine the answers to Research Questions Two, Three, and Four.

3.7.4 Audiotapes of Focus Group Sessions. Focus groups were conducted at the conclusion of the intervention. I selected a subset of students for participation based on their answers to journal prompts and survey questions. Two groups of three students were identified: those whose overall perceptions of the intervention were positive and those whose overall perceptions of the intervention were negative. During these sessions, students were questioned concerning different aspects of their experiences (see Appendix B.4 for interview prompts).
Their answers were audio-taped, selectively transcribed, and then used to answer Research Questions Two, Three and Four.

3.8 Data Analysis.

I triangulated the data from these multiple sources in an attempt to analyze and interpret implications for my four research questions using traditional qualitative methods that rely on an inductive and iterative approach (Bogdan & Biklen, 2007; Corbin & Strauss, 2008). Consistent with an action research methodology, I began analyzing the data as I collected it so as to use initial findings and insights to inform subsequent research actions and decisions I made.

To insure validity and trustworthiness in this process, I applied a number of criteria to my analysis of these data sources. These included: triangulation via the use of four different sources; maintenance of a reflective researcher’s journal which tracked and informed the collection and analysis process as well as the research decisions I made; the use of critical friends (a fellow-science teacher, a special education teacher and other doctoral students) as sounding boards to discuss both current and potential codes, themes, interpretations and findings; and member-checking where I purposely shared my analysis with selected participants during the focus group sessions. These sessions allowed me the opportunity to give students the chance to confirm my interpretations of the stories that seemed to be unfolding with respect to the research questions and students’ overall impressions of their experience. More specifically, I looked for answers to my research questions by analyzing various question-dependent data sources as described in detail in appendix C.1 and summarized below.

For Research Question One (elements of place-based education captured) I primarily analyzed my teacher log. This log was divided into the following sections: intended plan; enacted plan; pluses; minuses; costs incurred; level of student interest; comments/observations; plans for tomorrow; and my element capture chart (see Appendix B.3). The chart assigns a
numerical value to the success to which I captured that particular element with 1 signifying a poor capture and 5 representing a strong capture. At lesson’s end I simply placed a number between 1 and 5 in a parenthesis next to a particular element (see Appendix B.3). At the intervention’s conclusion I created a chart (as reported in Appendix D.1) by marking each lesson where a specific element of place-based education was used and also computed the percentage of time I successfully captured each element throughout the unit.

I used the “cost incurred” section of my teacher log to address Research Question Number four by noting the cost associated with integrating a particular element after each lesson (see Appendix B.3). Costs typical included things like time needed to make personal pre-Pond Day visits to collect artifact samples, time needed to co-construct artifacts list with students prior to pond day, frustration inherent in having to reschedule Pond Day due to inclement weather, anxiety inherent in trying to plan for and cover required content using a place-based approach and the fatigue and frustration involved in motivating my students to plan for, create and eventually finish the concluding slide show. Each cost was noted in the log at the end of the school day. At the conclusion of the intervention I turned to this rich data source to determine the cost of integrating place-based elements into my practice. I read through the log and highlighted all relevant costs in pink to differentiate them from other items I had used the teacher log to track (i.e., pluses, minuses, comments, observations, evidence of interest and elements captured). I then grouped each cost into an appropriate category (i.e., time, emotion or energy) and used this information to help determine both the nature and extent of the costs I incurred for having used the place-based approach. This data was supplemented with information gathered from students’ journals, survey responses and focus groups answers. I simply highlighted any data from these sources that could shed additional light on the cost of implementing the
approach. In the end, each of these sources made a unique contribution to the overall picture of the costs I incurred.

For Research Questions Two and Three, I analyzed data from student answers to journal prompts, surveys, and focus group questions specific to the particular research question. Specifically, for research question two (student interest) I read student journal responses with an eye toward determining what aspects of the intervention contributed to a heightened sense of interest and what did not. I further explored these responses in an effort to identify what it was about each experience that served to heighten this interest (i.e., hands-on nature of the approach; local focus; experiential nature of the approach, etc.). I did the same for journal responses articulating a dislike for a particular experience (liked learning a different way, dislike of bad weather, confusing community presenters, etc.). I then used this information to compile a table of things contributing to interest (see Appendix D.3). In this table each reason was identified (out of 127 total journal responses) along with the percentage of times it had been listed. I compiled a similar table to organize negative responses (see Appendix D.4). I then used both tables to determine the major reasons given for heightened student interest or the lack thereof and the relative importance of each reason. Analysis of this data helped me determine both the nature and extent to which a particular facet of the intervention was capable of generating interest or turning students off.

Next, I explored my survey results to help fill in the picture of which aspects of the intervention contributed to interest. Using these results I created a table that organized questions of interest around our visit to the ponds and our use of artifacts (see Appendix D.2). In this way I was able to determine the number and percentage of students who found these aspects of the
intervention interesting (and the same for those who did not). I used this information to complete the overall story of aspects contributing to student interest (or disinterest).

Two final data sources were used to complete the picture of student interest. One was the comments recorded in my teacher log concerning evidence of this interest (see Appendix B.3). I explored these daily notes-to-myself for both evidence of and reasons for that interest. Impressions gained were noted and eventually became part of my final analysis. With regards to focus group questions, I listened to tape-recorded sessions and selectively transcribed any mention of aspects of the experience that either facilitated or detracted from student interest. These transcribed notes were later explored for the contributions they could make to the answering of this question.

I approached Research Question Number Three in a similar fashion. I explored student responses to journal prompts, survey questions and focus group questions to determine what it was about each experience that served to heighten students’ perceived academic performance (i.e., hands-on nature of the approach; local focus; experiential nature of the approach, etc.). As with student interest, I organized results from journal and survey responses into data tables and used this information to help determine which aspects of the intervention facilitated perceived academic success and which did not (see Appendices D. 2, D.3 and D.4). With regards to focus group questions, I again listened to tape-recorded sessions and selectively transcribed any mention of the experience that contributed to, or detracted from, perceived academic success. These transcribed notes were later explored for the light they could shed with respect to this particular question.

Again, I refer the reader to Appendix C.1 for further details on how I analyzed specific data sources to address individual research questions.
How This Study Reflects the Key Principles of Action Research.

As discussed earlier in this document, action research is that which typically arises from the exploration of an educational issue in which people articulate a concern and, with input from other participants, explore possible solutions that address the concern (Kemmis and McTaggart, 1988). With respect to the current study, my concern, clarified and supported by the literature, centered on the inability of the standards-based approach to engage students in meaningful ways. My solution was to integrate key aspects of the place-based approach into my practice and examine the benefits as well as the costs of doing so.

In the action research paradigm, the identified concern should result in the development of an educational issue or broad educational question which defines the area in which the practitioner will focuses their strategy for improvement (Kemmis and McTaggart, 1988). In my study, the question I addressed is: How can science teachers capitalize on the rich affordances offered by a place-based approach despite the constraints imposed by a state-mandated curriculum and high-stakes testing?

The action researcher next plans an action to address and improve what is currently taking place. As mentioned earlier, good plans should be forward looking, flexible enough to adapt to unforeseen circumstances, critically informed to be effective over a wide range of circumstances, and designed to empower the researcher to transcend present constraints and act more effectively in the situations they encounter as educators (Kemmis and McTaggart, 1988). The plan I created (see section 3.6) addressed these issues by employing a creative pedagogy that held out the hope of engaging students because of its hands-on and locally focused perspective. As stated above, it was flexible enough to take account of student suggestions for improvement. It was critically informed by research-based suggestions as to what makes for quality educational experiences. This allowed me to transcend the pressures of accountability and deliver a product
that successfully covered required content in an engaging manner. Finally, as explained in Chapter Six, it pointed the way to further improvements that could be made in subsequent cycles of action research.

The next stage of action research is to implement a critically informed plan. The action one takes is bound by prior practice but seeks to improve and transcend it (Kemmis and McTaggart, 1988). I implemented my intervention with an eye toward learning what it could teach me about effectively using place-based education within the confines of a high-stakes science course. I also was open to the possibility that its weaker components could be improved. As mentioned earlier, I took note of such suggestions for improvements. The result was that my students and practice immediately benefited from what the experience was teaching us.

One next takes note of the effects of their action with the intent to evaluate it (Kemmis and McTaggart, 1988). One focuses on the action taken, the effects of that action, and the context within which the action occurred (Kemmis and McTaggart, 1988). The results of my systematic analysis of the data collected will be reported in Chapter Four.

The final step in the process is reflection. One must now consider the effect of one’s action and findings and uses them to inform future action. The evidence obtained must first be considered to determine the efficacy of the change with respect to their practice. One then decides where subsequent change may be appropriate. Thus evidence obtained from the action is ultimately used as a basis for further planning, subsequent critically informed action, observing, reflecting, and so on (Kemmis and McTaggart, 1988). The fruits of my efforts to honor this important aspect of action research have been reported in Chapters Five and Six.
CHAPTER FOUR

FINDINGS

“Getting to know home is the most human and necessary of occupations. To give that power of observation to students is to give them something of infinite value and importance — something to do with the rest of their lives.”

Ann Zwinger (as quoted in Leslie, Tallmadge & Wessels, p. vii)

4.1 Introduction and Overview.

In this chapter, I begin by reporting in detail on how the unit where I implemented a place-based approach (a 37 day long Ecology unit) developed—both to illustrate concretely how such an approach may play out in a high school science class and to ground the findings reported in the rest of the chapter. Then, I provide a comprehensive presentation and interpretation of the findings relevant to each research question. I conclude by highlighting some interesting discoveries that were generated by my attempt to use artifacts and weave elements of the place-based paradigm into the everyday world of a regents Living Environment class.

4.2 The Place-Based Approach in Action.

Our initiative centered on a day-long visit to Comstock Ponds, a local natural area. Prior to our trip, I took the opportunity to place the visit in its proper context for my students. This groundwork was informed by research which suggests that the educational value of field trips is significantly enhanced when preceded by a preparatory period that focuses on increasing students’ familiarity with the actual setting of the trip (Orion & Hofstein, 1994). Such introductions facilitate learning by eliminating the “novelty” inherent in a location students have not visited, thereby freeing students to focus on the tasks at hand.

I created this context by first talking with my students about my research, the notion of place-based education, and the nature of the planned intervention. I also discussed the role they would play in that intervention. Then, I provided them with an historical perspective of
Comstock Ponds—their nature, purpose and how they came to be. Students were then given various perspectives of the actual ponds—satellite views, USGS topographic maps of the ponds, and an actual map of the area. This was done to give them a geographical perspective and to help them understand how the ponds were situated in the context of the local watershed.

With this foundation laid, I invited Edith Davey, an educator with the Ontario County Soil and Water Conservation District, to visit our class and give a presentation on the watershed of which the ponds are a part: the Canandaigua Lake watershed. Our plan included the testing of the water quality (pH, dissolved oxygen, nitrate and phosphate levels, and alkalinity) of both the ponds and a pond outlet stream. I therefore wanted students to know that the ponds were part of a larger watershed and that they contributed—for good or ill—to the overall quality of the water in it. Ms. Davie visited our class and provided us with a quality presentation. However, due to a regrettable miscommunication between us, her presentation neglected to properly situate the actual ponds within the watershed. This unfortunate experience provided my first lesson in the potential pitfalls of school-community partnerships. However, building on her solid presentation, I simply took some time during the next class period to help my students make this important connection.

Ms. Davie promised to return in a week’s time to introduce students to the various species of macroinvertebrates they would encounter at the ponds. In the meantime I forged ahead with an exploration of various concepts in ecology. These included the concept of an ecosystem, the biotic and abiotic components of an ecosystem and the many interactions between them, and the definition of populations and communities. I also introduced students to the concept of an ecologist. I reminded them that our approach would give them the opportunity to play that role at the ponds.
I used artifacts to introduce, examine, and support the various ecological concepts we encountered. These included photos from last year’s visit to the ponds as well as specimens I had personally collected on a recent visit to the ponds. We used these to our best advantage. For example, fir needles collected at the ponds were placed under a microscope and students were allowed to view the stomata on the needles’ undersides. This up close and personal look at a mechanism for gas exchange served as an excellent reminder of the interplay between the biotic and abiotic. It also served to reinforce the notion that artifacts from the ponds were easily capable of illustrating such basic ecological concepts. Our use of goldenrod stem galls illustrates another example of how pond artifacts can embody and reinforce an ecological concept. I had collected the galls on my preliminary visit to the ponds. I opened a few to reveal the larva inside and passed them around the room for the students to examine. While serving as an excellent example of parasitism, the experience also helped to successfully establish that this “web of life” we had begun to study was present at the ponds in all its multi-faceted glory. It also revealed the ponds as an ecological story book waiting to be read. I believe that this approach also successfully whetted students’ appetite for visiting the ponds and experiencing it for themselves.

Ms. Davie soon returned and provided us with a wonderful hands-on experience in macroinvertebrate identification. We had been learning that these pond organisms could serve as valuable indicators of water quality. Students were given the opportunity to handle and identify many of the same species they would be finding at the ponds. The presentation served to move the concept out of the realm of the textbook and into the hands of students, who were eager to examine things for themselves. Upon her departure, we continued to explore various concepts in ecology as we awaited our trip to the ponds. Various notions were introduced and appropriate
artifacts were employed as examples and reinforcements of these concepts. Such artifacts (photos, physical specimens, etc.) were used in the same manner as previously indicated.

As the day of our pond visit approached we explored the nature of the various water tests (dissolved oxygen, phosphates, nitrates, pH, alkalinity) we would be taking at the ponds. Students were introduced to each parameter (see Appendix A.5) and then allowed to examine the equipment commonly used to test for it. Per research previously cited (Orion & Hofstein, 1994), this was done to eliminate the need for such explanations while at the ponds. I also took this opportunity to remind students that results from our stream tests would be used by the Finger Lakes Institute in a broader effort to understand the health of Finger Lake’s streams. Students later reminded me in their journals of the positive effects this knowledge had on their decision to take great care on these particular tests. We also took the time to co-construct a list of potential artifacts to be collected at the ponds (see Appendix A.3). We listed the various ecological concepts we had already encountered and those we were likely to encounter later in the course. Students then suggested possible artifacts they could collect that would best illustrate these concepts. I facilitated the discussion and offered some suggestions for the concepts we had yet to cover but would subsequently explore in later lessons.

I soon experienced one of my initial “costs” of trying to implement this approach. After investing a good deal of time in preparing for our trip (ordering buses, confirming adult chaperones, connecting with representatives from community agencies, obtaining parent permission forms, borrowing water-testing equipment, making an on-site visit to set up the various stations prior to our trip, co-constructing artifact lists with students, etc.), our pond-day trip had to be canceled due to inclement weather. The result was that many of the field trip incidentals mentioned had to be re-planned. The bad weather also made it impossible for one
community agency to have a presence at the ponds. Adding to this frustration was the fact that our “rain date” dawned to another day that was cold, drizzly and blustery. However, rather than cancel again, we bravely forged ahead in the hopes that a captivating setting and engaging projects would trump nature’s meteorological vagaries.

On the day of our actual visit to the ponds, the 63 students comprising my Living Environment classes were divided into groups of about 15 students. Each group was supervised by an adult and assigned to a particular station (pond water quality, stream water quality, tree identification, macroinvertebrate identification and a scavenger hunt). We allowed approximately 30 minutes for each station and students rotated through each as the day progressed. The stations provided students with an opportunity to explore various aspects of an aquatic ecosystem with an eye toward examining its overall health. The stations also gave students a hands-on and eyes-on opportunity to experience “ecology.” Two photographers, one student and one parent, were documented the pond experience. Many colored photos were taken of flora, fauna and students exploring various facets of pond ecology. These photos were eventually transferred to computer paper and used to decorate the walls of my classroom. There they served as daily visual, emotional, mental and cognitive reminders of important local ecological realities.

Artifacts were collected at the scavenger hunt station. Each group was given a different section of our previously constructed list and challenged to search for examples that illustrated the concepts listed. By the end of the day, we had successfully worked through the entire list and found many worthwhile examples of the concepts we had already encountered or would encounter later in the course. One highlight of the scavenger hunt was the timely flyby of a turkey vulture as we searched for some evidence of ecological scavengers. Another was students’
discovery of a perfectly intact woodcock carcass as we searched for evidence of decomposition. Still another was our discovery of a long shaft of bark that lightening had removed from a nearby tree. We found this as we searched for an appropriate example of the interplay between the biotic and abiotic. Each example served to remind me of the wonderful way that nature cooperates with those willing to explore her secrets.

Upon our return to the classroom, I broke students into groups and began to explore the overall health of the ponds using the data we had collected. We first compared our dissolved oxygen results with the numbers and kinds of macroinvertebrates species we had collected. We did this to gauge the level of agreement between the stories each could tell us about water quality. We also examined the pH ranges, nitrate and phosphate levels, and alkalinity levels in the pond and stream water. Each parameter was used in its turn to acquire a more complete picture of water quality at the ponds. pH values were later compared with Finger Lakes Institute data on pH levels in nearby Seneca Lake and also a lake in the Adirondack mountains. These efforts are examples of the place-based penchant for engaging students in authentic tasks (collecting and using water samples) and using the results to explore a real-life issue (determining the overall health of an aquatic ecosystem). It is also illustrates the benefits of using artifacts to enrich the learning experience. We shall see that such strategies serve to heighten student interest and engage them more deeply with the material. It is likely that they also help students retain the information they had encountered. In doing so, they seem to facilitate a higher degree of academic confidence on the part of students.

As we continued our exploration of ecological concepts, artifacts collected on Pond Day were continually used to introduce and reinforce particular concepts. It soon became apparent that our experiences at the ponds and the artifacts we had collected could be used as the context
for most of the concepts we were to encounter! A good example of this can be seen in our exploration of symbiosis. To explore this particular concept, students were broken into groups and given pieces of lichen-covered wood. The lichens had dried considerably since they had been retrieved and had turned a somber grayish color. However, when students added a few drops of water, the algal component of the lichen soon began its photosynthetic duties and the organism quickly turned a bright green color. The experience demonstrated that it was possible to collect living examples of an ecological concept (symbiotic relationships) from a local environment for use in a classroom. It also showed that such artifacts could be easily used to give students a hands-on and eyes-on opportunity to explore that concept. Lastly, it provided a potent example of how local realities could readily serve as wonderful examples of the concepts we were required to learn.

There are many additional ways pond artifacts were used to help us grasp content. Bluebird nesting boxes and plastic “Posted” signs served as constant reminders of the impact humans can have on their environment. Macrinvetebrate species previously identified provided convenient examples when the time came to co-construct food chains and food pyramids existing at the ponds. Even the clover plants we had collected provided useful visuals as we explored the nitrogen cycle. These few examples of their many uses serve as potent reminders of an artifact’s ability to heighten interest, reinforce concepts, and provide students with a deeper, more lasting understanding of ecological concepts. They also illustrate the wonderful ease with which pond reminders served us in our exploration of the concepts of ecology.

4.3 Research Question One: Integration of Place-Based Elements.

My first research question asked the following: Which Elements of the Place-Based
Paradigm Could I Effectively Integrate into a Living Environment Course? As reported in Chapter Three, at the end of each lesson I recorded in my Teacher Log (see Appendix D.1) the degree to which I was able to incorporate in that lesson each of the following key elements:

- Teacher as Facilitator and Guide
- Lesson Emerges from the Particular Attributes of a Place
- Meaning Derived from Studies by Connecting Content to Real-World Experience
- Provides Opportunities for Interactions with Peers
- In-depth Investigation of a Local Issue
- Fosters School-Community Partnerships
- Engages Students in Authentic Tasks
- Connects Students to the Communities in Which They Live

In what follows I will report on each of these elements separately. In each case, I will begin by summarizing relevant key principles from the literature on place-based education and then discuss how those principles played themselves out over the course of the intervention. As part of this analysis, I have decided to include some illuminative statements made by my students about their perceptions and reactions to these elements; although not part of the original research question, these comments shed some “expert” light on what students either liked or disliked about a particular element.

4.3.1 Teacher as a Facilitator and Guide. Place-based education eschews the “banking approach” to education where the teacher acts as knowledge giver and the student is a receiver of that knowledge. This transmission approach typical of traditional science classrooms places the teacher at the forefront of the educational enterprise where s/he offers pre-packaged knowledge—usually in lecture format—to students who eagerly consume it and regurgitate it on
the next assessment. Proponents of place-based education argue that to be meaningful, educational experiences require new roles for both teacher and students. In the place-based paradigm, a teacher’s expertise lays not so much in their stored knowledge (although this is important) as in their capacity for helping students acquire the skills and dispositions of effective learners (Sobel, 2005). In this vision, the teacher relinquishes the role of knowledge giver. Instead s/he acts as an experienced guide, a co-learner, and a broker of community resources and learning possibilities (Smith, 2002a). For meaningful and lasting learning to occur, the presence of an instructor who guides and facilitates students’ engagement with and understanding of the material is absolutely essential.

My attempts at using the place-based approach often necessitated the embracing of these new and sometimes challenging roles. In fact, the entire effort would have soon disintegrated were it not for the presence of a teacher who was knowledgeable of both science content and at least some of the nuances of the place-based approach. My role as teacher soon evolved into that of a quarterback charged with responsibility for making the entire experiment run smoothly. Such quarterbacking required a number of important attitudes/skills including:

- knowledge of the appropriate community agencies to involve;
- the fostering of positive school-community partnerships so as to best utilize their expertise;
- swallowing my pride and recognizing the unique gifts these individuals might contribute;
- deciding the proper timing of the contributions they could make;
- finding a real-life, community-related issue relevant to students’ lives that needed addressing.
Beyond these important considerations, my role also required the creation of a classroom atmosphere that invited and encouraged an examination of ecology concepts through a creative exploration of a local natural area. As mentioned earlier, this involved laying a foundation for the intervention and our Pond Day visit, including placing the ponds in their proper, historical, economic, geographical and ecological contexts. This foundation-laying served a two-fold purpose. Per the advice of Orion & Hofstein (1994), it helped prepare students for our actual visit to the ponds. Secondly, it helped them understand and appreciate the multi-dimensional significance of the ponds as a living laboratory for the exploration of ecological concepts we would encounter and explore there.

Facilitating also involved convincing students that much could be gained by turning to phenomena immediately around them rather than examining more distant and abstract knowledge from other places. This involved exploring some fundamental concepts in ecology from a place-based, i.e., locally focused approach. As mentioned previously, this was accomplished via the immediate use of online resources, photos from previous trips to the ponds and the use of pond artifacts. Each served to demonstrate the ponds’ potential to illustrate important ecological concepts. Each was a powerful testament to the ability of a local place to serve as a living textbook for the ecological concepts we were required to learn. All persuaded many of my students of the wisdom of searching the nearby to explore and appreciate important ecological phenomena. This preparatory strategy also helped whet their appetites for visiting the ponds and experiencing it for themselves consistent with the observations reported in Orion & Hofstein (1994).

Facilitating also involved the brokering of community resources. To be successful, I had to first become knowledgeable of the various local agencies and the expertise they had to offer. I
then had to contact these individuals and invite them to become part of the intervention. I next had to plan for and then utilize the best use of their time and talent. In the case of Ms. Davie of Soil and Water, this meant relying on her expertise of local watersheds and macroinvertebrate populations. In the case of Ms. Meyer, it meant relying on her knowledge of invasive species and her willingness to allow a portion of our data to be used in her data bank. In the case of Mr. Walker, it meant providing a forum where he could share his considerable knowledge of birds of prey. With Finger Lakes Community College, it meant relying on the donation of vital equipment so that important water tests could be completed. Lastly, such facilitation required the additional responsibility of insuring that students were conceptually ready for these presentations. It also involved the follow up necessary to keep the intervention flowing at the appropriate pace and in the proper direction once the presenter had made their unique contributions.

Another facilitative challenge was that of insuring that the approach maintained its place-based feel, especially in the time before we had actually visited the ponds. This involved the planning of the particular concepts to cover and the best way to cover them. This often necessitated my personally visiting the ponds in advance to collect artifacts that could embody concepts we were then exploring.

Students also had to be readied for the actual trip to the ponds. This involved helping students become acquainted with the various parameters to be tested, and the equipment used to test them. It also involved co-creating lists of possible artifacts to be collected on pond day. This was no small feat: it could be challenging to match an artifact with a particular concept we had yet to encounter in the curriculum.
Facilitation also meant navigating Pond Day itself—including creating student groups, acquiring parental permission, notifying teachers, getting buses, finding adult supervisors, finding photographers to document the pond experience, setting up tables and equipment and tearing down, and returning these tables and equipment.

My role as facilitator and guide did not end there. Upon our return I was faced with additional decisions. These included determining how best to use these mental, emotional and cognitive reminders of the ponds within the context of a particular lesson—including making important choices about linkages between a particular artifact and the appropriate concept it illustrated.

It also involved making decisions regarding the appropriate use of creative pedagogical strategies including teacher-demonstrations, pairs work, small group work, various lab work, and the passing of particular artifacts around the room. In the case of using lichens mentioned earlier, I broke students into groups of three or four. I used a class demonstration when using bits of limestone collected from the ponds to illustrate the buffering capacity of pond bedrock against acid rain. I first set up a container full of limestone chips at the front of the classroom. We tested the acidity of a water solution and then poured the solution through the bed of limestone. We then collected the water and tested its acidity after its journey through the “bedrock.” Students were amazed to discover the reduced acid level of the water after its journey. At other times, I would simply explain a particular ecological concept and then ask my students to close their eyes and imagine themselves back at the ponds. I would then call upon them to conjure a pond resident (flora and/or fauna) that best illustrated that particular concept.

Last, but not least, the act of guiding and facilitating often meant thinking on one’s feet. This required openness to students’ feedback which, in turn, necessitated an occasional tinkering
with the intervention. For example, when students complained about the constant use of local examples to illustrate ecological concepts, I was forced to search for and use some examples of a more exotic nature. When exploring the concept of ecological succession, for instance, I abandoned any reference to the ponds. Instead, I downloaded a brief YouTube video that examined the formation of the volcanic island of Surtsey off the coast of Iceland. The video then explored the subsequent colonization of the island by pioneer organisms. These occasional “departures from home” led to a delightful discovery. The occasional use of an exotic example actually enabled students to better see that value of a local example to illustrate the same concept. Our use of exotic examples thus became a potent bridge that served to illustrate the powerful capacity of the local to illustrate ecological concepts. In the end, students came to see that “home” could be a pretty cool place.

The above examples illustrate the fact that any teacher wishing to employ a place-based approach must be both willing and able to embrace some new and challenging roles. The good news is that embracing such roles is really quite possible. In fact, a brief look at the frequency chart (see Appendix D.1) suggests that, in some fashion, I assumed the role of a facilitator, guide or broker of community resources in 100% (N = 37/37) of my lessons. This analysis offers us important lessons. To begin with, it suggests that a teacher’s willingness to embrace such roles is essential for the success of any place-based initiative. Secondly, while challenging, acting in these new capacities is quite possible—even within the confines of a high-stakes course. Lastly, one’s willingness to embrace such roles, as we shall see, can add valuable dimensions to students’ educational experiences and one’s practice.

4.3.2 Lesson Emerging from the Particular Attributes of a Place. An important aspect of the place-based approach is its penchant for turning to local phenomena as the foundation for
curriculum development (Sobel, 2005; Smith, 2002a; Smith, 2002b). Using these experiences as a foundation, place based educators can then help their students examine more distant and abstract knowledge from other places. Over the course of my intervention, I soon discovered the ease with which we could situate the lesson within local realities. In fact, the ponds and their surrounding environs provided an excellent context for nearly every ecological concept we encountered. A look at the frequency chart (see Appendix D.1) shows that I was able in some way to successfully integrate this particular element in about 95% (N = 35/37) of my lessons. This was due in large part to our ability to take advantage of pond artifacts to illustrate ecological concepts.

For example, as a prelude to our visit to the ponds, students were given the opportunity to indentify live macroinvertebrates that play a crucial role as indicators of water quality. Students would need to be able to eventually identify these organisms at the ponds if they were to be able to adequately gauge the quality of its waters. With the help of educator Edith Davey, students eagerly handled and identified caddis fly, may fly and dragonfly larvae. This hands-on experience wonderfully illustrates the ease with which we coaxed an important lesson from pond realities. These pond residents provided an additional bonus. As mentioned earlier, they served as excellent examples of individual links in a pond food chain when the time later came to explore that particular concept.

It should be noted that feedback from student journals bore witness to the efficacy of this approach. Time and again students related that seeing and handling live organisms helped make the lesson more interesting and easier to understand. It also served to connect students with content and these connections seemed to help make the learning more memorable. One student explained that working with live macros “helped my learning become more interesting as I
actually got to see the live creature. With seeing things with my own two eyes I can make a better connection to what it is—like a mayfly—and as to what type of pollution it is telling me.” Another student who seldom comes to school shared that “it made it much more interesting and much more exciting when we did more of the hands-on stuff. In my opinion it is much easier learning by hands-on stuff rather than out of a textbook.” Similar sentiments were often expressed by others who struggled with things academic.

This hands-on, pre-pond-visit lesson bore other fruit as well. Students commented that the experience whetted their appetites to actually visit the ponds. Others were inspired to begin exploring their immediate surroundings for evidence of such realities. One student wrote that “after doing that study I took my dog down to West River. When I was there I looked for macros in the water. And I spotted at least twenty of them on a small side of the peninsula. It was really cool!” Another commented that the experience “gave me insight into the pollution of streams in my local area. I already have gone out to the creek in my back yard to look for some macros. I found some crayfish but not really much else.” As we shall see, statements articulating a deeper connection to one’s home ground were to become a common theme running through the journal pieces of many students. I suspect such connections are a fruit of the intervention.

There was an additional and pleasantly surprising consequence of this experiment with live macroinvertebrates. Some students expressed a new-found confidence in transferring the knowledge gained to other situations. One student wrote that “this experience will make it much easier to detect polluted waters or non-polluted waters.” Another commented that “it gives me a good picture image of how I will be able to tell on my own what water is good in quality.” Though not a focus of the current analysis, place-based proponents claim this ability to transfer knowledge from a familiar context to ones newly encountered is a skill often exhibited by
students schooled in its approach (Smith, 2002a; Sobel, 2005). If this is true, then the place-based approach could lay claim to another important outcome: the development of critical thinking and problem-solving skills in students. These journal entries certainly support the truth of that claim. Subsequent action research cycles may shed additional light on the veracity of this assertion.

The ponds also provided opportunities for students to experience another aspect of this particular element. As mentioned earlier, students engaged in a number of tests to gauge the quality of the water in the ponds including the levels of dissolved oxygen, nitrates and phosphates. These particular tests came in handy when we later explored the concept of nutrient pollution. Students were able to use the data they had collected—both to explore the actual concept and to gauge the actual health of this local natural area with respect to that parameter. Student feedback indicated the effectiveness of this approach. One student commented that one benefit was that “students can always link their work in class to the things they experienced at the trip, helping them remember and make sense of the subject better.” A number of student journal entries also revealed an additional benefit: it gave students a feel for the work of a real scientist. One student stated that for her, “the best was water quality. I liked testing with the chemicals. It made me feel like a real ecologist.” Another commented that it was “nice to know that what I did is what real ecologists and other people spend their whole lives doing.”

There are many additional ways our lessons emerged from the particular qualities of these local ponds. One worth noting involves our use of ecological artifacts. While exploring the ponds for “souvenirs” that could later remind us of the role scavengers and decomposers play in the overall health of an ecosystem, we were fortunate to discover the remains of two pond residents: a woodcock and muskrat. We carefully and safely collected the wing of the woodcock
and a portion of the muskrat’s skeleton and returned them to our classroom to be part of our collection. When the time later came to explore these two concepts, both wing and skeleton provided vivid local reminders of important ecological realities. For example, one student mentioned that the use of artifacts like wing and skeleton:

“made the learning of these concepts more interesting in that I can actually visualize what organisms look like, and also plants. It helps me because sometimes I have to visually see what we are talking about so I can see it in my mind when I have to talk about it. I think it is also cool to see what you are studying instead of taking just notes on it and have a boring class.”

Another commented on the wing’s ability to serve as a “pointer” that illuminates an ecological concept. In her journal she wrote:

“the approaches to science that were most interesting to me were looking under a microscope and handling real life artifacts. Looking under a microscope is interesting to me because I think it is very neat to see objects and organisms very close up so you can see the different textures and patterns of them. Holding real life artifacts really is very interesting to me because, for example, holding the bird wing was interesting because I got to mess around with it and see the different size feathers, and figure out where it bends and how big it is when it opens. And……instead of having to try to find the joints just by looking at a picture is much harder than feeling around for them and pin-pointing them with your fingers as well as pin-pointing other things by touch such as tendons.”

This notion of seeing, touching and feeling as an aid to engagement, understanding and retention is one that students frequently mentioned in their journals. Analysis of survey results confirmed these sentiments. For example, 67% (N = 38/57) of students surveys said they agreed
or strongly agreed that using artifacts helped make class more interesting for them. 70% (N = 40/57) agreed or strongly agreed that using artifacts helped make it easier for them to understand the material. 47% (N = 27/57) agreed or strongly agreed that using artifacts helped make it easier to remember the material. 44% (N = 25/57) agreed or strongly agreed that using artifacts helped them feel more confident on homework. 53% (N = 30/57) agreed or strongly agreed that using artifacts helped them feel more confident about quizzes they had taken. 51% (N = 29/57) agreed or strongly agreed that using artifacts has given them a greater appreciation for the place where they live. 56% (N = 32/57) agreed or strongly agreed that using artifacts has given them a greater appreciation for the natural world. And 69% (N = 39/57) disagreed or strongly disagreed with the statement that using artifacts collected at the pond took too much time.

A final note is worth mentioning: I soon realized that the ponds provided an excellent context for learning because of their proximity. It was not uncommon to read journal entries confirming this hypothesis. For instance, students often wrote that the lessons were interesting because we were studying things that “happen right in our area;” or that “happen in our everyday life;” or “because it’s so close to where we live.” In fact a glance at my coded notes indicates the use of the word “local” in over thirty-five different journal entries. Such feedback was heartening to read and has convinced me of both the wisdom and efficacy of using the local environment as a context for learning. It also confirmed what I had long suspected. Like the Sirens of old, the local has incredible power to draw students to the mysteries it hides and the lessons it has to teach.

4.3.3 Deriving Meaning by Connections to Real World Experiences.

Proponents of place-based education argue that connecting students’ education to real
world experience is an excellent formula for guaranteeing engagement with the lesson and positive educational outcomes (Gruenewald & Smith, 2008; Smith, 2002b; Sobel, 2005). Using the ponds and its artifacts as the focus of our ecology unit provided us with many opportunities to connect students’ learning to real world experience. In each case, I discovered that excitement was heightened, engagement guaranteed, and meaning derived in ways I could not have imagined.

For starters, Pond Day itself was an excellent way to connect students to real world experience. Indeed, its major purpose was to provide students with the real world opportunity to explore a nearby portion of the natural world in a hands-on fashion. Taking water samples or scavenging for environmental artifacts brought excitement, engagement, enjoyment and real understanding. Collecting, identifying and counting pond macroinvertebrates as indicators of water quality was another hands-on way in which we tied the exploration of ecological concepts to the real-world. Students’ journal entries often proclaimed the enjoyment they experienced with this approach to science learning. Many mentioned the pleasure they found in learning concepts via a hand-on approach. Others mentioned their appreciation for having the opportunity to leave the classroom in exchange for a real-world lesson. Still others spoke of the enjoyment they experienced learning things “in your own area” or “right near us.” Perhaps one student put it best when he suggested that “using Comstock Ponds is an advantage for our school, in my opinion, because we are learning with our hands right near home which makes it more interesting.”

Not all students were enamored with the approach. In his journal one student suggested that I “pick another day” (pond day was cold and rainy). Another offered that “it was so cold I didn’t find anything interesting!” Two focus group respondents mentioned the weather as the
main reason for their disliking Pond Day. In fact, adverse weather conditions on Pond Day accounted for the second highest reasons mentioned in journals for disliking the place-based approach (see Appendix D.4). Lastly, a student who is quite successful academically informed me that “Comstock Ponds wasn’t that exciting of a place, artifacts weren’t interesting and therefore weren’t memorable.” I think it telling that the most often cited reason for disliking the place-based approach was that these students preferred to learn in the traditional way (see Appendix D.4).

Exposing students to real scientists gave us another opportunity to connect the learning experience with the real world. Educators from Ontario County Soil and Water, the Finger Lakes Institute and Birds of Prey provided students with valuable hands on lessons in macroinvertebrate identification, invasive species and birds of prey respectively. These sessions also provided students with opportunities to engage with and learn from professionals in the field. Journal responses and focus group answers reveal that students found great value in the encounters. Some wrote of the satisfaction they experienced from having the opportunity to learn from these professionals. One focus group participant offered that it was “exciting to see what other people do for a living with regards to real world problems.” Others spoke of learning made easier for having experienced the same material through the eyes of a person other than their teacher. One student suggested that “presenters can’t give you different information but can give you a different perspective.” Others conveyed the satisfaction they felt from working with a professional who “does this for a living.” Finally, one student mentioned a benefit of working with individuals from community or government agencies. She commented that she was “compelled to listen [to the presenter] for it may be something I want to do for a career idea.” However, the use of community presenters also had its detractors. A few journal
responses suggested that some students found the presenters confusing or repetitive (see Appendix D.4).

A final note is worth illustrating. An important method of connecting our learning to the real world was to share the results of our water qualities tests with the Finger lakes Institute. The FLI plans to study the quality of water in local watersheds. They will be offering area students the opportunity to become “citizen scientists” by sampling local waters and sharing their results with the Institute. The Institute will store these results on a data base and eventually make them available to all participating schools.

I made the decision to partner with the Institute because I believed it would heighten student interest and help charge the overall experience with meaning. Evidence from journal entries indicate that students found enormous satisfaction in knowing the fruit of their efforts would eventually be shared with a community organization and their data used to help solve a real life problem. Journal entries give evidence of a number of benefits including students feeling “a sense of importance for having contributed to a solution,” “a sense of satisfaction knowing they were helping people and/or the environment,” and a greater desire to have their data to be the best it could be” because it would eventually be used by a community agency. Of interest to note is the fact that this connection to real world problem solving accounted for the 4\textsuperscript{th} highest reason students listed for why they found the place-based approach interesting to them (see Appendix D.3.A).

These selected examples bear witness to the value as well as the ease with which content can be connected to real world experience. In fact, my frequency chart indicates that when one includes our use of artifacts, we successfully integrated this particular place-based element into about 62\% (N = 23/37) of my lessons (see Appendix D.1). Such results suggest that the tactic of
connecting academic content to real world experiences—and the interest and engagement it generates—is a strategy that could be repeated in any science classroom.

4.3.4 Providing Opportunities for Interacting with Peers. An important characteristic of the place-based approach is its emphasis on creating learning experiences that allow students the opportunity to interact with their peers. Ownership and engagement are more likely to emerge when students have had the opportunity to work with the peers in the exploration of educational concepts (Gruenewald & Smith, 2008; Sobel, 2005).

Over the course of the intervention, my students interacted with their peers in various ways and to varying degrees. The place-based approach facilitated this interaction on a number of levels depending on the nature of the lesson. For example, students worked in pairs when they learned to identify the various macroinvertebrate species. This particular grouping of students was dictated by the space available and the considerable number of macroinvertebrates we had at our disposal. Students also worked in groups of four as we co-constructed lists of possible artifacts to collect on pond day. I felt that groups of this size allowed for the best exchange of ideas between the students. On Pond Day, students worked together in groups of 12-14 individuals to test the various water quality parameters mentioned, identify macroinvertebrates, identify and measure various tree species, and hunt for ecological artifacts. This number was determined by the need for dividing 63 students equally into five groups (the number of stations we had). Upon returning from the ponds students worked in groups of 5 or 6 individuals to process our water test results. These numbers approximated the number of students within a particular class who had shared the same Pond Day grouping.

Over the course of the intervention we took advantage of additional opportunities for peer to peer interactions. For example, students were broken up into groups of three or four students
as we explored the nature of symbiosis using lichens taken from the ponds. Groups of similar size were constructed as we used a lab to explore the effects of the pond’s limestone bedrock to ameliorate the effects of acid rain. Groups of these sizes seemed to work best given the space available and the amount of material with which we had to work.

Student interactions of a different sort took place as well. Students commonly interacted in non-group situations. For instance, a good deal of interaction took place when I first posted pictures of Pond Day on my classroom walls. Students were eager to walk around the room and explore the various photos. Interactions commonly occurred when we took note of individual artifacts and the ecological concepts they embodied. It was quite common for students to gather around me as I held an artifact like the praying mantis or baby snail and, together, we explored its ecological significance. At other times, these artifacts were simply passed around the room from student to student. It was common at such times for students to engage in conversations with the peer to whom they were passing the artifact. Such expressions included both delight and a reluctance to touch a particular artifact (i.e., bird wing).

Suffice it to say that the intervention provided us with many and varied opportunities for peer-to-peer interaction. The nature of the approach (learning in the environment, use of hands-on strategies, reliance on artifacts to reconnect with place) lent itself to the creation of such opportunities and we took advantage of each of them. I believe that such interactions helped create a more meaningful educational experience for my students. In fact, one student commented in his journal that “the ponds make hard topics easy to understand and the best part is that we will all work together to help each other learn.” Another offered that he thought this approach to science education was cool because “we will use everybody’s information.” These comments suggest that our place-based approach helped facilitate student interaction. My
frequency chart (see Appendix D.1) reveals that between Pond Day and our use of artifacts, such peer-to-peer interactions occurred in roughly 50% (N = 17/35) of our lessons.

4.3.5 **Investigation of a Local Issue Important to Community.** Place-based education seeks to integrate the curriculum around the study of place. It attempts to draw on local phenomena as the source of at least a share of students’ learning experiences. The wall between school and community thus becomes much more permeable and is crossed with frequency (Gruenewald & Smith, 2008; Sobel, 2005). Community members can take an active role in the classroom and students can play an active role in the community. From the student’s perspective, this cooperation usually takes the form of tackling a “real life” issue the community is facing and making a contribution to its solution. Such contributions can take any number of forms including the gathering of data and/or the provision of a particular service (Bartsch, 2001; Gruenewald & Smith, 2008; Sobel, 2005). This combination of service and learning seeks to assure that students are meeting intentional learning goals while at the same time addressing significant community needs (Sobel, 2005). The element’s ultimate goal is to make students part of their community rather than passive observers of it (Gruenewald & Smith, 2008; Sobel, 2005).

In the course of orchestrating my place-based intervention, I soon discovered how difficult it can be to find a local issue important to the community. I explored various possibilities with local agencies including the Ontario County Soil and Water Conservation District, Finger Lakes Community College, and even our own Marcus Whitman Eco Program. None seemed to have any pressing problem needing a contribution from a group of high school students. After a bit more searching I discovered that the Finger Lakes Institute was contemplating the creation of a data base of water quality data of various Finger Lakes streams and would welcome any contribution we could give them. This information would eventually be
placed in a large database and shared with other Finger Lakes schools that were intent on making similar contributions. At last I had found my “local issue.” It was not exactly an “in-depth problem,” but I deemed it valuable enough to make students feel like they were involved in the solution of a “real world” problem that had at least some significance to the community. How “important” the issue of the water quality of local watersheds was to the community could perhaps be a matter for debate. I hoped that making a contribution of this nature would allow my students to get a taste for this important component of the place-based paradigm. I also hoped this experience could help them come to understand their labors had significance over and above the simple learning of a concept or the mere earning of a grade.

My hopes were not disappointed. Time and again journal entries bore witness to the fact that, on a number of levels, students’ participation in this aspect of the intervention had made the experience profoundly meaningful for them. As reported earlier, some students wrote that knowing their work would be used by a community agency made them feel good because they were “doing something good for the community.” Others reported that doing water tests made them “want to help more because we are doing the tests for a reason and not just to do them.” Another student noted that their involvement in helping to solve a real life issue made the material easier to remember. One student reported that this part of the intervention made them “feel like I’m a part of the adults and scientists/ecologists because we are collecting data for an organization to actually use and benefit from. I felt like I was part of something in the real world.” Another stated that the experience “made the results I recorded feel meaningful and important. Instead of just recording results for the sake of learning, I feel like I may be actually contributing to the efforts of a community agency. Our results are just one less thing these agencies have to do, so they can focus on other areas which need solutions.” Still another
student offered that “it’s cool because even a little place in the middle of nowhere like Marcus Whitman is going to get noticed by doing something. That’s why I think it’s cool.” Another student offered that knowing their data would be used made them “try to be as correct as possible because if you are not, others may be affected.” Another student mentioned the importance of collecting real life data for the knowledge it could give him about his own local environment. He wrote that “it’s like I want to live here when I am older, so yeah, it’s important to know what the water is like.” Yet another commented on the excitement they felt about collecting real world data because “when I have a kid and if I am still around I would like my kid to see what it looked like back then.” A final example from a journal entry insightfully captured what I suspect many of my students felt. The author of this particular entry stated:

“…..instead of doing the activities for a grade you do them because they mean something. Knowing they would be used as data made me focus more, and make sure the data was the best it could be. Knowing the data was going to be used made me more interested and focused in getting correct data to solve a real-world [sic] local problem”.

An additional benefit should be noted. A number of students confided that the experience was positive because it made them feel like real scientists. One noted that being involved in the solution of a real problem “actually made me feel like I’m a part of the adults and scientists/ecologists as we are taking all the water qualities for an organization to actually use and benefit from. I felt like I was part of something in the real world.”

A final bit of evidence is worth mentioning. As mentioned earlier, analysis of journal responses indicated that the opportunity to connect to the real world in this fashion was the 4th highest reason mentioned for students being interested in the place-based approach (see Appendix D.3).
While each of these testimonies bears glowing witness to the positive effects of that an opportunity for community involvement can have on students, the approach was not without its detractors. One student complained in her journal entry that the idea of community involvement was an “iffy” proposition. While she did say that she felt “kind of accomplished by helping them,” she quickly countered by adding “but it does not make me want to go jump in below freezing water happily to get water samples for a dissolved oxygen tests!” Another student complained that the knowledge that our results would be used by a community agency would actually make their experience “less interesting because it will make me feel pressured to try to impress the community agencies.” Such comments illustrate the important fact that no approach will appeal to every student. In the end, however, focusing on a local issue important to the community was a powerful way to engage my students in the study of ecology.

Unfortunately, the magnitude of the problem we considered wasn’t enough for it to become the central focus of the intervention. Because of this, my frequency chart shows a 30% (N = 11/37) capture rate (see Appendix D.1). However, as I shall later demonstrate, this aspect of the place-based model made the educational experience of many students much more interesting and meaningful even if its contribution may have been humble. Therefore, it deserves an important place in any arsenal of strategies to teach science education.

4.3.6 Fostering School-Community Partnerships. Place-based education seeks to foster connections between schools and the communities they are a part of (Smith, 2002a). Along with connecting students to their communities, place-based educators are encouraged to invite the community into the classroom where it can take a more active role in students’ education. Its aim is to link community resources with the needs of the school (Sobel, 2005). Seen in this light, students and teachers enter into a collaborative enterprise with community members, government
agencies and community organizations with an eye towards learning about the social, political, economic and ecological environments right outside their door. In this way the place-based approach seeks to make a contribution not only to the education of students but to the enhancement of the social and natural environments in which they live (Gruenewald, 2003a; Gruenewald & Smith, 2008; Sobel, 2005).

Over the course of my intervention, I forged partnerships with a number of community organizations. These included the Ontario County Soil and Water Conservation District, Finger Lakes Community College, the Finger Lakes Institute and Birds of Prey. Partner contributions varied in the types of participation, including in-school presentations, on-site help on Pond Day, the loaning of valuable equipment, the provision of guidance for a particular pond day station, and the provision of ecological expertise in discerning the cause of a large die-off of fish just prior to our scheduled visit to the ponds. The nature of these partnerships also varied in the significance of their contributions to the intervention’s final outcome. My records indicate I was able to make some form of a community connection in 27% (N = 10/37) of my lessons (see Appendix D.1).

For example, Edith Davey, an educator with the county Soil and Water Conservation District, visited my classroom on two separate occasions. Her first visit focused on introducing students to the concept of watersheds, while her second visit centered on a hands-on exploration of live macroinvertebrates. Journal passages and answers to focus group questions bear witness to the invaluable contribution she made to the overall success of the intervention. As mentioned previously journal entries also revealed the fun and excitement generated by the opportunity she provided many students to explore the macroinvertebrates in a hands on fashion. A number of students indicated that the hands-on and eyes-on opportunity to work with live macros generated
a good deal of interest and excitement. One student mentioned that “live specimens provide me with examples as live as they come. Also, because they were living, it made them more memorable for me.” Another offered that “seeing with my own eyes helped me make a better connection to these organisms.” Still others suggested that the insights gained from such an approach heightened their ability to discern water quality in their own neighborhoods. One student wrote that handling the live organisms “made the learning very easy and understandable to me. This experience will make it easier to detect polluted waters or non-polluted waters.” Other students mentioned a greater degree of connectedness to their own ecological home ground as a result of their hands-on investigation. Another offered that the approach “gave me insight into the pollution of streams in my local area. I already have gone out to the creek in my back yard to look for macros.”

Conservation professor John VanNiel of Finger Lakes Community College provided invaluable input into the nature and structure of the scavenger hunt we were to conduct on Pond Day. He was also scheduled to be one of the group leaders of this hunt, but inclement weather on the day of our scheduled visit forced a cancellation of the trip. Unfortunately, prior commitments kept Professor VanNiel from participating on the day we eventually visited the ponds. Such prior commitments also prevented other adult helpers from the college from participating in pond day. The college, however, was able to provide additional help in the form of the loan of important water quality test kits. The loan of this equipment insured we would have enough kits to complete our important testing of the various water quality parameters.

Sheila Myers, an educator with the Finger Lakes Institute, visited our class and explored the concept of invasive species. Her place-focused lesson centered on problems occurring due to the unintentional introduction of zebra and quagga mussels into the local (Finger Lakes)
watershed. As mentioned previously, Ms. Myers also graciously provided my students with an opportunity to contribute a portion of their water quality findings to the forthcoming database the Institute will be establishing. Journal entries mentioned in the previous section attest to the significance of this opportunity—one that proved to be what I feel is the most powerful aspect of the entire place-based experience.

Lastly, Mr. Ron Walker, of Birds of Prey, visited our school with his incredible live birds-of-prey demonstration. Through his unique and exciting contribution, my students were introduced to some fascinating avian predators that reside at or around Comstock Ponds. Such exposure served to make the concepts of predator and prey come alive for many students. It also prepared them for a deeper exploration of other ecological realities that the ponds might reveal to us.

Each representative made important contributions to the overall success of the enterprise. Student feedback revealed their impact on a number of levels. The participation of community presenters in our intervention had a number of additional effects on the students they contacted. Already mentioned was the fact that working with these outside professionals made some students feel like real scientists and helped them see what other people do for a living; it actually gave them career ideas. A number of students also commented on how nice it was to know that what they did is what real ecologists and other people spend their whole lives doing. Others mentioned the pleasure that exposure to working professionals gave them “because they know what they’re talking about; I’m getting info from people who do it for a living.” One student mentioned that the community presenters made ecology concepts “a lot easier to understand and a lot more fun.”
As with other aspects of the intervention, some students took issue with the alleged contributions made by these outside educators. One student suggested that presenters “just make things more confusing for me……you tell us one thing and they tell us something totally different. It makes it harder for me to understand what is being taught than it should be.” This sentiment was echoed by another student who claimed that while engaging with community people was fun and exciting (because it took students out of their everyday learning experience), it was “also confusing for us to hear something on the same topic that we were doing in class but explained to us in a different ways.” Lastly, one student pleaded that I “please stop…..you’re boring us to death with guest speakers reinforcing macroinvertebrates as bioindicators!”

Not every student was enamored with my attempts at fostering school-community partnerships. These “negative” comments will be embraced with an appreciation for the positive feedback they can provide. However, I believe that the overall effect of this attempt at school/community synergy was a very positive one for the majority of my students. The majority of journal comments and focus group answers all confirm the powerful potential “community” involvement can have in contributing to the richness of an individual teacher’s practice and the educational experience as a whole. As we have seen and shall continue to see, such involvement can help connect students to both their human and non-human communities in very powerful ways.

4.3.7 Engaging Students in Authentic Work. A major aim of the place-based approach is to make education more meaningful by introducing concepts and skills in a realistic context and not in a manner that is isolated, disconnected, imaginary and abstract (Gruenewald & Smith, 2008; Smith, 2002b; Sobel, 2005). This strategy, in turn, can increase enthusiasm and lead to a greater degree of engagement and more authentic learning (Gruenewald & Smith, 2008; Sobel,
I believe that adding a place-based approach to my practice has lent a high degree of educational meaningfulness to our study of ecology. A glance at my capture chart shows a frequency rate of 92% (N = 34/37) with respect to capturing this element over the course of the unit (see Appendix D.1).

The ways in which the approach has added meaning to students’ educational experience are many and varied. Aspects of the approach previously cited (working with biology professionals, learning in their real-world setting, collecting data that will be used to help solve a real world problem) gave students the opportunity to act like real scientists and see what real scientists do. Statements like “I got to experience everything firsthand and see what it’s really like to be a biologist”, and “we can see what we’re talking about…..it’s not just empty words, or notes on a piece of paper…we can relate to what we’re learning and use it in real life” are testaments to the fact that many students were able to harvest meaning from their activities. They also suggest that for many students, the approach helped put the very nature of science at the heart of the intervention. I suspect that any science educator would be delighted with such an outcome as the fruit of her/his daily practice.

As indicated earlier, other students related that the opportunity to use their home ground as the context for learning ecological concepts had a profound effect on their ability to understand the material and to feel a deeper connection with the world around them. One wrote that “the visual examples and things are right around here….so it gets us a little more interested in it knowing that it happens in our own area.” Another stated that the approach was riveting “because Comstock ponds is right here where we live…..because it is so close to where we live that when we go outside at our own houses we pick up on the interactions in nature that interest us and we study these interactions outside of class [italics mine].” Still another claimed that
“everything I have learned about ecology has stuck in my head because this experience was so interesting to me. Now I know that all the things we have studied about ecology are all around us.” Finally, one student shared that

“Comstock Ponds is an area within the ecosystem which I am part of, which makes it more meaningful. Also, using artifacts from this nearby area made ecological concepts more interesting. It showed me that everyday artifacts, which I am familiar with, can easily be applied to “big picture” scientific concepts.”

Understandably, this approach had its detractors. One student complained that using a local focus to study ecology was “not that interesting because it made it harder to concentrate on notes.” Another protested that “I like taking notes rather than relating to pictures (artifacts). I would rather receive a worksheet to do after taking notes. Also, I feel that notes are better because when you study for tests I feel more prepared.” Still another complained that “this pond stuff is really dousing the flames! We are too far behind Mr. Fiori (another Living Environment teacher).” Another disgruntled individual protested that “I just don’t see fascination in a plant or animal.” One focus group participant informed me that our focusing on an authentic local setting was meaningless to her because she was not a native to the area and had no intentions of remaining there when she graduated. Another stated that she would much rather focus on exotic places than her own backyard.

It is often said that education is about meaning-making (Driver, Asoko, Leach, Mortimer, and Scott, 1994; Saunders, 1992). The above evidence strongly suggests that focusing on local realities relevant to students’ lives can add a great deal of meaning to a science lesson. This experience has taught me that the authentic can add relevance to educational experiences. Relevance, in turn, can add meaning and meaning can translate into enthusiasm, engagement,
understanding, retention, and, as we shall later see, a greater sense of academic confidence. Over the course of this study I have found that adding this element of the place-based recipe makes the educational experience more meaningful, both for many of the learners and the individual facilitating that learning. As such, it deserves a place in any science educator’s arsenal of teaching strategies.

4.3.8 Connecting Students to Their Communities. As we have seen, the place-based model encourages the use of the community and local places to enrich the curriculum. Ideally, students encounter learning experiences that arise from local contexts. Along the way, they are learning they have the capacity to use their minds and energy to make contributions to their communities that are valued by others and promise to improve people’s lives. We have witnessed some powerful ways in which such contributions can make education more meaningful. Proponents contend that when practiced as intended, the place-based approach can also serve to more deeply connect students to both the human and non-human communities in which they live (Gruenewald & Smith, 2008; Smith, 2002a; Sobel, 2005).

My analysis of the data reveals that my intervention served to connect students to their community in a number of ways and on a number of levels. For instance, journal responses and anecdotal statements by various students suggest that participating in the intervention had given them a greater appreciation for, and deeper connection to, their own neighborhoods. For instance, one student wrote that “the positive side to this approach was the fact that it was right in our own backyard as you stated which made me more in-tuned into what was being taught. The reason that I felt it was a good approach is because Comstock Ponds is a lot like our own environment at home. When I was home I could relate to examples we studied at Comstock Ponds. I find things at home that would make me think of class and our ecology unit.” Another
student wrote that the experience at the ponds gave him “insight into the pollution of streams in my local area. I already have gone out to the creek in my back yard to look for some macros. I found some crayfish but not really much else.” In another journal entry the same individual exclaimed that “when I go outside now, I see biology everywhere!”

Survey results are illuminating with regards to community connections. 60% (N = 34/57) of respondents surveyed agreed or strongly agreed that visiting Comstock Ponds had given them a greater appreciation for the place where they live. 65% (N = 37/57) agreed or strongly agreed that visiting Comstock Ponds has given them a greater appreciation for the natural world. In addition, 51% (N = 29/57) agreed or strongly agreed that using artifacts has given them a greater appreciation for the place where they live. 56% (N = 32/57) agreed or strongly agreed that using artifacts has given them a greater appreciation for the natural world (see Appendix D.2).

Such journal statements and survey responses illustrate a deeper connection to and appreciation for one’s own ecological community; however, other connections also occurred. When a student wrote that contributing water quality results to a community agency “made me feel like I’m part of the adults and scientists/ecologists as we are taking all the water qualities for an organization to actually use and benefit from…I felt like I was part of something in the real world.” I believe he was expressing a connection of different sort—the connection he felt to the community of professionals who work to insure a cleaner environment for everyone. Another connection often mentioned by students was that of feeling good about being able to contribute to the solving of a community problem. Because of their experience, they could now feel good about doing something for the community. For example, one student wrote that contributing data to the Finger Lakes Institute “makes me feel like I did something good for the community. This has made the study of ecology much more interesting for me because I know that my research
will be used in a community agency.” Another student offered that “I like helping people and
the environment, and contributing to solutions.” These statements reveal that the place-based
approach had facilitated a deeper connection between a number of students and the wider human
community around them.

Other kinds of connections were articulated as well. One student wrote that collecting
data to help solve a community problem was important because she wanted to “live here when
I’m older.” Another mentioned that contributing data was “very exciting because when I have a
kid and if I am still around I would like my kid to see what it looked like back then.” Both
students are expressing important connections to their own futures.

An interesting connection of a very different sort occurred as well. After visiting the
ponds, a young woman wrote in her journal that she “had not even been aware that there were
[environmental] issues!” Such statements indicate a surprising and unanticipated consequence of
this experience: it served to make students more aware of and become more in tune with some of
the environmental issues of their day. The fact that such issues were occurring in their own
neighborhoods represents another cord connecting students to their ecological communities.

A final word is appropriate. Throughout the intervention students would often bring
personal artifacts to class from their own property or neighborhood. One student brought in a
bag of items including leaves, lichens and seeds she had discovered walking through a nearby
park. Another student brought in the skin a snake had recently shed. Still another told me he had
acquired the habit of “really getting into nature and examining the natural world around him.”
He told me that he liked to “pick up leaves and see where they have been eaten or are falling
apart; or look at flowers.” He thought “it might be cool to bring in a leaf and put it under the
microscope, or maybe check out the woodcock wing to see if it was infested with mites!” Stories
such strongly suggest the power of the place-based approach to connect young people to the human and more than human world around them. In fact, this creative use of place-based pedagogy (including artifact use) served to foster connections with students’ community (the ponds, their own neighborhoods, local professionals, their own futures) in about 92% (N = 34/37) of our lessons (see Appendix D.1). The existence of such connections is a profoundly positive reason for employing this approach in one’s practice. My intervention was worthwhile, if for no other reason than it helped many students feel more connected to the places in which they live.

4.4 Research Question Two: Impact on Student Interest. Place-based proponents claim that a real strength of the approach lies in its ability to revitalize students’ interest in learning. They feel that its potent combination of local focus, hands-on activities, community involvement, authentic problem solving, teacher as guide, co-learner, and broker of community resources and learning possibilities, and the ability of the approach to fit and address local needs is a sure-fire recipe for piquing students’ interest (Smith, 2003a; Sobel, 2005). My data support this particular claim, showing that the place-based approach adopted in my intervention impacted many students’ interest in very positive and meaningful ways.

Evidence supporting this claim includes:

- students’ desire to explore their own backyards (as articulated in students’ journal responses);
- students bringing in artifacts from home (a frequent occurrence during the intervention);
- students’ revelations that the approach has helped them feel like ecologists/biologists (as articulated in journal responses);
- students’ expressing awareness of their ecological surroundings (articulated in journal responses).
• students suggesting particular websites to illustrate a concept we will be studying (unsolicited suggestions concerning certain upcoming topics);

• students desiring to take another trip (or two!) to the ponds (often articulated prior to classes);

• students remaining after class to ask questions about particular artifacts (frequent occurrence at end of classes);

• students from other Living Environment classes coming in and asking me questions about artifacts (occasional experience during the changing of classes);

• students expressing humor and joy upon seeing themselves in pond day pictures hung on classroom walls (frequent pre-class experience and during class discussions of particular artifacts they had collected);

• students approaching and examining these same pictures as they enter room for class (daily occurrence);

• students visiting and handling artifacts placed on the “please touch” table at the rear of classroom (daily occurrence);

• students suggesting other uses for pond artifacts (in response to journal prompt);

• students readily and quickly using pond examples when fielding questions in class (frequent in-class occurrence);

• students glancing at each other with pride when an artifact their group collected was held up as an example in class discussions (common classroom experience);

• and students being willing to stand before the class and explain the nature of a particular artifact they brought to school for extra credit (infrequent classroom occurrence).
Survey responses also indicate a high level of interest—in Pond Day, the use of artifacts and community presenters, and the overall approach in general. More specifically, 70% (N = 40/57) of students queried agreed or strongly agreed with the statement that “visiting Comstock Ponds has helped make class more interesting for me.” 67% (N = 38/57) agreed or strongly agreed that “using artifacts from Comstock Ponds has helped make class more interesting for me.” 74% (N = 42/57) of respondents agreed or strongly agreed with the statement that “overall, I think this approach to science education (working with community organizations, visiting the ponds, using pond artifacts) is a good way to learn ecology concepts.” 67% (N = 38/57) disagreed or strongly disagreed with the statement “I would rather learn ecology concepts some other way” (for example, by listening to my teacher lecture and give us notes and worksheets; by watching a video, etc.). Lastly, 70% (N = 40/57) of students questioned agreed or strongly agreed that “overall, my experience with using this approach to science education has been a positive one” (see Appendix D.2 for summary tally of survey responses).

Time and again student journal responses reveal the reasons for such high interest levels. They included:

- the hands-on nature of the approach;
- the eyes-on nature of the approach;
- the use of a local setting to explore and explain ecological concepts;
- the opportunity to help in the solving of authentic environmental issues;
- the connections encouraged by the attachment of concepts to students’ home grounds;
- the opportunity to interact with and act like environmental professionals;
- the use of live examples (macros) to explore ecological realities;
- the opportunity to apply learning to immediate realities;
• the opportunity to leave the classroom;

• knowing that concepts students studied happened “right in our area”.

• the use of artifacts to embody a concept and reinforce its understanding.

Analysis of journal responses reveals the reasons most often mentioned for heightened interest included:

• Hands-on nature of the approach = 24% (N = 30/127)

• Eyes-on nature of the approach = 21% (N = 27/137)

• Learning connected to a local setting = 19% (N = 24/127)

• Learning involved a real-life problem = 17% (N = 22/127) (See Appendix D.3 for more details).

Such reasons were commonly articulated in students’ journal entries. For example, one student wrote that:

“This approach to science education was interesting to me. The most interesting part was using a local habitat to explain these ecological concepts. In the past we had never focused on any place so close to where we live. We might have focused on a far away area or no area in particular to learn scientific concepts. Comstock ponds is an area within the ecosystem which I am a part of which made it more meaningful. Also, using artifacts, which I am familiar with, can easily be applied to big picture scientific concepts.”

Another student offered that:

“Live examples make material easier to comprehend (macros and artifacts). By making biology class more visual I can understand our environment. I like these methods better because I can relate to a place. Also, I can remember information more clearly.” Yet another student
explained that our use of environmental souvenirs helped make her learning experience more interesting. She wrote that:

“looking at artifacts and pictures from Comstock Ponds was very interesting to me. By this we could see all the different aspects of ecology at once. Since we found the artifacts ourselves, I will remember what each individual represents or does….”

Finally, one young man shared that:

“using hands-on activities has helped my brain grasp the concept of ecology much better than just sitting in a classroom. The topic is more concrete, and like they say, a picture (being outside and seeing it with my own eyes) is worth a thousand words. Not only do you remember the concept better, but also attach your knowledge to your own everyday life….like the woodcock and goldenrod.”

Such statements clearly indicate a heightened interest on the part of many students. It was a wonderful reward for having approached science content in this creative and unique way. These findings imply that a locally focused, hands/eyes-on, problem-specific approach is a sure-fire recipe for getting many students excited about science content. Therefore, I believe that such an approach merits a place in every science classroom.

4.4.1 Enhancing Engagement. A basic tenet of the place-based approach is that it increases enthusiasm and engagement with learning (Sobel, 2005). The many examples provided attest to the fact that many of my students were not only interested but also enthusiastically engaged in the lessons in which they participated. Many aspects of the intervention already mentioned and explored contributed to this heightened sense of engagement. These included:
• placing the learning in the context of a real world environment close to students’ home ground;

• offering opportunities to work with environmental professionals;

• the knowledge that test results would eventually be used to help solve real world problems;

• and, providing students with an authentic, hands-on learning opportunities (water quality testing, macroinvertebrate identification, scavenger hunting) that helped them experience the life of an authentic scientists).

Each of these authentic educational experiences played a role in enhancing the engagement of my students. A particularly telling comment was that of the student who wrote that “the use of a local, natural site to study ecology was quite engaging and will often leave a child curious for more.” Another excited student emphatically wrote that: “going to the ponds and listening to guest speakers helped me learn more about ecology that I ever have in my whole life!”

I believe such engagement was nurtured by the nature of the intervention. Many journal entries proclaimed the attractiveness of the place-based (i.e., locally focused, hands-on, real issues) approach with respect to the issue of engagement. These experiences bred interest and I suspect that engagement was simply the daughter of this interest. For example, one student wrote that the approach was interesting because: “you get to deal with the real life stuff and to see it up close.” Another offered that using:

“live examples make the material easier to comprehend. By making biology class more visual I can understand our environment. I like these methods better because I can relate to a place. Also, I can remember information more clearly.”
Most heartening to me, and perhaps the most important discovery of the entire experience, was the intervention’s apparent ability to engage “uninvested” students. These are students who for personal reasons (ability, problems with family life, emotional concerns, etc.) are frequently absent from school and/or unwilling to put forth the effort needed to be successful in science. In journal entry after journal entry, however, one could detect a common theme: this approach grabbed their interest, and that interest seemed to lead to engagement. One student wrote that the approach was more interesting because: “we used examples of such concepts that we as human beings encounter in our everyday lives.” Another wrote that the approach interested him

“because Comstock Ponds is right here where we live. Because it is close to where we live that when we go outside at our houses we pick up on the interactions in nature that interest us and we study these interactions outside of class” [italics mine].

Still another commented that: “my experience at the ponds has given me a reason to explore my own backyard and stream.”

As previously stated, this notion of closeness or nearness was a powerful attractant for many of my students, but these disaffected students in particular. It was the one most often mentioned in journal entries. I suspect the attraction for this type of student was the fact that we taught in the environment rather than about it (Greuenwald & Smith, 2008; Sobel, 2005). This was possible due to the ability of the place-based approach to offer experiences that are nearby, activity-based, concrete and practical. Experiences of this nature tend to provide such students with the grounded experience they need to develop abstract skills. I have already stated my belief that an unfortunate consequence of the standards movement has been the promulgation of practices that are ineffective for large numbers of students. It is interesting to note that the
majority of negative feedback I have received about the intervention has come from those of my students who tend to do very well in class. In fact, the reason most often mentioned in journal responses for why students disliked the approach was that they learned better a different way, that is, the traditional “school” way (see Appendix D.4). Perhaps approaches that are activity-based, concrete, and practical take such students out of their comfort zone. These findings suggest that place-based education has the potential to transform the very nature of schooling. Although it was not the focus of this study, reaching unengaged students through the place-based paradigm is a benefit that may deserve further exploration.

The stories recalled thus far illustrate the power of the place-based approach in enhancing interest and engagement. Performance, however, is another story. We have noted that interest appears to be the mother of engagement; but is engagement the mother of performance? We will explore this issue in another section of this chapter. For now, suffice it to say that the higher level of engagement witnessed likely translated into a higher degree of academic confidence.

These testimonies bear powerful witness to the inherent power a place-focused approach can have in generating interest in many students who practice it. I believe that such interest was the cornerstone of the intervention’s success. Students’ excitement with the approach gave birth to that interest. The fact that many of them found it to be fun was helpful as well. This interest, in turn, seemed to generate a deeper level of engagement which led to an apparently higher level of comprehension and understanding. I believe this deeper level of comprehension generated a higher level of retention which was probably responsible for a higher degree of academic confidence.

4.5 Research Question Three: Impact on Perceived Student Performance. While place-based education bucks the trend toward standardization and high-stakes testing, it does not eschew
academic achievement and improved test scores (Sobel, 2005). In fact, place-based proponents argue that the deeper level of engagement and more authentic learning engendered by the approach enhances understanding of course material and thus paves the way for higher levels of academic success (Glenn, 2000; Lieberman & Hoody, 1998; Sobel, 2005).

The constraints of my intervention prevented a thorough investigation of the degree to which the approach could affect actual student academic performance. Too many uncontrolled variables precluded an honest assessment of its effects relative to the students in other Living Environment classes not using the approach. A cursory comparison of unit test scores with another teacher who covered the same material without using a place-based approach revealed that, on average, my students scored at a higher level. Any conclusions that could be drawn from this comparison, however, are suspect as I could not control for the age and ability levels of students in both classes, teaching pedagogies used, amount of review for the test, and even the actual test questions used (we both used a few different test questions). Thus no reliable quantitative conclusions can be drawn about the effects of the place-based approach on students’ actual academic success at the time of this study.

However, I was able to examine the effect of the approach on students’ perceived academic success. By perceived success I mean the extent to which the approach helped students feel more confident and ready for any assessments (including homework, quizzes and tests) they were assigned. In examining responses to survey questions, answers to journal prompts and answers to focus group questions, it is apparent that engagement in the intervention led to a higher degree of academic confidence on the part of my students. Analysis of data reveals that the unique aspects of the approach made many students report a deeper understanding of the material. Many also felt this comprehension, in turn, generated a greater ability to retain the
information. This ability to remember appears to have given birth to a greater degree of confidence.

For example, 70% (N = 40/57) of students agreed or strongly agreed with the statement that “visiting Comstock Ponds has made it easier for me to understand the material.” Seventy percent (70%) (N = 40/57) also agreed or strongly agreed with the statement that “using artifacts gathered from the ponds has made it easier for me to understand the material.” In addition, 63% (N = 36/57) of respondents agreed or strongly agreed with the statement that “visiting Comstock Ponds has made it easier for me to remember the material.” Forty-seven percent (47%) (N = 27/57) of those questioned agreed or strongly agreed with the statement that “using artifacts gathered from the ponds has made it easier for me to remember the material.” Moreover, 43% (N = 24/57) agreed or strongly agreed with the statement that “visiting Comstock Ponds has helped me feel more confident on the homework I have been assigned.” Equally, 44% (N = 25/57) of students agreed or strongly agreed with the statement “using artifacts gathered at the ponds has helped me feel more confident on the homework I have been assigned. Additionally, 44% (N = 25/57) of students agreed or strongly agreed with the statement that “visiting Comstock Ponds has helped me feel more confident about the quizzes I have taken.” Finally, 53% (N = 30/57) of respondents agreed or strongly agreed with the statement that “using artifacts gathered at the ponds has helped me feel more confident about the quizzes I have taken.”

These results beg an interesting question. A large percentage of students maintained that visiting the ponds and using artifacts gathered from there facilitated their understanding and retention of the material. However, a smaller percentage reported that these same experiences facilitated their feeling confident on homework assigned or quizzes taken. Why the discrepancy?
I believe the answer lies in my own failure to assign homework and/or administer quizzes in a timely fashion following these experiences. The fault is not entirely mine. I have not taught a Living Environment course in over twenty-five years. The rigors of planning lessons and developing curriculum, along with my continued attempts to determine best practices regarding the planning and delivery of various aspects of the intervention, often precluded my adequately planning for the timely provision of homework and quizzes. Hence, students were not allowed the benefit of using their experiences on such assessments as often as I would have liked. It is heartening to note the results of an artifact recognition quiz administered toward the intervention’s conclusion. This assessment was designed to test the degree to which students could match an artifact with an ecological concept. Students were asked to use their notes and construct a list of ten ecological concepts they felt they understood fairly well. They were then challenged to walk around the room and match the concept with an actual artifact (or picture of an artifact) that embodied that particular concept. A total of 63 individuals took this test, and the results revealed that students successfully matched a concept with an artifact 85% of the time. This outcome suggests that the learning strategies we used *did* help many of my students feel more academically prepared. Proof of this fact may have been more evident had assessments followed more quickly on the heels of a particular lesson.

In view of this reality I am actually impressed by the relatively high percentage of students who *did* maintain that such experiences had a positive effect on their perceived readiness for homework assignments and quizzes. I suspect that with the benefit of experience (in pedagogy, content and intervention design and implementation) efforts in subsequent years will provide for the timely delivery of such assessments.
That being said, journal comments provide further evidence that many students felt the approach helped them feel a greater degree of confidence. The reasons most often mentioned include:

- the hands-on nature of the approach = 25% (N = 26/104);
- the eyes-on nature of the approach = 21% (N = 22/104);
- the collection and use of artifacts = 17% (N = 18/104);
- use of local setting = 11% (N = 12/104).
- pond day itself = 10% (N = 10/104). (see Appendix D. 3 for more details).

A look at some responses sheds additional light on these findings. Reasons include:

- the hands-on approach made things more interesting so it was easier to learn and remember the material;
- the eyes-on nature of the approach gave students an opportunity to touch and see objects and materials, and such feeling and visualizing led to better understanding and retention;
- the hands-on and “eyes-on” approach made it easier to stay focused which, in turn, made it easier to remember;
- learning/doing via a hands-on approach was easier, more fun, and more interesting—all of which helped students remember and so feel confident about upcoming assessments;
- the use of environmental artifacts to embody ecological concepts helped students to better “see” and thus grasp content and remember it, thus the artifact could be used as an example on an assessment;
- the approach made it easier to relate to concepts and thus helped understanding and retention;
- in summation, as one student expressed it: “it was interesting so it made it easier to learn so I will remember it for tests.”
When asked in what ways our visit to the ponds helped them feel better prepared for quizzes and tests one student answered:

“when asked for real examples of an ecosystem, I just imagine myself at the ponds from the pictures I’ve seen and it helps me to come up with the best and most realistic answer.”

Another offered that:

“going to the ponds helped me remember everything better because I can apply everything we learned to stuff around me like our neck of the woods. So with test questions I can change the answer to where it’s something I’m use to. It also helped me remember because I got to experience everything firsthand, and see what it’s really like to be a biologist.”

Yet another student explained that getting ready for tests was easier now:

“because we ourselves are being ecologists, studying populations, communities and the ecology itself. Through this method it’s easier to memorize things; and because we can relate them to real life, and because we have our own original examples, it makes taking quizzes very simple.”

When asked about the ways in which our use of artifacts helped them feel more prepared for homework, quizzes and tests one student offered that:

“instead of just sitting in class and listening to the teacher talk and us take notes it gave us more of a visual concept to work with. It made me pay more attention so I knew what I was doing on assessments. Also, I felt more prepared because the things we learned stuck more easily in my mind since it was more hands on and visual….it helped me remember.”

Another commented that:
“it (the use of artifacts) has given me a good idea and it leaves a picture or feeling in my mind [italics mine] after being able to see it or to touch it. What I mean is it helps me learn better and remember more about what we are leaning because I get to do hands on stuff instead of just taking notes.”

The following journal entry perhaps best captures students’ perceptions about the approach’s ability to help them feel better prepared in an academic sense. I include it here both as an example of one student’s insight and to also illustrate what I feel is a wonderful summation of the powerful effect this approach can have on the perceived academic success of many students. This student wrote:

“The hands-on learning makes the lesson a lot easier to comprehend. If the lesson is easier to learn it makes it easier to remember it and use it in the future. This way of teaching also helps me feel more prepared for quizzes and tests. Being able to recall the information on a test can be the deciding factor between passing and failing. With the hands-on approach to this topic the information seems to get glued in your mind; whether or not you use it all the time, it’s there for you when you need it. On a test this information could be crucial to passing. If we learned this lesson with a book the information would not be as easily remembered.”

The above evidence shows that many students felt that our use of a hands-on, locally focused and problem-centered approach to science curriculum helped them feel more confident with respect to their academic tasks. In view of these findings, I would encourage my fellow science educators to implement at least some aspects of the place-based approach into their practices.
4.6 Research Question Four: Implementation Costs. Proponents of the place-based model recognize the challenges facing educators who want to experiment with some or all of its elements. Many of these challenges are deeply rooted in the current grammar of schooling (practices, structures, and philosophies) commonly encountered in American schools (Smith, 2002a; Nichols & Berliner, 2005; Settlage & Meadows, 2002). For educator Gregory Smith (Smith, 2002a) these challenges include:

- the need for teachers to create curriculum rather than dispense curriculum created by others;
- the need for everyone to set aside assumptions that “legitimate learning” occurs only in classrooms;
- the need to make the connection between the unpredictability of out-of-class experiences and student performance standards set by the district or state;
- the need to find the time to employ creative pedagogy in the face of accountability;
- the need for parents to accept alternative measures of academic success;
- the need for the community to see itself as an important partner in the education of its children;
- the need for adults to see students as capable of making valuable contributions to community well-being.

Indeed, I did experience a number of costs/challenges associated with the intervention as reported in detail in this section. For ease of understanding, I have grouped these costs into three major categories: time, emotion and energy. It should be noted that there was often significant overlap between these categories. For instance, things that were time consuming or that demanded a good deal of energy were often emotionally taxing as well.

To begin with, the approach can be quite time consuming. Issues that need addressing
include things like obtaining parental permission, scheduling buses, finding adult chaperons, informing other teachers that students will be missing a day of class, finding equipment, insuring students have proper medications, and setting up and tearing down the field trip site. Our preparations also included enlisting the help of community agency experts, assigning students to pond-day groups, co-constructing lists of artifacts to collect and properly prepping students for the pond day tests they would eventually take.

Identifying an important local concern and a community and/or government agency or agencies willing to partner with a school district in exploring a solution may not be easy. It may be time consuming as well. Problems that lend themselves to this approach may be few and far between, and one may have to settle for a smaller issue or be willing to create an issue from the material at hand. After a good deal of fruitless exploration, our solution involved creating a question about a local habitat that students could investigate. In our case, the question we asked centered on the overall health of an aquatic ecosystem. We were fortunate in that a portion of the water quality data we collected was valuable to a community agency that eventually planned on studying the health of many streams in the area. As we have clearly seen, this aspect of our intervention added a great deal of interest and meaning for students.

Another, more subtle, energy-related cost was the enthusiasm required to sell students on the idea of the place-based approach. As some journal entries have shown, many students are perfectly comfortable with the “teacher as expert and student as learner” approach to education. I suspect that asking such students to embrace a hands-on, investigative, out-of-classroom approach to education that positions the teacher as facilitator and guide represented a significant educational “culture change” that took them out of their comfort zone. These students seemed to resist and yearn for the “good old days” when all they had to do was remember the notes from
the board! I suspect that such resistance may be encountered by any teacher who sets out to integrate some place-based elements into their practice.

The next type of emotional cost can be placed beneath the heading of inevitable frustrations. In other words, the best laid plans of mice and men often go awry. Put another way, expect life to happen and temporarily ruin your plans. I suspect that how it will happen will vary with every intervention, but let the reader be warned: life WILL happen!

For example, I contracted bronchitis a few weeks before the planned trip to the ponds and lost about a week of contact time. The downside to this sickness was the fact that I had lost approximately five classes in which I could have covered important content. The upside to it was the fact that my illness gave me a wonderful opportunity to explore the feasibility of covering all that missed content via a place-based approach. I am pleased to say that we were able to cover all required content, despite this loss of time.

Another unexpected issue was that after weeks of planning, Pond Day dawned to a very cold and rainy morning—so cold in fact that we had to cancel the trip. This meant rescheduling buses, teachers, presenters, helpers, students, equipment, etc. It also resulted in the inability of one agency to send helpers. We eventually ended up visiting the ponds on another cold and drizzly day. This put a damper on some of our fun but, as evidenced by student feedback, the day was still an overwhelming success.

Another energy-related cost can be placed under the category of “creative energy” used that could have been put elsewhere. This is best reflected in the time-consuming planning for and use of artifacts. To begin with, we had to procure a permit to collect them. Thankfully we were able to use a permit belonging to Finger Lake’s Community College. We next had to explore a number of strategies for their use including group work, lab exercises, passing them
around the room, viewing them under microscopes, and seeing pictures of them on my Smartboard. Issues sometimes arose when students became reluctant to touch certain artifacts (like a bird’s wing)—either to collect them, or when we were passing them around the room. Each method required a nuanced approach to get the most out of our use of the particular artifact or artifacts. Each method also required time that would not be lost had I chosen to remain in “lecture mode.”

Another example of creative energy that could be used elsewhere is the time needed to complete our final project. Once the intervention was finished we had to honor one final element of the place-based model: sharing our findings with a broader community. This necessitated soliciting student feedback as to best messages to convey and the best vehicle for conveying that message. I was eventually forced to use valuable class time to poll students to discover the answers to these questions. We eventually decided to create a musical slide show that would inform the wider school community of the important things we had been learning. We formed volunteer committees of students who worked on the project after school for extra credit. These after school committee sessions comprised small groups of students who haggled over the exact messages to convey, the appropriate pictures to use, and the best music to hear. Needless to say, this was time consuming. It was also very stressful. I often had to coax these students to come in after school to complete the project. Also, they often needed some gentle prodding to “stay on task”. To their credit, they eventually produced a product that nicely captured the entire experience. It was a slide show informing students that ecology is all around them; that they are also part of the environment; as such, what they do to their environment they do to themselves; and it is their responsibility to make decisions that protect the health of the environment—not only for themselves, but for their children and the organisms with whom they share it. While I
was very proud of the product they produced and the messages it contained, it was still a very
time-consuming portion of our place-based approach.

Another emotional cost can be put under the heading of professional anxiety. This stems
directly from the need to cover the content that will eventually be tested on the high-stakes state
exam at the conclusion of the course. Due to personal illness, the weather, and the general nature
of the approach, I began to fall behind the other Living Environment teachers. This caused some
moments of panic as I questioned my ability to cover the state-mandated content using a place-
based strategy. It also elicited a few negative responses from students with friends in those
particular classes. In the end, we were able to adequately cover all required content using the
approach we took. However, one should be prepared to deal with these inevitable “covering
content” anxieties that come with trying to integrate placed-based aspects into their practice.

Surprisingly, one of the biggest challenges to the intervention’s success was my own
misgivings about the practicality of implementing the place-based approach successfully. After
all, the “teacher as expert” model is a fairly attractive way of covering content, especially after
one has taught for a time and has had the opportunity to amass a good deal of tried and true
“curriculum.” I had to have faith in myself and my own abilities to orchestrate the entire affair.
I had to convince myself that it was a positive thing to become the creator of curriculum rather
than the dispenser of curriculum developed by others. I had to believe that I could make the link
between the unpredictable activities that can happen beyond the classroom and student
performance standards set by the district or state. I had to set aside my own assumptions that
what now passes for legitimate learning (the kind that will help students do well on high-stakes
tests) happens only in classrooms. I had to believe that agencies outside the school would be
willing to see themselves as partners in the education of young people. And I had to trust their
willingness to make space for the contributions my students were capable of making. Finally, I had to have a certain degree of faith in my students’ ability and willingness to try something different, to be open to “possibilities,” to see education in a whole new light, and in the end, come to see their world in a whole new way.

Yet another emotional cost could be put under the category of “disheartening realities.” I tasted such discouragement when I discovered that some students soon tired of our “pointing to the ponds” approach, and they wanted me to use examples of artifacts from exotic places to help us explore the concept at hand. However, this actually turned into a real gift. As stated previously, I discovered that the use such of these “exotic” artifacts actually lent credibility to the local ones. It also taught me an important lesson about not overdoing it with respect to a continual “pointing to the ponds.” I will discuss this more in the lessons learned section of this chapter.

Another drawback in this particular category of costs involved my use of presenters. Students sometimes complained that the presenters were confusing because they contradicted something I had already told students. Others lamented that they were repetitious. Still others maintained they were boring. I tried to avoid becoming too disheartened and to take such setbacks in stride. However, readers are advised to anticipate and prepare for them. They seem to be an inevitable part of doing business in this fashion.

A final, not-so-obvious cost must be mentioned. It involves the cost incurred by a few of my colleagues. I had not taught a Living Environment course in over twenty-five years and my knowledge of content and pedagogy was a bit “rusty.” These fellow Living Environment teachers often provided helpful guidance with regards to choice of curriculum and pedagogy. They also offered invaluable suggestions with respect to the planning and implementation of
pond day and the collection and use of artifacts. I owe much of my success to their unselfish willingness to provide timely emotional, intellectual and content-related support.

When all is said and done, a place-based approach to science education takes energy, emotion and above all time—time to conceive, time and courage to convince yourself (and parents, students, administrators, and fellow teachers) of the worthiness of the approach, time to carry out, time to determine its effects, and time and courage needed to confront one’s own ideas about teaching and education. It requires the successful navigation of all the stress, anxiety, aggravation, frustration, fatigue, and disillusionment that inevitably come when one attempts to implement creative pedagogy. However, I personally found the paybacks (in terms of heightened interest, deeper engagement, educational meaningfulness, deeper understanding, lasting retention, greater level of academic confidence, and connection to community and ecological surroundings) well worth the effort. It is also heartening to realize that most of these “costs” can be anticipated and dealt with in a less stressful and time consuming manner with each successive incarnation of the intervention.

4.7 Some Surprises and Lessons Learned.

“The most interesting approach to science education for me was the going to the ponds. To take what I learned in class and to apply it to my own community was just amazing. With the hands-on activities and gathering of artifacts, I can grasp the concepts of ecology better. They always say a picture is worth a thousand words.....”

- Student Journal Entry

I conclude with an examination of some lessons learned that were the surprising fruit of my attempt to weave elements of the place-based paradigm into the everyday world of a Regents Living Environment course. Following are some interesting discoveries and wonderful surprises that I feel are worth sharing.
To begin with, it was wonderfully relieving and inspiring to discover the ease with which I could integrate the ecology curriculum around the study of place. The ponds and their artifacts were easily and powerfully used to contextualize most of the state-mandated ecological concepts we encountered. As such they provided an excellent way to connect content to real world experiences. Many students seemed to love the opportunity to leave the four walls of the classroom and use their hands and eyes to explore the world around them. Many also appreciated the occasions to see, and touch, to explore and to ask “just like real scientists do.” In the end, I believe these experiences served as wonderful illustrations of the power inherent in attaching learning to everyday places and real-life experiences.

A second discovery was the realization that while it was difficult to locate an “in-depth investigation into a local problem important to the community,” it was reassuring to discover that making even a relatively small contribution (like providing data on water quality to the Finger Lakes Institute) sufficed to provide students with a meaningful way to become contributing community members. And along those same lines, I found it refreshing to discover how willingly community agencies lent a hand whenever needed. Lastly, I was impressed with how well, with just a few exceptions, students reacted to this exposure with these out-of-school resources. As mentioned, some were drawn to the expertise of these presenters; others appreciated the perspective they shared; some saw in them an example of a possible future occupation; and others simply loved being taught by folks who spend their lives working on environmental issues.

Another pleasant discovery was the extent to which the approach could make many students more aware of their local environment and connect them to their own surroundings. As we have seen, students frequently expressed this deeper connection in their journals. I believe
such connections were facilitated, at least in part, by providing students with the opportunity to learn in and from these local places. They were fostered by my willingness to explicitly point out and challenge students to consider such connections as they presented themselves. They were also encouraged by my continued insistence that students can and should make a difference in their communities. This awareness of a deeper emotional connection to place is especially heartening in an era where students so often seem to be more connected to electronic devices than to the natural world around them. Also, I feel that in this era of transience and increased globalization, any approach that helps young people feel like they “belong” is worth employing. I fervently hope that at least some of my students will carry this important sense of “connectedness” with them into their adult lives.

Still another pleasant surprise was in the discovery that our engaging content in a place-based fashion seemed to help some of my students come to a deeper understanding of the material. Place-based educators do not dismiss the importance of content and skills but argue that the study of places can help increase student engagement and understandings through multidisciplinary, experiential, and intergenerational learning that is not only relevant but potentially contributes to the well-being of community life (Gruenewald, 2003a; Gruenewald, 2003b; Gruenewald & Smith, 2008; Smith, 2002a; Sobel, 2995). Student journal responses already cited clearly indicate that at least a few of my students achieved this higher level of understanding. Certainly most students learned basic concepts in ecology. However, journal entries such as “I think of biology every time I go outside” indicate that at least some students were also grasping understandings well beyond the mere level of content knowledge.

This evidence clearly reveals the place-based ability to blend both scientific process and the exploration of scientific content (Sarkar & Frazier, 2008). They also bear strong witness to
its power in helping students acquire a deeper level of understanding about science topics in general, and the nature of the science in particular (Crawford, 2000). Finally, my results illustrate the potent manner in which a place-based approach to science education can open the minds and hearts of many young people to the wonders and mysteries of the natural world right outside their doorsteps.

Yet another surprise and corollary to this deeper understanding of the material was the degree to which this hands-on approach helped many students remember the material. Time and again student journals speak of the ability of the approach (“hands-on” and “eyes-on” quality; use of local setting; contributing to solutions) to help them engage with and thus remember important ecological concepts. As we have seen, such enhanced retention helped many students feel more confident about upcoming assessments. Therefore, it served as a potent facilitator of academic confidence for a number of my students.

Another important discovery was the way in which the place-based approach served to motivate a number of my unengaged students. They were attracted to the hands-on and eyes-on nature of the project. Time and again students’ journals bore witness to the fact that such experiences made the learning both easier and more engaging. This was a pleasant surprise and it was heartening to see young people actually excited about learning. A subsequent cycle of action research might shed more light on the nature of and reasons for this very important outcome.

Still another surprise I particularly loved was the wonderful way in which serendipitous events seemed to happen precisely when we needed them to. A case in point is our discovery of the woodcock and muskrat skeleton just as we began searching for artifacts that could depict decomposition. I was overjoyed with the precise timing of a turkey vulture flyby just when we
were looking for evidence of scavengers. These events gave me a greater confidence in my ability to employ the approach. They are joyful reminders to me of the way nature cooperates with those who seek to explore her mysteries and learn about her secrets.

Yet another important lesson learned involves my experience of partnering with community agencies. I was pleasantly surprised with how graciously they agreed to participate. I was also impressed with how generous they were in donating their time, talent and treasure. This attests not only to their willingness to help but also to their acknowledgement of the importance of the younger members of the community. All in all, these community representatives made very positive contributions to the overall educational richness of the intervention.

Another pleasant surprise worth noting concerns the level of expertise (in terms of content knowledge and familiarity with the place-based approach) one needs to successfully implement a place-based approach in a high school Living Environment class. I was able to achieve the successes documented in this study despite the fact that I have not taught a Living Environment course in over twenty-five years. As remarkable is the fact that this was my very first attempt at implementing place-based strategies. Such findings suggest that one need not be an expert in either content or approach to successfully integrate place-based elements into his/her course. I feel this is good news for recently graduated practitioners who are hungry to experiment with creative ways of delivering science content in high-stakes environments.

Lastly, are the valuable lessons I have learned concerning the use of artifacts. As mentioned earlier, there is a paucity of literature concerning their use in science classrooms. However, research in social studies classes suggests that artifacts can serve as powerful facilitators of important educational outcomes. These include stimulating interest and curiosity,
facilitating attention, serving as a sensory means for exploring the connection between an object and the concept it embodies, serving as emotional links with the concept being studied and creating a contextual framework that enriches understanding of content (Labbo & Field, 1999; Morris, 2000; Morris, 2002).

The results of this study confirm such contentions. My own observations and student testimonies revealed in journal essays, survey answers and focus group responses all bear witness to an artifact’s power to pique interest, facilitate engagement, concretize the abstract and simplify the complex. For example, the idea of gas exchange between an evergreen tree and its surrounding atmosphere is greatly simplified when a student is able to view the enlarged stomata (breathing pores) of a hemlock needle beneath a microscope. The notion of symbiosis becomes more concrete when students are allowed to handle larva extracted from a goldenrod stem gall. And the ability of limestone bedrock to neutralize the negative effects of acid rain become obvious when students can pour acidified water thru a pile of limestone pebbles and then measure the water’s subsequent rise in pH for having traveled through the rock.

I have learned other valuable lessons as well. These come under the heading of “best practices” and concern the ways in which one can get the most from artifacts use. For starters, it is important to allow for student input in the construction of lists that match artifacts with concepts. These lists will ultimately determine which artifacts are collected and giving students their say in this regard is a sure fire way to generate excitement during the hunt.

Another beneficial strategy I would recommend concerns the collection of the actual specimens. On Pond Day each group of students was responsible for collecting only a particular section of the total artifact list. Upon our return to class, it was fun for the students to see what the other groups had chosen as specimens to collect for embodying this or that particular
concept. This was a good strategy for stimulating conversations about the appropriate choice of artifact-concept matchups. It also reinforced the notion that such souvenirs served as reminders of important ecological realities.

I would also suggest that a teacher use these artifacts in a judicious manner. I say this because our constant use of them bored some students. They demanded we use more exotic examples to embody the concepts we were learning. Along these same lines I would recommend a more discerning method of their use. In the future I would complement their use with other strategies for exploring concepts. Such alternating of pedagogies may prevent boredom and actually facilitate students’ appreciation for an artifact’s inherent power to embody a concept.

Another strategy I found very useful and would recommend involves that of soliciting students’ ideas about the best ways to use artifacts. Near the end of the intervention I assigned a journal prompt that asked this very question (see Appendix B.1, SRJ5). Student responses included the following:

- the suggestion to use artifacts from more exotic locations;
- the idea of students collecting and caring for their own “pet” artifacts;
- the suggestion that students bring in artifacts collected from their own property for extra credit and teach the class about their value as a concept-specific ecological souvenir;
- the suggestion that I explore an ecological concept with students and then assign them the task of collecting artifacts that embodied that concept;
- the idea of creating a collage of various artifact photos and displaying it in the halls;
- the notion of creating a game of artifact jeopardy in which students match an artifact with an appropriate ecological concept as a way to review for assessments;
- the idea of conducting an artifact scavenger hunt on school grounds;
• the suggestion to test students by challenging them to match an artifact with an ecological concept.

In the spirit of action research, I took these ideas into consideration and actually incorporated a few into the study. Such suggestions added to the overall effectiveness of the intervention and contributed to the arsenal of teaching strategies I am developing concerning artifact use.

It is clear that the use of artifacts played an essential role in the success of this study, and I regret lacking the foresight to foreground their use as one of my research questions. However, I believe the lessons learned along with the suggestions listed above are valuable contributions to the literature on artifacts use in science classrooms. They also lay the groundwork for potential future studies on best practices regarding their use.
CHAPTER FIVE

ACTIONS RESULTING FROM THIS STUDY

5.1 Introduction and Overview. As noted in Chapter Three, action research is research we conduct on our own work with the intent of improving it. We critically scrutinize our practices with an eye toward interpreting, changing and improving them. The present study is no exception, so I now articulate the actions that have already resulted from it. I then discuss its implications for my future practice. I conclude by identifying a number of alternatives for the next stage of the action research cycle.

5.2 Actions Resulting From This Study. This study has already begun to bear some valuable fruit. As of this writing, one can visit our school’s homepage and access a slideshow of the intervention developed by my students. The five-minute show includes pictures and text written by students that reflect the important things they have learned and want to share. It also includes the song “Colors of the Wind” from the Disney production of Pocahontas. The song’s words echo the project’s message: ecology is everywhere; we are part of it; the decisions we make effect all of life, including ourselves; therefore, we must make decisions that benefit all living things; and we must pass this knowledge along to our children. The project helped honor the place-based belief that emphasizes the importance of sharing one’s findings with the broader community. In this case the broader community was the larger district the school is a part of.

Another action resulting from our study is the fact that the water quality data collected from a pond outlet stream will be included in the data bank soon to be compiled by the Finger Lakes Institute. Our data will be added to that of other area schools and studied in an attempt to ascertain the quality of streams in local watersheds.
Another positive consequence of our efforts involves a decision made by the Living Environment teachers at our school to include our intervention’s scavenger hunt as a permanent part of Pond Day. I have already spoken of the contribution these teachers made to the success of this intervention. They frequently shared their extensive knowledge of content and pedagogy to guide me in certain aspects of the intervention’s design and delivery including the matching of artifacts with the appropriate concepts they embody.

For the past few years, the Living Environment teachers have embedded a section of their ecology unit is a pond experience. In fact, I used their Pond Day idea as the framework for my particular study. However, their approach lacked a number of place-based elements as well as the artifact component, and they were impressed by the excitement with which students hunted for these ecological souvenirs. As they watched the manner in which the ecology unit played itself out in my post-Pond Day practice these teachers came to appreciate the powerful way that place can serve to contextualize curriculum. They also came to realize the powerful way in which artifacts can help illumine ecology concepts. This has motivated them to declare that all future Living Environment students will be required to hunt for ecological artifacts as part of their Pond Day experience. These souvenirs will be returned to the classroom where they will help future students explore ecological concepts and remain connected to a place and experience they thought they had left behind.

One final short-term benefit must be noted: the positive impact this approach has had on many of my participating students- especially those who tend to be unengaged with school. It has been inspiring to see students excited about coming to class and encouraging for me to witness their enthusiasm for learning about the natural world around them. I am convinced that my decision to embed the ecology curriculum in local realities has contributed to their
excitement. And our strategy of providing students with a hands-on and eyes-on view of the natural world—complete with the opportunity to contribute to the solution of a problem in that world - has only contributed to this enthusiasm. In a nation overly focused on educational accountability, such results are both heartening and hopeful.

5.3 Implications for My Practice. In this section I explore the ramifications of my research findings for my own professional practice. I will examine my successes; these are things I feel worked well and that will become part of my arsenal of teaching and learning strategies. Then, I will explore areas that need to be tinkered with, changed outright, or omitted all together. I conclude with some possible next steps I may take as a high school science teacher as I design and teach my future classes.

5.3.1 Success Stories I Want to Repeat. This experience has clearly showed me that place can be a wonderfully powerful teacher. The results strongly suggests that contextualizing the learning locally can lead to a number of positive outcomes including heightened interest, deeper engagement with and capacity for understanding of the content, greater ability on the part of students to retain the information and a higher degree of academic confidence. It also hints at additional positive outcomes such as engaging the unengaged, making young people more environmentally aware, and fostering a deeper connection to one’s home ground. It is safe to say, then, that I will continue to use a hands-on and place-based (i.e., locally focused) approach to science education in some manner for the foreseeable future, despite its undeniable costs. I love the way the approach engages students and draws them into the subject matter. I especially love the way it connects them to the world (their world) around them—no small feat in an age where young people seem continually indoors and hooked to electronic devices! And finally, I love the meaning they can subsequently find – both in education and their communities because
of their experience with this approach. In this era of educational approaches stressing the use of mass-produced and mass-consumed, one-size-fits-all content, I believe such educational fruits are of inestimable value.

Another important aspect of the intervention I will keep as part of my teaching arsenal is the use of artifacts to illustrate important scientific concepts and realities. Using artifacts allows one the luxury of “returning” a portion of a place to the classroom. Such a strategy helps make the material come alive and also allows us to maintain our “local focus” for extended periods of time.

Another important feature of the place-based model I will continue using in my practice is creating opportunities for engaging science content in a way that allow for a hands-on approach to learning. This is one of the key elements of the approach that most seemed to attract the unengaged student. Such opportunities seemed to heightened their interest, enhance engagement, and increase their capacity for understanding and retention. Especially when connected to a local setting, it appears to have become the hook that drew students into lessons and ultimately allowed for the possibility that lessons deeper than immediate content (awareness of environment around them; deeper connections to that environment; potential for beings good stewards and citizens) could germinate and eventually grow to their full stature. Therefore, it is definitely an aspect of the experience I will want to employ as frequently as possible.

Still another aspect of this experience of and with place that I intend to continue employing in my practice is to constantly exhort my students to open their eyes to the value of that which is nearby. It has much to teach us. The local has value because it is easily accessible. It has value because it is a living laboratory that offers lessons on a wide range of topics to those willing to explore her mysteries. It has value because it can often reveal the universal in the
humblest of ways. And, most importantly, it is valuable because it is *home*, to both the human and more-than-human creatures with which we share this beautiful Earth. It is worthy of our love, respect and protection.

As such I will continually strive to remind my students that they need not be passive observers of these communities. Instead, I will challenge them to become active members who seek to make positive *contributions* to the social and natural environments in which they live. I will also challenge them to take the lessons learned at the local level and begin applying them to the problems of the wider communities that exist beyond their immediate homes and villages. In this way, place can become a mechanism for widening students’ vision to recognize their responsibilities to the broader, more global “communities” to which they belong.

Yet another fruit of this study will be a continued effort on my part to teach with an eye toward ascertaining any additional effects of the place-based approach on the parameters already examined. One never stops learning; the more one looks, the more one sees. I intend to continue to use my practice to look, to listen, too see and to learn about the best ways of continuing to use science curriculum to engage my students in the world around them—a world which, as we have come to learn, begins at their very doorstep.

Next fall I will be returning to my regular duties as a teacher of Earth Science, Astronomy and Meteorology. Pond day, scavenger hunting, artifact use and “pointing to the ponds” will have become permanent fixtures in the school’s Living Environment classes, but I will have to look elsewhere for meaningful local connections for my own classes. I am already considering a number of strategies for contextualizing the curriculum in realities close to students’ experience. One strategy involves exploring ways in which a few of the larger local lakes contribute to lake effect snow events. This plan would challenge my students to use
meteorological concepts (direction of local air flow) and geological concepts (the placement and contours of the lake basins) to explain how such events are possible. Another strategy involves encouraging my students to explore ways in which the agents of weathering and erosion are currently working to mold and shape the local geography. This plan would require a visit to a local gorge where students could observe these forces in the process of cutting ravines, shaping waterfalls, and depositing sediments to create the deltas that have become the picnic grounds for state parks. A final possibility involves helping my students construct a stone wheel that follows the sun’s yearly path along the eastern horizon—complete with markers pointing to the sun’s horizon rise and set points for both equinoxes and both solstices. Construction of such a device would necessitate my students researching the precise local times and dates on which these events take place. They would also have to discover the exact direction one must look to witness these events as they happen. It would also require them to collect local rocks to construct the wheel. This would in turn provide a wonderful opportunity to discuss the nature of the local bedrock as well the reason for the presence of glacial erratics that were left behind as the last glaciers abandoned the Finger Lakes. Thus, we would create a unique way to use local astronomy and geology to study the wonderful predictability of the seasons.

I have been heartened by the wisdom my experience with the place-based approach has given me and I am confident that I will be able to discover many creative ways to employ Place in a manner that fits well with the geosciences content I am charged with covering. I look forward to the challenge.

5.3.2 Opportunities for Professional Development. Place-based education has many practitioners, both in this country and around the world. These educators practice the approach, learn from their experience and share the results with others who are interested in using local
realities to teach lessons in history, economic, social studies or science. They frequently publish their findings in professional journals of education. I intend to keep abreast of the latest developments in the fields by the frequent reading of such journals.

Place-based practitioners also periodically meet to exchange information, share best practices and discuss the latest developments in the field. I attended one such gathering last February 2009 in Jackson Hole, Wyoming. The meeting provided me the opportunity to network with teachers, authors and indigenous people from around the world who all shared one thing in a common: a love for the place-based model. I intend to continue attending such gatherings for the remainder of my teaching career. An October 2010 gathering in Vermont organized by the New England Environmental Education Alliance is an example of one such opportunity (see: http://www.neeea.org/conference.html). Such gatherings are invaluable opportunities to remain current on the latest developments in the fields while also gaining the support and encourage of likeminded people.

Closer to home there are a number of ways I can continue to learn on this topic. The local Finger Lakes Institute frequently offers professional development opportunities for science teachers eager to explore new ways of using Place (in this case, the Finger Lakes) as a context for learning. Workshops are held during both the school-year and summer vacation. I intend to participate in them once my doctoral studies have been completed.

Another way I intend to remain current and connected on the topic of place-based education is to reconnect with individuals from Antioch/New England Graduate School in Keene, New Hampshire. This graduate school is an epicenter for place-based initiatives in the New England area and around the country. As such it has a number of individuals who are deeply interested in the approach and in exploring both its qualitative and quantitative effects on
students. I earned a Masters Degree in Environmental Education from Antioch/New England in 1985. Reconnecting with these individuals, learning of the results of their research and sharing ideas and best practices is another way I can continue to develop my skills as a place-based practitioner.

It is encouraging to know there are so many educators who see the value of using the local as a context for learning. I find it valuable to read their stories and to benefit from their experiences. I am also inspired and gladdened by this opportunity to make my own unique contribution to the place-based enterprise. It is my hope that my readers will take note of the results presented here and be encouraged to join the community of we who practice Place.

Lastly, I will continue to share the fruits of my experience with any teacher who will listen. This will include anecdotal stories to colleagues I teach with or connect with on state listserves, the delivering of workshops at science-educator gatherings, and the publishing of important findings and lessons learned in educational journals. The intervention has borne much interesting fruit, and I am both willing and anxious to share it with other science educators. Some such sharing has already begun to occur. As mentioned earlier, the other Living Environment teachers in my school have already decided that collecting artifacts will become a permanent part of the pond day experience. They have also chosen to integrate the practice of using artifacts to point to ecological realities into their current pedagogical practices. It is heartening to know that others recognize the value of such strategies and have been motivated to incorporate them into their practices. It is also inspiring to think that my intervention will continue to bear precious fruit in the lives of other teachers and students long after this study concludes.
5.4 **Next Stage of the Action Research Cycle.** After reflecting on the findings reported in the previous chapter and the observations reported in the first part of this chapter, I believe there are a whole range of issues that would benefit from a subsequent cycle of observing, reflecting, planning, and acting – as identified later in Chapter 6. Among the many worthwhile research opportunities, the ones I hope to be able to personally pursue the following ones in the near future include:

- a more thorough examination of the ability of the place-based approach to motivate unengaged students and thus help ameliorate their alienation from school;
- a deeper look into the effects of the approach on students’ environmental attitudes and notions of stewardship and citizenship.

I chose the first because my research revealed the ability of this approach to engage many students who often miss school and/or do poorly when in school. Time and again, students’ journals bear witness to the fact that such experiences made their learning both easier and more engaging. This was a pleasant surprise and it was heartening to see young people actually excited about learning. I think it would be enlightening to explore this intriguing outcome in a more thorough manner. I would like to know exactly what inspired these new-found attitudes, why they were inspired, and how best to maintain that inspiration over the course of a long school year. I believe it possible to accomplish such an examination in the next cycle of action research (that is, the next time I incorporate a place-base element into my pedagogy). I could then craft appropriate journal prompts, survey questions and focus group questions that would serve to illicit a deeper understanding of these students’ reactions to various components of intervention. Along the way I could also explore the intervention’s effects on ameliorating their sense of alienation from school. As an aid in exploring this particular issue, I could collect and
examine records of students’ attendance and discipline referrals along with each of the previously mentioned data collection devices. Comparing such records before and after the institution of a place-based initiative might help reveal the models’ effects on students’ attitudes toward science education in particular and schooling in general.

The other issue worthy of closer inspection is the effects of the approach on students’ environmental attitudes and their notions of stewardship and citizenship. My study strongly suggests the place-based approach facilitated a deeper connection of many students with their home ground. The fact that students were learning about the environment in their local environment served to deepen their interest in the content and helped them come to the deeper understanding that “ecology” is everywhere they look, including their own backyards. This, in turn, motivated a number of them to explore these personal spaces. I suspect that, in the end, it also facilitated a deeper emotional connection to these places. Perhaps it even gave them a greater sense of belonging—a profound benefit in this era of educational discourses that seek to standardize the experience of students from diverse geographical and cultural places so that they can compete in the global economy (Gruenewald & Smith, 2008; Sobel, 2005). Therefore, I believe it would be quite fruitful to explore the extent to which a portion of a place-based intervention can facilitate such emotional connections. Included in the study could be an examination of the design elements needed to help a teacher capitalize on this affordance.

Along these same lines, I believe it would also be revealing to examine the extent to which the intervention helps encourage a sense of citizenship and stewardship in students. A frequent boast of the place-based paradigm is its ability to make education a preparation for citizenship by involving students in the solution of real world problems (Smith, 2002b; Sobel, 2005). It also argues that the contributions students make allows them to discover that living in a
place requires stewardship of that place (Gruenewald, 2003a; Gruenewald, 2003b). It would be enlightening to examine an intervention’s effect on these two parameters. Following an aspect of a subsequent place-based intervention, an analysis of wisely crafted journal prompts, survey questions and focus group responses could shed some interesting light on the nature of the extent to which the place-based model facilitates and encourages these traits in student practitioners.
CHAPTER SIX
CONCLUSIONS

“Place is an excellent starting point because places live in the deepest parts of us. In one sense, we never leave them. We soak them up; carry them around, all the various places we have known”

Ralph Fletcher (as cited in Bishop, 2004, p.66)

6.1 Introduction and Overview.

In this final chapter, I review the genesis, context and purpose of my study. I summarize my key findings, and examine both their potential contribution to the field of science education and their broader implications for classroom curriculum and pedagogy. I conclude with a brief discussion on the study’s limitations and suggest areas where additional research would be fruitful.

6.2 Genesis, Context and Purpose of the Study.

This dissertation was designed to address the following overarching question: How can science teachers capitalize on the rich affordances offered by a place-based approach to science education despite the constraints imposed by a state mandated curriculum and a high stakes test? I was frustrated with educational experiences that are the fruit of a standards-based, de-contextualized approach to science education. Such strategies employ a one-size-fits-all curriculum which largely ignores local contexts relevant to students’ lives. In this way, they tend to discourage student engagement and ultimately work against a deep and lasting understanding of content. In contrast, the place-based paradigm uses students’ local communities (economic, political, social and environmental) as an integrating context for learning. Employing a hands-on, problem-based, and locally focused approach, it seeks to engage students more deeply with these communities with an eye towards raising academic achievement. Along the way, it fosters students’ appreciation for the natural world while also heightening their commitment to be active
stewards of that world (Bartsch, 2001; Clark, 2007; Gruenewald & Smith, 2008; Smith, 2002a; Sobel, 2005).

Such outcomes deeply resonate with me, and I became curious as to the extent to which it would be possible to integrate elements of this place-based approach into my daily practice as a high school science teacher. I especially wanted to explore the practicality of this approach in the everyday world of a high-stakes science class. I also wanted to examine its potential for bearing fruit that could enrich the educational and personal lives of my students while perhaps enlivening my own practice in the process.

To help answer this overarching question I designed, implemented and evaluated an intervention that integrated certain components of a place-based approach into a high school science course constrained by a high-stakes test. Using action research as the methodological approach, I explored the following research questions:

1. Which elements of the place-based paradigm could I effectively integrate into a regents Living Environment course?
2. In what ways would this integration impact students’ interest?
3. In what ways would this integration impact students’ perceived academic performance?
4. What are the costs of implementing this approach on the teacher?

I implemented my intervention in all three sections of the Living Environment course I taught at the Marcus Whitman high school in Rushville, New York in the autumn of 2009. Within the context of our ecology unit we examined the ecological health of a local natural area (Comstock Ponds) utilizing a hands-on, experiential, project-based and locally focused, i.e., place-based, approach. This included a day-long visit to local ponds where we collected various
types of data that could help us determine the overall health of this ecosystem. While on site, we also collected environmental “artifacts”—samples of both living and nonliving things (plants, water samples, rocks, etc.). These later served as intellectual, emotional and cognitive reminders of that initial place-based experience and served to connect our pond experience to content we would encounter later in the curriculum. It was our way of allowing “Place” to continue to weave its spell long after we had left the actual site.

True to the place-based paradigm, I attempted to enrich students’ overall experience by enlisting the expertise of various community agencies. Such cooperation with outside experts in the field of the biological sciences served to fulfill the place-based requirement that schooling in some way be connected to community life. It also provided my students valuable exposure to professionals who live and work in the same region in which these young people attend school. One such agency also agreed to place the results of our water testing into a data base they are compiling. This data will be added to that of other area schools and eventually used to examine the water quality of various streams in the Finger Lake’s watershed. Service to the community is an important aspect of the place-based approach and this feature of the intervention was intended to help students experience the rewards that come from contributing to the solution of a real community problem.

To address my research questions, I collected, analyzed and interpreted data from four sources over the course of the 15 week intervention. These data sources included a Teacher Log in which I recorded successes, failures, evidence of student interest, personal observations and comments, a record of the costs experienced from having employed a place-based approach and the degree to which I was able to successfully integrate particular place-based elements into a particular lesson or the unit as a whole. Other data sources analyzed included the answers to
journal prompts recorded in students’ reflective journals, student responses to survey questions and student responses from selectively transcribed portions of audiotapes focus group sessions I conducted with a few students at the intervention’s conclusion. This rich set of data was coded and analyzed to identify patterns and themes associated with each research question. Numerous direct quotations taken from students’ journal entries, student survey and focus group responses, and notes taken from my daily personal teacher log were used as evidence to support my claims. They also served to provide a deeper insight into the major discoveries made and the important lessons learned.

6.3 Summary of Key Findings and their Significance.

As stated previously, my study examined four research questions informed by the following overarching question: How can science teachers capitalize on the rich affordances offered by a place-based approach despite the constraints imposed by a state-mandated curriculum and high-stakes testing? In this section I summarize the key findings related to each question.

6.3.1 Integration of Place-Based Elements.

Place-based education can take a variety of forms. Indeed, one of its strengths lies in its ability to adapt to the unique characteristics of a particular place. Despite this variability, there are some common elements. For purposes of this study, I chose to focus on those elements that could be woven into the scope of my unique intervention. My study suggests that, to varying degrees, it is indeed possible to successfully integrate a number of these elements.

The first element I was able to integrate into essentially every lesson is that of the teacher as a facilitator and guide. Indeed, I discovered that a teacher’s willingness to frequently forgo the role of expert in exchange for that of facilitator, guide, creator of learning opportunities and
broker of community resources is an absolutely essential component of any successful place-based initiative. As such, my experience confirms the literature concerning the new roles teachers must be willing to embrace for place-based education to be an effective strategy (Bartsch, 2001; Clark, 2007; Gruenewald & Smith, 2008; Smith, 2002a; Smith, 2002b; Sobel, 2005).

Examples of ways I have facilitated students’ learning include: the conceiving of the actual intervention, the choice of appropriate artifacts to use in daily lessons, the guiding of students in the exploration of a local habitat, the creation of various learning opportunities like Pond Day and the Pond Day scavenger hunt, and facilitating the community-involvement piece. If one acknowledges that every pedagogical decision was made with an eye toward illuminating the ponds as a context for learning, then I can accurately claim that I was able to incorporate this element into every lesson I taught.

The second element I found quite easy to integrate was that of allowing my daily lessons to emerge from the particular attributes of a place. As stated earlier, the ponds were more than generous in providing us with a context within which to embed many, if not most, of our daily lessons. Between our actual visit to the ponds and our subsequent use of artifacts gathered there, we were able to reference the ponds with respect to the ecological concepts we were exploring in 95% of the lessons in the ecology unit. These included concepts such as ecology, the web of life, biotic and abiotic components of an ecosystem, populations, communities, food chains, food pyramids, producers and consumers, predator and prey, herbivores, carnivores, omnivores, decomposers, scavengers, nutrient cycling, invasive species and ecological succession.

Referencing the ponds gave us the added dimension of tying our learning to a local reality students were a part of and could relate to. As we have seen, such connections can serve to
deepen many students’ interest, engagement, understanding, retention and confidence. They also confirm the literature’s contention that place-based strategies can illicit such responses in students (Bishop, 2004; Crawford, 2000; Smith, 2002a; Sobel, 2005).

A third place-based element I successfully integrated into many lessons was that of helping students derive real meaning from their studies by connecting content to real world experiences. Indeed, the experience offered my students the opportunity to connect their learning to the world around them in 62% of our lessons. Our use of the ponds as a local ecological laboratory, the use of ecological artifacts to further deepen that connection, our engagement with community agencies and the provision of our data to one such agency all serve as examples of how such connections were established and maintained. Conclusions drawn from my analysis of the data (especially journal entries) strongly suggests that no other element of the intervention was more powerful at piquing student interest than the manner in which we strove to continually engineer a connection between content and the world these students inhabit. Therefore, these results confirm the literature’s contention that this particular place-based strategy is capable of eliciting such responses in the students who experience it (Bartsch, 2001; Clark, 2007; Gruenewald & Smith, 2008; Sobel, 2005).

A fourth element of the place-based approach I was able to integrate into about half of my daily lessons was that of providing opportunities for students to have many and varied interactions with their peers. These included both pre and post-Pond Day experiences. Co-constructing an artifacts list for the scavenger hunt and the opportunity to identify macroinvertebrates were important pre-Pond Day exercises that involved some degree of peer-to-peer interactions. Pond Day activities, processing the data collected upon our return to the classroom, occasional group work involving artifacts usage, and various lab opportunities used to
explore pond-related ecological realities are some examples of post-Pond Day interactions. The very nature of our approach (water testing, macroinvertebrate identification and scavenging for artifacts at the pond, processing our results and continually referencing the ponds upon our return) made such interactions inevitable. Judging from student journal answers, survey responses and focus group answers, these peer-to-peer experiences added to the overall enjoyment of the experience for many students. I suspect they also helped make the understanding of the ecological concepts we explored more interesting, understandable and memorable for many of them as well. Such outcomes support the ample literature suggesting that the nature of the place-based approach easily facilitates such peer-to-peer interactions (Gruenewald & Smith, 2008; Smith, 2002a; Sobel, 2005).

A fifth element captured over the course of the intervention was that of focusing on an in-depth investigation of a local issue important to the community. Ideally the place-based approach is centered on students’ exploration of an in-depth problem currently facing their community. This problem can be of a political, economic, social or environmental nature. As explained elsewhere in this document, discovering such an issue at the time our particular intervention was occurring was challenging. In the end, my students and I had to accept that only a minor portion of our experience (about a third of our lessons) was to be centered on this important aspect of the approach. Although seemingly small, it still played an important role in lending a “real life” quality to the intervention, and ultimately served as a very potent motivator for many students. In fact, I now see this involvement with a real life community issue—however minor—as an essential piece of any place-based intervention. Indeed, my results suggest that even issues of seemingly little import can still help students derive both personal and educational benefit for having engaged with them. Again, such findings confirm
the assertion frequently found in the place-based literature that engaging students in the solution to real-life problems can be a potent motivator for learning (Bartsch, 2001; Clark, 2007; Gruenewald & Smith, 2008; Sobel, 2005).

A sixth place-based element successfully woven into the design of the intervention was the fostering of school-community partnerships. Place-based education aims to link community “treasure” with the needs of the school. It recognizes the wealth of resources, human and otherwise, that community and government agencies can bring to bear on the education of young people. However, the connection is meant to be a two-way street. Students’ are encouraged to become involved in contributing to the solution of community problems as well. Here we see a two-fold purpose of the place-based approach: it seeks to contribute to the education of students while also enhancing the social and natural environments in which they live (Bartsch, 2001; Clark, 2007; Gruenewald & Smith, 2008; Sobel, 2005). As stated previously, I successfully partnered with a number of community agencies in this two-way fashion. These agencies or their representatives provided us with their time, treasure and talent in varying ways and to varying degrees. We provided at least one of these agencies with information (in the form of water quality data we had collected) as our contribution to the solution of a real-life problem. This school-community synergy proved to be a vital aspect of the experience and lent an invaluable contribution to its overall effectiveness. Due to the nature of the intervention, we were able to include this community component directly in only about a fourth of our classes, yet it remained a vital part of students’ experience. In fact, I now understand that any place-based effort worthy of the name must include at least some element of this important component of the place-based approach. I can also better appreciate the literature’s assertions that place-based
strategies can be potent facilitators of such school-community synergy (Clark, 2007; Greunewald & Smith, 2008; Sobel, 2005).

A seventh aspect of the approach successfully woven into the design of the overall experience was in our use of the place-based approach to *engage students in authentic work*. Analysis of the data has clearly demonstrated our success at capturing this important place-based claim. The many and varied educational experiences I provided my students all played their unique role in adding to the “authentic” nature of their experience. As we have seen in Chapter Four, exposure to outside agencies and their representatives, our use of a hands-on approach to learning, our use of ecological artifacts to help re-capture our sense of place, our opportunity to contribute to the solution of a real-life issue and the overall attempt to contextualize our learning in an environment near and dear to students’ hearts all made their unique contribution to the authenticity of many students’ experiences. In fact, my experience with implementing aspects of the place-based model have convinced me that a properly facilitated use of this approach cannot help but imbue the learning experience with an authenticity that many students will long remember. Indeed, I suspect certain outcomes engendered by a positive place-based experience (i.e., facilitating a deeper connection to human and ecological communities) may empower some students in meaningful ways well into their adult lives. My results confirm the literature’s contention that involving students in authentic tasks can add richness to the educational experience not commonly found in a more traditional approach to science learning (Glenn, 2000; Lieberman & Hoody, 1998).

The eighth and final element of this approach I was able to capture (in about 92% of my classes) was the place-based penchant for *connecting students to the communities in which they live*. Unlike the *fostering of school-community partnerships*, the connections I speak of here...
imply that students feel more deeply connected to the human and more than human environments they are a part of, including any agencies that happen to comprise a part of those communities. I have already articulated the powerful ways in which the place-based strategies we employed served to connect students to such real world “realities.” As we have seen, such connections included a greater awareness of the natural community around them, a deeper awareness of “biology” in their own yards and neighborhoods, a connection to the community of local science educators, a connection to the community itself, a connection to each other as co-learners, and a connection with their own futures. It is my fervent hope that as a result of this exercise, many of my students also came to experience a greater sense of their own “place” in the world of people and animals, plants and rocks, and the many other things that surround them. These results assure us that schools need not be isolated from life. They also confirm the literature’s contention that in this age of national standardization, corporate globalization, and high-stakes testing of mass-produced and mass-consumer one-size-fits-all knowledge; such outcomes are of inestimable value (Bartsch, 2001; Kannapel, 2002; Smith, 2002a, Sobel, 2005).

6.3.2 Impact on Student Interest.

This study’s second question explored the impact of the place-based approach on students’ interest. Place-based proponents claim this approach can increase both student interest and engagement with the learning process (Glenn, 2000; Lieberman & Hoody, 1998; Sobel, 2005). My findings support these claims. Evidence of high interest levels include: students’ wishing to explore environments close to home, students bringing ecological artifacts collected during these explorations to school, students contention that the approach helped them feel like ecologists/biologists, and students’ expression of a deeper awareness of their ecological surroundings. Survey responses also confirmed this contention.
This enhanced interest can be connected with the hands-on, problem-based, and locally focused nature of the intervention, as well as the fact that students could apply what they were learning to their own surroundings. Such curiosity seemed to birth engagement which in turn may have birthed a higher level of comprehension. I suspect this deeper level of understanding was ultimately responsible for the higher degree of perceived academic success which my students reported in their journals, survey responses and focus group answers.

6.3.3 Impact on Perceived Student Performance.

This study’s third question examined the impact of the approach on students’ perceived academic success. As stated previously, place-based proponents do not disparage academic success. In fact, they contend their approach enhances the likelihood that students will experience a greater degree of it (Glenn, 2000; Lieberman & Hoody, 1998; Sobel, 2005). While the constraints of this study did not allow me to verify this claim directly, I was able at least to explore the ways in which the approach served to help students feel more confident about their ability to succeed academically.

This study has shown that participation in the intervention led to a high degree of academic confidence for many of my students. Much of the data (students’ journal entries, focus group answers, and survey responses) speak to the fact that many found the approach interesting and this likely translated into a deeper level of engagement. I also suspect that the more authentic learning experiences I provided probably helped these students develop more relevant and enduring understandings. This, in turn, likely insured a higher level of academic confidence. A number of previously cited journal entries bear powerful witness to the ability of the place-based model to have this ultimate effect on students. It is yet another reason to consider integrating at least some of its elements of the model into their daily teaching practice.
6.3.4 Implementation Costs.

My study’s fourth and final question explored an aspect of the place-based approach that will likely concern many educators interested in attempting this approach—namely, the practical costs of implementing it on teachers and students.

Not surprisingly, I experienced a number of costs/challenges associated with implementing the intervention. Most involved the time, energy, frustration, anxiety and aggravation that come with such an undertaking. It obviously requires time and energy to plan a meaningful experience that uses a local place as the context for learning. It was not easy to find a suitable location, individuals willing to help supervise, appropriate agencies willing to help, a meaningful community problem worthy of investigating, and useful artifacts that can be later used to recapture a sense of place. Furthermore, a good deal of creative planning and implementation was needed to make the entire effort bear fruit long after we have left the ponds. There was also the additional effort needed to convince some recalcitrant students that the place-based approach is a valuable way to learn that will not hurt their GPA. Finally I experienced the anxiety generated by the loss of control that comes with abandoning the role of expert in favor of the role of facilitator and guide. For example, one wonders if students would respect a teacher who reveals they may not be experts on every facet of content and/or approach. One also wonders whether an expert community presenter would usurp the teacher’s role as classroom authority and leader. Lastly, one tends to worry about their ability to successfully facilitate this unique experiment in learning. Each of these considerations took their toll. However, in the end, all such considerations paled for me in comparison to the wonderful fruit this experience yielded.
6.4  **Limitations of the Study and Potential Pitfalls.**

I have explored the place-based model and have woven its elements into the real world of a high-stakes science course which concludes with an “important” test. I have measured the costs incurred, and have witnessed the fruit it has borne. I have met with a certain degree of success. However, such success must be tempered by acknowledging this study’s limits with respect to other individual and contexts. They include the following:

- the study explores only one practice (mine);
- the study examines only one subject area (science);
- the study examines only one unit of that subject area (ecology);
- the study involves select participants (mostly freshman and sophomore high school students);
- the study investigates one type of high school (a rural one);
- the study was conducted over a relatively brief period of time (7 weeks);
- the study does not profess to utilize the entire gambit of place-based strategies available;
- the study does not seek to measure quantitative outcomes (like academic performance).

Changes in any of these factors may produce results different from the ones I experienced. Therefore, the implications of the study’s findings for another teacher’s practice may be limited. For example, this study centers on my practice as a science teacher with a Master’s Degree in Environmental Education and 25 years of teaching experience. I also embrace an educational philosophy that views students as persons with unlimited potential and see education’s role as that of helping to facilitate the release and expression of that potential. The setting in which this study occurred was a small school in rural upstate New York—a setting with a unique history, geography and ecology that affected the ways in which Place can be used to contextualize learning. Each of these realities may be very different from that of another
teacher who is interested in embracing a place-based approach. It is therefore difficult to predict the degree to which my success could be repeated by a teacher facing his/her unique realities.

Nevertheless, because it is education grounded on place, it is easily adapted to the unique characteristics of a particular location, subject, grade-level and teacher’s experience—as demonstrated by accounts in the literature about a high school writing class in rural Nebraska (Bishop, 2004), a four grade math class in Asheville, North Carolina (Sobel, 2005), and an elementary school social studies class in rural Kentucky (Sobel, 2005). I can easily envision a Geology teacher who is fresh out of college taking her students for a walk in downtown New York City while they explore the rock type (igneous, metamorphic and sedimentary) and fossil remnants revealed in that city’s architecture. It is precisely this quality of the place-based approach (its adaptability to the unique identity of a place) that makes it such a worthwhile investment of any teacher’s time and talent. The only requirement is a basic knowledge of the subject matter and a willingness to observe its expression in the local landscape and/or culture.

6.5 Study’s Contributions to the Literature.

Despite the caveats identified in the previous section, I believe that findings from this study can contribute to the literature on place-based education and science education in a number of complementary ways.

I will begin by recalling the difficulty of trying to locate studies in the science literature which document the use of artifacts in science classes. There is a positive side to this struggle. While this study confirms the claims (Labbo & Field, 1999; Morris, 2000) that the main benefit of artifacts lie in their ability to make the abstract, remote and complex more tangible, immediate and obvious, it also demonstrates that there is ample room for their use as a teaching strategy in
science classrooms. Such a finding is a unique contribution to the literature on science pedagogy (see Chapter Four, section 4.7).

It must also be noted that my exploration of the literature failed to uncover similar attempts at integrating place-based aspects within the confines of a high-stakes science course. Many studies have employed place to cover required content (Gruenewald & Smith, 2008; Liebermann & Hoody, 1998, Sobel, 2005). However, I have yet to find any that have attempted to use place alone to cover the actual content required in a high-stakes regents Living Environment course. Therefore this study may be the first documented attempt to use creative science pedagogy within such an environment. Its findings can therefore help other New York State teachers who are wondering if such strategies are practical and possible.

6.6 Recommendations for Other Science Teachers.

“This approach to science education was interesting to me. The most interesting part was using a local habitat to explain these ecological concepts. In the past we had never focused on anyplace so close to where we live. We might have focused on a far away area or no area in particular to learn scientific concepts. Comstock Ponds is an area within the ecosystem which I am a part of which made it more meaningful. Also using artifacts from this nearby area made ecological concepts more interesting. It showed me that everyday artifacts, which I am familiar with, can easily be applied to ‘big picture’ scientific concepts.”

(Student journal response)

“I think of Biology every time I go outside”
(Student journal response)

The above passages selected from students’ journals capture the great potential of a local place to serve as the context for teaching science content. Along with the many and varied positive perceptions of their peers as explicates throughout this thesis, they illustrate the potential power of the place-based approach to heighten student interest, engagement and a deeper understanding of material. They reveal its propensity for involving students in processes that help them learn science (and the nature of the scientific enterprise) by doing real science.
They also bear witness to the potent ways in which a focus on local places can serve as connections to larger concepts while opening students’ eyes to the value of “home.” Finally, they reveal the ability of the place-based approach to help many students experience a greater sense of purpose and meaning, both educationally and in their personal lives. In this way, they serve to illustrate some ways in which place-based education is a powerful educational strategy.

Another benefit is worth mentioning. It involves the realization of the ways in which the place-based approach can positively impact one’s practice. If given an honest try this approach can expand one’s repertoire of teaching and learning strategies and re-energize one’s professional life. The experience of teaching and, more importantly, of facilitating students’ learning, can become more meaningful for teachers, and they can discover a new-found self-respect as their role becomes more facilitative and less directive. I believe they can also discover a new sense of purpose. As they create learning experiences that are both academically significant and valuable to the communities in which students live, they may come to see how valuable this approach to science education can be. In addition to promoting academic success, it can also help overcome the separation between the classroom and the community that Dewey found so troubling while at also making important contributions to the well-being of those communities (Gruenewald & Smith, 2008, Sobel, 2005).

I would encourage teachers contemplating the use of a place-based approach—regardless of their context—to carefully consider the positive impact such an undertaking can have on both young people and one’s own practice. It is considerable. And it is heartening to keep in mind the relative ease with which I was able to employ such an approach. Other teachers may then seek to find even more creative ways to connect curriculum to the world their students inhabit.

That being said, teachers interested in this approach would be wise to benefit from some
lessons learned over the course of this intervention. Based on my experience the potential pitfalls to be avoided include the following:

- insufficient prior explanation of the place-based philosophy and its educational implications;
- neglect to place chosen location in its proper historic, economic and scientific context;
- insufficient preparation (in terms of content and use of testing equipment) for Pond Day;
- insufficient preparation (in terms of procuring buy-in of community agencies);
- inability to find a local problem worth addressing;
- failure to properly facilitate activities outside the confines of a classroom;
- focusing too much on the chosen place to teach important concepts;
- an over-reliance on artifacts/examples to embody scientific concepts;
- an over-reliance on *local* artifacts/examples to embody scientific concepts;
- over-reliance on a given pedagogical approach to explore content and convey material;
- failure to adequately assess the learning in a timely fashion (via quizzes and tests);
- failure to acknowledge and plan for activities that are, by nature, time consuming;
- failure to appeal to students who are more comfortable with a more traditional approach;

Proper forethought and planning can insure that many of these issues are adequately addressed in a timely fashion. Also, a willingness to consider the needs of students more comfortable with the lecture/notes/worksheet approach to learning will encourage them and facilitate their acceptance of an approach that may be a bit more creative than they are comfortable with.

### 6.7 Suggestions for Future Research.

Despite the important contributions identified in the previous sections, there is always room for further reflection, planning, acting, and ultimately learning so as to broaden our
understanding of the ways in which this unique model can positively impact one’s practice and the educational enterprise. The results of this particular study hint at any number of possible topics that merit a deeper examination of the ability of the place-based approach to positively impact both the educational and personal lives of the teachers and students who practice it.

As suggested earlier, one area warranting closer inspection is a more thorough examination of the ability of the place-based approach to motivate unengaged students. The hands-on, problem-based and locally focused approach to science education seems to resonate with individuals chaffing at the restrictions which the banking-style of education can impose on them. I suspect that a place-centered alternative would serve to heighten the interest and engagement of many such students. Ultimately, everyone involved with the educational enterprise would benefit from such students’ new-found interest in and commitment to their studies.

An important corollary that warrants deeper exploration is the ability of the place-based approach to ameliorate students’ alienation from schools. I believe that students who are disinterested and unengaged tend to miss a good deal of school. I also suspect that many become discipline problems when they do attend school. Given the propensity of the place-based approach for capturing the imagination of such students, I suspect that a closer look at the connection between the approach and the degree of school-connectedness of the students who are allowed to practice it could be very fruitful.

Another area that would benefit from additional research is an investigation of the cost of a place-based approach on the students themselves. As mentioned earlier, encountering elements of the place-based paradigm may represent a significant shift for many students formed by a different culture of schooling. It may lead to student uneasiness and anxiety as they struggle to
embrace a way of learning that is often different from the way they have been taught in the past. I saw this in a number of my own students who seemed very content with the way things “used to be” and resented our new approach to learning. It would be enlightening to explore the various costs of integrating the approach on the students who practice it through the perspective of these very students. Such an investigation could also include an exploration of ways in which resistant students could be nurtured to more readily accept the change in educational practice they are encountering.

Another important issue worthy of a closer look would be an exploration of the effects of the approach on student awareness of and deeper connection to their local environment. While this study did not target this potential, my analysis of the data clearly suggests that it is an important outcome of the approach for many students. Perhaps a closer look at the ways the approach serves to facilitate these connections would reveal additional ways it can be employed to both facilitate and strengthen such connections.

A related issue worthy of deeper investigation is the degree to which the place-based model can serve to develop and encourage attitudes of environmental stewardship and citizenship in the young people who practice it. Many of my students drew great inspiration from knowing they were contributing to the eventual solution of a problem facing the community. It helped them feel like real scientists and gave their labors a meaning far greater than the mere earning of a grade. This, I believe, served to draw them more deeply into the particular lesson and also deepened their understanding of the reasons why we even explore ecological concepts. I suspect it had this effect because students knew that in helping the environment they were being good stewards of the land. In the process, they were also learning how it feels to become contributing members of their communities. I believe a further
exploration into the possible connection between such practices and the attitudes they engender would be a worthwhile endeavor.

Still another area ripe for exploration is the impact the place-based approach can have on students’ ability to transfer knowledge from familiar to less familiar contexts. A number of students wrote that their new-found knowledge of an organism’s ability to be indicators of water quality could be used to help them determine the water quality of bodies of water they later encountered. They articulated, albeit unknowingly, evidence that they could apply this knowledge in a different context or setting. If true, it would indicate that the approach can help facilitate students’ critical thinking and problem solving skills. It would be enlightening to discover the extent to which the approach can strengthen such skills. Evidence of this would indicate that the approach can help students develop vital skills needed to deal with realities they encounter in other situations. Therefore, it merits a closer look.

An exploration into the ability of the approach to enhance actual student academic performance also has the potential for bearing some positive fruit. As stated previously, many students have indicated that the practice of visiting the ponds, engaging in hands-on learning experiences while there, working with community agencies, contributing to solutions and collecting and eventually using artifacts from the ponds all helped them become more interested and engaged. My observations suggest that such heightened attention may have helped facilitate a deeper understanding of the material, which in turn, probably helped students remember the information better, ultimately resulting in a greater degree of academic confidence. However, for a number of reasons previously stated, it was not possible to collect data to measure the extent to which the approach served to increase students’ actual learning and test scores. A study that explores the ability of the approach to improve scores on homework, quizzes and tests, as
well as students’ conceptual understanding of key scientific concepts covered in the curriculum, would be both informative and also a powerful argument to counter the proponents of an educational approach that focuses mainly on teaching to a test.

Another area worthy of examination is an investigation that specifically targets the use of artifacts in science classrooms. While the present study offers some first insights on this topic, a more focused and rigorous investigation into the benefits and pitfalls associated with their use would be beneficial. I regrettably lacked the foresight to foreground this issue as a formal research question, but future research can begin where this study has left off.

Still another area meriting further investigation is a closer examination of the ways in which student involvement in community issues effects the way the community perceives them. Such positive involvement in the life of the community may make community members come to see students as valuable resources and contributing members of it.

Yet another area worthy of exploration concerns a deeper examination of the effects of the place-based approach on student-teacher relations. As we saw in Chapter Two, accountability education can negatively impact the ways teachers and students view one another. We have also seen that place-based education encourages new roles for teachers (facilitator, guide, broker of community resources, etc.). It would be enlightening to explore the ways in which teacher adoption of these new roles encourages more positive teacher-student interactions and ameliorates such tensions.

Lastly, I believe that a deeper examination of the ways in which the place-based paradigm can re-energizes a teacher’s practice is in order. Implementation of the approach did necessitate a more time-consuming commitment than one normally experiences in lecture-mode. And certain students felt uneasy with an approach that eschewed constant lecturing, the taking of
copious notes and the completion of homework assignments that parroted what I had taught. By day’s end however, it was obvious to me that the time and energy I invested was well worth the effort in terms of engaged students—most of whom embraced the new approach and eventually found great merit in it. However, the evidence I offer is personal and pertinent to only one practice. I suggest that a more in-depth study that uses a larger population of teachers to focus on this important connection between use of the approach and teacher attitudes would be most revealing.

6.8 Concluding Thoughts.

This study explored ways in which teachers can capitalize on the rich affordances offered by a place-based approach to science education despite the constraints imposed by a state mandated curriculum and a high stakes test. Using action research as the research methodology, I explored the feasibility of implementing elements of this approach into my daily practice with an eye toward gauging its impact on student interest and perceived academic performance. I also examined the cost of using the approach on the teacher. In the process I discovered that it is possible to integrate important aspects of the place-based paradigm into my practice. I found that utilizing such an approach can enrich that practice in meaningful ways with respect to student interest, engagement, understanding, retention, and academic confidence. I also learned that this approach can foster meaningful connections between students and the human and non-human communities of which they are a part. Finally, I learned that this practitioner’s satisfaction with regards to these positive outcomes more than outweighs the inevitable costs associated with implementing such a strategy.

This study’s ultimate value lies in its ability to demonstrate the feasibility, practicality and importance of employing authentic and locally-based strategies within the confines of a high-stakes high school science course. A recent news story illustrates both the truth and
timeliness of this assertion. The article speaks of an effort on the part of the nation’s governors and school superintendents to enact a uniform set of national academic standards for what public school children should learn in Math and English, from kindergarten all the way to high school graduation (Dillon, 2010). It mentions these new proposals will likely touch off an enormous effort to rewrite textbooks, train teachers and produce appropriate tests should enough states adopt these new standards (Dillon, 2010). Such efforts clearly reveal how a mass-produced, mass consumed, one-size-fits-all knowledge approach to education could become nationwide in the very near future. In light of such realities, this study’s findings offer a unique and exciting alternative. I believe this news is both impressive and heartening.
REFERENCES


The campus consists of ponds, an open field, transitional fields, a wet lowland woods, an upland woods, streams, and a gully. It offers diverse habitats and an extensive sampling of flora and fauna. Learning opportunities abound in many areas: hiking, x-c skiing, fishing, canoeing, camping, wild flower study, tree study, bird/wildlife observation, writing, sketching, foraging, seed dispersal study, re-enactment, measurement, water sampling, GPS study, orienteering, historical study, mapping, listening, observing, and reflecting....

It's just a short bus ride from any of our district buildings. How might you use it as an engaging learning environment for students?
APPENDIX A.1

MAP OF THE PONDS

Map Key and Trail Length
- **Red** property line
- **Orange** pond loop (.8 mile)
- **Yellow** field loop (1.2 miles)
- **Blue/Green** loop (1 mile)

Some hopes for future development include:
- Picnic/study pavilion
- Canoe/kayak dock
- Pond observation deck
- X-C ski warming hut
- Lean-to structure
- Interpretive trails
- Toilets
- Parking space
- **Your ideas and use!**
APPENDIX A.2

STUDENT LAB

Ecology Field Study Lab

Living Environment Classes
Marcus Whitman CSD
October 2, 2008

Purpose:

- To study the biotic and abiotic factors that affect the Comstock Ponds freshwater aquatic ecosystem.
- Use information about these factors (Dissolved oxygen, pH, nutrient levels, and temperature) to determine the current status of the ponds. (Are they eutrophic or oligotrophic aquatic ecosystems?)
- Gather data about the types of organisms (trees, fish, and macroinvertebrates) living in and around the pond and compare that data to the physical data from the ponds.

Methods:

1. Students will collect water samples from each of the 3 ponds and measure the level of dissolved oxygen, pH, nitrate & phosphate, and temperature.

2. Each student will identify 3-4 tree species, measure the circumference of the tree and record the GPS location of that tree.

3. Students will catch fish in the large south pond, identify the fish species, mass the fish, measure its length, insert an ID tag, and re-release the fish into the pond.

4. Students will use a secchi disk to measure the depth of light transmittance in the water column of the large south pond and gather pond depth readings along a north-south transect and east-west transect and record the GPS location of each depth reading.

5. Students will perform a sediment dredge to determine the types of macroinvertebrates that live in the large south pond and compare the presence of these to what is expected in a healthy pond.

6. Students will complete a 150-250 journal entry in their lab journal/notebooks.
Water Samples: Physical parameters of ponds

Pond #1 (small North pond)
Location of Sample Site: GPS Latitude: ___________ Longitude: ___________
Water depth at sample site: ______ (estimate)
Water Conditions: (How does the water appear?)
Probe Dissolved O₂: ______ mg/L Wet Chem Test Dissolved O₂: ______ mg/L
pH: _______ Temperature: ______ ° C
Nitrate: ______ ppm Phosphate: ______ ppm

Pond #2 (large North pond)
Location of Sample Site: GPS Latitude: ___________ Longitude: ___________
Water depth at sample site: ______ (estimate)
Water Conditions: (How does the water appear?)
Probe Dissolved O₂: ______ mg/L Wet Chem Test Dissolved O₂: ______ mg/L
pH: _______ Temperature: ______ ° C
Nitrate: ______ ppm Phosphate: ______ ppm

Pond #3 (South pond)
Location of Sample Site: GPS Latitude: ___________ Longitude: ___________
Water depth at sample site: ______ (estimate)
Water Conditions: (How does the water appear?)
Probe Dissolved O₂: ______ mg/L Wet Chem Test Dissolved O₂: ______ mg/L
pH: _______ Temperature: ______ ° C
Nitrate: ______ ppm Phosphate: ______ ppm
Tree Population Sample - LOWLAND TREES

1. Tree Species Name

circumference: ______ cm  (diameter = circumference ÷ π)  diameter = ______ cm
GPS Latitude___________  Longitude__________________

2. Tree Species Name

circumference: ______ cm  (diameter = circumference ÷ π)  diameter = ______ cm
GPS Latitude___________  Longitude__________________

3. Tree Species Name

circumference: ______ cm  (diameter = circumference ÷ π)  diameter = ______ cm
GPS Latitude___________  Longitude__________________

4. Tree Species Name

circumference: ______ cm  (diameter = circumference ÷ π)  diameter = ______ cm
GPS Latitude___________  Longitude__________________
Note: Fish capture and measurement station was cancelled due to a large fish die-off just prior to pond day. Pond depth and clarity measurement station was also cancelled when our canoe hauler was destroyed in an accident prior to Pond Day.
APPENDIX A.3

LIST OF POSSIBLE CONCEPTS/ARTIFACTS

**Examples of Biotic Components of an Ecosystem:**
- Tree bark
- Tree leaves
- Stick
- Bone
- Praying mantis
- Goldenrod larva
- Snail

**Examples of Abiotic Components:**
- Stones/rocks
- Water (photo of pond)
- Soil

**Examples of Interactions Between the Two:**
- Deer rubbings
- Weathered stone
- Goldenrod stem gall fly
- Person studying pond life
- Student catching a fish
- Praying mantis eating insects
- Beaver-gnawed stick

**Examples of Populations**
- Anything!

**Examples of Communities**
- Photos of organisms that I can establish a relationship between

**Examples of Limiting factors:**
- Water quality data: DO data; phosphate data; pH readings; alkalinity readings

**Examples of Carrying capacity:**
- Aerial map; size of ponds; size of forested area; bottom muck from large north pond;

**Examples of Food chains (examples of energy flow):**
- Duck weed……..use in CIBT lab
- Macroinvertebrate food chain example

**Examples of Food webs:**
- Use photos of organisms…..heron; muskrat lodge; bird(s) of prey

**Examples of Tropic (feeding) levels:**

**Examples of Autotrophs (producers)**
- Any leaves
Examples of Heterotrophs (consumers)
Macroinvertebrates (in alcohol); 2nd order = dragonflies larva; terrestrial bugs; fox scat; deer scat; rabbit scat; animal tracks;
Examples of Decomposers:
Shelf fungi
Examples of Scavengers:
Photo of fox tracks; photo coyote tracks; Turkey vulture feather; any carcass
Examples of Disease carriers:
Examples of Predator/prey:
Dragonfly nymphs; evidence of deer-coyote connection; fox-rabbit connection;
Examples of Parasite/host:
Mosquito & you; woodbine or poison ivy and tree;
Examples of Symbiotic relationships:
Mutualism - + and +
Lichens
Parasitism - + and –
Us and mosquitoes;
Commensalism - + and neutral
Lichens and tree substrate
Examples of Competition: (for food, space, sex)
Intra (same species)
Photo of a stand of Aspen Trees
Inter (between species)
Large Basswood Leaves
Trailing Vines Growing on other Plants
Examples of Natural cycles:
Stellar (we are star stuff)
Water
Stomata from hemlock
Oxygen
D.O. readings
Carbon dioxide
Any plant; picture of kid with plant; bromothymol blue w/ kids; any living thing
Nitrogen
Clover; trefoil; alfalfa; honey locust tree
Matter
Examples of Ecological succession:
Pioneer plants, midways, climax
Big trees by ravine(Corey gully ridge)white pines; red oak; beech (photos)
Examples of invasive species:
Garlic mustard
Loosestrife
Bamboo
Buckthorn
Fragmites?

Examples of Diversity/biodiversity
20 different tree species
Macroinvertebrate varieties

Examples of Human impact:
Ponds themselves
Culverts
Aerators
Drainage creek connecting to streams
Cans/bottles/garbage
Loosestrife
House sparrows
Bluebird boxes
Pollutants
Land use practices
Wood duck boxes

Examples of nutrients required for living things:
DO readings; nitrates reading; phosphate readings; soil samples for N & Phosphates

Examples of Photosynthesis:
Any leaves; filamentatious algae; pond water with microscopic algae

Examples of cellular respiration:
Any plant; any animal; us!
APPENDIX A.4

REFLECTIVE JOURNAL RUBRIC (EXAMPLE)

NATURE JOURNAL RUBRIC  
Name ____________________
Entry # _________  
Grade ________________

2 Points: State the main question you are trying to answer in this entry.  

6 Points: 150-250 word written reflection/observation  

2 Points: Reflections & observations are original, thoughtful, and descriptive  

5 Points: Journal entry makes reference to two or more of the following terms:  

Ecosystems    Populations    Communities
Species interaction    Biomes    Habitats
Symbiotic Relationships (parasitic, mutualistic, commensalistic)
Predator/Prey Interactions
Identify any autotrophs, heterotrophs, detritivores observed
Abiotic factors

..............................................................................................................Total____
APPENDIX A. 5

EXPLANATION OF WATER QUALITY TESTS

Value of water quality tests:

**Temperature** - this measures the heat content of a water body expressed in Fahrenheit degrees (°F) or Celsius degrees (°C). It is an important regulator of the metabolic rate of aquatic organisms. Many species become more active as the water warms. Because warm water is less dense, the microscopic plankton have evolved many adaptations to compensate for the reduced buoyancy they experience during the summer. Variability in the temperatures of a water body help to explain the great diversity of organisms present. In deep lakes, temperature patterns across the water column document the extent of the summer warm water zone at the surface (the epilimnion) and the cold water zone near the bottom (the hypolimnion). This summer condition is known as lake stratification. Temperature will also influence water circulation patterns in the lake (e.g., seiches and timing of mixing events in stratified lakes, as known as spring and fall turnover). With temperature profiles and volume information, predictions can be made about the possibility and extent of winter ice cover.

**Dissolved oxygen** – the measures the oxygen present as a gas (O₂) dissolved in the water. It is essential for the respiration of most desirable aquatic organisms, particularly fish and invertebrates. Cold water has the potential to hold greater amounts. Relative content of dissolved oxygen (D.O.) is measured as percent saturation. It is desirable in supporting aquatic life to be at or near 100% saturation. Absolute content of D.O. is measured as parts per million (ppm) or its equivalent, milligrams per liter (mg/L). Oxygen has low solubility in water, with maximum amounts seldom exceeding 14.6 mg/L. Cold water fish species like trout require a minimum D.O. of 7 to 8 mg/L. Warm water fish species like bass are more tolerant but still require a minimum D.O. of 5 mg/L. D.O. is positively correlated with atmospheric pressure. Lake and pond D.O. concentrations are influenced by replenishment rates (contribution from aerated tributary streams, surface exchange with the atmosphere, amount of aquatic photosynthesis) and consumption factors (respiratory demands of lake organisms, amount of oxygen demanding wastes). Stream D.O. concentrations are positively influenced by ripples, rapids and waterfalls. If D.O. levels drop to near zero, the water is anoxic, temporarily bound nutrients are released from bottom sediments and undesirable anaerobic biota will predominate.

**Alkalinity** – this measures the capacity of water to neutralize acids. This is also known as the buffer capacity. In nearly all natural water bodies, the presence of carbonate (CO₃⁻), bicarbonate (HCO₃⁻) and hydroxyl (OH⁻) ions accounts for essentially all of the alkalinity. In regions subject to acidic precipitation, the buffer capacity helps to reduce or eliminate the harmful impacts of acidifying a water body. Alkalinity provides a stabilizing influence in the water. Alkaline waters contain more mineral nutrients (e.g., calcium, magnesium) that are described in a related property called **hardness**. Because more nutrients are available in alkaline water, the alkalinity test is also used to assess the overall ecological productivity of the water.
**pH** – this measures the activity of hydrogen ions ($H^+$) in the water. Water samples can be measured electronically in a laboratory or with pH sensitive dyes in the outdoors. The pH scale runs from 1 to 14, with the middle value of 7 described as the neutral point. Values in pH below even indicate acidic conditions while those above seven indicate alkaline conditions. The pH scale is logarithmic, that is a unit decrease on the scale means that the hydrogen ion concentration has increase tenfold. In the Finger Lakes, pH values are often above the neutral point but in the High Peaks of the Adirondack Mountains pH values have plummeted to as low as three! This has resulted in biological dysfunction for those water bodies and has led to the local extirpation of many aquatic organisms.
# APPENDIX A.6

## LESSON PLANS DOCUMENT

(Major Understandings to be Covered/Time Needed)

<table>
<thead>
<tr>
<th>Concepts/ Themes/ Essential questions</th>
<th>Time in weeks</th>
<th>Key Ideas What students need to know</th>
</tr>
</thead>
<tbody>
<tr>
<td>What are the interrelationships among organisms?</td>
<td>6 weeks</td>
<td>Key Idea 6, 1 Performance indicator 6.1a-g; 6.3a-c</td>
</tr>
<tr>
<td>How do the abiotic factors affect living systems?</td>
<td></td>
<td>Performance Indicator 1.1a-f</td>
</tr>
<tr>
<td>How are essential compounds cycled through ecosystems?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>What are the necessary components of a self sustaining ecosystem?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Skills- What students need to be able to do (Content specific skills and literacy, math, technology, problem solving skills)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Observation, data collection and analysis, computer graphing, sequential reasoning, Differentiates between independent and dependent variables;</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Strategies</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture, demonstration; hands-on activities; web-based activities; analogy; work sheets;</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Assessments</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Tests, quizzes, labs, homework assignments</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Resources/websites</th>
<th></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Labs</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Stream study; biome lab; population growth curves; population density; food web lab; microscope basics</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Standards</th>
<th>4, 1</th>
</tr>
</thead>
</table>
Key Idea 6:
Plants and animals depend on each other and their physical environment.

The fundamental concept of ecology is that living organisms interact with and are dependent on their environment and each other. These interactions result in a flow of energy and a cycling of materials that are essential for life.

Competition can occur between members of different species for an ecological niche. Competition can also occur within species. Competition may be for abiotic resources, such as space, water, air, and shelter, and for biotic resources such as food and mates. Students should be familiar with the concept of food chains and webs.

**PERFORMANCE INDICATOR 6.1**

Explain factors that limit the growth of individuals and populations.

**Major Understandings**

6.1a Energy flows through ecosystems in one direction, typically from the Sun, through photosynthetic organisms including green plants and algae, to herbivores to carnivores and decomposers.

6.1b The atoms and molecules on the Earth cycle among the living and nonliving components of the biosphere. For example, carbon dioxide and water molecules used in photosynthesis to form energy-rich organic compounds are returned to the environment when the energy in these compounds is eventually released by cells. Continual input of energy from sunlight keeps the process going. This concept may be illustrated with an energy pyramid.

6.1c The chemical elements, such as carbon, hydrogen, nitrogen, and oxygen, that make up the molecules of living things pass through food webs and are combined and recombined in different ways. At each link in a food web, some energy is stored in newly made structures but much is dissipated into the environment as heat.

6.1d The number of organisms any habitat can support (carrying capacity) is limited by the available energy, water, oxygen, and minerals, and by the ability of ecosystems to recycle the residue of dead organisms through the activities of bacteria and fungi.

6.1e In any particular environment, the growth and survival of organisms depend on the physical conditions including light intensity, temperature range, mineral availability, soil/rock type, and relative acidity (pH).

**PERFORMANCE INDICATOR 6.1 continued**

6.1f Living organisms have the capacity to produce populations of unlimited size, but environments and resources are finite. This has profound effects on the interactions among organisms.

6.1g Relationships between organisms may be negative, neutral, or positive. Some organisms may interact with one another in several ways. They may be in a producer/consumer, predator/prey, or parasite/host relationship; or one organism may cause disease in, scavenge, or decompose another.
PERFORMANCE INDICATOR 6.3

Explain how the living and nonliving environments change over time and respond to disturbances.

Major Understandings

6.3a The interrelationships and interdependencies of organisms affect the development of stable ecosystems.

6.3b Through ecological succession, all ecosystems progress through a sequence of changes during which one ecological community modifies the environment, making it more suitable for another community. These long-term gradual changes result in the community reaching a point of stability that can last for hundreds or thousands of years.

6.3c A stable ecosystem can be altered, either rapidly or slowly, through the activities of organisms (including humans), or through climatic changes or natural disasters. The altered ecosystem can usually recover through gradual changes back to a point of long-term stability.
## APPENDIX B.1

### JOURNAL PROMPTS

<table>
<thead>
<tr>
<th>Question</th>
<th>When Assigned</th>
<th>Research Question</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SRJ 1</strong>&lt;br&gt; In what ways (if any) has our use of examples from Comstock Ponds (photos, goldenrod stem gall, fir needles) helped make your learning of these concepts more interesting?&lt;br&gt; In what ways has it helped you feel more prepared for the homework you’ve been assigned?&lt;br&gt; In what ways has it helped you feel more prepared for the quiz you have taken?&lt;br&gt; Early in the second week of school after we had used these artifacts, assigned homework, and assessed student understanding on a quiz.</td>
<td>RQ2 &amp; RQ3</td>
<td></td>
</tr>
<tr>
<td><strong>SRJ 2</strong>&lt;br&gt; In what ways (if any) has using live aquatic macroinvertebrate specimens helped make the learning of macroinvertebrates as water quality indicators more interesting for you?&lt;br&gt; In what ways (if any) has it helped you feel more prepared for the quiz you will take on it next week.</td>
<td>RQ2 &amp; RQ3</td>
<td></td>
</tr>
<tr>
<td><strong>SRJ 3</strong>&lt;br&gt; In what ways (if any) did our experiences at the ponds make the study of ecology concepts (water quality, tree identification, macroinvertebrates as bio-indicators, scavenger hunts) more interesting for you?&lt;br&gt; In what ways will it help you feel better prepared for the quizzes and tests you will take on this material?</td>
<td>RQ2 &amp; RQ3 &amp; possibly RQ1</td>
<td></td>
</tr>
<tr>
<td><strong>SRJ 4</strong>&lt;br&gt; In what ways (if any), has this approach to learning biology concepts (hands-on, on-site investigation of a local place, working with community agencies, reflective journaling, etc. made the learning of ecology more interesting for you?&lt;br&gt; In what ways (if any) does knowing that our results will be used by a community agency to help solve a real-world local problem make our study of ecology concepts more interesting for you?</td>
<td>RQ2 &amp; RQ3; possibly RQ1</td>
<td></td>
</tr>
<tr>
<td><strong>SRJ 5</strong>&lt;br&gt; In what ways (if any) can we improve the way we currently use the artifacts we collected?</td>
<td>RQ 1, RQ 2, RQ 3 &amp; RQ4.</td>
<td></td>
</tr>
<tr>
<td><strong>SRJ 6</strong>&lt;br&gt; Please tell me what about his approach to science education (pointing to the ponds) was MOST interesting to you. Also, please take a minute and consider what was least interesting to you about this approach. As always, please give a very specific example or two to support your answer.&lt;br&gt; Please tell me what about this approach MOST helped you understand and remember the material/concepts we studied. Also, please tell me what was least helpful about this approach in terms of helping you understand and remember the material/concepts we studied. As always, please give a very specific example or two to support your answer.</td>
<td>RQ 2, RQ3, RQ4, RQ4</td>
<td></td>
</tr>
</tbody>
</table>
The final stage of our place-based approach to science education is to share what we have learned with a wider community. You have already decided that the best way to do this is through a slide presentation and/or photo collage. Now it’s time to decide what it is we want the community to know! Take a minute and consider what message you would want to share with the Whitman community. What exactly is it that you would want them to know? Perhaps it’s a concept you’ve learned. Maybe it’s the manner in which you’ve learned it. It could be some aspect of our field trip to the ponds and the way we used the artifacts we collected that really touched you or spoke to you in some way. Be creative and tell me what it is about your educational experience that is important for others to know. As always, please give a specific example or two to support your statements.

Assigned as final essay on concluding unit test. RQ1, RQ2, RQ3, RQ4.
# APPENDIX B. 2

**SURVEY QUESTIONS**

Survey on Place Based Education  

October 29, 2009  

Name _______________________________________

<table>
<thead>
<tr>
<th>Number</th>
<th>Question</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Slightly Disagree</th>
<th>Slightly Agree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Visiting Comstock Ponds has helped make class more interesting for me.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>2</td>
<td>Using artifacts gathered from Comstock ponds has helped make class more interesting for me.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>3</td>
<td>Visiting Comstock Ponds has made it easier for me to understand the material.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>4</td>
<td>Using artifacts gathered from the ponds has made it easier for me to understand the material.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>5</td>
<td>Visiting Comstock Ponds has made it easier for me to remember the material.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>6</td>
<td>Using artifacts gathered from the ponds has made it easier for me to remember the material.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>7</td>
<td>Visiting Comstock Ponds has helped me feel more confident on the homework I have been assigned.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>8</td>
<td>Using artifacts gathered at the ponds has helped me feel more confident on the homework I have been assigned.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>9</td>
<td>Visiting Comstock ponds has helped me feel more confident about the quizzes I have taken.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>10</td>
<td>Using artifacts gathered at the ponds has helped me feel more confident about the quizzes I have taken.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>
11. Visiting Comstock Ponds has given me a greater appreciation for the place where I live.

12. Using artifacts gathered at the ponds has given me a greater appreciation for the place where I live.

13. Visiting Comstock Ponds has given me a greater appreciation for the natural world.

14. Using artifacts collected at the ponds has given me a greater appreciation for the natural world.

15. Visiting Comstock Ponds takes too much time.

16. Using artifacts collected at the pond takes too much time.

17. Overall, I think this approach to science education (working with community organizations, visiting the ponds, using pond artifacts) is a good way to learn ecology concepts.

18. I would rather learn ecology concepts some other way (for example, by listening to my teacher lecture and give us notes and worksheets; by watching a video, etc.).

19. Overall, my experience with using this approach to science education has been a positive one.

20. Which of the following projects would you rather see our class do as a way of letting the school community know what we’ve been up to?
   a. Slide show with music for the Whitman Website
   b. Article in the school newspaper
   c. Photo collage to be placed in the hallway
   d. Visit a board of education meeting and tell them about our project

21. Would you personally be willing to work on one of these projects for extra credit? If so, which one?
APPENDIX B.3

TEACHER LOG PROMPTS

Intended Plan

Enacted Plan

Pluses

Minuses

Costs incurred

Perceived Student Interest

Comments/Observations

Plan for Tomorrow

Elements Capture Chart (single lesson & overall unit)

Elements Captured Within the Scope of The Intervention:

1. Teacher as Facilitator and Guide
2. Lesson Emerges from the Particular Attributes of a Place
3. Meaning Derived from Studies by Connecting Content to Real-World Experience
4. Provides Opportunities for Interactions with Peers
5. In-depth Investigation of a Local Issue
6. Fosters School-Community Partnerships
7. Engages Students in Authentic Tasks
8. Connects Students to the Communities in which they Live

Capture Chart: rate each on a scale of 1 (poor) to 5 (excellent)

Element One ( )  Element Two ( )  Element Three ( )  Element Four ( )  
Element Five ( )  Element Six ( )  Element Seven ( )  Element Eight ( )
APPENDIX B. 4

FOCUS GROUP QUESTIONS

1. We explored ecology this semester using a local place (Comstock ponds) as a focus for our studies. We listened to presenters from community agencies, and conducted an actual field day at the ponds. There we collected data about the health of the pond ecosystem and scavenged for ecological artifacts that were good examples of the concepts we would later study. Upon our return to class, we often used these artifacts along with our data and photos of pond organisms to help us understand the concepts we were studying. What was your favorite aspect of this approach to science education? Why was it your favorite?

2. What was your least favorite aspect of this approach? Why was it your least favorite?

3. What was your favorite part about using pond artifacts?

4. What was your least favorite part about using pond artifacts?

5. What was your favorite part about using community presenters?

6. What was your least favorite part about using community presenters?

7. In what ways, if any, did this approach help you succeed in an academic sense? Explain.

8. In what ways, if any, did it prevent or hinder you from succeeding in an academic sense? Explain.

9. Now that the intervention is over, what is one thing you would change about it?

10. What is one thing you would keep the same?
APPENDIX C.1
DATA ANALYSIS PLAN

The study will be informed by the following specific research questions:

1. Which elements of a place-based paradigm am I able to effectively integrate into a Living Environment course?
2. In what ways does this integration impact student interest?
3. In what ways does this integration impact students’ perceived academic performance?
4. What are some of the practical costs of implementing this approach on teachers and students?

Data Sources Used:
Teacher Log (to answer questions 1 & 4 and possibly 2)
Student Journal Responses (to answer questions 2 & 3 and possibly 4)
Survey Answers (to answer questions 2 & 3 and possibly 4)
Focus Group Responses (to answer questions 2 & 3 and possibly 4)

<table>
<thead>
<tr>
<th>Research Question</th>
<th>Data Sources</th>
<th>What to do with Data/How can I use?</th>
<th>Needed Prompts/Tool Used to Elicit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Which elements of a place-based paradigm am I able to effectively integrate into a Living Environment course?</td>
<td>Teacher Log</td>
<td>Identify elements of place-based education (including artifacts from Pond Day) that I was able to capture in each lesson and to what extent. Identify the cost associated with trying to integrate particular elements.</td>
<td>Sections of Teacher Log designed to capture intended plan, actual plan, artifacts used, pluses &amp; minuses of lesson and frequency of element capture. (See Appendix B.3.)</td>
</tr>
<tr>
<td>2. In what ways does integration impact student interest?</td>
<td>Teacher Log (sections dealing with interest).</td>
<td>Identify and compile all instances where evidence of student interest in recorded. Use analysis of results to help answer what generates Students’ interest and what does not.</td>
<td>(See Appendix B.3) Teacher Log’s section designed to capture perceived student interests and observations.</td>
</tr>
</tbody>
</table>
| RQ 2 | Answers to journal prompts (interest-related questions) | Highlight all answers related to interest.  
Collate answers.  
Create table & use analysis of results to help answer what generates student interest and what does not. | See Appendix B.1 – questions related to interest. |
| --- | --- | --- | --- |
| RQ 2 | Answers to survey questions (level of interest section) | Collate responses to each question in the Interest section.  
Compile responses related to interest level from open-end survey questions.  
Create table & analyze results to answer things that generate student interest. | Refer to Appendix B.2 – questions # 1, 2 and open questions. |
| RQ 2 | Transcripts of final focus group discussions (level of interest section) | Highlight in transcripts all answers related to interest.  
Collate answers.  
Use analysis of results to help answer what generates student interest and what does not. | See Appendix B.4 – all questions. |
Create table & use analysis of results to help answer what generates student academic success and what does not. | See Appendix B.1 – questions related to preparation. |
<table>
<thead>
<tr>
<th>RQ 3</th>
<th>Survey answers (those related to perceived academic success).</th>
<th>Collate responses to each question in the academic success section. Compile responses related to academic success from open-end survey questions. Create table &amp; use analysis of results to help answer what generates student academic success and what does not. Use survey answers to choose candidates for focus groups.</th>
<th>Refer to Appendix B.2 - questions 3-14 and open questions.</th>
</tr>
</thead>
<tbody>
<tr>
<td>RQ 3</td>
<td>Transcripts of final focus group discussions (perceived academic success section).</td>
<td>Highlight in transcripts all answers related to perceived academic success. Collate answers. Use analysis of results to help answer what generates student academic success.</td>
<td>Appendix B.4 – especially questions 7 and 8.</td>
</tr>
<tr>
<td>4. What are the actual costs of integration on teachers thinking of employing this approach?</td>
<td>Teacher log (section related to costs).</td>
<td>Explain the hidden and obvious costs to me. Compile all comments made about. Use information to refine intervention.</td>
<td>Appendix B.3</td>
</tr>
<tr>
<td>RQ 4</td>
<td><strong>Student journal responses</strong></td>
<td>See Appendix B.1</td>
<td></td>
</tr>
<tr>
<td>------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>------------------</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Compile all comments that refer to obvious and hidden costs (from students’ perspective).</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Use analysis of results to help answer what students perceive as “costly”.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Use to refine intervention.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RQ 4</td>
<td><strong>Student survey answers related to costs.</strong></td>
<td>Refer to Appendix B.2 question 15 and 16.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Compile responses related to costs from open-end survey questions.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Use to refine intervention.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RQ 4</td>
<td><strong>Answers from final focus group discussions.</strong></td>
<td>See Appendix B.4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Highlight in transcripts all answers related to costs.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Collate answers.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Use analysis of results to help answer what students perceive as costly.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Use analysis of results to refine future interventions.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX D.1

ELEMENT FREQUENCY CAPTURE CHART

Elements Tracked:

1. Teacher as Facilitator and Guide
2. Lesson Emerges from the Particular Attributes of a Place
3. Meaning Derived from Studies by Connecting Content to Real-World Experience
4. Provides Opportunities for Interactions with Peers
5. In-depth Investigation of a Local Issue
6. Fosters School-Community Partnerships
7. Engages Students in Authentic Tasks
8. Connects Students to the Communities in which they Live

<table>
<thead>
<tr>
<th>Lesson #</th>
<th>Element One</th>
<th>Element Two</th>
<th>Three</th>
<th>Four</th>
<th>Five</th>
<th>Six</th>
<th>Seven</th>
<th>Eight</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>2</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>5</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>6</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>7</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>8</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>9</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>10</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>35</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>----</td>
<td>----</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>----</td>
<td>---</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>% total</td>
<td>37 = 100%</td>
<td>35 = 95%</td>
<td>23 = 62%</td>
<td>17 = 50%</td>
<td>11 = 30%</td>
<td>9 = 24%</td>
<td>34 = 92%</td>
<td>34 = 92%</td>
</tr>
</tbody>
</table>
## APPENDIX D.2

### SURVEY SUMMARY DATA

**Visiting Comstock Ponds**

<table>
<thead>
<tr>
<th>Question</th>
<th># Agreed/Strongly Agreed</th>
<th>% of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>has helped make class more interesting for me.</td>
<td>40</td>
<td>70%</td>
</tr>
<tr>
<td>has made it easier to understand the material.</td>
<td>40</td>
<td>70%</td>
</tr>
<tr>
<td>has made it easier to remember the material.</td>
<td>36</td>
<td>63%</td>
</tr>
<tr>
<td>Has helped me feel more confident on the homework I’ve been assigned.</td>
<td>24</td>
<td>43%</td>
</tr>
<tr>
<td>helped me feel more confident about the quizzes I’ve taken.</td>
<td>33</td>
<td>58%</td>
</tr>
<tr>
<td>has given me a greater appreciation for the place I live.</td>
<td>34</td>
<td>60%</td>
</tr>
<tr>
<td>has given me a greater appreciation for the natural world.</td>
<td>37</td>
<td>65%</td>
</tr>
<tr>
<td>takes too much time.</td>
<td>4</td>
<td>.07%</td>
</tr>
</tbody>
</table>
## Using Artifacts from Comstock Ponds

<table>
<thead>
<tr>
<th>Question</th>
<th># Agreed/Strongly Agreed With Statement (out of 57 respondents)</th>
<th>% of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Using artifacts from Comstock Ponds</td>
<td></td>
<td></td>
</tr>
<tr>
<td>has helped make class more interesting for me.</td>
<td>38</td>
<td>67%</td>
</tr>
<tr>
<td>has made it easier to understand the material.</td>
<td>40</td>
<td>70%</td>
</tr>
<tr>
<td>has made it easier to remember the material.</td>
<td>27</td>
<td>47%</td>
</tr>
<tr>
<td>has helped me feel more confident on the homework I’ve been assigned.</td>
<td>25</td>
<td>44%</td>
</tr>
<tr>
<td>helped me feel more confident about the quizzes I’ve taken.</td>
<td>30</td>
<td>53%</td>
</tr>
<tr>
<td>has given me a greater appreciation for the place I live.</td>
<td>29</td>
<td>51%</td>
</tr>
<tr>
<td>has given me a greater appreciation for the natural world.</td>
<td>32</td>
<td>56%</td>
</tr>
<tr>
<td>takes too much time.</td>
<td>0</td>
<td>0%</td>
</tr>
</tbody>
</table>
## Miscellaneous Results

<table>
<thead>
<tr>
<th>Question</th>
<th># Agreed/Strongly Agreed With Statement (out of 57 respondents)</th>
<th>% of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>This approach to science education is a good way to learn ecology concepts.</td>
<td>42</td>
<td>57%</td>
</tr>
<tr>
<td>I would rather learn ecology concepts some other way.</td>
<td>4</td>
<td>.07%</td>
</tr>
<tr>
<td>My overall experience with using this approach to science education has been a positive one.</td>
<td>40</td>
<td>70%</td>
</tr>
</tbody>
</table>
## APPENDIX D.3

### SELECTED JOURNAL RESPONSES SUMMARY DATA

#### THINGS CONTRIBUTING TO INTEREST

<table>
<thead>
<tr>
<th>REASON FOR INTEREST</th>
<th>TIMES MENTIONED (out of 127 journal entries)</th>
<th>% OF TOTAL RESPONSES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning was connected to local setting</td>
<td>24</td>
<td>19%</td>
</tr>
<tr>
<td>Opportunity to leave classroom</td>
<td>5</td>
<td>4%</td>
</tr>
<tr>
<td>Learning dealt with authentic problem</td>
<td>12</td>
<td>9%</td>
</tr>
<tr>
<td>Opportunity to help solve real-life problem</td>
<td>10</td>
<td>8%</td>
</tr>
<tr>
<td>Hands-on nature of the approach</td>
<td>30</td>
<td>24%</td>
</tr>
<tr>
<td>Eyes-on nature of the approach</td>
<td>27</td>
<td>21%</td>
</tr>
<tr>
<td>Opportunity to work together as a group</td>
<td>2</td>
<td>2%</td>
</tr>
<tr>
<td>Actual pond day experience</td>
<td>5</td>
<td>4%</td>
</tr>
<tr>
<td>Use of artifacts</td>
<td>5</td>
<td>4%</td>
</tr>
<tr>
<td>Liked working with community presenters</td>
<td>7</td>
<td>5%</td>
</tr>
</tbody>
</table>

#### THINGS CONTRIBUTING TO PERCEIVED ACADEMIC SUCCESS

<table>
<thead>
<tr>
<th>REASON</th>
<th>TIMES MENTIONED (out of 127 journal entries)</th>
<th>% OF TOTAL RESPONSES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual Pond Visit</td>
<td>10</td>
<td>10%</td>
</tr>
<tr>
<td>Collecting and Using Artifacts</td>
<td>18</td>
<td>17%</td>
</tr>
<tr>
<td>All aspects helped equally</td>
<td>4</td>
<td>4%</td>
</tr>
<tr>
<td>Knowledge that results will contribute to solution of problems</td>
<td>2</td>
<td>2%</td>
</tr>
<tr>
<td>Hands-on nature of work</td>
<td>26</td>
<td>25%</td>
</tr>
<tr>
<td>Eyes-on nature of work</td>
<td>22</td>
<td>21%</td>
</tr>
<tr>
<td>Involvement with Community Presenters</td>
<td>4</td>
<td>4%</td>
</tr>
<tr>
<td>Learning in a local setting</td>
<td>12</td>
<td>11%</td>
</tr>
<tr>
<td>Being a real ecologist</td>
<td>3</td>
<td>3%</td>
</tr>
<tr>
<td>It was fun!</td>
<td>3</td>
<td>3%</td>
</tr>
</tbody>
</table>

Total = 104  Total = 100%
## APPENDIX D.4

### NEGATIVE FEEDBACK SUMMARY DATA

*(From Student Journal Responses)*

<table>
<thead>
<tr>
<th>REASON</th>
<th>TOTAL OCCURANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Don’t like to touch “stuff”</td>
<td>2</td>
</tr>
<tr>
<td>Like school labs better than outdoor labs</td>
<td>1</td>
</tr>
<tr>
<td>Didn’t like weather on pond day</td>
<td>5</td>
</tr>
<tr>
<td>Approach too repetitious</td>
<td>2</td>
</tr>
<tr>
<td>Don’t like seeing ourselves in pictures</td>
<td>1</td>
</tr>
<tr>
<td>Community Presenters too repetitious</td>
<td>2</td>
</tr>
<tr>
<td>Community Presenters too confusing</td>
<td>2</td>
</tr>
<tr>
<td>Learn better a different way (lectures, worksheets, notes, etc)</td>
<td>7</td>
</tr>
<tr>
<td>Don’t feel connected too place (not from here; won’t stay)</td>
<td>1</td>
</tr>
<tr>
<td>Don’t feel connected to place (like far-away better)</td>
<td>1</td>
</tr>
<tr>
<td>Not fascinated by natural world (plants or animals)</td>
<td>1</td>
</tr>
<tr>
<td>Contributing results makes me feel judged by others</td>
<td>1</td>
</tr>
<tr>
<td>Not enamored with the idea of pond day (too long)</td>
<td>2</td>
</tr>
<tr>
<td>Artifacts not particularly interesting</td>
<td>1</td>
</tr>
<tr>
<td>Makes me feel too far behind other class</td>
<td>1</td>
</tr>
<tr>
<td>Dislike constant focus on <em>local</em> artifacts</td>
<td>1</td>
</tr>
<tr>
<td>Journal Prompts too time consuming</td>
<td>1</td>
</tr>
<tr>
<td>Would like to visit an additional natural area as well</td>
<td>1</td>
</tr>
<tr>
<td>Presenters too boring</td>
<td>1</td>
</tr>
<tr>
<td>Nothing on quiz relevant to examples used in class</td>
<td>1</td>
</tr>
<tr>
<td>Total Comments = 35</td>
<td></td>
</tr>
</tbody>
</table>